Research Article

Research on Efficiency in Financing of Small and Medium Companies Based on DEA Method

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At this stage, SMEs cannot survive and grow without the support of large amounts of capital, and the issue of financing efficiency has always been a bottleneck for different types of SMEs. This paper studies the financial data of relevant enterprises by constructing variable index evaluation systems such as anti-risk ability, internal management, financial system, market competitiveness, short-term debt, long-term debt, paid-in capital to property right ratio, comprehensive efficiency, pure technical efficiency, and scale efficiency and takes manufacturing, service, high-tech, and community-based small-sized and medium-sized enterprises as the research points. The DEA model is used to analyze the financing efficiency of enterprises. The results show that small-sized and medium-sized enterprises in high-tech and manufacturing industries are in the stage of increasing returns to scale. In a homogeneous environment, internal financing environment variables, total assets, asset liability ratio, debt service ratio, current ratio, and other variables have an impact on liquidity efficiency. External financing environment variables, science and technology investment, and economic level have a good and significant impact on enterprise financing.

1. Introduction

Small-sized and medium-sized enterprises are an important part of the national economy. At the same time, they play an important role in raising the level of national economic development, easing employment pressure, optimising the economic structure, and promoting social stability. As the main force of high-tech industry, Smaller and small enterprises have made some development in recent years, but they still face some difficulties and problems. The current situation of financing is not optimistic, and the low efficiency in financing has become the shackle of the development of small and medium companies. It is urgent to solve the problem of efficiency in financing of high-tech small and medium companies. Based on this, this paper will discuss the efficiency in financing of small and medium companies from the perspective of financing cost and capital use. Reviewing the relevant theoretical research on efficiency in financing, we find that the

efficiency described in western economics mainly has three meanings: First, it refers to the utility expressed by the ratio of input and output and refers to the comparative relationship between cost and income. Second, it refers to whether the economic subject has brought about the rational utilization of resources in the whole society while pursuing microeconomic efficiency, and whether the allocation of resources has reached Pareto efficiency. Third, it refers to the impact of the existing institutional arrangements on the micro efficiency and allocation efficiency, as well as the efficiency evaluation of the economic system itself on this basis. The literature on efficiency in financing mainly focused on theoretical research in the early stage. There are many definitions of efficiency in financing in domestic theoretical circles. Feldman first used the concept of “efficiency in financing” when analyzing the two financing methods of direct financing and indirect financing and analyzed seven factors affecting efficiency in financing and cost [1]. Shi pointed out that enterprise financing is a

system and is closely related to transaction efficiency and allocation efficiency. Financing costs are actually composed of a variety of costs. First of all, we need to clarify what financial costs include. In short, the financial cost of the real economy mainly includes the interest and handling charges paid when receiving financial services such as credit. At the same time, these interests and service charges are the income of financial enterprises, which is used to cover various expenses for the provision of financial services—mainly including operating costs, capital costs, regulatory costs, write-down costs of nonperforming assets, and reasonable returns of shareholders [2]. If we only focus on reducing the short-term financial costs of the real economy without considering the changes in the costs related to the provision of financial services, this may lead to the contraction of the supply of financial services (such as credit), resulting in the sharp fluctuation of the financial costs of the real economy. In addition, although the income of financial enterprises is relatively explicit, many costs related to credit services are implicit and have the characteristics of unpredictable and serious postponement, which is equivalent to the functional efficiency proposed by Tobin [3, 4]. Jiny pointed out that the calculation index of efficiency in financing should at least reflect the comparative relationship between financing cost and capital use efficiency, take the comprehensive capital cost of the enterprise in the financing process as the investor, take the return on investment of the enterprise as the output, and fully consider the risk degree of financing structure and the tax credit effect of debt capital to calculate the efficiency in financing of the enterprise. Many domestic scholars tend to evaluate and analyze the efficiency in financing of listed companies by using different empirical methods. Among them, data envelopment analysis (DEA) method is relatively easy to use [5–12]. It is mainly used to analyze the relative effectiveness of multiple inputs and multiple outputs. By testing effectiveness, suggestions are put forward for invalid units. DEA method is mainly realized by DEAP 2.1 software, which is highly operable and simple.

