

DOI: 10.55643/fcaptop.6.59.2024.4551

Linh DT Trinh

PhD in Economics, Researcher of the
Faculty of Business Administration,
Industrial University of Ho Chi Minh
City, Ho Chi Minh, Vietnam;
e-mail: trinhdoantuanlinh@iuh.edu.vn
ORCID: [0000-0003-1942-405X](https://orcid.org/0000-0003-1942-405X)

Received: 01/09/2024

Accepted: 14/11/2024

Published: 31/12/2024

© Copyright
2024 by the author(s)



This is an Open Access article
distributed under the terms of the
[Creative Commons CC-BY 4.0](https://creativecommons.org/licenses/by/4.0/)

DETERMINANTS OF EFFICIENCY OF NON-LIFE INSURANCE COMPANIES: EVIDENCE FROM VIETNAM

ABSTRACT

Insurance companies play a major role in the financial systems of countries. However, studies on the efficiency and factors affecting the efficiency of insurance companies in Vietnam are still very limited. The purpose of the paper is to explore the efficiency and determinants of efficiency of non-life insurance companies operating in Vietnam. The author applies methods such as descriptive statistics, data envelopment analysis (DEA) and Tobit regression. The results show that the mean efficiency of non-life insurance companies operating in Vietnam during the research period is 0.806, the highest mean efficiency is 1.0 and the lowest is 0.303. Also, domestic insurance companies have the highest mean efficiency of 0.855, while joint venture insurers and foreign insurers have lower efficiency with a mean efficiency of 0.739 and 0.728. The research results also show that equity, debt-to-asset ratio, the ratio of operating expenses to assets, ROE, ROA, foreign capital to total capital ratio and annual GDP growth rate affect the efficiency of non-life insurance companies in Vietnam.

Keywords: efficiency, Tobit model, non-life insurance, data envelopment analysis, insurance companies, technical efficiency

JEL Classification: C14, F65, G22, P47

INTRODUCTION

Along with the development of the current economy, insurance increasingly proves its important role in social and economic. The important role of insurance as a type of financial service and as one of the mechanisms to ensure social security in the national economy can be mentioned as follows: (1) The beneficiary the insurance has transferred the consequences of financial risks to the insurance company; (2) Insurance has the effect of sharing the financial loss of a few people with a large number of people; (3) By paying insurance premiums (very small compared to the damage, loss when the risk occurs), customers will be guaranteed safety by insurance companies; (4) By participating in insurance, the insured has transferred his risk to the insurance company, so he has relieved his fears and worries about possible losses; (5) When there is no risk, insurance is one of the effective forms of savings for customers; (6) Concentration of capital (via premium) to invest in the economy; (8) Insurance companies create jobs when attracting social workers is not small. In addition, through investment in many forms, insurance indirectly creates more jobs for other industries. In today's very competitive environment, insurance companies need to organize and execute their activities effectively to increase their competitiveness with other financial institutions. Effective analysis and finding determinants of the efficiency of insurance companies are essential, helping insurance managers improve and increase operational efficiency for Vietnam's insurance industry.

LITERATURE REVIEW

There are many studies on the effectiveness of insurance companies and the impact of different factors on efficiency in many countries. However, to date, there has not been any research related to insurance companies in Vietnam. Studies such as Fenn et al

(2008) applied stochastic frontier analysis to estimate cost functions for European insurance companies over the period 1995 to 2001. The results show that larger companies with high market shares tend to have higher levels of cost inefficiency. Zanghieri (2009) assesses and explains differences in firm-specific efficiency using a panel of European insurers over the period 1997–2006. The results suggest caution in assessing insurer performance apart from local market structures. While in the non-life insurance industry, cost efficiency and profitability are positively related to size, implying economies of scale, in the life insurance industry, large firms tend to be relatively less efficient.

Al-Amri et al. (2012) analyzed the performance of the insurance industry in the Gulf Cooperation Council (GCC) countries and conducted a comparative analysis for different units of the industry. The authors analyzed the technical efficiency of insurance companies in the GCC countries using the DEA method.

Ahmad et al (2013) measured the relative performance of life insurance and general insurance in Malaysia using SFA for the year 2007 to 2009, covering 13 life insurance companies and 26 general insurance companies. The overall results showed that there was an increase of 1% to 17% per year in the life insurance industry, which shows that the performance of the life insurance industry is in good shape.

