

The Financing Efficiency of Medical Device Industry in the Secondary Market

Deng Junrong¹, Zhao Huanli²

¹Xidian University, Xi'an 710071

²Xidian University of Economic and Management Xi'an 710071

Abstract: *The growth enterprise market was founded in 2009 for our country, and it received seriously attention and further activate the development for the domestic market. Besides, the source of the growth enterprise market is mainly based on scattered small and medium-sized enterprises which can't satisfy large enterprises that listed on the basic conditions. Owing to enterprise's transaction intrinsic motivation, and formed the growth enterprise market. With the improvement of people's living standard, thus medical equipment companies is playing a more and more important role in our daily life. As the emerging economic enterprise for medical device industry, it also be paid much attention. Moreover, the medical device enterprise's financing efficiency is the decisive factor.*

Keywords: Second board Medical device industry financing efficiency

Main body

According to the latest data, the world's top 25 medical apparatus and instruments sales total accounted for 60% of the world's total sales of medical equipment. For the Europe and the United States developed countries as the center of the new type of medical device industry chain gradually stable. Medical devices industry which including CT, magnetic resonance and high spectrometer will be developed in developed countries in Europe and America. As emerging industry for medical device industry in our country, the government should guarantee the preferential policy, furthermore, it can ensure relatively sufficient cash supply subsidies. To improving production technology, and researching the development of new products, so to meet the market demand.

Studying the medical enterprises' financing efficiency on the second board from this paper, and which mainly through three inputs and three outputs to analyze the financing efficiency. From analyzing the data of 38 marketing enterprises, furthermore, the 34 enterprises is rational.

1. Introduction

1.1 The background and significance for research

1.1.1 Researching background

In developed countries, the medical device industry and the pharmaceutical industry are roughly equal in value. However, the output value of the former is only 1/5 of that of the latter in our country, thus this serious imbalance of proportion was deserved our attention. On the contrast, in the developing countries, such as China's market is mainly produce low-tech medical products.

Therefore, the investment of high-tech medical equipment in China is greatly urgency. Furthermore, because it has a large population desire the medical device to cure their illness which determines the demand for medical equipment

has a huge amount certain. So the China has a huge potential for development of medical equipment market.

1.1.2 The meaning of research

As for the capital and technology intensive enterprise for medical devices industry, which involving a number of science and technology, thus the quality level of science and technology determines the development of medical device industry. The medical device industry has already played an important role in China's science and technology industry and has a strong competitiveness. According to analyze the state of development of medical device industry and the trend of professional medical treatment apparatus in China, thus constructing China's medical equipment industry into emerging industries be well prepared.

Our country should increase the technological input of medical device enterprises, just like supporting and increasing the attention to the high-tech industry. Besides, the government authorities can provide policy to protect the patent in medical device and funding support. At the same time, to speeding up the pace of industrial transformation to improving the medical treatment.

1.2 The main prospects of the medical industry at home and abroad

1.2.1 Research status at abroad

At present, the concept of the financing efficiency is still not very clear definition at abroad. But the foreign enterprises based on the equilibrium theory and the enterprise capital structure and other important theory to research the financing efficiency at home which made a more solid theoretical foil.

Volume 7 Issue 7, July 2018

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY

2. The Theory of Corporate Capital Structure

1) The theory of MM

Shen Yi Feng (1999), who is the professor of financial authority and he said that the mainstream school of western economics could be divided into the three stages of development, and which mainly including traditional capital structure theory, modern capital structure theory and new capital structure theory. As (Modigliani & Miller, 1985) published "The cost of capital, corporate finance and investment theory" who put forward the theory of MM, namely no taxes of the MM theorem and it marks the birth of modern capital structure theory.

2) The theory of signal transfer

In the middle of 1970s, with the foreign scholars in the field of the enterprise capital structure tax environment, lending environment and "external factors" such as bankruptcy costs gradually transferred to the enterprise. Besides, it also including the different investors and managers how to influence and determine the enterprise capital structure from the "internal factors".

3) The theory of credit rationing

Schumpeter who is Austrian economist put forward the innovation theory and the theory comprehensively in his famous book which was named "the theory of economic development" and it affirming the correlation between innovation and finance.

2.1 Financing theory

In the western literature, there is hardly such a concept of enterprise financing efficiency, which may have a great relationship with the existing property organization system or property right system in the west. The decentralization, socialization, marketization and the private characteristics of property right system in western countries as well as the relatively perfect capital market make enterprise financing have the inherent meaning of efficiency naturally. Classical economists who represented by Adam Smith, he realized that the adoption of new products and technologies was the main source of social and economic development.

