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APPLYING DEA METHOD AND MALMQUIST INDEX IN EVALUATING THE BUSINESS PERFORMANCE OF SECURITIES COMPANIES LISTED ON THE VIETNAM STOCK MARKET

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ABSTRACT

The study was conducted for the purpose of analyzing the business performance of listed securities companies in Vietnam. The applied approach includes Data Envelopment Analysis (DEA) and evaluation change in Total Factor Productivity (TFP) through the Malmquist index. The results show that during the research period, no securities company maintained absolute efficiency 1. In which, there are 4 securities companies including FPTS, BSI, VND, SHS with fairly uniform technical efficiency, nearly reaching 1. Results from measuring the Malmquist index also show a slight decrease in average productivity, with the change in the total productivity caused by technological progress being the largest.

KEYWORDS: Business performance, technical efficiency, securities company, stock market, data envelopment analysis (DEA), Malmquist index.

1. INTRODUCTION

The stock market plays an important role in supporting economic development, facilitating capital mobilization and providing an investment opportunity for investors.In particular, business organizations on the stock market are indispensable subjects in the financial market operating apparatus. This not only creates a favorable environment for stock transactions but also makes an important contribution to the process of enhancing the health and transparency of the national financial system. For example, the 2022 research paper: "*Methodological approaches to assess the Regional Stock Market Development*" proves that the health and development of the stock market directly depends on the performance of securities companies. Therefore, research Assessing the

business performance of securities companies or more specifically, determining the level of technical efficiency that securities companies achieve is extremely necessary.

Business performance is always considered a decisive factor in the competitiveness of securities companies. It evaluates through financial efficiency and technical efficiency; in which financial efficiency is evaluated through financial indicators such as ROA, ROE, ROS, ROI, NIM,… Technical efficiency is defined differently by Farrell (Farrell, 1957)under the output approach, including pure technical efficiency (PTE) and scale efficiency (SE). Group of authors (T. J. Coelli et al., 2005)added in the input maximization approach, that is, with the minimum amount of input that can produce a fixed amount of output, the technical efficiency is achieved. Thus, technical effectiveness is assessed through the strategist in arranging and evaluating input resources to achieve optimal output.There are currently two ways to approach measuring technical effectiveness: parametric methods and non-parametric methods. The author(Farrell, 1957)came up with the DEA data envelope model, which is a typical non-parametric method. Subsequently, this study(Charnes et al., 1978)was submitted in the paper entitled "*Measuring the Efficiency of Decision Making Units*". From there, to evaluate business performance, securities companies use the DEA method in evaluating the effectiveness of Decision Making Units (DMUs) in using input resources to generate the desired output.

The content of the article includes: research overview, theory of technical efficiency, scale efficiency and estimate of total factor productivity combined with the Malmquist index; analysis of these indicators at securities companies listed on the Vietnamese stock market; and some discussions.

2. RESEARCH OVERVIEW AND THEORETICAL BASIC

1. 2.1. Literature review

A well-functioning stock market contributes to the growth of the economy. The authors(Oriakpono et al., 2022)of the study "*An empirical analysis of investment in securities on the Nigerian economy growth*" show that securities have a positive impact on economic growth in a dynamic framework. The author(Gavi, 2018)conducted the study "*The relationship between Stock market development and Economic growth. The case of South Africa*" to consider the short-term and long-term relationship between the development of the stock market and the economic growth used in a period with the use of real GDP at current prices, stock market capitalization, shares traded, total value at current value and revenue. The current trend of economic growth is a reliable stock market return index that is (Kamongo, 2022)studied on the relationship between the stock market and economic growth in Kenya as measured by GDP growth rate.Another study "*Stock market capitalization and economic growth in ASEAN 6*" by the author (Phuong, 2020)assessed the development scale of the stock market, Government spending and trade openness are valuable for managers to develop the stock market sustainably and contribute to promoting economic growth.