Rao et al (2014) measured the efficiency of non-life insurance companies in India from 2008 to 2013 using Stochastic Frontier Analysis. The results show that the average efficiency score of non-life insurance companies is increasing year by year. Micajkova (2015) estimated the efficiency of the insurance sector of the Republic of Macedonia for the period 2009–2013. The technical efficiency, pure technical efficiency and scale efficiency of 11 Macedonian insurance companies were measured using Data Envelopment Analysis (DEA), both CCR and BCC output-oriented models. The results from the analysis show that the average efficiency increases over most of the observation period. The average technical efficiency score of the Republic of Macedonia in 2013 was 0.84387 indicating a relatively high efficiency of the insurance sector.

Babatunde & Haron (2015) investigated the activities of Nigerian insurers using Data Coverage Analysis (DEA) over a five-year period from 2008 to 2012. Biener et al. (2015) used modern frontier efficiency methods to study the efficiency and productivity of Swiss insurance companies in the life insurance sectors from 1997–2013. The results showed that productivity and efficiency improved for property/casualty and reinsurance. The authors found that diversification strategies targeting European markets were more profitable than those targeting markets outside Europe.

Gramanová & Strunz (2017) analyzed the efficiency of 15 commercial insurance companies in Slovakia during the period 2013–2015 using the DEA model and assessed the relationship between technical efficiency score and efficiency indicators represented by Tobit regression.

Nourani et al (2017) measured the technical efficiency of Malaysian insurance companies using a novel framework of operational efficiency. The study measured the technical efficiency of Malaysian insurance companies using dynamic network coverage analysis to assess the operational efficiency of insurance companies by type (life, general and hybrid insurance companies) and ownership (domestic and foreign), over the period 2007–2014. The findings revealed inefficiencies in the investment capacity function among domestic insurance companies compared to their foreign counterparts.

Grmanová et al (2018) compared the life insurance efficiency of commercial insurance companies in the Czech Republic and Poland using Data Envelopment Analysis (DEA) models. Using descriptive statistics, DEA models and Tobit regression models.

Taib et al (2018) use data envelopment analysis (DEA) to calculate the Efficiency (Technical, Pure Technical and Scale Efficiency) of 19 companies in the Pakistani insurance industry (14 conventional companies and 5 takaful companies). Sharew & Fentie (2018) empirically evaluated the efficiency of insurance companies in the Ethiopian insurance industry using Data Envelopment Analysis (DEA) method.

Jaloudi (2019) assessed technical efficiency in the Jordanian insurance market and examined the internal and external determinants that appear to influence the technical efficiency of insurance companies over the period 2000 – 2016. Lanfranchia et al (2020) applied Stochastic Frontier Analysis to evaluate the efficiency of public P&C insurers in the United States during the period 2012–2018, the results showed that, even though the overall technical efficiency of the whole industry increased during the analyzed period, the comparative efficiency between insurers decreased over time.

Abdin et al (2022) analyzed the efficiency of general insurance companies in Indonesia using the DEA method with data in the period 2017–2018. The results show that the efficiency of general insurance companies is on a positive trend. Testing the determinants of efficiency using the Tobit regression model shows that the expense ratio is the only factor that significantly affects the efficiency of general insurance companies in Indonesia.

These studies analyze efficiency and have similar and different results in terms of efficiency levels, and factors affecting the effectiveness of insurance companies. The difference in the results stems from the selection of data, and the choice of insurance company type (life insurance, non-life insurance, general insurance). The common point of the above studies is that the factors of enterprise size, market share, total cost and type of business affect the efficiency of insurance companies. However, these studies have not considered the impact of macro factors on efficiency.

Overall, these are studies that make an important contribution to the analysis of efficiency and identify factors affecting efficiency in insurance companies. This article adds macro factors such as GDP growth rate and annual inflation rate that affect the performance of insurance companies. According to Daare (2016), and Berhe et al. (2017), macro factors such as GDP growth rate and annual inflation rate affect the business results of insurance companies. The purpose of this article is to analyze and rank the efficiency of insurance companies and compare the efficiency by types of ownership (Domestic, foreign, joint venture) using the data envelopment analysis model (DEA) and identify factors affecting the efficiency of non-life insurance companies operating in Vietnam by Tobit regression. The research question is specifically: (1) Are domestic insurers more efficient than foreign and joint venture insurers? (2) In addition to the factors identified in previous studies, do macro factors such as inflation and GDP growth rate affect the efficiency of non-life insurance companies in Vietnam?

