The Impact of Registration System Reform on Corporate Financing Efficiency—A Case Study on the GEM

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Abstract: In this paper, a data envelopment analysis (DEA) model was used to study the impact of the registration system reform on corporate financing efficiency with enterprises of the Growth Enterprise Market (GEM) as examples. The paper starts with theories related to financing structure and efficiency, and expounds basic theories involved in the analysis process. Later in the empirical analysis part, relevant data of GEM enterprises from 2018 to 2022 were collected and processed to determine input indicators such as the turnover rate and output indicators such as the amount of capital raised in the initial offering for empirical comparative analysis. It is finally concluded that the registration system reform positively affects corporate financing efficiency. Specifically, after the reform, there are changes including more diversified corporate financing channels, improvement of pure efficiency and scale efficiency to different extents, lower financing cost, and higher financing efficiency. The findings can provide some reference for corporate financing, and some policy recommendations are lastly presented on other factors affecting the efficiency of registration system implementation, hoping to provide some insight into the development of securities market.

Keywords: Registration System, Financing Efficiency, GEM, Data Envelopment Analysis (DEA) Model

1. Introduction

Capital is one of the important operational elements in business operation. In the prevailing viewpoint, the purpose of enterprise operation is to pursue the maximization of capital value, which is essentially to obtain capital appreciation through financial activities. However, capital appreciation requires continuous operation of capital, including enterprises' production, operation and investment activities, which all require surplus funds held by the enterprises. When the capital held by an enterprise is insufficient to meet its investment or operation needs for various reasons, it needs to consider financing. Since 1990, the Shenzhen Stock Exchange and the Shanghai Stock Exchange have been open to transactions, marking the establishment of China's stock market. After developing for decades, the securities market has become the most important capital market in the market economy and an important channel for enterprise financing. In the course of the continuous development of the stock market, we have gradually realized the significant impact of financing efficiency on enterprises. Enterprises with high financing efficiency can access funds fasters with less costs, thus satisfying their own capital needs with low risk. In order to study the efficiency of corporate financing, it is necessary to analyze, consider and research in a comprehensive manner upon drawing on the relevant theories and cost effects of previous generations.

2. Analysis Methods Related with Equity Financing Efficiency

2.1. The Concept of Equity Financing Efficiency

Equity represents the way of corporate financing mainly through issuing shares, and equity financing is a kind of exogenous financing. In terms of efficiency, enterprises should consider the relationship between what they cost and what they get when carrying out equity financing, and strive to raise capital with less financing costs, so as to reduce costs and increase revenues.

2.2. Overview on DEA Model

There are many research methods for the empirical analysis of equity financing, such as DEA model, SBM model, Malmquist index, super-efficient EBM model, difference-in-difference method (PSM-DID), constrained dependent variable regression model (Tobit), *etc*. In this paper, the data envelopment analysis (DEA) method was used for analysis.

DEA was proposed by Charnes (1978) *et al.* as a performance assessment approach, with the concept of relative performance as a theoretical basis. Being a method of operational research and one studying economic production frontiers, DEA can be used to assess the effectiveness for multiple input and output indicators. Expressed as the ratio of output to investment, the method is generally used to measure some decision sectors' production efficiency .

The main reasons for choosing DEA model are as follows. Firstly, traditional efficiency assessment methods have to consider whether the selected indicators can be converted into the same unit, thus there are certain restrictions on the selection of indicators, while DEA model is suitable for analyzing multiple inputs and outputs and decisions that cannot be converted into the same unit. Secondly, DEA is a non-parametric economic model with direct data input, so it is not necessary to build a mathematical function model to predict the parameters, and it is more objective and comprehensive to measure the relevant indicators by DEA. Finally, DEA model can not only effectively assess the impact of registration system on financing efficiency, but also provide relevant strategy support according to the results, and its analysis angle is more consistent with the connotation of financing efficiency, and its measurement is more accurate and objective[1].