2.2 The theory of financing efficiency

When summarized the related financing theory, it belongs to the category of microeconomic efficiency determines the enterprises' financing efficiency, it refers to the micro economic subject for production operation and financing ability and the effectiveness of the implementation, including the embodiment of the amount of the financing efficiency of enterprises, enterprises financing efficiency qualitatively reflect efficiency and institutional arrangement. The low degree of integration between science and technology and finance is the main reason for the financing fault of medical device enterprises, and the insufficient effective supply of funds is one of the reasons for the low financing efficiency of high-tech enterprises.

2.2.1 Domestic development and related research theories

1) The related theory on second board in our country

Cao Dong (2007) in the literature and thinking of the growth enterprise market big development in China, the growth enterprise market is mainly for those who have potential and long-term development of small and medium-sized enterprise service, it can be seen that the growth enterprise market of the barriers to entry are compared, the specific net profit of enterprise and enterprise profit no particular high demand. The pharmaceutical, medical and biological industry is an indispensable part of life. It is becoming more and more important in the high-tech industry.

Yin Lili (2017) on October 30, 2009, the growth enterprise market, mainly for independent innovation and growth enterprises, emerged at the historic moment. Although the establishment of gem is not long, but its development speed is fast. As of February 28, 2017, the number of enterprises listed on the gem increased from 28 at the beginning to 601.

2) Related financing efficiency theory

Ye Wang Chun (2000), based on the analysis of financial efficiency will be the financial efficiency is decomposed into the financial market efficiency, efficiency of commercial Banks and non-bank financial institutions, enterprises financing efficiency of monetary, financial macro efficiency and central Banks the regulation efficiency of these aspects.

Liu Hai Hong (2000) who from the fickle kinds of capital is essentially a process of "pointed out that corporate financing in the form of money supply and demand of resources disposition process", because it is always the fickle kinds of funds prompted to individual yields higher enterprise flow. Whether an enterprise can obtain funds, in what form and through what channels, that is, the size of its financing capacity the connotation of the concept of enterprise financing efficiency.

2.3 The main innovation of this paper

The main innovation points of this paper is to, there is no research on the growth enterprise market of medical apparatus and instruments industry specific financing efficiency analysis, and its relevant variables have done the relative innovation and change, pay more attention to enterprise input or output of the relative growth rate. The main output variables include the growth rate of intangible assets, the growth rate of net assets and the income of main businesses. The input variables mainly include the main business cost, the total assets of the enterprise and the ratio of assets to liabilities.

2.4 The main methods involved

1) Normative research and empirical analysis: both are widely used methods in scientific research. Generally speaking, the former focuses on the rational judgment of

the research object, while the latter focuses on the objective description of the research object.

- 2) Combination of qualitative and quantitative analysis: it qualitatively studies the influencing factors of financing efficiency of high-tech enterprises, the characteristics of capital supply and demand of high-tech enterprises, and the selection of financing methods. Quantitative analysis method is adopted to analyze a large number of data in the evaluation of financing efficiency combined with financial indicators, and the results are fully explained.
- 3) Literature classification: consult a large number of literature, through the understanding of the literature, summarizes the conclusion of previous literature, summed up the literature about the gem and main board before the crux of the information disclosed the question research.
- 4) The method of comparative analysis: as in the high and new technology enterprise of our country money supply status quo analysis, comparative analysis with historical data, then explain the funds inadequacy of effective supply in evaluation, the financing efficiency of high-tech enterprise continuous years comparative analysis, explain the reason for its trend and the efficiency is not high, and so on.

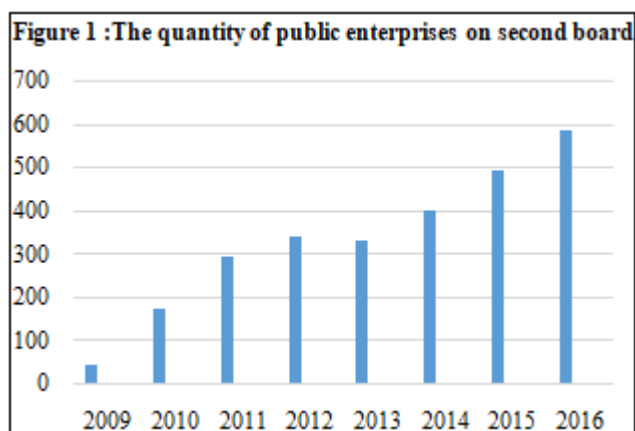
3. Relevant theoretical definition and theoretical basis

3.1 Relevant theories and definitions of second market

Cao Dong in the literature and thinking of the growth enterprise market big development in China, the growth enterprise market is mainly for those who have potential and long-term development of small and medium-sized enterprise service, it can be seen that the growth enterprise market of the barriers to entry are compared, the specific net profit of enterprise and enterprise profit no particular high demand.