Efficiency is a commonly used term in many fields such as economics, technology, social sciences, etc. In economics, efficiency can be understood as productivity and is measured by the ratio between the output and the input that is used to produce it. In practice, companies often use multiple inputs to produce one or more outputs. In cases where multiple inputs and outputs are used, researchers tend to call it technical efficiency (Siems and Barr, 1998). At the organizational (company) level, there are two approaches to measuring the performance of a company: parametric and non-parametric approaches. Each method has its own advantages and disadvantages compared to the other methods. The parametric approach can provide information on confidence intervals and biases; however, it faces problems in choosing the right functional form and requires large samples (Berger and Humphrey, 1997). In contrast, non-parametric approaches tend to envelop data collected from sampled financial institutions to estimate the optimal bounds of the entire sample, and then score each institution by comparing its current level with the optimal level. This approach is therefore more flexible than the parametric approach (Charnes, Cooper and Rhodes, 1978, Farrel, 1957) and suitable for non-productive organizations. In fact, we can analyze the performance of insurance companies as a single entity by applying the definition of technical efficiency. Thus, a system of insurance companies is defined as efficient if it can fulfil the task of providing insurance services. Therefore, its efficiency can be calculated by comparing the output (income from the provision of insurance services and investment) and the input (Capital, labour) through the data envelopment analysis (DEA), a popular method of the non-parametric approach.

Some studies using DEA include Al-Amri et al (2012), Micajkova (2015), Babatunde & Haron (2015), Biener et al (2015), Gramanová & Strunz (2017), Nourani et al. (2017), Gremanová et al. (2018), Taib et al (2018), Sharew & Fentie (2018), Jaloudi (2019, Abdin et al. (2022). Studies using the SFA method include Fenn and associates (2008), Zanghieri (2009), Ahmad et al (2013), Rao et al (2014), Lanfranchia et al (2020). In this study, the author proposes to use the DEA method to analyze the efficiency of insurance companies.

According to Edward Gardener et al. (2011), one of the disadvantages of the non-parametric method is that it cannot assess the degree of influence of each independent variable on the outcome of the dependent variable. Therefore, the non-parametric method is often applied along with the regression function. One of the regression functions selected in popular financial research is Tobit regression, as studied by Edward Gardener et al (2011); Grmanová, E., & Strunz, H. (2017), Sharew & Fentie (2018), Abdin et al. (2022). Tobit regression is a type of function with a limited dependent variable, that is, a function in which the dependent variable is continuous for all positive values and is only zero for some part of the population. In this study, the dependent variable is the technical efficiency score of insurance companies, this efficiency score ranges from 0 to 1, so the Tobit regression function is applied.

AIMS AND OBJECTIVES

The primary purpose of the paper is to delve into the evaluation of the efficiency and determinants of the efficiency of insurance companies. This study specifically aims to shed light on the internal and external macro factors of insurance companies as well as how these factors generally affect the efficiency of insurance companies. To pursue this overarching goal, the authors set out to address the following key questions:

1. How efficient are insurance companies?

2. Which type of ownership is the most efficient among insurance companies classified by ownership type?
3. What are the micro and macro factors that determine the efficiency of insurance companies?
4. The extent to which each factor impacts the efficiency of non-life insurance companies operating in Vietnam.

This study aims to explore the technical efficiency of each non-life insurance company, classifying the efficiency according to each type of insurance company ownership (Domestic insurance company, foreign insurance company and joint venture insurance company). This study also investigates internal factors such as Financial efficiency, cost efficiency, capital structure, shareholder structure, equity size, and asset size and how macro factors such as economic growth, and inflation rate affect the performance of non-life insurance companies.

METHODS

DEA method

In this paper, the DEA method is chosen for two main reasons. First, the DEA method does not require defining a production function and is a linear-based technique, so DEA is user-friendly because it requires less econometric specification than the Stochastic Frontier Analysis (SFA). Second, the sample of this study was small. To construct a production function for efficient estimates, SFA often requires relatively large datasets with a significant number of parameters to be estimated (Gardener et al. (2011)).