The most common application of the DEA method is to analyse regional data (e.g., all provinces in China, districts, and towns in X province), in addition to other applications. Secondly, DEA method has a variety of models, such as BBC model, CCR model, and three-stage method. It is suitable for papers on different research topics. It is enough to find a suitable model according to the problems to be solved [13–18].

The most important thing in DEA method is to find the appropriate output index and input index. The input indicators are generally considered from the aspects of parameters such as human, financial, and resource resources. The output indicators are determined according to the research topics. Try to find existing recognized data as the output indicators. For example, to study the efficiency of e-government in each province, select the public performance evaluation results of provincial government websites as the output indicators of e-government, and select the popularity of Internet users and information infrastructure as the input indicators.

The weight in model is generated by method programming. It can meet the principle of foothold equality and has been recognized by more and more people. Zhao, Yan, Yang, and Bing used DEA method to comprehensively analyze the equity efficiency in financing of 90 listed companies initially issuing shares in the world in 2018. The research results show that the equity efficiency in financing of listed companies is generally inefficient. Ranas and Sainis make an exploratory study on the efficiency in financing of technological innovation of high-tech enterprises by using DEA model. The research shows that the efficiency in financing of technological innovation of high-tech enterprises is improved year by year, and the use efficiency of equity financing is the best. DEA is a research method of multi-index input and output evaluation. It uses mathematical programming model to calculate and compare the relative efficiency between decision-making units (DMUs) and evaluate the evaluation object. For example, there are 10 schools (i.e. 10 DMUs). Each school has input indicators (such as the per capita investment of students) and output indicators (such as the average score of students, the proportion of students' Mathematical Olympiad competition). Some schools have more investment, and some schools have less investment, but more or less investment will have corresponding output, so which school's input/output is better? The advantages and disadvantages of such input/output can be analyzed by DEA model. To put it simply, there are three people. A uses one a to produce one B, B uses two a 's to produce one B, and C uses three a 's to produce one B. obviously, A has the highest efficiency. We define A as the technological frontier, and A's efficiency is 1. Then, the efficiency of B is $1/2$, and that of C is $1/3$. Thus, we can calculate everyone's efficiency level [19–24].

2. Evaluation and Analysis Methods of Efficiency in Financing of Small and Medium Companies

- (1) Analyzing multiple inputs and outputs is the most obvious advantage of data envelopment analysis. Of course, data envelopment analysis has many other advantages. There are two important links in using data envelopment analysis to construct an article. The first is the construction of decision-making unit. First, it needs to be clear that the decision-making unit is not only an entity, but also a conceptual level, such as agricultural finance, land use, and urban development. As long as you have reason and data, you can build the decision-making unit you need. For the detailed construction principles of the decision-making unit, please refer to data envelopment analysis—let the data speak for themselves by Joe Zhu. However, this does not mean that you can build the decision-making unit at will, because finally you must explain the benefits of the decision-making unit you build. If you are not familiar with the decision-making unit you build, you will have no way to start the final result analysis. Your empirical part will be disconnected from the result analysis part. The

second is the selection of input and output indicators. For the decision-making unit of the entity, the input and output indicators are actually very good to select, but for the decision-making unit at the conceptual level, the input and output indicators are more difficult to select. For example, there are many kinds of input and output indicators in the decision-making unit of “agricultural development.” In this case, according to personal experience, all options are usually listed, and then data are collected to determine the final input and output indicators in combination with the availability of data. In addition, another important thing is that the number of decision-making units should be at least three times or more than the number of input and output indicators, with five times or more being the most appropriate. Joe Zhu explained this in detail in his book.