3. Analysis of the Impact of Registration System Reform on the Financing Efficiency of GEM Enterprises

3.1. Impact of Registration System Reform on the Financing Efficiency of GEM Enterprises

The BCC model in DEA model was applied to argue whether the efficiency of corporate finance is really improved. The interval from January 2018 to December 2022 was selected for the analysis and divided into two equal time periods, including (a) January 2018 to June 2020 with 30 sets of data before the registration system and (b) July 2020 to December 2022 with 30 sets of data after that. This time span was chosen because, on the one hand, it was not a long time span and there were fewer influencing factors, i.e., it is assumed that the changes in corporate financing efficiency were only caused by the changes in the stock issuance system and had little relationship with other factors such as the impact of the epidemic and the economic environment; on the other hand, the data used were close to the real situations at present, while using the month as the sample unit and expanding the sample capacity made the analysis more accurate. The data used in the empirical analysis were obtained from Wind, Shenzhen Stock Exchange and publicly disclosed financial reports.

3.2. Sample Selection

The number of IPO companies, the number of delisted companies, and the annual turnover rate of stocks were selected as input variables, while the total amount of IPO and the total amount of capital raised by additional issue were taken as output variables. The analysis data were obtained from Shenzhen Stock Exchange.

3.2.1. Selection of Input Indicators and the Seasons

(1) Number of IPO companies: The advantageous approval time of the registration system and the relaxation of listing requirements made the number of IPO companies under the system significantly higher than under the approval system, so the number of new IPO listed companies before and after the implementation of the registration system can be used to reflect the changes in the system of issuing new shares.

(2) The number of delisted companies: Because the core advantage of the registration system is "the implementation of market-based delisting standards", the number of delisted companies would increase significantly under the registration system. The data for the month with currently 0 delisted company was changed to 0.001 for data processing[2].

(3) Stock turnover rate: The turnover rate refers to the frequency of stock trading, which can reflect

the supply and demand of shares. A higher the turnover rate indicates more frequent trading and stronger liquidity. The securities market is usually more active under the registration system[3].

3.2.2. Selection of Output Indicators and the Reasons

(1) Amount of IPO: The amount of IPO can directly reflect the results of corporate financing efficiency. In order to compare and analyze the corporate financing efficiencies before and after the implementation of the registration system, the amount of IPO was selected as the output indicator. The larger the value, the easier it is for corporate financing, and the higher the financing efficiency.

(2) Total amount of capital raised by additional issue: Additional issue is a financing method in which an enterprise that had issued shares raises capital by offering additional shares to specific investors or all investors. There is no fixed maturity date for additionally issued shares, which require no repayment at maturity like debt, and can quickly raise a large amount of capital for the enterprise's production and operation or investment activities. In general, the total amount of capital raised by additional issue is positively correlated with the financing capacity of the enterprise.

3.3. Data Analysis

After determining the input and output indicators separately, the raw data were determined as shown table 1.

Table 1: Overview on the Initial Data

Before the implementation of the registration system (Jan. 2018 to Jun. 2020)	Total (0.1 Billion CNY)	Mean	After the implementation of the registration system (Jul. 2020 to Dec. 2022)	Total (0.1 Billion CNY)	Mean
Amount of IPO	747	25	Amount of IPO	4005	134
Amount of additional issue	1380	46	Amount of additional issue	3738	125
Number of IPO companies	109	3.63	Number of IPO companies	428	14.27
Number of delisted companies	10	0.33	Number of delisted companies	28	0.93
Turnover rate	/	77.10	Turnover rate	/	92.34

As can be seen from the above table, before the implementation of the registration system, the total amount of IPO was 74.7 billion CNY (the monthly average of 2.5 billion CNY); the total amount of additional issue was 138 billion CNY (the monthly average of 4.6 billion CNY); the total number of IPO companies was 109 (the monthly average of 3.63); the total number of delisted companies was 10 (the monthly average of 0.33). After the implementation, the total amount of IPO for the 30 months from July 2020 to December 2022 was 400.5 billion CNY (the monthly average of 13.4 billion CNY); and the total amount of additional issue was 373.8 billion CNY (the monthly average of 12.5 billion CNY); a total of 428 companies (the monthly average of 14.27) passed the IPO meeting, and a total of 28 companies (the monthly average of 0.93) delisted. From the above data, it can be seen that after the implementation of the registration system in the GEM, the amount of initial and additional issue financing of GEM as well as the turnover rate, the number of listed and delisted companies had increased significantly, and the financing efficiency seemed to have been improved, but whether this change trend is caused by the implementation of the registration system needs to be further proved by empirical tests.