DEA was first introduced by Charnes et al. (1978) based on Farrell's (1957) idea of estimating technical efficiency with production frontiers. The model uses linear programming to construct an efficiency frontier that covers all the technical efficiency scores of a firm achieved by maximizing production with the number of factors of production used. The technical efficiency index is defined as the quotient between the level of production achieved and the maximum that a firm can achieve by combining the inputs-outputs of the firms in the sample, where the most efficient firms on the frontier are compared with similar firms on the frontier to estimate the efficiency score. According to Charnes et al. (1978), The technical efficiency of insurance companies is measured using the Charnes, Cooper and Rhode (CCR) DEA model with the assumption of constant return to scale (CRS). Model is:

$$\text{Max } E_m = \sum_{j=1}^J V_{jm} Y_{jm}$$

$$\sum_{j=1}^J V_{jm} Y_{jm} - \sum_{i=1}^I U_{im} X_{im} \leq 0 \text{ for all } i$$

$$\sum_{i=1}^I U_{im} X_{im} = 1 \text{ (to move from ratio to linear programming form),}$$

where, E_m : Technical efficiency of the m^{th} company, Y_{jm} : The j^{th} output of m^{th} company, V_{jm} : The weight of j^{th} output of m^{th} company, X_{im} : The i^{th} input of m^{th} company, U_{im} : The weight of i^{th} input of m^{th} company, $V_{jm}, U_{im} \geq 0; i = 1, 2, \dots, I; j = 1, 2, \dots, J$.

Input and output selection

Measuring the efficiency of decision-making units using the DEA method requires selecting input and output variables that are appropriate to the characteristics of each industry. However, the selection of input and output factors of financial institutions in general and insurance companies in particular in efficiency measurement and analysis studies is still inconsistent. In empirical studies, the selection of inputs and outputs for financial institutions is mainly based on two different approaches, the intermediary approach and the production approach. Berger & Humphrey (1997) argue that there is no perfect approach, but the intermediate approach may be more appropriate to evaluate the entire financial institution.

The selection of input and output variables by the previous authors is as follows: Al-Amri et al. (2012) selected two inputs as management expenses and claims and two outputs as premium income and investment income; Micajkova (2015) selected three inputs as administrative expenses, commission payments and total capital and chooses one output as total insurance premiums; Babatunde & Haron (2015) selected two inputs as commission and management expenses and two outputs as income from insurance premiums and income from investment activities; Gremanová & Strunz (2017) selected as inputs including claims incurred and operating expenses and outputs as insurance premiums and investment income; Nourani et al (2017) selected three inputs as operating expenses, liabilities and equity, and two outputs as income from investment activities and net profit; Taib et al. (2018) selected three inputs as equity, operating expenses and claims and two outputs as premium revenue and income from investments; Sharew & Fentie (2018) selected two inputs as total operating expenses and total assets and two outputs as premium income and profit after tax; Jaloudi (2019) selected

three inputs as total operating expenses, debt and equity, and total technical provisions, and two outputs as net premiums earned and income from investments; Abdin et al (2022) selected two inputs as total assets and total operating expenses and two outputs as premium revenue and investment income.

From previous studies, in this study, the author inherits and adds variables in the research model of the performance of insurance companies. Accordingly, to calculate technical efficiency, three inputs are selected as equity (Nourani et al., 2017; Taib et al., 2018; Jaloudi, 2019); liabilities (Nourani et al., 2017; Sharew & Fentie, 2018; Jaloudi, 2019) and operating expenses (Babatunde & Haron, 2015; Grmanová & Strunz, 2017; Nourani et al., 2017; Sharew & Fentie, 2018; Taib et al., 2018; Jaloudi, 2019). The two outputs are premium and investment income (Al-Amri et al., 2012; Micajkova, 2015; Grmanová & Strunz, 2017; Taib et al., 2018; Babatunde & Haron, 2015; Jaloudi, 2019; Abdin et al., 2022). We have a summary of the inputs and outputs in the DEA model as follows:

Input: X1 – Equity; X2 – Liabilities; X3 – Operating expenses;

Output: Y1 – Premium revenue; Y2 – Investment income;

DEAP 2.1 software (Coelli, 1996) was used to estimate the model.

Tobit regression

The disadvantage of the DEA method is that it does not determine the influence of factors in the econometric model. Therefore, to overcome the above disadvantages, people use a regression model. In the next step, the efficiency score in the DEA model is used as a dependent variable in the regression model to determine the factors affecting the efficiency of insurance companies. Tobit regression was used because the efficiency score was limited between 0 and 1 (Lovell, 1993). The Tobit regression method was used in the studies (Grmanová & Strunz, 2017; Sharew & Fentie, 2018; Abdin et al., 2022).