If you want to make innovations in the article by using data envelopment analysis, I think you need to make breakthroughs in two aspects. The first is the analysis dimension, which is actually the construction of decision-making unit at the conceptual level. Taking agriculture as an example, the novelty of entity decision-making units such as agricultural materials enterprises and large farms is not obvious, and the novelty of conceptual decision-making units such as agricultural finance is not obvious. Too many people have studied them, but the research on poverty alleviation, agricultural water use, and transportation construction is very popular. The second is about the application of the combination model. Those who have done data envelopment analysis will understand that with the help of DEAP 2.1 and other measurement tools, the benefit status of the decision-making unit can be calculated quickly, so its workload is not large, which is a relatively simple thing. In this case, if the research and analysis can be combined with other data models, such as Tobit, Cobb–Douglas, gray prediction, and other models, their highlights will be very prominent. At present, there are many people studying data envelopment analysis + Tobit analysis, so I think the follow-up is of little significance.

When using data envelopment analysis to write articles, I think one of the most difficult points that can reflect personal academic skills and discipline

cultivation is the analysis of results and policy suggestions. The result of data envelopment analysis is a pile of cold data. How to interpret the data is particularly important. For example, the following is the result of data envelopment analysis of urban development. There were problems in pure technical efficiency and scale efficiency in 2010. Among them, pure technical efficiency is more famous. What does this mean? This requires a detailed discussion on the decision-making unit of urban development and what the technical aspects of urban development are, followed by making the corresponding result judgment in combination with the actual situation [25–28].

- (2) Selection of decision-making unit (sample data) in VRS model in order to make the analysis results better reflects the overall situation of efficiency in financing of small and medium companies. This paper selects 80 listed multitype small and medium companies as the reference set, of which 41 are from Shenzhen smaller enterprise board and 24 are mainland enterprises from Hong Kong GEM. Due to the short establishment time of the SME board and the small proportion of companies listed before 2016, this paper only selects the data of listed companies in 2017 and 2018 to analyze the efficiency in financing of science- and technology-based SMEs with direct financing ability in mainland China. The 41 companies in the SME board are mainly concentrated in electronics, medicine and biology, catering services, and information technology industries. The 24 mainland companies in the Hong Kong GEM are from the “List of H-Share Companies of Chinese Enterprises (GEM)” published by the Hong Kong GEM on June 30, 2019, and are distributed in high-tech industries such as electronic and electrical appliances, medicine and pharmacy, medical and health services, Internet consulting suppliers/multimedia, computer products, and application services/software suppliers.

- (3) Selection of evaluation indexes in VRS model
Investment and financing issues mainly reflect the profitability of the project, so that investors can see the return and profitability. Equity financing cost (Re) is calculated as follows:

$$Re = Rf + \beta(Rm - Rf) = \text{risk-free rate of return} + \beta \times \text{rate of market portfolio.} \quad (1)$$

- (4) Construction and evaluation of VRS model

According to the rule of thumb, the number of samples required to build the model is at least twice the sum of input and output items. The number of samples is more than twice the sum of input and

output items, which is in line with the rule of thumb. The DEA method requires that the input and output indicators cannot be negative, and the net profit of some enterprises in the current year is negative, resulting in a negative number in the output.

Therefore, this paper determines that the efficiency in financing of enterprises with negative ROA in the current year is not effective, and its efficiency in financing value is 0. Excluding the decision-making units with negative ROA, there were 58 in 2017 and 56 in 2018.

In this paper, DEA model method is mainly used to conduct multifactor sample research to understand the impact of internal and external factors on efficiency in financing.

The basic principle of DEA model is as follows:

$$\begin{aligned}
 &123 \dots j \dots n \text{ } N \text{ decision – making units (DMUs)} \\
 &v1x_{11}x_{12}x_{13} \dots x_{1j}x_{1n} \\
 &v2x_{21}x_{22}x_{23} \dots x_{2j}x_{2n} \\
 &\vdots \\
 &vi. \\
 &\vdots \\
 &vmx_{m1}x_{m2}x_{m3} \dots x_{mj}x_{mm} \text{ } m \text{ inputs} \\
 &\text{weight coefficient.}
 \end{aligned} \quad (2)$$

For each decision-making unit, DMU_j has a corresponding efficiency evaluation index:

$$\begin{aligned}
 h_j &= \frac{u^T y_j}{v^T x_j} \\
 &= \frac{\sum_{i=1}^n u_i y_{ij}}{\sum_{i=1}^n v_i x_{ij}}, \quad j = 1, 2, \dots, n.
 \end{aligned} \quad (3)$$

We can always take appropriate coefficients V and u so that

$$h_j < 1, \quad j = 1, \dots, n. \quad (4)$$

For the efficiency evaluation of the J_0 decision-making unit, generally speaking, the larger HJ_0 indicates that $dumj_0$ can obtain relatively more outputs with relatively less inputs.