Competitive advantage is important for Vietnamese securities companies in developing strategies to achieve sustainable competitive advantage (Tuan et al., 2022). The study "*Research on the Investment Value of Stocks of the CITIC Securities Company* " by the authors(Li & Peng, 2023)to assess the cash flow of the company can have a great impact on the value of securities investment

for securities companies. The authors(Cường & Anh, 2019)studied the factors affecting the business performance of 71 securities companies on the Stock Exchange in Vietnam by measuring the return on assets (ROA). Researching financial factors affecting the business performance of enterprises listed on the Vietnamese stock market was conducted by (Hung, 2015), found that the size of the enterprise and the growth rate are positively correlated to business performance; on the contrary, the capital structure is negatively correlated to business performance.

Using technical efficiency to evaluate the performance of the securities company(Lamichhane, 2023)studied "*Efficient Market Hypothesis in the Nepal Stock Exchange (NEPSE)*" fortechnical analysis and efficient market hypothesis at the Nepal Stock Exchange.(Zimková et al., 2023) evaluated the technical efficiency of Slovak companies: Application of the DEA network demonstrates the excellent skills of managers in technically effective companies, regardless of company size and region. Group of authors(Tayebi et al., 2024)conduct the study "*Technical efficiency measurement in insurance companies by using the slacks-based measure (SBM-DEA) with undesirable outputs: analysis case study Technical efficiency measurement*" to provide a more comprehensive assessment of the technical efficiency of companies Algerian insurance. The inverse correlation between bank size and technical efficiency provides insights into banking management and policy development in Islamic banking was conducted by (Hidayati & Nandiroh, 2023)with the study "*Technical Efficiency and Intellectual Capital Islamic Banks in Indonesia*" through Data Envelope Analysis (DEA) and Fractional Regression Model (FRM).

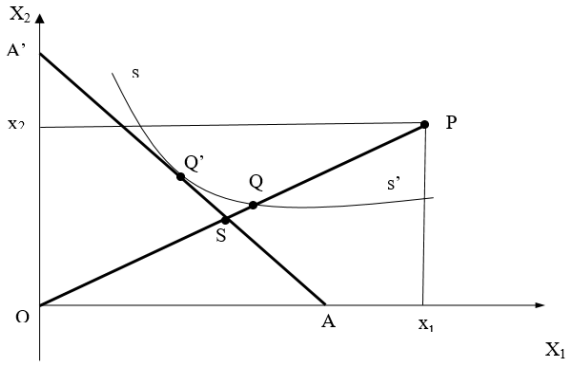
Productivity and operational efficiency are steadily improving, technical advances are the main reason for promoting operational efficiency in the study "*Analysis on Operating Efficiency of Chinese Securities Companies Based on Super Efficiency DEA and DEA-Malmquist Index Method* ", Conducted by the authors(He, 2021)analyzed the management and use of capital of securities companies as well as changes in operating efficiency. (Nourali et al., 2014) studied the regulations of Iran's water industry and its technical efficiency as well as productivity measured by the Malmquist index where there are varying returns to scale and constant returns to scale. Increasing the scale of production innovation investment can improve the innovation efficiency of the city circle manufacturing industry, which is assessed by (Du et al., 2022)in the Wuhan city area based on the DEA-BCC model and the DEA-Malmquist index method. The author (Wu & Sheng, 2023)studied "*Uncertain DEA-Malmquist productivity index model and its application*" combined Malmquist productivity index and uncertain DEA model (uncertain DEA-Malmquist productivity index model) to calculate the change in DMU efficiency over time.

2. 2.2. Theoretical basis

2.2.1. DEA data envelopment method

According toMichael James Farrell(Farrell, 1957)proposed the theory of using the production possibilities frontier as an indicator to evaluate relative performance between companies in the same field. Farrell illustrated his idea by giving a joint example of businesses involving the use of SS' which is quant lines combine a minimum of 2 inputs x1 and x2 to produce a single output factor of (y), provided efficiency is constant by scale (CRS). If the given business uses the amount of input, defined by point P, to produce a unit of output, then the technical inefficiency of that business can be represented on the graph by the QP distance. At that time, the non-efficiency curve

is the QP distance, which is the amount of input that can be reduced without reducing the output for optimal technical efficiency. This is usually expressed in terms of a QP/OP ratio, which denotes the percentage at which all inputs can be reduced. *Technical efficiency* -TE of an enterprise is usually measured by the ratio: TEi = OQ/OP. Technical efficiency ranges from 0 to 1 and therefore provides an indicator of the level of technical inefficiency of the firm. If TE=1, that is, the business is most efficient when QP =0 and the business does not exist at an inefficient level when TE gradually drops to 0 is an inefficient business.