3.1.1 Development status of gem market

As the follow picture, which shows that the quantity of the public corporations.

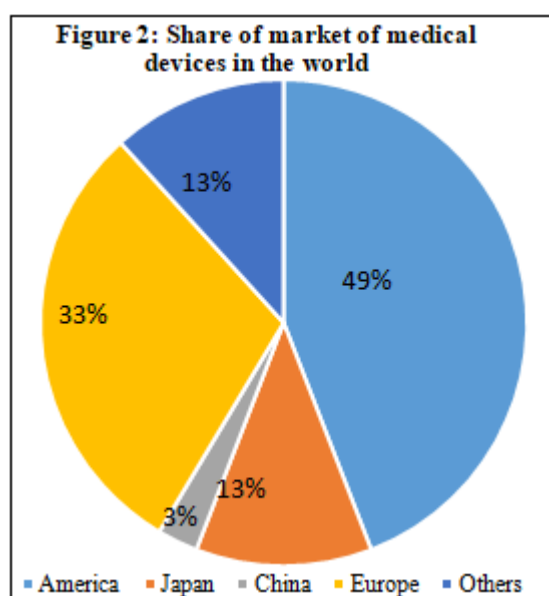


3.2 The definitions of the medical device industry

3.2.1 Definition of medical device industry related concepts

Medical equipment industry is a sunrise industry developed in recent years, it is a blend of high and new technology industry's development and progress, has played a large role on the development of enterprises, the regulations on the supervision and administration of medical devices in clearly gives the definition of medical apparatus and instruments, medical equipment, which namely refers to directly or indirectly for human instrument, equipment, instruments, in vitro diagnostic reagents and calibration, materials, and other similar or related items, including computer software that is needed.

3.2.2 The share of market for medical devices in the world



Source from: The European commission on medical devices

China has been one of the fastest growing economies in the world with a GDP of 7.7 percent in 2013. China's medical device market is ranked second largest in the world.

The global medical device industry is mainly concentrated in Europe, America, Japan, Germany and other developed countries, and China's medical device enterprises are still underdeveloped. Continued increase in the global economic integration and the Chinese government to guide the backdrop of the support, medical equipment industry development in our country present a prosperous and active new look, industry maintained a rapid development momentum. According to the statistics, the compound annual growth rate of medical device industry was about 23.3% from 2011 to 2013, higher than the compound annual growth rate of China's pharmaceutical industry at the same time by 21.5%.

3.3 Relevant definitions of financing efficiency

The word of “efficiency” the notion is a percentage, it equals It's the ratio of input to output. Economic activity, first we will invest, invest a certain amount of money, labor, or other fixed assets, and then we will wait for the output, efficiency is to measure how much we can switch back to the former for the latter. Economists in different fields have different understandings of efficiency.

1) The theory of classical economy

The classical economists' study of efficiency is only a preliminary understanding, they only have some superficial concepts in this aspect, and they do not form a rigorous theoretical system. First came the idea of efficiency, in 1776, when he used productivity. Adam Smith then extended the concept of turning "productivity" into "labor productivity".

2) The theory of efficiency

New classical economists also interested in efficiency and study it, the famous economist which is Pareto refers the theory of efficiency always be applied. The theme of these economists' research is the efficiency of resource allocation. In microeconomics, we ever learn "Pareto efficiency", this is Pareto, and that was the first time in 1896 have been proposed, he assuming that the allocation of resources has been identified, no longer change, in this case, if the change of other conditions, of a good is equal to another person go bad to replace, namely, the allocation of resources to achieve the most effective. However, this analysis is still flawed, which can only be studied statically, so it cannot calculate the accurate efficiency value.