In this way, if we evaluate $dumj_0$ to see whether $dumj_0$ is relatively optimal in these n DMUs, we can investigate the maximum value of HJ_0 when the weight is changed as much as possible. For example, taking the efficiency index of the J_0 decision-making unit as the constraint, the following CCR (C2R) model is constructed:

$$\left\{ \begin{aligned} &\max h_{j_0} = \frac{\sum_{r=1}^s u_r y_{rj_0}}{\sum_{i=1}^m v_i x_{ij_0}} \\ &\text{s.t. } \frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \leq 1, \quad j = 1, 2, \dots, n \\ &u \geq 0, v \geq 0 \end{aligned} \right\}. \quad (5)$$

The above planning model is a fractional planning, which uses Charnes–Cooper change to make

$$\begin{aligned}
 t &= \frac{1}{v^T x_0}, \\
 w &= tv, \\
 \mu &= tu,
 \end{aligned} \quad (6)$$

$$t = \frac{1}{v^T x_0} \Rightarrow w^T x_0 = 1.$$

The linear programming model p can be changed into the following formula:

$$(p) \left\{ \begin{aligned} &\max h_{j_0} = \mu^T y_0 \\ &\text{s.t. } w^T x_j - \mu^T y_j \geq 0, \quad j = 1, 2, \dots, n \\ &w^T x_0 = 1 \\ &w \geq 0, \mu \geq 0 \end{aligned} \right\}. \quad (7)$$

The dual programming of programming p is programming D:

$$\left\{ \begin{aligned} &\min \theta \\ &\text{s.t. } \sum_{j=1}^n \lambda_j x_j \leq \theta x_0 \\ &\sum_{j=1}^n \lambda_j y_j \geq y_0 \\ &\lambda_j \geq 0, \quad j = 1, 2, \dots, n \\ &\theta \text{ Unbound} \end{aligned} \right\}. \quad (8)$$

For the convenience of discussion, calculation, and application, the relaxation factor S^+ and residual variable s^- are further introduced to change the above inequality constraints into equality constraints, as follows:

$$\left\{ \begin{aligned} &\min \theta \\ &\text{s.t. } \sum_{j=1}^n \lambda_j x_j + s^+ = \theta x_0 \\ &\lambda_j \geq 0, \quad j = 1, 2, \dots, n \\ &\theta \text{ Unbound } s^+ \geq 0, s^- \leq 0. \end{aligned} \right\}. \quad (9)$$

The above programming (d) is directly defined as the dual programming of programming (P).

The above is the calculation principle of DEA method. The following can be further understood through the whole calculation flow field, as shown in Figure 1.

3. Efficiency in Financing Theory

3.1. Meaning of Efficiency in Financing. Efficiency, in short, is the input or output in unit time and unit space. Different scholars have different definitions of efficiency in financing. Some scholars believe that efficiency in financing refers to the convenience of enterprise financing, financing cost, financing risk, and other indicators. Some scholars also believe that efficiency in financing refers to

FIGURE 1: Calculation flow of the DEA model.

the change of enterprise capital structure in the financing process; pay attention to the utilization efficiency of funds and the improvement of operating efficiency; and mainly investigate the relevant costs, benefits, and risks of financing; the core of the analysis is capital cost and leverage efficiency. This paper holds that the efficiency in financing of small and medium companies is the evaluation of financing input and output of small and medium companies in a certain time and space. The evaluation of efficiency in financing of small and medium companies mainly includes financing cost, financing mechanism, financing freedom, and financing profit.

3.2. Evaluation Indicators of Efficiency in Financing. The evaluation indicators of efficiency in financing mainly include the following five aspects.