Source: Farrell (1957)

Figure 2.1: Technical efficiency and allocation efficiency

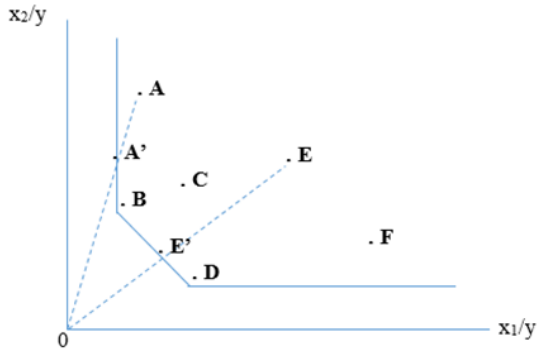
If the input ratio, indicated by the AA' line on the graph (Figure 2.1) also indicates that the *allocative efficiency* - AE. The allocation efficiency (AE) of the enterprise represented at point P is determined by the ratio AE = 0R/0Q. In particular, the RQ gap represents the reduction in production costs that would occur if production took place at the Q' allocation efficiency point, instead of at the technical efficiency point but not effective in terms of Q allocation.

Economic efficiency or cost effectiveness (CE) is a combination of x1 and x2 inputs at the lowest cost. Cost effectiveness is determined by the ratio between actual cost and lowest cost, then cost effectiveness (CE) = 0R/0P. Cost effectiveness (CE) is made up of two parts, technical efficiency and allocation efficiency: it can be seen that the product of technical efficiency (TE) and allocation efficiency (AE) brings the overall economic efficiency as follows:

$$\text{TE} \times \text{AE} = \left(\frac{0Q}{OP}\right) \times \left(\frac{0R}{0Q}\right) = \frac{0R}{0P}$$

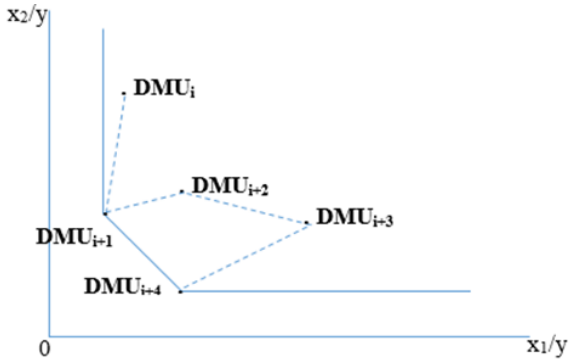
Scale efficiency - (SE) measures the rate of variation of outputs as inputs change, with production technology and management unchanged at the optimal production scale. According to the research of Rahman and Rosman (2013), there are three possible scenarios: (1) Increased efficiency due to scale (Irs) occurs when increasing inputs lead to an increase in outputs that exceed the rate of increase in inputs; (2) Decreased efficiency due to scale (Drs) occurs when increasing inputs leads to an increase in outputs that is less than the rate of increase in inputs; (3) Performance does not change by scale (Crs) when the rate of increase in outputs scale and the rate of increase in input costs are equal.

Farrell (1957) put forward an idea using a non-parametric segmental linear convex isometric line constructed such that no effective observation point is not located to the left or below the SS' isometric line (*figure 2.2*) which is estimated from the given sample data. Accordingly, a DMU manufactured at position Q (TEQ = 0Q/0Q=1) is considered to be technically effiency. For example, point Q is technically effective because it is above the effective SS'isotope line. Whereas if it is produced at the P site (TEP= 0Q/0P<1) is less efficient.