Tobit model was first used in econometric theory for analysis by economist James Tobin in 1958, it is called regression function with limited dependent variable. The dependent variable continuously for positive values and only zero for some part of the population. The symbol Y is a continuous variable for all positive values, taking the value 0 with positive probability. A linear model can be used to model this phenomenon:

$$E(Y | X_1) = \beta_0 + \beta_1 X_1$$

This model can also lead to a possibly negative Y^* value. This problem is similar to the linear probability model. To fix this one solves as follows:

$$Y^* = \beta_0 + \beta_1 X_1 + u \tag{1}$$

$$Y = \max(Y^*, 0) \tag{2}$$

$$X = (1, X_1), (X_i = (1, X_{1i}))$$

Where u satisfies the assumptions of the classical regression model, $u | X_1$ has the distribution $N(0, \sigma^2)$. Thus Y^* also satisfies the assumptions of the classical regression model. Equation (2) implies that the variable Y is observable, $Y = Y^*$ if $Y^* \geq 0$; $Y = 0$ if $Y^* < 0$. Since Y^* has a normal distribution, Y will be continuous for truly positive values, the density function of Y for positive values is the density function of Y^* for a given X . Therefore:

$$\begin{aligned} P(Y=0|X) &= P(Y^* < 0|X) \\ &= P(u < -\beta_0 - \beta_1 X_1) = P(u < -X\beta) \\ &= P(u/\sigma < -X\beta/\sigma) \\ &= F(-X\beta/\sigma) \\ &= 1 - F(X\beta/\sigma) \\ P(Y > 0|X) &= F(X\beta/\sigma) \end{aligned}$$

F – is the probability distribution function of the normal distribution

Since u/σ has a normal distribution and is independent of X , the density function of Y for given X :

$$(2\pi\sigma^2)^{-1/2} \exp(-(Y-Xi\beta)^2 / (2\sigma^2)) = (1/\sigma)f((Y-Xi\beta)/\sigma), Y > 0$$

$$P(Y_i = 0|X_i) = 1 - F(X_i\beta/\sigma)$$

Therefore, Ln is the maximum rational function for each observation:

$$L_i(\beta, \sigma) = 1(Y_i = 0)\ln(1 - F(X_i\beta/\sigma)) + 1(Y_i > 0) \{\ln((1/\sigma) f((Y - X_i\beta)/\sigma))\}$$

Where 1(.) is the value of the logical expression, if the condition in the brackets is true, the expression is equal to 1. Otherwise, the value is 0. The estimators of β and σ found by the method of reasonable maximum estimation. From equation (1) β_1 measures the specific effect of X on $E(Y^*|X)$. Y^* can be explained economically, but the variable to be explained is Y, not Y^* .

Evaluation of factors that impact the efficiency of insurance companies in recent years has been studied: Gramanová & Strunz (2017) in studying the factors affecting the efficiency of insurance companies in Slovakia, identified three factors as ROA, ROE and assets. Sharew & Fentie (2018) identified four influencing factors including assets, the ratio of liabilities to assets, the number of branches and the number of years of establishment of the insurance company. Jaloudi (2019) also identifies four influencing factors: assets, reinsurance ratio, ROA and type of insurance company. Abdin et al (2022) identified three influencing factors: ownership form (domestic and foreign), the ratio of operating expenses to assets and the investment ratio to assets. The author inherits from previous studies, in this study, the factors used are assets, equity, liabilities-to-asset ratio, the ratio of operating expenses to assets, return on asset (ROA), return on equity (ROE) and the ratio of foreign capital to capital. The dependent variable is the efficiency score (TE) in the DEA model, the Tobit regression model is as follows:

$$TE_{it} = \beta_1 + \beta_2(SIZE_{it}) + \beta_3(EQT_{it}) + \beta_4(DEB_{it}) + \beta_5(OPE_{it}) + \beta_6(ROA_{it}) + \beta_7(ROE_{it}) + \beta_8(VNN_{it}) + \beta_9(LPH_{it}) + \beta_{10}(GDP_{it}) + U_{it}$$

In which, *t* and *i* are the year and insurance company respectively, β_1 is the constant/intercept coefficient, $\beta_2 - \beta_{10}$ are the regression coefficients and U_{it} is the noise term; *TE* – Technical efficiency is in the range (0,1); *SIZE* – Assets; *EQT* – Equity; *DEB* – Liabilities /Assets; *OPE* – Operating expenses/Assets; *ROA* – Return/Assets; *ROE* – Return/Equity; *VNN* – Foreign capital/Capital; *LPH* – Annual inflation rate; *GDP* – Annual GDP growth. Stata 14 software to estimate the above model.

Data

Research data for the period 2015-2022 was collected from financial statements and annual reports of insurance companies. Data on the inflation rate and GDP were obtained from the General Statistics Office of Vietnam (GSO). The study population is all non-life insurance companies operating in Vietnam and the sample selection is based on the following criteria: non-life insurance companies are operating in Vietnam and published annual financial statements during the study period. Therefore, in this study, the sample includes 20 non-life insurance companies that fit the above criteria. Among the 20 companies, there are 5 foreign insurance companies, 12 domestic insurance companies and 3 joint venture insurance companies (Table 1).