3.2.1. Financing Cost. The cost of financing is the cost that a business has to pay when it raises capital. This cost represents the rate of return of capital. When choosing financing mode, enterprises give priority to the level of financing cost.

3.2.2. Standardization of Financing Mechanism. The standardization of the financing mechanism can also be said to be the maturity of the capital market. The capital market with standardized mechanism often has more financing channels, less risk, and relatively high efficiency. It is difficult to quantitatively describe the financing standardization. Generally speaking, the financing mechanism

can be investigated from several aspects, including policy, bank enterprise relationship, information openness, and whether there is ownership discrimination.

3.2.3. Capital Utilization. The evaluation of enterprise fund utilization rate is mainly carried out from two aspects: fund availability rate and fund utilization rate. The capital in place rate refers to the ratio between the amount of funds already raised and the expected amount of financing funds. The higher the capital in place rate, the more successful the financing of the enterprise. Among the different ways of financing a business, endogenous financing is the most efficient. The financing methods in the stock and bond markets will be undersubscribed, and the financing through bank loans will also be unable to obtain full loans. Fund utilization refers to the ability of financing enterprises to effectively digest funds. Capital utilisation is positively correlated with financing efficiency. Therefore, the higher the fund utilization rate, the higher the efficiency in financing.

3.2.4. Freedom of Financing Subject. Generally speaking, the greater the constraint, the lower the degree of freedom and the lower the final efficiency in financing. From the current financing subject in China, internal financing is less constrained by the outside world, and stock financing is mainly affected by shareholders. Therefore, it has a greater degree of control over funds, while creditor's rights financing is more constrained by creditors. If the bank loans financing now, there are very many constraints, so in general the freedom of debt financing is relatively low.

3.2.5. Financing Risk. Avoid filling out loan contracts roughly. If the purpose and use of the loan in the loan contract are not filled in correctly, the enterprise will be required to repay the loan at any time. In addition, the legal representative and operator of the enterprise still have the legal risk of committing the crime of defrauding loans. It is suggested that enterprises should strictly review the loan contract and treat the non-format part of the contract carefully.

Avoid the invalidity of the bill due to the defects of the recorded items. When the bill lacks or does not comply with the provisions, this may lead to the invalidity of the bill and affect the normal financing of the enterprise. It is recommended that enterprises fully understand the items that must be recorded when issuing bank acceptance bills, such as the words "bank acceptance bill," the entrustment of unconditional payment, the determined amount, the name of the payer, the name of the payee, the date of issuance, and the signature and seal of the drawer. In the absence of any of the above particulars, the bill of exchange shall be null and void. The bank acceptance bill shall be issued by the depositor who opens a deposit account with the acceptance bank.

Loan guarantee refers to the legal act that the bank requires the borrower to provide guarantee to ensure the realization of loan creditor's rights when issuing loans. Loan guarantee, like contract guarantee, includes guarantee, mortgage, and pledge.

Mutual guarantee loan means that two enterprises guarantee each other to obtain loans, bear the guarantee responsibility equally, and apply for loans from financial institutions. This kind of loan method is a financing tool that can obtain large loans without mutual credit guarantee of real collateral.

Joint guarantee loan refers to the loan granted by the bank to any member of the joint guarantee group after multiple natural persons or small enterprises without direct relatives voluntarily form a joint guarantee group.

Avoid the risk of borrowing new and returning old. Both parties of the loan contract agree to repay the old loan with the new loan. As the guarantor of mutual insurance and joint insurance, the guarantor may still bear the guarantee responsibility for the new loan by issuing the consent letter or receiving the notice of borrowing and repaying the old loan. It is suggested that when providing guarantee for others, enterprises should fully consider whether they are willing to bear the guarantee liability for new loans.

Avoid illegal external guarantee. An enterprise's investment in other enterprises or providing guarantee for others shall be decided by the board of directors or the shareholders' meeting (general meeting) in accordance with the provisions of the articles of association. However, the current law does not stipulate that the external guarantee provided by an enterprise in violation of internal procedures shall be deemed invalid; that is, the enterprise still needs to bear the guarantee responsibility.