(Source: Charnes et al., 1978)

Figure 2.2. Technical efficiency of securities companies



(Source: Charnes et al. (1978), Asmild et al. (2004); Dang Thanh Ngo (2012)

Figure 2.3. Efficiency according to the DEA model of securities companies in a period

The DEA model is usually selected in one of two forms, input-oriented technical efficiency and output-oriented technical efficiency. The solution for each decision making unit (DMU) is to use inputs at the minimum necessary level to produce a certain set of outputs. Output-driven technical efficiency is a measure of the potential output of a DMU from a given set of inputs. This model shows that the securities company with optimal efficiency has a TE value of 1, but not completely effective with a TE value < 1. To calculate the indices of inefficient units is calculated by reconciling the inefficient units on the effective margin with the most effective 1; Or analyzing the time series efficiency of a securities company with the use of the DEA model to consider how the efficiency changes over time, increasing or decreasing, the years of optimal efficiency will have a technical efficiency of 1, compared to the years of inefficiency that have a value of descending to zero.

The choice of input-oriented or output-oriented model depends on the ability to control the inputs of DMUs and the selection is not much different in terms of efficiency evaluation points(T. Coelli, 1996). Previously, researchers often used 5 output and input variable approaches: production,

intermediation, assets, value added, cost of use. In particular, the intermediary approach is most used by researchers, especially when studying securities companies as an intermediary financial institution. From previous studies and from the perspective of (Berger & Humphrey, 1997)accompanied the same study(Thi & Anh, 2023), the authors decide to choose input and output variables based on the intermediate approach.

2.2.2. Malmquist Index

When considering time trend analysis, most authors tend to view efficiency as total factor productivity (TFP) and use the gap function (Shephard, 1970) tomeasure productivity change. (W.Caves et al., 1982)applied productivity indicators from Shephard's gap function as a theoretical framework for measuring productivity and its change which later became the Malmquist productivity index approach. The author(T. Coelli, 1996)first used the DEA method in combination with the Malmquist measurement index.

It estimates the change of relevant components including: technological progress (techch) is determined by a constant payback coefficient by scale, scale efficiency (sech) is determined by a distance function that satisfies a constant payback coefficient by scale on a distance function with a variable payback coefficient technology by scale. As for scale variable return technology, the pure efficiency coefficient (pech) is determined by the distance function in each period.

The Malmquist Productivity Index was developed by(W.Caves et al., 1982)the following:

$$M_0^t = \frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)}$$

In which $M^0{}_t$measures the change in productivity derived from the change in technical efficiency in the period t with t+1 with t+1 period technology is given as follows:

$$M_0^{t+1} = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^t,\ y^t)}$$

The Malmquist-TFP composite factor productivity index according to the output of(Fare et al., 1994) is determined as follows:

$$M_0\ (x^{t+1},\ y^{t+1},\ x^t,\ y^t) = \left(\frac{D_0^{t+1}(x^{t+1},y^{t+1})}{D_0^t(x^t,y^t)}\right)\sqrt{\left(\frac{D_0^t\ (x^{t+1},y^{t+1})}{D_0^{t+1}\ (x^{t+1},y^{t+1})}\right)\left(\frac{D_0^t\ (x^t,y^t)}{D_0^{t+1}\ (x^t,y^t)}\right)}$$

In which, the first term on the right side$\left(\frac{D_0^{t+1}(x^{t+1},y^{t+1})}{D_0^t(x^t,y^t)}\right)$measures the relative efficiency change between the years t and t+1 under the condition of constant efficiency by scale (CRS), and the remaining term $\sqrt{\left(\frac{D_0^t\ (x^{t+1},y^{t+1})}{D_0^{t+1}\ (x^{t+1},y^{t+1})}\right)\left(\frac{D_0^t\ (x^t,y^t)}{D_0^{t+1}\ (x^t,y^t)}\right)}$ shows the technical change index, which means the boundary technology change between the two periods t and t+1.