No	Companies	Ownership	No	Companies	Ownership
1	Bao Minh	Domestic	11	Saigon – Hanoi insurance	Domestic
2	Bao Viet	Domestic	12	Global Insurance	Foreign
3	AIG Insurance	Foreign	13	VASS Insurance	Domestic
4	BIDV insurance	Domestic	14	Vietinbank Insurance	Domestic
5	Buu Dien Insurance	Domestic	15	Tokio Marine Insurance	Joint venture
6	FubonVietnam	Foreign	16	Cathay	Foreign
7	Aviation Insurance	Domestic	17	Liberty	Foreign
8	United Insurance	Joint venture	18	Mbbank Insurance	Domestic
9	Agribank Insurance	Domestic	19	Petrolimex Insurance	Domestic
10	Samsung Vina Insurance	Joint venture	20	PVI Insurance	Domestic

The data of variables in the efficiency evaluation model of insurance companies (DEA model) are described in Table 2, whereby the research model consists of 2 output variables, Y1, Y2, and 3 input variables. X1, X2, X3. Premium revenue (Y1) is the total premium revenue an insurance company earns from providing products and services to customers, the

data is taken from the income statement. Income from investment activities (Y2) is income from investment activities of an insurance company such as real estate investment, financial investment and other investments. This data is taken from the insurance company's annual income statement. Equity (X1) and liabilities (X2) are the respective items taken from the balance sheet of the insurance company. Operating expenses (X3) are the total operating expenses of the insurance company, this figure is taken from the income statement.

Table 2. Descriptive statistics of input and output – DEA model (VND million).

Variable	Obs	Mean	Std. Dev	Min	Max
Y1 – Premium revenue	160	3,065,281	6,700,028	55,498	42,650,508
Y2 – Investment income	160	427,437	1,363,053	1,055	8,082,124
X1 – Equity	160	1,972,372	3,759,592	300,000	22,031,321
X2 – Liabilities	160	7,479,187	24,600,000	211,995	180,393,019
X3 – Operating expenses	160	396,085	708,700	26,802	4,019,572

The variables in the evaluation model of factors affecting the efficiency of insurance companies in Vietnam are described in Table 3. In which the dependent variable (TE) is the efficiency score in the DEA model; Assets (SIZE) figures are taken from the assets section of the insurance company's balance sheet; Equity (EQT) figures taken from the company's equity portion including owners' contributed capital, equity surplus, funds and undistributed profits in the balance sheet; The liabilities-to-asset ratio (DEB) is the total debt divided by the insurance company's assets and is derived from the liabilities and assets entries on the balance sheet. The ratio of operating expenses to assets (OPE) is the ratio between an insurance company's operating expenses and assets, taken from the operating expenses and assets section of the income statement and balance sheet. ROA, ROE is the ratio of return on assets and return on equity, the data is taken from the income statement of the insurance company. The ratio of foreign capital to capital (VNN) represents the ratio of capital contribution/ownership of foreign organizations and individuals in insurance companies in Vietnam, the data is taken from annual reports, financial statements and on the insurance company's website. LPH and GDP are the annual inflation rate and GDP growth rate, the data is taken from the General Statistics Office of Vietnam.

Table 3. Descriptive statistics of variables – Tobit Regression Model.

Variable	Obs	Mean	Std. Dev	Min	Max
TE – Technical efficiency	160	0.806	0.193	0.303	1.000
SIZE – Asset	160	4,009,052	4,274,244	689,046	20,166,398
EQT – Equity	160	1,972,372	3,759,592	300,000	22,031,321
DEB – Liabilities/Asset	160	0.923	1.347	0.071	8.945
OPE – Operating expenses /Asset	160	0.108	0.134	0.019	0.938
ROA – Return on asset	160	0.030	0.066	-0.547	0.247
ROE – Return on equity	160	0.075	0.161	-1.258	0.498
VNN – Foreign capital/ Capital	160	0.393	0.409	0.000	1.000
LPH – Annual inflation rate	160	2.671	0.932	0.630	3.540
GDP – Annual GDP growth	160	5.914	1.898	2.580	8.020

RESULTS AND DISCUSSION

Efficiency of insurance companies

The results of estimating the efficiency of insurance companies by the DEA method (Table 4) show that the average efficiency of the entire system during the study period is 0.806. This result shows that with constant input, the mean efficiency under best conditions can be increased by 0.241. In contrast, with constant output, insurance companies can save up to 0.194 inputs during business operations. The insurance companies with the highest mean efficiency are Saigon – Hanoi Insurance, VASS Insurance, and Bao Viet Insurance with mean efficiency are 0.979; 0.964 and 0.963. The lowest efficiency is in Tokio Marine Insurance, Fubon Vietnam Insurance, and AIG Insurance with the mean efficiency in the study period being 0.533; 0.618 and 0.634.