Avoid providing guarantee for loan contracts suspected of violating laws and regulations. In reality, borrowers often provide false materials or forge materials to defraud bank

loans, which constitutes a crime. Enterprises as guarantors still have the risk of bearing guarantee liability. It is recommended that guarantee is provided for others, especially for enterprises in mutual insurance and joint insurance. When negotiating loans with bank staff, they should try to follow the operating specifications and workflow to avoid participating in the production or submission of false materials. In mutual insurance and joint insurance, if bank staff or other enterprises require or imply that they can make loans only by making fraud and are unwilling to bear risks, they will explicitly refuse and retain relevant evidence.

Avoid senior executives taking responsibility for loans in the name of the enterprise. The person in charge directly responsible for the enterprise pledges the loan in the name of the unit and takes the loan as his own, and the enterprise cannot avoid bearing the repayment responsibility. For enterprises, the most effective preventive measure is to improve the corporate governance structure to ensure its effective operation. Ensure that the business license, organization code certificate, other licenses, property registration form, account opening license, production related qualifications, business status of the main body, and financial statements of the enterprise must indicate its purpose. If it is necessary to affix the official seal, the official seal management personnel shall verify it.

Private financing is a channel and means to obtain monetary funds by paying relatively high interest, which is different from financing from legal financial institutions. Some private small and medium companies have limited funds from formal financial institutions due to their small scale and credit problems. Therefore, they have to choose financing channels other than formal financial funds, and private financing came into being in small and medium companies. After the emergence of private financing, it has played an important role in alleviating the financing difficulties of small and micro enterprises, but there are also problems such as uneven financing institutions and easiness of causing financial risks.

Avoid listing failure. For example, due to obvious doubts about the authenticity of income, significant financial irregularities, or inability of industries or companies requiring special qualifications to obtain qualifications, the enterprise may fall into a financial crisis due to excessive financing expenses in the early stage.

The preventive method is that enterprises should understand the local policy guidance before determining to carry out the financing of the new third board. If the local government promotes the listing of enterprises on the new third board, they should understand the conditions and amount of subsidies issued by the local government. In addition, before considering the listing and financing of the new third board, enterprises should compare various intermediaries to avoid affecting their listing due to the rectification of intermediaries.

Avoid the financing effect falling short of expectations. Although the enterprises are listed on the new third board, the transactions are cold. For example, some enterprises have been listed for more than a year, but there are few transactions. The consequence is that the enterprises cannot

achieve the purpose of financing; not only can they not obtain capital support, but they also spend unnecessary costs. It is recommended that enterprises determine their positioning before determining the financing of the new third board, reasonably evaluate the quotation in the financing roadshow promotion, and carry out necessary promotion after listing.

The whole financing and influencing factors can be as shown in Figure 2.

How do the evaluation indicators reflect the efficiency in financing? For the enterprise itself, they are anti-risk ability, internal management, financial system, and market competitiveness. Specifically, what are the impacts of these four factors on different enterprises. By analyzing the relevant data, we get the results shown in Figure 2.

It can be seen from Figure 3 that the management of high-tech is relatively strict, but the anti-risk ability is relatively weak, and the market competitiveness is very high. The manufacturing industry as a whole is relatively stable, but it also has market competitiveness. For service industry and community enterprises, it is very stable and has high resistance to risks.

Further analysis and research on anti-risk ability are mainly reflected in asset liability ratio, debt service ratio, and current ratio.

$$\text{Asset liability ratio} = \frac{\text{liabilities}}{\text{assets}} \times 100\%. \quad (10)$$

It can reflect the proportion of liabilities. If an enterprise's debt level is already high, you can also compare it with its historical data to see if there is any change and what its profit was when it was in high debt in the past.

$$\text{Cash flow ratio} = \frac{\text{net cash flow from operating activities}}{\text{current liabilities}}. \quad (11)$$

The debt service ratio is to divide the relatively stable corporate profits by the debt level that must be paid. It has a greater reference value than the asset liability ratio. The mystery lies in the word "must." As a natural person, you should always consider repaying the principal and interest on loans, but as an enterprise, if your premise is to operate forever, you do not have to consider paying off the debt at all. You can borrow new debt and repay the old debt. Therefore, to identify a company's good or bad, you only need to look at how much debt it must pay.