3.4 The development of medical devices enterprises on second board

3.4.1 The proportion of medical device industry

Among the listed companies of Shenzhen securities LTD, medical device enterprises (subdivided on the website Tong Huashun), in Shenzhen stock exchange, mainly belong to the part of manufacturing industry, accounting for about 1/10. So the medical device industry is important for the domestic economy.

3.4.2 Major financing models and structure

The fund supply of medical device enterprises can be divided into two sources: one is the external fund supply of enterprises, and the other is the fund formed by the self-accumulation of enterprises for the development and use of enterprises. Only money supply, to promote independent innovation of enterprise, can have a first-class advanced technology, in order to have advantage position in the international market competition, in order to have a group of high and new technology enterprises with intellectual property, realize the whole of science and technology innovation ability raise, to build an innovative country. Therefore, the development of high and new technology enterprise, still need to external financial institutions financial support.

4. Empirical Analysis

4.1 DEA-model

DEAP which was written by Tim Coelli. This program is used to construct DEA frontiers for the calculation of technical and cost efficiencies and also for the calculation of Malmquist TFP Indices. The program has three principle DEA options: Standard CRS and VRS DEA models that involve the calculation of technical and scale efficiencies (where applicable). The application of Malmquist DEA methods to panel data to calculate indices of total factor productivity (TFP) change; technological change; technical efficiency change and scale efficiency change.

4.2 Construction of BBC and CCR models for growth enterprise market

As Farel considered that, the efficiency of technology which reflects that the technical efficiency, it reflects the enterprise under the given input for maximum output capacity allocation efficiency of it is reflected in the established level of the price and production technology, enterprise ability to use the best investment proportion,

Technical efficiency is reflected in the ability of an enterprise to obtain the maximum output from production with a given input. The technical efficiency measures the distance between the enterprise under investigation and the production front when the scale remuneration remains the same. In addition, technical efficiency can be further decomposed into pure technical efficiency and scale efficiency.

At the same time, the pure technical efficiency measures the distance between the enterprise and the production front when the scale remuneration is variable. Furthermore, the scale efficiency measures the relationship between the production frontier with constant scale reward and the production frontier with variable scale reward.

4.3 Selection of relevant indicator variables

4.3.1 The index of output that mainly including main business income, the growth rate of intangible assets, and the net capital increasing ratio. What's more, it mainly includes enterprise size and asset structure, financing cost, financing channels and financing structure, profitability and success.

In the long run, period and future expectation of investment projects. Measurement and evaluation of the efficiency of financing is mainly by fuzzy evaluation and hierarchical analysis method, is the evaluation on the efficiency of the financing way and existence concept and conclusion incomplete, hard to avoid the subjectivity of the DEA method and effectiveness of the mathematics analysis the effectiveness of the “Pareto effect” in the economic phenomena.

4.3.2 Dimensionless quantization formula

Induces of input and output all have different units, but it is not the problem. The decisions of The optimal efficiency of decision-making units index has nothing to do with chooses The dimension of input and output index, but in The model requirement for input and output indicators of nonnegative, in practical application, The original data may be negative. The input formula is dimensionless as follows:

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

$$m_j = \min(x_{ij}) \quad M_j = \max(x_{ij}) \quad i=(1,2,\dots,n)$$

4.4 Analysis on financing efficiency of medical industry in gem market

As shown in figure,the maximum value and standard deviation of 34 medical device enterprises in the gem market were systematically described. Then the specific analysis is carried out to replace the scale of diminishing returns, increasing or unchanged. Technical efficiency = pure technical efficiency x scale efficiency

Table 1: Analysis on financing efficiency of 34 medical device industries in 2016