In this paper, DEAP2.1 software was used to measure the value of financing efficiency for the 60 months before and after the implementation, and the output decision model (*i.e.,* in the case of determined input factors, obtain the maximum value of financing efficiency as the output) was selected. The empirical evidence was based on a multi-stage model, while returns to scale was set to variable [4]. The output results are as table 2.

Table 2: Results of Empirical Analysis

Efficiency summary.				
Firm	Comprehensive efficiency	Pure technical efficiency	Scale efficiency	
2018.01	0.98	1	0.98	irs (incremental return to scale)
2018.02	0.721	1	0.721	irs
2018.03	0.55	0.55	1	-
2018.04	0.834	0.834	1	-
2018.05	0.583	0.583	1	-

2018.06	1	1	1	-
2018.07	1	1	1	-
2018.08	0.339	1	0.339	irs
2018.09	0.144	1	0.144	irs
2018.10	1	1	1	-
2018.11	0.218	0.218	1	-
2018.12	0.405	0.533	0.759	irs
2019.01	1	1	1	-
2019.02	0.885	1	0.885	irs
2019.03	0.358	0.364	0.984	irs
2019.04	0.419	0.422	0.993	irs
2019.05	0.288	0.363	0.794	irs
2019.06	0.496	0.765	0.649	irs
2019.07	0.223	0.276	0.807	irs
2019.08	0.465	0.549	0.847	irs
2019.09	0.43	0.456	0.943	irs
2019.10	0.488	1	0.488	irs
2019.11	0.35	0.402	0.869	irs
2019.12	0.465	0.481	0.966	irs
2020.01	0.246	0.353	0.697	irs
2020.02	0.158	0.184	0.857	irs
2020.03	0.284	0.304	0.932	irs
2020.04	0.361	0.373	0.968	irs
2020.05	0.782	0.795	0.984	irs
2020.06	0.265	0.288	0.918	irs
mean	0.524	0.636	0.851	
2020.07	0.286	0.296	0.965	drs (diminishing return to scale)
2020.08	0.814	0.85	0.958	drs
2020.09	0.473	0.54	0.877	drs
2020.10	1	1	1	-
2020.11	0.425	0.429	0.989	drs
2020.12	0.452	0.453	0.999	irs
2021.01	0.925	0.925	1	-
2021.02	0.564	0.93	0.606	irs
2021.03	0.502	0.505	0.994	irs
2021.04	0.712	0.765	0.931	drs
2021.05	0.402	0.492	0.818	irs
2021.06	0.319	0.323	0.989	irs
2021.07	0.39	0.407	0.957	drs
2021.08	0.537	0.588	0.913	drs
2021.09	0.36	0.361	0.995	irs
2021.10	0.892	0.93	0.959	irs
2021.11	0.654	0.654	1	-
2021.12	1	1	1	-
2022.01	0.854	0.855	0.999	irs
2022.02	0.914	1	0.914	irs
2022.03	1	1	1	-
2022.04	0.744	0.744	0.999	irs
2022.05	0.33	0.375	0.879	irs
2022.06	0.55	0.558	0.986	irs
2022.07	1	1	1	-
2022.08	0.86	0.863	0.997	irs
2022.09	1	1	1	-
2022.10	0.645	1	0.645	irs
2022.11	0.844	0.856	0.986	irs
2022.12	1	1	1	-
mean	0.68	0.72	0.95	

In the above table, "Firm" represents the 60 samples of decision units, which were divided into two groups of 30 samples before and after the implementation of the registration system. In terms of the result, technical efficiency (the gap between the maximum possible amount and the actual amount of financing) was to examine the technological development effect of the market scale efficiency, which is the part of efficiency arisen from financial institutional settings, equity policies, financial institutions' operations,

regulation and scientific and technological progress; scale efficiency (the gap between the possible optimal financing size and the actual size) was to examine the effect of market scale of the market scale efficiency. Technical efficiency and scale efficiency are breakdowns of the overall efficiency, as well as the benefits arisen from the development, capital optimization, and securities market size, (the "irs", "-" and "drs" in the last column, respectively, indicated increasing, constant and decreasing market size benefits); comprehensive efficiency is the efficiency of financing (total efficiency / technical efficiency) without considering the returns to scale, and is the evaluation of the efficiency of the fund use in the stock market determined by the system of (IPO financing amount reflects efficiency of resource allocation) [5].