$$\text{Current ratio} = \frac{\text{current assets}}{\text{current liabilities}} \times 100\%. \quad (12)$$

Current ratio measures the ratio between current assets and current liabilities. Current assets are assets that can quickly realize, that is, to see whether the money that can be taken out immediately is enough to pay off the debt that needs to be paid immediately. For companies with good market performance, you do not need to pay much attention to this indicator, because even if you cannot afford to pay back the money at the moment, some banks will be willing to provide loans. However, for those enterprises with difficult days and great competitive pressure, we should pay attention to the change of this ratio at any time. After processing the

data, we can get the impact of different types of small and medium companies on asset liability ratio, debt service ratio, and current ratio, as shown in Figure 4.

Figure 4 clearly shows that the assets of high-tech enterprises are in a high operation state, which helps to accelerate the efficiency in financing. The manufacturing industry can accelerate the asset flow due to the ability of rapid manufacturing and sales, which can also realize the capital flow, which is conducive to financing. The other two enterprises have too slow financing due to too slow asset flow.

On this basis, this paper studies and compares the asset liability ratio, debt service ratio, and current ratio of different enterprises in different levels of cities, as shown in Figures 5–7.

Through Figures 5–7, it can be seen that high-tech, manufacturing, service, community, and other enterprises at different urban levels show a high trend in first-tier cities, and high-tech and manufacturing enterprises show a high value. This also has a very important impact on the financing time and efficiency of enterprises. Previous scholars' research on the influencing factors of enterprise efficiency in financing is mostly limited to the impact of a single external environment or enterprise internal environment on efficiency in financing, with less empirical research on enterprise internal and external financing environment at the same time. Enterprise efficiency in financing should be affected by both external financing environment and internal financing environment. The external financing environment indirectly creates opportunities for enterprise financing, while the internal financing environment directly affects the efficiency in financing of enterprises. To sum up, we can understand that external factors and internal factors are jointly composed. We introduce the financing time and efficiency of different enterprises to further understand the financing situation of each enterprise, as shown in Figure 8.

In order to fully understand the financing situation of various enterprises under the condition of multiple factors, here we take the multifactor research parameters of different types of enterprises as an example, use DEAP software to solve the linear programming problem of DEA model, sort out the evaluation results under the influence of the parameters of small and medium companies, and get Table 1.

It can be seen from Table 1 that high-tech enterprises are obviously higher in debt than other enterprises, but their financing efficiency in technology is much higher than that of other enterprises. The scale efficiency is also relatively large, but the overall paid-in capital to property right ratio is relatively high and stable. The debt is also relatively small and relatively stable as a whole. We can get the comparison of efficiency in financing under the influence of multiple factors shown in Figure 9.

Through Figure 9, we can see the peak changes of enterprises under different factors. This change shows the actual impact on efficiency in financing. In view of these situations, we can achieve more efficiency improvement through special schemes. Recommendations will be made in the next section.

FIGURE 2: Financing and influencing factors.

FIGURE 3: Financing factor values of different enterprises.

3.3. Suggestions on Efficiency in Financing of Small and Medium Companies

- (1) Improve strength of high-tech small and medium companies. Medium and small high-tech companies should optimize the financing structure, reduce the debt level, broaden financing channels, and optimize the corporate governance structure, so the efficiency in financing will be improved. Increasing the main business income of the enterprise will contribute to the sustained and stable growth of the enterprise profit. The growth of the enterprise profit will certainly enable the enterprise to have more idle funds for reinvestment and other capital investment in the

main business such as expanding the enterprise scale, so as to continuously expand the enterprise profit and form a virtuous circle conducive to the development of the enterprise. At the same time, it can also improve the core competitiveness of enterprises, enhance the growth of enterprises, and directly contribute to the improvement of enterprise efficiency in financing. As a high-tech smaller enterprise, we must also strengthen technological innovation and improve the high-tech content of products. Under the condition of market economy, technological innovation with the development of new products and the application of new

FIGURE 4: Asset liability ratio, debt service ratio, and current ratio of different enterprises.