Firm	crste	vrste	scale		
Ed Biological	1.000	1.000	1.000	-	1
Derrick medical	1.000	1.000	1.000	-	2
Canmax	1.000	1.000	1.000	-	3
Sinocare Inc	1.000	1.000	1.000	-	4
Edan Instruments	1.000	1.000	1.000	-	5
Tofflon	0.536	0.568	0.943	irs	6
Hokai Medical	1.000	1.000	1.000	-	7
Sanxin Medtec	1.000	1.000	1.000	-	8
Improve Medical	1.000	1.000	1.000	-	9
Robot	0.279	0.328	0.853	irs	10
ZhongYuan Stock	1.000	1.000	1.000	-	11
Chieftain Control	0.148	0.350	0.423	irs	12
Wolwo	0.516	0.553	0.934	drs	13
David Medical Device	1.000	1.000	1.000	-	14
Biolight	0.663	0.740	0.896	drs	15
Kaibao	0.133	0.150	0.887	irs	16
Furui Medical	1.000	1.000	1.000	-	17
Lepu Medical	0.333	0.513	0.649	drs	18
Anke Biotechnology	1.000	1.000	1.000	-	19
Kinetic Medical	0.915	0.929	0.985	irs	20
Tigermed Consulting	0.228	0.244	0.935	irs	21
Aier Eye Hospital	0.028	0.057	0.497	irs	22
Biotechnologies	1.000	1.000	1.000	-	23
Bohui Innovation	0.448	0.500	0.897	irs	24
Wondfo Biotech	1.000	1.000	1.000	-	25
Chnsun	0.251	0.258	0.976	drs	26
Autek China	0.184	0.186	0.990	irs	27
SonoscapeMedical	1.000	1.000	1.000	-	28
Starway	0.312	0.500	0.623	irs	29
LeKing Wellness	0.628	1.000	0.628		30
Jafron Biomedical	0.811	1.000	0.811	irs	31
Transtek Medical	0.177	0.323	0.546	drs	32
Grandhope Biotech	0.900	1.000	0.900	irs	33

Dian Diagnostics	0.622	1.000	0.622	drs	34
Mean	0.680	0.741	0.882		

It can be seen from the above table, “-”represents unchangedscale, the DRS which shows decreased scale, IRSwhich describes increased scale, it can be clearly seen that the 16 firm of scale is unchanged,which represents the firms is efficiency. Furthermore, Comprehensive technical efficiency is a comprehensive measure and evaluation of the resource allocation ability and resource utilization efficiency of decision making units.

Pure technical efficiency is the production efficiency influenced by management and technology, while scale efficiency is the production efficiency influenced by enterprise size. It is generally believed that comprehensive technical efficiency = pure technical efficiency *scale efficiency.

In detail, the comprehensive technical efficiency =1 which indicates that the input and output of the decision-making unit is comprehensive and effective,both technical efficiency and scale efficiency. Pure technical efficiency = 1, it was said that the use of its resources is efficient in the current technical, and the root cause of the failed to achieve comprehensive and effective is its size is invalid, so its reform is focused on how to better play its scale.

Table 2: The loose variables of output

Firm	Main business income	Growth rate of intangible assets	The increase rate of net asset
Tofflon	518.053	0.000	0.000
Robot	748.176	114.715	0.000
Chieftain Control	508.836	111.872	604.888
Wolwo	432.846	287.796	0.000
Biolight	0.000	26.349	0.000
Kaibao Pharmaceutical	751.020	0.000	334.791
Lepu Medical	787.744	0.000	0.000
Kinetic Medical	170.464	0.000	0.000
Tigermed Consulting	717.022	0.000	120.911
Aier Eye Hospital	660.819	0.000	227.085
Bohui Innovation	333.042	83.102	0.000
Chnsun	0.000	31.549	0.000
Autek China	592.895	235.464	0.000
Starway	114.396	0.000	234.757
Jafron Biomedical	85.037	0.000	0.000
Grandhope Biotech	317.983	79.823	0.000
Mean	198.186	28.549	44.777

As shown in the above chart which was named the loose variables of output, it can be obviously shown that the company of Chieftain Control Engineering Technology, Kaibao, Tigermed, Strawy and Aier Eye Hospital of the increase ratio of net asset still has a large space to improve. Furthermore, the firm of WOLWOand Autek China should pay much attention on their Growth rate of intangible assets. Finally, except a few companies, the most firms should

increase their main business revenue.

Table 3: The loose variables of input

Firm	Total asset	Main Business cost	Balance sheet ratios
Tofflon	310.645	12.397	0.000
Chieftain Control	0.000	0.000	325.059
Wolwo	0.000	0.000	183.641
Biolight	0.000	0.000	310.358
Kaibao Pharmaceutical	2.062	0.000	0.000
Lepu Medical	99.137	0.000	0.000
Tigermed Consulting	14.220	0.000	0.000
Aier Eye Hospital	7.165	0.382	0.000
Bohui Innovation	1.291	0.618	0.000
Chnsun	9.279	0.000	0.000
Starway	8.343	12.189	0.000
Jafron Biomedical	29.283	90.836	0.000
Transtek Medical	0.000	31.571	91.783
Grandhope Biotech	21.437	114.991	0.000
Mean	14.790	7.735	26.789

As shown in the above table, the table mainly illustrates that the loose of input. It can be clearly represents that the firm of Biolight, Chieftain Control should improve their balance sheet ratios and finally to promote their financing efficiency. Besides, the company of Tofflon should increase its total assets. Last but not least, the firm of Jafron Biomedical and Grandhope Biotech could improve their main business revenue.