Assuming that financing efficiency (total efficiency/comprehensive efficiency/technical efficiency) = pure technical efficiency × scale efficiency, this is the financing efficiency studied in this paper[6]. The results, as shown table 3, are summarized from the measurements in the above table.

Table 3: Summary of Empirical Analysis

Type	Efficiency Scale	Before the implementation of GEM registration system (Jan. 2018 – Jun. 2020)	After the implementation of GEM registration system (Jul. 2020 – Dec. 2022)
Financing efficiency (total efficiency/comprehensive efficiency/technical efficiency)	Comprehensive efficiency = 1	4	6
	0.8≤ Comprehensive efficiency <1	3	7
	0≤ Comprehensive efficiency <0.8	23	17
	Average	0.52	0.68
Pure technical efficiency (Gap between possible maximum amount of financing and the actual amount)	Pure technical efficiency = 1	10	8
	0.8 ≤ pure technical efficiency <1	1	7
	0 ≤ pure technical efficiency <0.8	19	15
	Average	0.64	0.72
Scale efficiency (Gap between possible maximum financing size and the actual size)	Scale efficiency = 1	8	8
	0.8 ≤ scale efficiency <1	14	20
	0 ≤ scale efficiency <0.8	8	2
	Average	0.85	0.95

3.4. Conclusions of the Empirical Analysis

Based on the empirical analysis, two main empirical conclusions can be drawn as follows:

(i) Scale efficiency (representing the gap between the possible maximum financing size and the actual size) was improved after the implementation of the GEM registration system; among the 30 months before the implementation, 8 and 14 months had the efficiencies of 1 and 0.8, respectively; after the implementation, about 20 months had a scale efficiency of 0.8, which was more improved than before the implementation. However, some months showed diminishing returns to scale after the implementation, which may be influenced by some other uncertainties in the real situation. Analyzed from the perspective of limited market resources alone, this suggests that the size of the securities market in China reached the top after the implementation, and therefore must be reduced for higher efficiency.

(ii) Pure technical efficiency (representing the difference between the possible maximum amount of financing and the actual amount) was also improved. Without considering scale efficiency, the larger the pure technical efficiency, the smaller the gap. In the 60-month empirical analysis, 10 months before the implementation reached the pure technical efficiency of 1, which was not much different from that after the implementation, and 1 month before the implementation reached 0.8; while after the implementation, 7 months reached the pure technical efficiency of 0.8, which showed the overall high pure technical efficiency of the GEM after the implementation. The above situation shows that the GEM registered issuance mechanism, management, financial system and market environment reform in China's stock market had achieved some results, and the reason for this phenomenon can be traced to two aspects, (a) the significant reduction in approval time and (b) the significant increase in the number of listed companies and financing scale, which can be observed from the basic input data in the previous section.

In a comprehensive view, the financing efficiency of enterprises has been improved after the

implementation, indicating that the registration system reform is in line with the basic national conditions and development of China at this stage, but the analysis results show that there is still much room for improving the financing efficiency, and some of the suggestions are briefly listed in the latter part.

4. Related Suggestions

4.1. Improve the Status of the Stock Exchange

At this stage, most of the power under the IPO procedure is in the hands of China Securities Regulatory Commission (CSRC), and the stock exchanges lack independence in the appointment or removal of relevant personnel as well as the issuance application to be passed by the enterprise, resulting in the unclear positioning of the stock exchanges. The government can make relevant rules according to the actual situation, and fully exploit other functions of the stock exchanges, such as management autonomy and punishment, *etc*. Besides, the currently weak punishment mechanism for violations remains to be strengthened by relevant departments; it is also necessary to improve the relevant mechanisms to guarantee the effective operation of the prior supervision mechanism, so as to "act according to regulations strictly".