The Malmquist yield change index according to the output can be decomposed into:

$$M_0\ (x^{t+1}, y^{t+1}, x^t, y^t) = \sqrt{\left(\frac{D_0^t\ (x^{t+1},y^{t+1})}{D_0^t(x^t,y^t)}\right)\left(\frac{D_0^{t+1}\ (x^{t+1},y^{t+1})}{D_0^{t+1}\ (x^t,y^t)}\right)}$$

TFPCH = (EFCH) × [TECHCH]
If applied to the case of variable efficiency of scale (VRS):
EFCH= PECH × SECH
Generally: **TFPCH= (PECH × SECH) × [TECHCH]**

A Malmquist index greater than 1 will show increased productivity, and conversely less than 1 will show decreased productivity. In addition, the increase in each division of the Malmquist index will result in the value of that division greater than 1. The Malmquist index estimates the effectiveness between different periods through table data. The estimation results from the Malmquist index to compare and evaluate the effectiveness over time, and evaluate the relevant performance components and forecast future trends. By definition, the product of effective change and technical change will be equal to the Malmquist index, the components in the TFP index can change in the opposite direction.

3. RESEARCH MODEL

Data sources are collected from the most consolidated financial reports and annual reports over the years of 10 securities companies listed on hose and HNX on the Vietnam stock exchange in the period 2012 - 2022. Based on previous studies, the authors have chosen the input and output variables in the intermediate approach, and at the same time rely on the income from business activities of listed securities companies with the main source of revenue from net revenue. The authors select input variables related to equity, assets and expenses in the course of securities business activities to create revenue sources (output variables) of securities companies.In particular, 03 input variables are equity, indicating the financial strength of the securities company; fixed assets represent the physical basis factor participating in many business cycles, contributing to creating profits for the company and the cost of business activities represents the level of using costs to generate revenue for the securities company.

Factors	**Units**	**Previous researches**
Input		
Equity (X1)	Billion Dong	(Soewignyo, 2010)
Business operating expenses (X2)	Billion Dong	(Phuong, 2020)
Fixed assets (X3)	Billion Dong	(Kieu& Trang, 2021)
Output		
Net revenue (Y1)	Billion Dong	(Najadat et al., 2020)

Profit after tax (Y2)	Billion Dong	(He, 2021)

(Source: Research team's proposal)

4. RESEARCH RESULTS

14.1.Evaluate the technical performance of securities companies in the research phase through the DEAP 2.1 model

Table 4.1: Technical performance of securities companies in the period 2012-2022

	SSI		FPTS		HSC		BSI		VND		PSI		BVS		HBS		SHS		MBS	
YEAR	TE		TE		TE		TE		TE		TE		TE		TE		TE		TE	
2012	0.775	drs	1.000	-	1.000	-	1.000	-	0.790	irs	0.541	irs	0.693	irs	0.356	irs	1.000	-	1.000	-
2013	1.000	-	0.682	irs	1.000	-	1.000	-	0.828	irs	0.803	irs	0.600	irs	0.366	irs	0.563	irs	0.365	irs
2014	0.820	drs	1.000	-	1.000	-	1.000	-	0.933	drs	0.516	irs	0.840	irs	0.622	irs	1.000	-	0.762	irs
2015	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-	0.656	irs	1.000	-	0.737	irs	1.000	-	0.685	irs
2016	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-	0.825	irs	1.000	-	0.727	drs
2017	0.700	drs	1.000	-	0.972	drs	0.916	irs	1.000	-	0.787	irs	0.366	irs	0.766	irs	1.000	-	0.877	irs
2018	1.000	-	1.000	-	1.000	-	0.910	irs	1.000	-	0.656	irs	0.687	irs	0.394	irs	1.000	-	1.000	-
2019	0.836	drs	1.000	-	0.942	drs	0.908	irs	1.000	-	0.401	irs	0.706	irs	0.846	irs	1.000	-	1.000	-
2020	0.778	drs	0.932	irs	0.631	-	1.000	-	1.000	-	0.463	irs	0.539	irs	0.503	irs	1.000	-	0.938	irs
2021	0.878	drs	1.000	-	0.750	drs	1.000	-	1.000	-	0.945	irs	0.861	irs	0.666	irs	1.000	-	0.982	irs
2022	1.000	-	1.000	-	0.857	irs	0.866	irs	1.000	-	1.000	-	0.942	irs	0.634	irs	1.000	-	1.000	-