5. The main suggestions and measures

5.1 Some advices and actions for internal financing

- 1) Enterprises should standardize the financial system and improve the efficiency of capital utilization. Modern enterprise financial management system mainly includes working capital management, long-term capital structure management, and the cost and profit management. We will strengthen the construction of employee organizations to enhance the competitiveness of enterprises in science and technology, establish an internal tolerance mechanism for R&D failure, and strengthen intellectual protection of their own property rights.
- 2) Enterprise's R&D is the important guarantee of medical device companies realize rapid growth, according to different stages of enterprise development characteristics of the demand for funds rationally choose the financing way, to effectively improve the efficiency of its financing. For enterprises in the stage of research and development, the optimization of internal capital structure should be strengthened and the ability of transformation of research and development results should be strengthened.

5.2 Some suggestions and measures for external financing

- 1) Government should constantly optimize the enterprise's external financing environment, establish a service for medical equipment enterprise financing professional organization, for the medical device companies provide small free of fixed assets to pledge loan, loan guarantees and other indirect financing of local government. At the same time, we will vigorously develop specialized private equity financing institutions to help high-tech medical device enterprises share the excessive risks in the R&D process. In addition, the government should strengthen the efficiency and structure of its own financing and continuously strengthen preferential policies and subsidy policies for medical device enterprises.
- 2) By encouraging to medical equipment enterprises financing credit policy and for this kind of enterprise R&D spending to reduce tax obligations corresponding tax policy, further money supply tensions ease in the process of research and development of technology-based.

References

- [1] Banker R. D, Charnes A. and Cooper W. W. *Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis*[J]. Management Science, 1984, 30(9):1078-1092.
- [2] Berger A. N., Udell G. F. *Small Business Credit Availability and Relationship Lending: The Importance of Bank Organizational Structure* [J]. The Economic Journal, 2002,112(477):F32-F53.
- [3] Bradford W. D, Chao Chen. *Creating Government Financing Programs for Small-and Medium-Sized Enterprises in China*[J]. China&World Economy, 2004, 12(-):50-b5.
- [4] Charnes A, Cooper W. W. Golany B, Seiford L and Stutz J. *Foundation of Data Envelopment Analysis for Pareto-Koopmans Efficient Empirical Production Functions*[J]. Journal of Econometrics, 1985, 30(85):91 – 107.
- [5] Charnes A., Cooper W. W. and Quanling Wei. *A Semi-infinite Multicriteria Programming Approach to Data Envelopment Analysis with Infinitely Many Decision-Making Units*[R]. Center for Cybernetic Studies Report, CCS 551, 1986.
- [6] Dixon-Woods Mary, Amalberti Rene, Goodman Steve et al. *Problems and promises of innovation: why healthcare needs to rethink its love/hate relationship with the new.*[J]. BMJ Quality and Safety, 2011, 20 Suppl 1.
- [7] Fare R., Grosskopf S., Norris M. and Zhongyang Zhang. *Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries*[J]. The American Economic Review, 1994, 84(1):66-83.
- [8] Farrell M. J. *The Measurement of Productive Efficiency*[J]. Journal of the Royal Statistical Society, 1957, 120(3):253-290.

- [9] Stiglitz J. E., Weiss A. *Credit Rationing in Markets with Imperfect Information* [J]. The American Economic Review, 1981, 71(3):393-410.
- [10] Fare, R.S.Grosskopf, P.Roos,Malmquist. *Productivity Indexes: A Survey of Theory and Practice*[M]. Boston Kluwer Academic Publisers,1998:1731-1743.
- [11] Booth, Aivazian, Demirguc Kunt, *Capital Structure in Developing Countries* [J]. Journal of Finance,2001(56) :87-130.
- [12] Myers.S,N.S.Majluf. *Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have*[J].Journal of Financial Economies,1984 (13):78-90
- [13] Stephen.A.Ross.*The Determination of Financial Structure:The Incentive signaling Approach*[J]. Bell Journal of Economics,1977(8):23-40
- [14] Sulla, Victor, Sarria-Allende, Virginia. *Small and Medium Size Enterprise Financing in Eastern Europe*. [J].American Economic Review,2003(6):459-487.