4.2. Accelerate the Formation of a Normalized Delisting Mechanism

Currently, most delisting situations are relatively simple as companies are delisted for failing to meet the requirements related to relevant financial indicators. In addition, companies can reverse disqualified financial indicators through artificial means, and once this happens, the regulator, as an external department, cannot fully grasp the internal management information of the company, resulting in a small possibility of fraudulent behavior being detected by the regulator before the event is eventually exposed. Such events would disrupt the market order and reduce investors' confidence in the market. Therefore, to improve the normalized delisting mechanism, considerations should be taken to financial indicators as well as corporate governance and other non-financial indicators that are closely related to company operation.

4.3. Improve the Information Disclosure System

The registration system-based review is mainly based on post-event review. In a mature securities market, government regulation of securities issuance is essentially disclosure regulation, *i.e.,* the goal is to improve information disclosure. Besides, the relevant laws and regulations also give certain investigation and participation rights to the relevant regulatory authorities, which are mainly responsible for verifying the relevant documents disclosed or issued by enterprises. However, in practice, investigating and dealing with information disclosure problems generally requires greater regulatory costs, and in-depth investigations are usually conducted only when the relevant regulatory authorities have evidence of corporate non-compliance problems. Improving the relevant information disclosure system and enhancing the credibility of information issued by enterprises is not only helpful to reduce the supervision cost, but also more likely to improve investors' access to market information, which ultimately facilitates enterprises to raise more capital.

4.4. Improve the Overall Quality of Investors

A healthy investment market environment cannot be achieved without the overall quality of investors. At this stage, the overall quality of individual investors in China is still low, and some investors have investments blindly and overreact to the normal fluctuations of stock prices. In this regard, the Securities Industry Association can play its role as a "bellwether" and educate individual investors through publicity, guidance and other means to improve their securities-related knowledge and promote the investors' quality, thus maintaining the relative stability of the securities market.

4.5. Improve the Effectiveness and Soundness of Corporate Internal Control

The effectiveness and soundness of an enterprise's internal control system can also have a certain impact on the efficiency of its financing. For example, the information issued by an enterprise for the purpose of listing is the integration of information from various departments within the enterprise. In this process, the effectiveness of its internal control directly affects the speed of information integration and

the accuracy of information review, which in turn affect the speed of enterprise financing; besides, a good internal control system can promptly identify the defects of the enterprise's internal management for timely correction, and reduce its operation risk, therefore lowering the risk of losing equity financing due to poor operation and eventual delisting. The effectiveness and soundness of the internal control system can be evaluated by an independent third party, such as an accounting firm, so that the company can make improvements based on the evaluation results.

4.6. Strengthen the Construction of Clean Government

The problem of corruption in the securities market cannot be solved by the punishment mechanism alone. Generally speaking, heteronomy is far less effective than self-discipline, and the key to solving this problem is to improve the moral and personal quality of the personnel concerned. First, the relevant departments can consider expanding the weight of the ethics test in the selection of personnel, and organize regular meetings on integrity thinking, *etc*.; second, regularly review the content of their work to reduce the risk of corruption; finally, "do not rely solely on the punishment mechanism" does not mean that punishment is useless. Punishment is also a hard means in the construction of integrity, with self-discipline as the main direction and heteronomy as a supplement to build a clean market atmosphere.

5. Conclusions

At present, the registration system for stock issuance has been fully implemented as an important initiative to deepen reform in China and a great policy to implement the spirit of the 20th National Congress of the Communist Party of China. The implementation of the registration system has enabled some high-quality small and medium-sized enterprises to meet their own financing needs, injecting new vitality into the capital market and helping the high-quality development of market economy. Of course, the trial of the registration system on the GEM has not achieved expected results for a variety of reasons, such as the defects caused by the changes in the system as well as the long existing problems of corruption and supervision. In general, the full implementation of the registration system is more beneficial than harmful. Targeting the long-existing problems in its implementation process, the previous section has given some policy recommendations. However, because of the short duration of the full implementation, there may be some new problems that we have not expected in the trail operation process, and the relevant departments should also make a good plan ahead. In the end, under the implementation of the new system, China's securities market will usher in a bright future.

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