

# Analysis of Corporate Governance Efficiency Differences in Different Life Cycles

-- Empirical Research based on Data about Listed Companies

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**Abstract:** In order to provide reference for quantifying and improving corporate governance efficiency, the DEA model was used to measure the input and output efficiency of a total of 776 listed companies in A-share market from 2012 to 2020. Then a comparative analysis of the governance efficiency at different corporate life stages was made from static and dynamic perspectives, and a regression analysis was conducted on factors influencing corporate governance efficiency via the Tobit model. The results are as follows: (1) A discrepancy can be found in main contribution sources of corporate governance efficiency in different stages as scale investment contributes to much of the governance efficiency of growing and declining enterprises while technical advancement features prominently in that of mature enterprises; (2) the total factor productivity of corporate governance increases progressively from the growing stage to the mature phase and then to the declining period, and the younger a company, the weaker its governance capacity; (3) the significance of factors influencing governance efficiency differs in different periods. This paper analyzes corporate governance in terms of the life cycle and deepens relevant research content.

**Keywords:** Corporate governance, DEA model; Malmquist index, Enterprise life cycle, External governance mechanisms.

## 1. Introduction

Guided by the "Belt and Road Initiative" and the "go global" strategy, listed companies, which have played a significant part in high-quality economic development, are booming under China's new normal economic development, but are also faced with growing challenges in governance due to insufficient market regulation, increasingly intense competition and rising financial pressure. Corporate governance is mainly intended to solve relation problems. In order to effectively resolve contradictions between operators and owners, between shareholders, as well as between actual controllers and stakeholders, a series of corporate governing measures were proposed for the sake of reducing agency costs and improving financial performance. It is fair to say that the improvement of corporate governance efficiency features prominently in safeguarding investor interests and perfecting the modern enterprise system, which highlights its importance in the stable development of the domestic capital market.

## 2. Research Methods

### 2.1. DEA Model

The DEA model refers to each measured object as a decision unit (DUM), considering that there is an undesirable output, and the input must be controlled to be more in line with the practical significance, so the input-oriented BCC model is used to measure its pure technical efficiency, the CCR model measures the comprehensive technical efficiency, and the product is the scale efficiency result.

The input-oriented CCR model is planned as follows:  
$$\min \theta$$

$$s.t. \sum_{j=1}^n \lambda_j x_{ij}^t \leq \theta x_{ik}^t, \sum_{j=1}^n \lambda_j y_{rj}^t \geq y_{rk}^t, \lambda_j \geq 0, i=1,2,\dots,m; r=1,2,\dots,q; j=1,2,\dots,n$$

To measure how many of these changes are due to overall technological advances and how many are due to individual firm behaviors, the Malmquist Index captures these dynamic changes and analyzes productivity and the impact of technological efficiency advances on productivity. Assuming that  $E(t,s)$  is expressed as the technical efficiency value of a decision unit from time  $s$  to time  $t$ ,  $M^s = E(t,s) / E(s,s)$  is used to measure the improvement of the decision unit in the  $s$ - $t$  period under  $s$ -technical conditions; If  $M^s$  is greater than 1, the company has advanced technologically during the  $s$ - $t$  period. Similarly,  $M^t = E(t,t) / E(s,t)$  represents the technical efficiency value under  $t$ -technical conditions, both represent the same meaning, and finally the Malmquist exponent takes its geometric average.

### 2.2. Selection of Data and Indicators

With reference to the existing literature, the input-output index system is established from the three aspects of regulatory mechanism, salary incentive and equity structure.

The Shanghai Stock Exchange (SSE) A-share companies listed before 2012 were selected as sample objects, and the unavailable samples were excluded, and the annual indicator data of 776 listed companies in A-share market from 2012 to 2020 was retained. The input-output indicator system is shown in Table 1.

**Table 1.** Variable definitions

	Variable dimensions	Variable	Definition
out put	Expect output	Return on assets	Net assets/Average total assets
	Undesirable outputs	Agent costs	Manage expenses/Revenue from main business
inp ut	Monitoring mechanisms	Remuneration of the members of the first three Supervisory Boards	Natural log of the top3 Supervisory Board members
		Size of the Supervisory Board	Supervisory Boards / Minimum standard number of statutory Supervisory Boards
		Ratio of independent directors	Independent directors/ Board members
	Shareholding structure	Equity balances	Second largest shareholder shareholding ratio /first largest shareholder shareholding ratio
	Compensation incentives	Executive compensation	The shareholding ratio of the top shareholder
		Executive compensation	Natural log of the top3 Executive compensation