Table 4. Efficiency of insurance companies.

No	Companies	2015	2016	2017	2018	2019	2020	2021	2022	Mean	Ranking
1	Bao Minh	0.890	1.000	1.000	1.000	1.000	1.000	0.887	0.561	0.917	5
2	Bao Viet	1.000	1.000	1.000	1.000	1.000	0.855	1.000	0.846	0.963	3
3	AIG Insurance	0.638	0.637	0.400	0.642	0.535	0.502	0.715	1.000	0.634	18
4	BIDV Insurance	0.672	0.857	0.815	0.719	0.629	0.578	1.000	0.521	0.724	17
5	Buu Dien Insurance	1.000	0.872	0.752	0.799	0.867	0.948	1.000	0.645	0.860	8
6	FubonVietnam	0.624	0.878	0.482	0.482	0.459	0.474	0.546	1.000	0.618	19
7	Aviation insurance	1.000	0.993	0.837	1.000	1.000	0.706	1.000	0.389	0.866	7
8	United Insurance	0.911	0.674	0.772	0.672	0.547	0.485	0.811	0.926	0.725	16
9	Agribank Insurance	0.943	1.000	0.653	0.834	0.749	0.718	0.787	0.398	0.760	12
10	Samsung Vina Insurance	0.971	1.000	1.000	1.000	1.000	1.000	1.000	0.709	0.960	4
11	Saigon – Hanoi Insurance	0.829	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.979	1
12	Global Insurance	0.520	0.475	0.637	0.783	0.775	0.964	0.752	1.000	0.738	15
13	VASS Insurance	0.708	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.964	2
14	Vietinbank Insurance	0.841	1.000	0.303	1.000	0.769	0.752	0.809	0.598	0.759	13
15	Tokio Marine Insurance	0.589	0.560	0.473	0.479	0.472	0.450	0.492	0.749	0.533	20
16	Cathay	0.861	1.000	0.942	1.000	0.611	0.677	1.000	0.388	0.810	10
17	Liberty	1.000	1.000	0.590	0.864	0.710	0.918	1.000	0.658	0.843	9
18	Mbbank Insurance	0.705	0.803	1.000	0.828	0.700	0.688	0.754	0.899	0.797	11
19	Petrolimex Insurance	0.887	0.983	0.648	0.649	0.687	0.762	0.695	0.743	0.757	14
20	PVI Insurance	1.000	1.000	1.000	1.000	1.000	1.000	0.651	0.676	0.916	6
Mean		0.830	0.887	0.765	0.838	0.775	0.774	0.845	0.735	0.806	
Min		0.520	0.475	0.303	0.479	0.459	0.450	0.492	0.388	0.303	
Max		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	

There are 3 types of insurance companies operating in Vietnam: Foreign insurance companies (100% foreign capital); Joint venture insurance companies (Joint venture between a foreign insurance company and a domestic insurance company); Domestic insurance companies. During the study period, the domestic insurance companies had the highest mean efficiency with a mean efficiency of 0.855, ranked second by the group of joint ventures with a mean efficiency of 0.739, and behind the group of foreign insurance companies with a mean efficiency of 0.728 (Table 5). Most of the domestic insurance companies are subsidiaries of large banking and financial groups with a long history of operation in Vietnam, so they have the advantage of a large and stable customer base from customer data within the group should be more effective than other groups of companies. Most of the foreign insurance companies and joint ventures have a short time to penetrate the Vietnamese market, the market share is still low, and companies have to invest a lot in marketing, sales, product promotion, etc. So, in this period, the efficiency is not high.

Table 5. Descriptive statistics of efficiency by ownership.

