The Performance Evaluation of the Listed Security Companies in China Based on the DEA Model

Yan-liang Zhang*, Ran-ran Chu, Xiao-qi Zhao

Shandong University of Finance and Economics. Jinan China

Received 13 October 2014, www.cmnt.lv

Abstract

With the continuous development of domestic stock market, the listed security companies have stepped into a stable growth period, the study of their performance becomes also deeper. This paper firstly introduces the methods of evaluating the performance of the listed security companies, and discusses the DEA method in detail. Then we evaluate the corporate performance of 16 domestic security companies by the DEA method. Finally we analyses the empirical results from three aspects, which are technical efficiency, pure technical efficiency and scale efficiency. This paper evaluates the performance of the listed security companies with a more scientific method.

Keywords: Listed Security Company; Corporate Performance; DEA Model

1 Introduction

After years of reform, the research on China's securities industry about whether the real operating efficiency improved, whether operating efficiency differences between different types of security companies, has made extensive progress. As to the research method, according to the comprehensive index of the degree of information is different, can be divided into the single index evaluation method and the comprehensive index evaluation method.

The single index evaluation method is through a specific security company calculating financial ratios, such as return on equity(ROE), return on assets(ROA), asset size, etc, and with the history of longitudinal comparison with other securities or horizontal comparison, so the overall operating conditions of a financial institution to do the evaluation and judgment. Sun Yong-xiang and Huang Zu-hui(1999) [1]uses a single index evaluation method as a measure of operating performance indicators securities. However, the accounting profit based financial indicators as the evaluation standard of stock performance, ignoring the existence of opportunity cost, but also allows securities operators as an agent is not to maximize shareholder value for the business objective, but one-sided accounting pursuit of self-interest to maximize profits. To remedy the defects of this approach, in the 1990s economic value added (EVA) performance evaluation methods produced. EVA is equal to after-tax operating profit minus its total capital (debt and equity) costs, which will consider the opportunity cost of equity capital. Compared with the previous financial indicators, EVA stressed only when economic profit over the cost of debt and equity for all costs, will generate real profit, that is, economic profit. And Zhu Jian-wu(2005) [2]uses the EVA method to calculate China's small and medium-sized security company business performance. Although EVA evaluation methods to achieve the performance evaluation of the economic profit from accounting profit changes, the core remains the profits, while the impact on the future development of the securities industry's key non-financial indicators of liquidity, security, quality of service and customer satisfaction, etc. factors not assessed.

Comprehensive index evaluation method is through the securities profitability, liquidity, security, capacity development and other aspects to set the number of indicators, and using statistical methods for data processing, to arrive at a comprehensive evaluation value. Xie Chi.etc(2002)[3], Yang De-yong, Cao Yong-xia(2007)[4]by selecting multiple indicators reflect the security company operating characteristics, using factor analysis methods results reflect the value of the security company business performance evaluation. Security company business performance is an important content of the comprehensive evaluation method. Studies on the security company business efficiency can be divided into parametric methods and non-parametric methods. In Berg & Humphrey (1998) [5] literature review make a comprehensive summary to these methods. Parametric methods can be further decomposed into stochastic frontier approach (SFA), thick frontier analysis (TFA) and the free distribution method (DFA). And nonparametric methods mainly include data envelopment analysis (DEA) and free disposal hull (FDH). In contrast, DEA method does not require the production of a specific form of the function, without defining the shape of the efficiency frontier, while able to measure technical efficiency, scale efficiency, cost efficiency and allocation efficiency, and can be evaluated on all aspects. Therefore, DEA method was used more widely in the relevant research literature.

* ***Corresponding author's*** e-mail:zhyanliang@sina.com

And Siems (1992), Sathye (2001), Casu & Molyneux (2003), Zhang Jian-hua (2003), Ke Kong-lin &Feng Zong-xian (2008),Cai Yue-zhou & Guo Mei-jun (2009) [6] have adopted the DEA method to measure the security company business efficiency.

2 DEA Empirical Model and Data Description

Data envelopment analysis (DEA) is a linear programming method, which is based on the productivity frontier theory that Farrell (1957) was made. Charnesetal (1978) developped the theory and used to assess the efficiency of the public sector and non-profit sectors. Sherman & Gold (1985) [7] were the first one who used the DEA method to evaluate security company efficiency. The efficiency of DEA measure is weighted by input-output ratio, in the efficiency frontier security company (or the security company's branch) is valid, and the security company (or the security company's branch) production may be in optimum state with the objective of minimizing investment or maximum output. Therefore, DEA model is a method that measure relative efficiency rather instead of absolute efficiency of decision making units (Decision Marking Unit, DMU) with the same input, output and nature. Depending on the different hypothesis of returns to scale, DEA estimation techniques can be divided into CCR model under the conditions of constant returns to scale and BBC model under the conditions of variable returns to scale.