### 3. Results

#### 3.1. Static Analysis of the BCC Model

Input-output data organized according to the above indicators was input into MaxDEA. The output-oriented BCC model was used to calculate relevant values of 776 companies listed in Shanghai Stock Exchange in China. The average efficiency value of those enterprises in different life stages is shown in Table 1. On the whole, the average comprehensive benefit of those enterprises declined year by year, so it enjoys great potential for growth in the future. The effectiveness of DEA was judged by measuring the overall efficiency of each DUM. It was found that effective DEA makes up a large proportion in growing enterprises with a great volatility, which indicates that the management of growing enterprises maintains a solid development momentum accompanied with a large discrepancy in their governance changes, whereas the proportion of efficient DEA in mature and declining enterprises is generally lower than the average. The overall efficiency of all the three stages exhibited a similar negative

trend from 2017 onwards, demonstrating its general decline in A-share companies. Therefore, it is evident that the overall governance of listed companies has not been improved since the Governance Standards for Listed Companies was modified in 2018.

Much of the overall efficiency of growing enterprises is attributable to scale efficiency, and the technical efficiency has been maintained at approximately 0.82, which indicates that the scale effect in this stage has a significant impact on efficiency, and the growing companies are able to improve their governance efficiency through allocation optimization. When it comes to mature enterprises, scale efficiency used to make the largest contribution to governance efficiency, but technical efficiency has assumed a more significant role since 2018, which reveals that the governance efficiency of mature enterprises is now more heavily influenced by technology than by scale effect, that is, the decrease in their comprehensive governance efficiency is primarily resulted by a reduction in their governance investment scale. The measure mean and the change trend of declining enterprises are close to those of growing enterprises.

**Table 2.** Efficiency scores for different life stages

		2012	2013	2014	2015	2016	2017	2018	2019	2020
growing enterprises	effective DEA proportion	5.30%	3.40%	6.80%	1.60%	3.30%	5.70%	1.20%	1.70%	2.60%
	overall efficiency	0.715	0.725	0.714	0.698	0.689	0.702	0.660	0.653	0.658
	technical efficiency	0.815	0.830	0.822	0.803	0.805	0.820	0.810	0.828	0.806
	scale efficiency	0.878	0.872	0.867	0.870	0.858	0.858	0.817	0.791	0.820
mature enterprises	effective DEA proportion	4.00%	2.70%	3.20%	2.90%	3.70%	1.20%	1.50%	2.90%	1.50%
	overall efficiency	0.725	0.717	0.724	0.707	0.702	0.687	0.686	0.679	0.680
	technical efficiency	0.841	0.828	0.823	0.812	0.805	0.810	0.840	0.837	0.832
declining enterprises	effective DEA proportion	2.30%	2.90%	3.00%	3.80%	2.70%	2.60%	1.40%	1.30%	1.10%
	overall efficiency	0.724	0.718	0.721	0.701	0.689	0.693	0.684	0.683	0.682
	technical efficiency	0.831	0.828	0.825	0.796	0.809	0.815	0.831	0.824	0.840
	scale efficiency	0.870	0.867	0.874	0.882	0.853	0.851	0.825	0.831	0.815
Mean	effective DEA proportion	3.48%	2.96%	3.87%	2.84%	3.22%	2.32%	1.42%	2.06%	1.68%
	overall efficiency	0.724	0.720	0.721	0.704	0.695	0.691	0.682	0.677	0.676
	technical efficiency	0.834	0.829	0.824	0.805	0.807	0.813	0.833	0.830	0.827
	scale efficiency	0.867	0.868	0.875	0.874	0.863	0.851	0.821	0.817	0.819

#### 3.2. Dynamic Analysis of DEA-Malmquist index

Malmquist index is helpful to analyze how corporate governance efficiency changes over time. The results and

decomposition of Malmquist index calculated in accordance with the technical conditions in 2012 is displayed in Table 3, demonstrating the dynamic change of the overall governance efficiency of listed companies. From the perspective of vertical time, the total factor productivity of the governance

of A-share companies underwent a fluctuation process from a rise to a decline and then to an upswing between 2012 and 2020, so governance efficiency did not show an obvious growth trend, and only the total factor productivity from 2019 to 2020 was greater than 1, which indicated that the overall governance efficiency is declining, and its increase between 2019 and 2020 was owing to the improvement of pure technical efficiency. On the whole, the total factor productivity decreased by 0.6 percent from 2012 to 2020, and the governance efficiency brought by technical advancement remained declining although technical efficiency had increased by 2.5 percent, which demonstrated that the relevant system and management technologies were still somewhat outdated despite the fact that the governance efficiency had been improved through resource integration.

Among other decomposition indicators, the fluctuation

trend of technical efficiency was close to that of total factor productivity. The period from 2014 to 2018 did not witness an increase in technical efficiency but saw a continuous rise in total factor productivity, which indicated that the improvement of corporate governance efficiency during this period was mainly resulted by technical changes. That is, more attention were paid to the functions of the supervision mechanism and management technologies in corporate governance. In contrast, the index of technical changes remained less than 1 between 2018 and 2020 while the growth rate of total factor productivity increased from -0.8% to 0.2% as a result of technical efficiency improvement, which was bound up with the growing governance awareness and relevant concepts in China after the revision of the Governance Standards for Listed Companies.