(Source: Results from DEAP 2.1 software)

From the research results of the table above, the group found the volatility of technical efficiency in most securities companies in the period 2012-2022. The companies with the most volatility are SSI, HSC, PSI, BVS, HBS, MBS; especially PSI and HBS securities companies are difficult to achieve maximum technical efficiency in the research period. This proves that the above companies have not used the inputs well to improve their business efficiency. In addition to companies that have not done this well, securities companies such as FPTS, BSI, VND or SHS have handled the use of inputs very effectively, proving that the technical efficiency of these companies has been very stable over the years and is almost approaching 1. Some companies that have also shown progress in technical efficiency are VND and SHS securities companies.

Considering the effectiveness of changes in scale, all securities companies have an increase or decrease in efficiency by scale in each year. However, it canseen that the SHS securities company was almost unchanged in size in all years during the research period, except in 2013, the efficiency decreased by scale. FPTS and VND securities companies also achieved a fairly stable target, in which FPTS only decreased in size in 2013 and 2020, VND companies fluctuated in the first 3 years of the research period and stabilized effectively in the following years. The remaining companies have increased and decreased in size as shown in the table above.

4.2. Analysis of Malmquist index estimation results

The Malmquist Index is used to estimate the variability of aggregate productivity change (Tfpch) and the variability of related efficiency components including technical efficiency (Effch), change

of technological progress (Techch), net efficiency change (Pech), and scale efficiency change (Sech). The results of efficiency estimation through the Malmquist index fluctuate, showing that 10 securities companies are trying to improve business efficiency.

Table 4.2: Average Malmquist Index for the period 2012-2022

YEAR	Effch (Changes in technical efficiency)	Techch (Technological change)	Pech (Change in net efficiency)	Sech (Change in scale)	Tfpch (Change in total factor productivity)
2012-2013	0.927	1.102	0.836	1.109	1.022
2013-2014	1.090	1.102	1.098	0.993	1.201
2014-2015	1.047	0.842	1.078	0.972	0.882
2015-2016	0.846	1.187	0.926	0.914	1.005
2016-2017	0.917	1.112	0.898	1.021	1.019
2017-2018	1.309	0.669	1.186	1.104	0.876
2018-2019	0.843	0.966	0.931	0.906	0.815
2019-2020	1.138	0.643	1.009	1.128	0.732
2020-2021	0.852	3.198	1.008	0.845	2.723
2021-2022	1.187	0.362	1.079	1.101	0.430
Average	**1.004**	**0.958**	**1.000**	**1.005**	**0.962**

(Source: Results from DEAP 2.1 software)

Table 4.2 shows that the average TFP composite factor productivity growth index of the research securities companies is 0.962, which is a decrease in productivity of up to 3.8%, and unstable over the periods from 2012 to 2022. The period 2012 – 2013 increased slightly by 2.2%, faster growth in the period 2013 – 2014 at a rate of 20.1% due to changes in net technical efficiency and changes in technological progress. The period 2014 – 2015 decreased by 11.8% but quickly increased in 2 periods 2015 – 2016 and 2016 – 2017. However, the TFP composite factor productivity index appeared in remission in the period 2017-2020, mostly due to a sharp decrease in technological progress. The period 2020 – 2021 reached the highest level at 2,723, the reason is that the securities companies focused on developing technical technology, contributing to improving the TFP index. In the last period of 2021 – 2022, the TFP index decreased the most, up to 57%, also due to the decline of the technology change index.