CCR model was first proposed by Charnes, Cooper and Rhode three academics in 1978, it is known as CCR model. The model is under constant returns to scale (Constant Returns to Scale, CRS) assumption, make the concept of the two-input-one-output proposed by Farrell popularize to the multiple input-output, and use linear programming method to obtain the production boundary, to assess the relative efficiency of DMU's.

Suppose there are n security companies, each security company has m input variables and s output variables. Among them,

$$x_j = \left(x_{1j}, x_{2j,} \cdots, x_{mj}\right)^T \geq 0, j = 1, \cdots, n,$$

$$y_j = \left(y_{1j}, y_{2j}, \cdots y_{sj}\right)^T \geq 0, j = 1, \cdots, n,$$

That is, its components are non-negative and at least one positive.

Then the constant returns to scale (CRS) CCR model is formulated as follows:

$$\min[\delta - \varepsilon\left(\hat{e}^T s^- + e^T s^+\right)]$$

$$s.t.\begin{cases}\sum \lambda_j x_j + s^- = \delta x_0, \sum \lambda_j y_j - s^+ = y_0, \lambda_j \geq 0, s^- \geq 0, s^+ \geq 0 \\ \hat{e} = (1,1,\cdots,1)^T \in R^m, e = (1,1,\cdots,1)^T \in R^s\end{cases}$$

The CRS model is the most basic DEA model, wherein, ε is an infinitesimal Archimedes. The model is used to evaluate the overall technical efficiency (TE) of DMU, which is the overall efficiency of pure technology and scale, reflecting the ability of a given investment companies to get the maximum output or the ability of a given output companies to invest minimum. δ is the valid values of the decision making unit DMU_0, x_0 is the $j_0 - th$ input vector of DMU_0, y_0 is the $j_0 - th$ output vector of DMU_0, λ_j is the $j_0 - th$ composition ratio of a valid combination of DMU_j that is reconstructed relative to DMU_0, s^- is a vector composed with slack variables which corresponds with the investment, s^+ is a vector composed with slack variables which corresponds with the output, and

$$s^- = \left(s_1^-, s_2^-, \cdots, s_m^-\right)^T,\ s^+ = \left(s_1^+, s_2^+, \cdots, s_s^+\right)^T.$$

If $\delta = 1$ and $s^- = s^+ = 0$, then DMU_0 is DEA efficient, that is, in the n decision-making units, obtained optimal output y_0 on the basis of the original input x_0. If $\delta = 0$ and $s^- \neq 0$ or $s^+ \neq 0$, then DMU_0 is weakly DEA efficient; if $\delta < 1$, then DMU_0 is DEA non-efficient.

CCR model only can handle DMU efficiency assessment with constant returns to scale characteristics. In order to analyze the variable returns to scale DMU, Banker, Charnes and Cooper (1984) proposed a variable returns to scale (Variable Returns to Scale, VRS) in the BBC model, and amended the concept and scope of CCR model, decomposed the technical efficiency (TE) into pure technical efficiency (Pure Technical efficiency, PTE) and scale efficiency (Scale Efficiency, SE).

For any of the decision-making unit (DMU_0), and its dual form of BBC mode (input-oriented) can be expressed as:

$$\min\left[\delta - \varepsilon\left(\hat{e}^T s^- + e^T s^+\right)\right]$$

$$s.t.\begin{cases}\sum \lambda_j x_j + s^- = \delta x_j, \sum \lambda_j y_j - s^+ = y_j \\ \lambda_j \geq 0; s^+ \geq 0; s^- \geq 0, \sum \lambda_j = 1\end{cases}.$$

Among them, δ is the effective value of the decision-making unit (DMU_0). If $\delta = 1$ and $s^- = s^+ = 0$, DEA is effective; If $\delta = 0$ and $s^- \neq 0$ or $s^+ \neq 0$, DEA is weakly effective; if $\delta < 1$, DEA is non-effective.

The paper selects 12 listed security companies: Guangfa Securities, Haitong Securities, Hongyuan Securities, CITIC Securities, Guoyuan Securities, Southwest Securities, Changjiang Securities, Northeast Securities, Sinolink Securities, Pacific Securities, China Merchants Securities, Huatai Securities, during the study period of 2006-2011. Data is from the China Financial Statistics Yearbook, China Statistical Yearbook and various securities company annual report.

DEA method is critical to select the appropriate input and output indicators. According to the relevant securities investment, different definitions of output, divided into the production method, the asset approach, intermediaries method, the user cost, value-added approach and modern methods of six. China's securities industry, combined with its own operating characteristics, the paper selected deposits, net fixed assets, number of employees as the input variables, representing the capital of capital, physical capital and human capital. And select the operating income and net profit as output variables.