**Table 3.** Malmquist index summary of annual means

Year	effch [A=C*D]	techch [B]	pech [C]	sech [D]	tfpch [E=A*B]
2012-2013	1.121	0.884	1.129	0.993	0.991
2013-2014	1.095	0.913	1.131	0.968	0.999
2014-2015	0.99	0.995	1.002	0.988	0.985
2015-2016	0.975	1.022	0.985	0.99	0.996
2016-2017	1	0.995	0.972	1.028	0.995
2017-2018	0.997	0.993	1.02	0.977	0.99
2018-2019	1.021	0.972	1.016	1.005	0.992
2019-2020	1.009	0.993	1.021	0.988	1.002
Mean	1.025	0.97	1.033	0.992	0.994

The decomposition of Malmquist index of different life cycles exhibited in Table 4 shows how corporate governance efficiency changes and decomposes in each stage. According to the table, the total factor productivity increased progressively from the growth stage to the mature phase and then to the declining period, and its value of each stage is higher than the average but not greater than 1, which indicates that the corporate governance of all stages had not achieved the best results, and the younger a company is, the poorer its governance ability. The ratio of total factor productivity that exceeds 1 also supports this claim. If the total factor productivity of a company is greater than 1, it means that the company's governance efficiency improves and its governance structure has played a positive role. About 46%

of mature and declining companies saw an increase in their governance efficiency, which exceeded the average level. Thus, it can be inferred that growing enterprises are more concerned with survival and expansion, and enjoy much potential for governance structure improvement in order to achieve technical advancement. In contrast, mature and declining enterprises are more efficient in governance, primarily due to the increase in their scale efficiency resulted by a sound governance structure and greater investment in corporate governance, but the stable increase in scale efficiency demands for more supervision and management costs for the sake of improving governance efficiency. As a result, resource integration is essential to the improvement of technical application efficiency.

**Table 4.** Malmquist index summary for different life stages

lifecycle phase	effch [A=C*D]	techch [B]	pech [C]	sech [D]	tfpch [E=A*B]	tfpch >1 proportion
growing enterprises	1.025	0.977	1.036	0.991	0.996	43.82%
mature enterprises	1.033	0.972	1.040	0.994	0.997	46.08%
declining enterprises	1.030	0.975	1.036	0.995	0.999	46.45%
Mean	1.025	0.97	1.033	0.992	0.994	45.83%

### 3.3. Analysis of Factors Influencing Corporate Governance Efficiency

The above part focuses mainly on the static and dynamic analysis of corporate governance efficiency. In addition to input and output indicators, factors influencing governance efficiency should also be taken into account. Based on a

literature review, the Tobit regression analysis of multiplicative total factor productivity indicators was conducted through six indicators from three prominent dimensions, including the external governance mechanism, corporate self-development and the external governance environment. The indicator composition is shown in Table 5:

**Table 5.** Variable definition

Affects dimensions	Variable	Definition
External governance mechanisms	Product market	Lerner Index
	Competition (compet)	
	Institutional Investor Ownership (inst)	
The development of the company	Company Size (lnsize)	Natural log of Net assets
	Asset-liability ratio (liab)	Total Assets/Total Liabilities
External governance environment	Government Intervention (gov)	According to Fan Gang's Report 2019 the data on “the relationship between the government and the market” reasonably extrapolated for one year
	Market Progress(market)	According to Fan Gang's Report 2019 the data on “marketoriented total index”reasonably extrapolated for one year

In order to examine the factors influencing the efficiency of corporate governance, this paper constructs a fixed-effect panel model at different life cycle stages based on considering the differences between individual companies:

$$tfpch_{it} = \beta_0 + \beta_1 compet_{it} + \beta_2 inst_{it} + \beta_3 lnsize_{it} + \beta_4 liab_{it} + \beta_5 gov_{it} + \beta_6 market_{it} + \varepsilon_{it} \quad (1)$$

The regression results are shown in table 6. The sample population represents the Tobit regression result of the governance of listed companies as a whole. At the significant level of 1 percent, the degree of product market competition, the external governance mechanism represented by the Lerner index, is negatively correlated with governance efficiency. The lower the Lerner index, the higher the competition degree and the more significant the governance effect, because company managers will make more effective business decisions when faced with a highly competitive market so that agency costs will be reduced accordingly. The shareholding ratio of investors has a significant positive effect on the improvement of governance efficiency. Investor shareholding,

which functions as a company's external supervision mechanism, plays a supervisory role in decision-making activities of corporate management to a certain extent, making up for the flaws of the internal oversight and incentive system, and reducing the behaviors that are detrimental to the interest of the company. A further study on the government intervention degree and marketization process revealed that the two external environmental governance indicators have opposite effects. Different marketization degrees have resulted in distinct relationships between government and market in different regions. The higher the marketization degree is, the less the government intervenes in corporate operation, and vice versa. At the significant level of 1 percent, governance efficiency is positively correlated with the government intervention degree and negatively related with the marketization process. That is to say, the government plays a pivotal role in guiding listed companies to establish a sound governance system.