FIGURE 5: Asset liability ratio of various industries in different cities.

technologies as the main content is the key to the accelerated development of small and medium companies. Small and medium companies should constantly increase investment in technological innovation and accelerate the renewal of technical equipment, the transformation of process, and the improvement of personnel quality, so as to improve the high-tech content of products, occupy a larger market share, and ensure the growth of main business income.

FIGURE 6: Debt service ratio of various industries in different cities.

- (2) To create a good external financing environment, the state should introduce policies to further encourage and support the development of smaller financial institutions, improve the indirect financing market for small and medium companies, and provide more financial support for small and medium companies. At present, the development of small and medium companies urgently requires more smaller financial institutions to meet their increasing capital needs and make up for the lack of financing support from

FIGURE 7: Current ratio of industries in different cities.

FIGURE 8: Time curve of efficiency in financing of each enterprise.

TABLE 1: Changes in different enterprises under multiple factors.

Enterprise type	Short-term liabilities	Long-term liabilities	Paid-in capital to equity ratio	Comprehensive efficiency	Pure technical efficiency	Scale efficiency
Manufacturing SMEs	0.2	0.1	0.5	0.2	0.3	0.5
Service industry	0.1	0.2	0.4	0.2	0.05	0.1
High-tech	0.3	0.3	0.3	0.5	0.6	0.4
Community type	0.1	0.2	0.2	0.1	0.1	0.1

large financial institutions. Smaller financial institutions have low transaction costs and strong risk control ability. Most smaller financial institutions and small and medium companies have regional

direct dependence. The problem of serious information asymmetry of science- and technology-based small and medium companies can be solved. The state should consider developing a multi-level capital

FIGURE 9: Impact of enterprises under multiple factors.

market, provide direct financing space, and encourage small and medium companies to go public and issue bonds for financing. There is room for direct financing as opposed to indirect financing, and this reduces the risk to society as a whole. Establishing a perfect credit guarantee system can establish a good relationship between small and medium companies and banks, improve the credit degree of small and medium companies, and promote the reform and development of China's credit system. The economic leverage effect of credit guarantee system in the allocation of social resources can reduce the cost of loans for small and medium companies and help to solve the problem of difficult loans for small and medium companies.

4. Conclusion

By using DEA model to calculate the financing efficiency of small-sized and medium-sized enterprises under multiple factors, this paper studies the impact of internal and external financing environment and related factors on enterprise financing efficiency and draws the following conclusions: The factors affecting the efficiency of SME financing are influenced by, among other things, the relationship between financing efficiency and the economy. External financing environment and random factors have a significant impact on the financing efficiency of science- and technology-based small-sized and medium-sized enterprises. The high level of economic development can accelerate the financing efficiency of enterprises, and the investment of government scientific research funds also

has a significant impact on the financing efficiency of enterprises. Enterprise internal financing environment plays an important role in enterprise financing efficiency. Relevant factors will promote the improvement of enterprise financing efficiency, and the increase of the proportion of current liabilities in the debt structure will have a negative impact on enterprise financing efficiency.

At the same time, enterprises should also pay attention to the following:

- (1) For the integration of funds and sales collection, corresponding supporting arrangements should be made to make the capital flow efficiency better. However, in terms of investment, we should reasonably deal with some mortgage or project installment relations in order to really achieve better financing management and bring higher and higher capital efficiency.
- (2) In the process of realizing cash flow sharing, we should reasonably grasp and manage the financing cost and form a reasonable scale. Remember, financing is for the operation of the company, not for financing. The primary and secondary relationship between the two should be clarified. Therefore, in the management process of regional companies, some people believe that it is necessary to grasp all aspects of management measures.
- (3) In terms of financing management, it is necessary to formulate corresponding financing planning, and its enterprise credit management should be more professional and reliable. Standing at the strategic height of the enterprise and analyzing it as a whole, we find that it plays an irreplaceable role in the development of the enterprise. In terms of financing standards, we should continue to establish them to truly form financing evaluation rules.

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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