TABLE 1 Statement of Changes in Chinese listing security company technical efficiency: 2006-2011

	2006	2007	2008	2009	2010	2011	Mean
Guangfa	1.00	1.00	1.00	1.00	0.72	0.72	0.91
Haitong	1.00	0.61	0.24	0.88	0.73	1.00	0.74
Hongyuan	0.76	0.88	0.15	0.70	0.80	0.54	0.64
CITIC	1.00	0.72	0.47	0.91	1.00	1.00	0.85
Guoyuan	0.84	1.00	0.11	0.77	0.80	0.70	0.70
Southwest	0.64	1.00	0.44	1.00	0.58	0.53	0.70
Changjiang	0.78	0.89	0.21	0.76	0.42	0.59	0.61
Northeast	0.48	0.66	0.12	0.59	0.39	0.27	0.42
Sinolink	1.00	1.00	1.00	1.00	1.00	1.00	1.00
China Merchants	1.00	0.71	1.00	1.00	0.73	0.98	0.90
Pacific	1.00	1.00	0.10	1.00	0.80	1.00	0.82
Huatai	0.61	0.92	0.07	0.70	0.50	0.66	0.58
All mean	0.84	0.87	0.41	0.86	0.71	0.75	0.74

In the empirical study, first use CCR model calculated the broke' technical efficiency (overall efficiency), and then calculated the pure technical efficiency and scale efficiency based on BBC model. If the scale inefficiency, combined with analysis of returns to scale, and draw the conclusions of decreasing returns to scale or incremental, to determine should expand or reduce the size of its operations, then in order to improve operational efficiency.

3 Analysis on listing security companies operating performance measure results

3.1 TECHNICAL EFFICIENCY

Technical efficiency (overall efficiency) represents security companies under the maximum output, minimum cost of factor inputs. It can measure elements of waste under the guidance of investment. If the technical efficiency value is less than one, we can reduce investments and then save costs.

As can be seen from Table 1, the average technical efficiency of the listing security companies for six years was 0.74, which means that the presence of 26% of the listing security company investment put the waste of resources. Judging from the trend, the minimum technical efficiency reached 0.41 in 2008, mainly due to the 2008 U.S. subprime mortgage crisis triggered by the global financial crisis. Among security companies, Sinolink securities efficiency is the highest, the six-year average is 1.00, followed by Guangfa Securities and China Merchants Securities, 0.90 and 0.91, respectively, two of the least efficient is the Northeast securities, Huatai securities, 0.58 and 0.42 respectively.

3.2 PURE TECHNICAL EFFICIENCY

Pure technical efficiency is under the maximum output of the same size, minimum element of input costs. Pure technical efficiency is determined by the variable returns to scale in the BBC model, we can measure the investment wizard model to determine the technical inefficiency of securities how much is due to the pure technical inefficiency. The pure technical efficiency indicators reflect more security company daily operation and management of policies and standards

From Table 2, the six-year average of the listing security company pure technical efficiency is 0.83, which indicates that the daily management of the listing security companies at a relatively high level. Six years of pure technical efficiency of the listing security companies has great change. More significant is that the listing security company pure technical efficiency is on the borderline, reflecting Chinese listed security company higher management level. It should be noted that the management capabilities are talking about here is the decision-making mechanism to coordinate, efficiency and strength, marketing capabilities between various departments securities firms. Commonly referred to as the low level of management of the securities industry in China, more is due to the expansion of the scale, irrational management structure, personnel burden.

TABLE 2 Statement of Changes in Chinese listed security companies pure technical efficiency: 2006-2011

	2006	2007	2008	2009	2010	2011	Mean
Guangfa	1.00	1.00	1.00	1.00	0.73	0.74	0.91
Haitong	1.00	0.83	0.85	1.00	0.75	1.00	0.90
Hongyuan	0.88	0.97	0.37	0.89	0.88	0.55	0.76
CITIC	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Guoyuan	1.00	1.00	0.41	0.87	0.91	0.75	0.82
Southwest	0.76	1.00	1.00	1.00	0.64	0.55	0.82
Changjiang	0.95	1.00	0.29	0.86	0.49	0.61	0.70
Northeast	0.51	0.69	0.45	0.65	0.44	0.32	0.51
Sinolink	1.00	1.00	1.00	1.00	1.00	1.00	1.00
China Merchants	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pacific	1.00	1.00	0.27	1.00	0.84	1.00	0.85
Huatai	0.61	1.00	0.28	0.82	0.54	0.66	0.65
All mean	0.89	0.96	0.66	0.92	0.77	0.76	0.83

3.3 SCALE EFFICIENCY

Scale efficiency refers to the ratio of technical efficiency of production boundary inputs to the investments in the optimal size under the maximum output, it is equal to the total technical efficiency value of CCR model divided by the pure technical efficiency value of BBC model, this indicator can measure whether the security companies are in the optimal production scale under the investment-oriented. If the security company is increasing returns to scale, it should expand the scale of production and increase factor inputs in order to obtain the maximum benefit; if the security company is decreasing returns to scale, the scale of production should be reduced and reduce the factor inputs.