Table 4.3: General Malmquist Index of listed securities companies in the period 2012-2022

	Effch (Changes in technical efficiency)	Techch (Technological change)	Pech (Change in net efficiency)	Sech (Change in scale)	Tfpch (Change in total factor productivity)
SSI	0.960	0.949	1.000	0.960	0.911
FPTS	1.056	0.938	1.000	1.056	0.990

HSC	1.016	0.929	1.000	1.016	0.944
BSI	0.987	0.899	0.990	0.997	0.887
VND	1.002	0.921	1.000	1.002	0.923
PSI	1.010	0.905	1.008	1.002	0.914
BVS	1.009	0.991	1.000	1.009	0.999
HBS	1.000	1.020	1.000	1.000	1.020
SHS	1.006	1.020	1.000	1.006	1.026
MBS	1.000	1.017	1.000	1.000	1.017
Average	**1.004**	**0.958**	**1.000**	**1.005**	**0.962**

(Source: Results from DEAP 2.1 software)

The results of estimating the average TFP index for the period 2012 - 2022 for each securities company shown in Table 4.3 show that there are 03 companies with TFP index greater than 1 and 07 companies with TFP index less than 1. In particular, only 04 securities companies achieved above average combined efficiency in the entire research period 2012 - 2022 such as Bao Viet Securities Joint Stock Company, Hoa Binh Securities Joint Stock Company, Saigon Securities Joint Stock Company - Hanoi and MB Securities Company, most of the remaining securities companies have not achieved the desired efficiency. The average amount of input can be reduced so that the securities companies listed on the stock exchange reach the fully optimal status of 14.3%. The results from the DEAVRS model also show that there exists a net technical inefficiency of 5% and a scale inefficiency of 9.9%. The total factor productivity in the period 2012 – 2022 is slightly reduced, reaching an average of 0.962; technological progress has the largest contribution to the change in total productivity.

5. DISCUSSIONS AND CONCLUSIONS

Through the calculation results, the majority of securities companies operate effectively above 90% and no securities company operates effectively below average. Estimated results from the DEA model also identified a source of inefficiency from the scaling factor of 9.9% and from the executive management factor of 5%. At the same time, analyzing the total factor productivity change index with the same data set, the study also shows that the productivity of Vietnamese securities companies is uneven over the years due to the influence of many factors.

When considering each securities company individually, we find that most of the efficiency increases/decreases over the years from 2012-2022; but when considering all securities companies over a long period of time, the scale efficiency does not change.

Similarly, when evaluating total factor productivity, most of the technical efficiency indicators, net technical efficiency or scale efficiency do not fluctuate too much over the years. This further confirms the view that securities companies need to invest in technology and service quality to optimize business efficiency. In addition, securities companies also need to have solutions to improve the quality and adjust business activities accordingly, towards sustainable development.

Through the study of the topic "Using the method of data envelope analysis (DEA) and Malmquist index in evaluating the business performance of securities companies listed on the Vietnamese

stock market", the article has clarified the view of the business performance of securities companies, the indicators of evaluating the business performance of securities companies, the factors affecting the business performance of securities companies and the solutions to improve the business performance of securities companies. Based on the theoretical basis of the securities company's business performance, the study analyzed and evaluated the current business performance of 10 securities companies listed on two stock exchanges hose and HNX in Vietnam in the period 2012-2022.

In general, the business performance of securities companies is unstable, uneven and not commensurate with the potential of securities companies. The cause is shown through the DEA model that evaluates the performance of Vietnamese securities companies combined with the Malmquist index that measures the change in aggregate factor productivity. However, the study still has some limitations such as: the number of securities companies selected for the survey is still not rich, and the thesis has not studied the social efficiency achieved by securities companies. The above limitations are also suggestions for further research directions.

APPENDIX

Appendix 1: List of securities companies selected as research samples

NO.	SECURITIES COMPANIES	SECURITIES CODE
1	Saigon Securities Company	SSI
2	FPT Securities Joint Stock Company	FPTS
3	Ho Chi Minh City Securities Joint Stock Company	HSC
4	Bank for Investment and Development of Vietnam Securities Joint Stock Company	BSI
5	VNDIRECT Securities Joint Stock Company	VND
6	Petroleum Securities Joint Stock Company	PSI
7	Bao Viet Securities Joint Stock Company	BVS
8	Hoa Binh Securities Joint Stock Company	HBS
9	Saigon – Hanoi Securities Joint Stock Company	SHS
10	MB Securities Company	MBS

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