**Table 4.** The Tobit Regression results of Corporate governance efficiency factors

Variable	Total	growing enterprises	mature enterprises	declining enterprises
compet	-0.024***	0.089***	-0.041***	-0.010
inst	0.023***	0.053***	0.043***	-0.004
size	0.001	-0.001	-0.005***	0.001
liab	0.050***	0.024	0.005	0.043***
gov	0.516***	0.143	0.321**	0.879***
market	-0.591***	-0.138	-0.243	-1.263***

Note : "\*\*\*\*" , "\*\*\*" , "\*\*" means Significant at 1%,5%,10% level respectively.

Then the regression results of the influencing factors were further investigated in different stages.

According to the research results in columns 3 and 4 in Table 4, only the market competition degree and institutional investment shareholding had a significant positive impact on the governance efficiency of growing enterprises, and similar results were found in mature and growing enterprises while the governance efficiency of declining enterprises were mainly influenced by government intervention and the marketization process, which demonstrated that in the early corporate life stage, enterprises lay more emphasis on management and governance, so they are more subject to market competition and supervision by external financial institutions, which will prompt the management to make more favorable decisions. In other words, external governance mechanism plays a better role in this stage. But in the later life stage, the corporate management structure has taken

shape and is more likely to be influenced by external governance environment. A closer political relationship between government and enterprises has a greater influence on the internal decision making and the performance of an enterprise, thereby affecting the governance efficiency. Therefore, guiding and preferential policies should be introduced to specific regions. Moreover, in terms of corporate self-development, both global analysis and phased sample analysis showed that company scale and balance sheets are both insignificant, or the coefficients are significant but the results are close to zero with little impact, which indicates that corporate self-development are not able to effectively promote corporate governance efficiency.

## 4. Conclusion

An input-output system of the governance efficiency of listed companies was developed in this paper on the basis of

the existing literature and research. Firstly, the governance efficiency of a total of 776 listed companies in A-share market from 2012 to 2020 was comprehensively measured with the DEA model. According to the life cycle theory, the comparative analysis of governance efficiency was made from the static perspective. It is believed that the governance efficiency of growing and declining enterprises is mainly contributed by scale efficiency, whereas mature enterprises demands more for stable scale investment and reasonable governing measures as they are undergoing a transformation in dominating benefits. Then the Malmquist index model was used to measure dynamic changes of governance efficiency, and the results demonstrated a general decline in the the total factor productivity of corporate governance as a result of technical changes. It can be inferred from the progressive increase of total factor productivity from the growing stage to the mature phase, and to the declining period that the younger an enterprise is, the weaker its capacity in improving governance efficiency. Hence, enterprises in the early stage should place more emphasis on learning and improving relevant management techniques, as well as increasing investment in management resources, while those in later stages should focus more on resource integration. Finally, external influencing factors were studied by establishing the Tobit regression model. The results showed that corporate self-development has little bearing on governance efficiency improvement on the whole, while the external governance mechanism dramatically influences growing and mature enterprises, and its impact is more considerable on declining enterprises.

Based on the above conclusions, three suggestions regarding the governance of listed companies are proposed as follows:

Enterprises should attach importance to scale efficiency, step up their efforts in governing measures such as internal supervision and salary incentives especially in the early corporate life stage, and do more to improve their scale effect so as to enhance their ability in improving governance efficiency.

Enterprises should also keep learning from excellent managerial experience, upgrade their management technologies, adjust the corporate governance mechanism, and further improve their technical efficiency. According to the above results, both governance efficiency and growth are closely related to technical efficiency development,

especially in mature and declining enterprises. Redundancy of investment and organizations is prominent in enterprises of later life stages. Therefore, it is necessary to develop a reasonable system of checks and balances and form a science-based internal governance structure in conjunction with the external governance mechanism to maximize the effect of the governance mechanism at these two stages.

Given different characteristics of enterprises in different life stages, the influence of different factors should be taken into consideration so as to take targeted measures and strategies. Growing and mature enterprises should attract more external investment and keep a close eye on market competition, while declining enterprises should downsize, reduce redundant investment and enhance supervision to ensure a stable governance environment. Furthermore, they should adhere to local policies and innovate accordingly. In short, the optimal mechanism combination should be achieved in each stage to improve governance efficiency.

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