As can be seen from Table 3, the average scale efficiency of six years of the listing security company is 0.87 in China, scale efficiency reached its lowest point in 2008 affected by the U.S. subprime mortgage crisis, and then restored to the original level in 2009, and the impact of the subprime crisis gradually disappear.

TABLE 3 Statement of Changes in Chinese listing security companies scale efficiency: 2006-2011

	2006	2007	2008	2009	2010	2011	Mean
Guangfa	1.00	1.00	1.00	1.00	0.98	0.98	0.99
Haitong	1.00	0.73	0.28	0.88	0.97	1.00	0.81
Hongyuan	0.86	0.91	0.41	0.78	0.91	0.98	0.81
CITIC	1.00	0.72	0.47	0.91	1.00	1.00	0.85
Guoyuan	0.84	1.00	0.28	0.89	0.88	0.93	0.80
Southwest	0.84	1.00	0.44	1.00	0.90	0.97	0.86
Changjiang	0.82	0.89	0.74	0.89	0.86	0.97	0.86
Northeast	0.95	0.95	0.27	0.91	0.87	0.85	0.80
Sinolink	1.00	1.00	1.00	1.00	1.00	1.00	1.00
China Merchants	1.00	0.71	1.00	1.00	0.73	0.98	0.90
Pacific	1.00	1.00	0.37	1.00	0.96	1.00	0.89
Huatai	0.99	0.92	0.23	0.85	0.94	1.00	0.82
All mean	0.94	0.90	0.54	0.92	0.92	0.97	0.87

Acknowledgements

This is a phase achievement of science and technology development project of Shandong province which is "Study on the relationship between the listed company ownership structure and business performance 2011GGH12206". It funded by the center of optimizing the financial industry and regional financial management synergy innovation of Shandong province.

References

[1] Sun Yongxiang, and Huang Zuhui , "The ownership structure and performance of listed companies," China Journal of Economic Research, (12), 23-39, 1999.
[2] Zhu Jianwu, "A probe into the relationship between performance and corporate governance of small-medium bank based on DEA," China Journal of Finance and Economics, (5), 52-62, 2005.
[3] Xie chi, and Zhong zan, "Entropy method and its application in comprehensive evaluation of bank's performance," China Journal of China Soft Science, (9), 108-110, 2002
[4] Yang Deyong, and Cao Yongxia, "An empirical study of China's listed banks ownership structure and performance," China Journal of Financial Research, (5), 87-97, 2007
[5] Berg, and Humphrey, "Efficiency of financial institutions: international survey and directions for future research," European Journal of Operational Research, Elsevier, vol. 98(2), 175-212, 1998.
[6] Cai Yuezhou, and Guo Meijun, "Empirical study on total factor productivity of China's listed commercial banks," China Journal of Economic Research, (9), 52-65, 2009.
[7] Sherman HD and F Gold, "Bank branch operating efficiency," Banking and Finance 9(2), 297-315, 1985.

Authors

Yan-liang Zhang, born in Oct.11 1967, Laiwu city, Shandong Province, P.R.China

Current position, grades: Professor of Shandong University of Finance and Economics
University studies: Bachelor of Shanghai University of Finance and Economics, P.H.D of Liaoning University
Scientific interest: Finance
Publications: More than 80 papers published in journals
Experience: Teaching experience of 24 years, 10 scientific research projects

Ran-ran Chu, born in Feb.12 1991, Jining city, Shandong Province, P.R.China

Current position, grades: Master of Shandong University of Finance and Economics
University studies: Bachelor of Shandong University of Finance and Economics
Scientific interest: Finance
Experience: Information and Computational Science learning experience of 4 years; Finance learning experience of 2 years

Xiao-qi Zhao, born in Nov.12.1987, Jinan city, Shandong Province, P.R.China

Current position, grades: Employee of Shandong Branch of Industrial and Commercial Bank of China
University studies: Bachelor of Shandong University of Finance and Economics, Master of Shandong University of Finance and Economics
Scientific interest: Finance
Publications: One paper published in South Asian Studies Quarterly
Experience: Master of Finance learning experience of 2 years; Financial Engineering learning experience of 4 years