Ownership		2015-2022	2015	2016	2017	2018	2019	2020	2021	2022
Foreign	Mean	0.728	0.7259	0.798	0.610	0.754	0.618	0.707	0.803	0.809
	Max	1.000	1.000	1.000	0.942	1.000	0.775	0.918	1.000	1.000
	Min	0.388	0.520	0.475	0.400	0.482	0.459	0.474	0.546	0.388
Joint venture	Mean	0.739	0.824	0.745	0.748	0.717	0.673	0.645	0.768	0.795
	Max	1.000	0.971	1.000	1.000	1.000	1.000	1.000	1.000	0.926
	Min	0.450	0.589	0.560	0.473	0.479	0.472	0.450	0.492	0.709
Domestic	Mean	0.855	0.873	0.959	0.834	0.902	0.867	0.834	0.882	0.690
	Max	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Min	0.303	0.672	0.803	0.303	0.649	0.629	0.578	0.651	0.389

Determinants of efficiency of insurance companies

The results of the Tobit regression model analysis with the dependent variable being the efficiency score in the DEA model, with the help of Stata 12 software are described in Table 6, according to which factors such as Equity; Liabilities -to-asset ratio; The ratio of operating expenses to assets; ROE; ROA; The ratio of foreign capital to capital and GDP growth rate have an impact on the efficiency of non-life insurance companies in Vietnam. Equity factor EQT has a positive effect on the efficiency of insurance companies at the 5% significance level. This shows that companies with larger equity are more efficient. The liabilities-to-asset ratio factor has a negative impact on the efficiency of insurance companies at the 10% significance level, this result is consistent with the study of Sharew & Fentie (2018), this result shows the higher the debt ratio, the lower the efficiency. The factor of the ratio of operating expenses to assets has an impact on the efficiency of the insurance companies with a significance level of 10%, this result is consistent with the study of Abdin et al (2022). Return on equity (ROE) affects the efficiency of the insurance companies with a significance level of 5%, this result is consistent with the study of Gremanová & Strunz (2017). The factor of return on total assets (ROA) affects the efficiency of the insurance companies with a significance level of %, this result is consistent with the study of Gramanová & Strunz (2017), and Jaloudi (2019). The factor of the ratio of foreign capital to capital affects the efficiency of the insurance companies with a significance level of 1%, this result is consistent with the study of Abdin et al (2022), this result shows it is found that the higher the proportion of foreign capital, the less efficient the insurance companies in the research period, this result is consistent with the results of analysis by the DEA model (Table 6), the foreign insurance companies and joint ventures companies are less efficient than domestic insurance companies. Among the macro factors, the annual GDP growth rate affects the efficiency of the insurance companies with a significance level of 5%, this result shows the addition of the macro factor to the research model is necessary.

Table 6. Determinants of efficiency.

Variable	Coef	Std. Dev	t	P > t	95% Conf. Interval	
SIZE	0.15	0.15	1.00	0.321	-0.148	4.45
EQT	0.94	0.44	2.16	0.034	0.074	1.80
DEB	-0.002	0.44	-1.82	0.072	-0.004	0.001
OPT	0.005	0.002	1.91	0.060	-0.001	0.009
ROE	-0.017	0.007	-2.55	0.012	-0.030	-0.004
ROA	0.042	0.015	2.70	0.008	0.011	0.072
VNN	-0.002	0.001	-2.92	0.004	-0.003	-0.001
LPH	0.012	0.024	0.50	0.617	-0.035	0.059
GDP	-0.169	0.084	-2.02	0.046	-0.336	-0.003
Cons	1.999	0.547	3.65	0.000	0.912	3.087
Sigma	0.214	0.547	-	-	0.173	0.255
LR chi2 (9)	49.37					
Prob > chi2	0.000					
Psedu R2	0.597					
Obs:	160					

CONCLUSIONS

The study was conducted on a sample of 20 insurance companies in the popular 30 non-life insurance companies operating in Vietnam. Using the research DEA method, the average overall efficiency of insurance companies in the research period was 0.806, the lowest efficiency was 0.303, and the highest efficiency was 1.0. This result shows that, in the research period, the efficiency of insurance companies is relatively good. This shows that insurance companies are on a sustainable development trajectory after the period of global economic crisis and the restructuring of the financial system by the Government of Vietnam.

The results also show that domestic insurance companies have the highest average efficiency, followed by joint venture companies and foreign companies. Most of the domestic insurance companies are subsidiaries of large banking and financial groups. These companies have a long operating history in Vietnam, so they have the advantage of the group's large

customer data, so they are more effective than other companies. The majority of foreign insurance companies and joint venture companies have a short time to penetrate the Vietnamese market, the market share is still low, and companies have to invest a lot in marketing, sales, product promotion, etc., so they are not effective at this stage. The study also found factors such as Equity; Debt to total assets; Operating expenses on total assets; ROE; ROA; The ratio of foreign capital to total capital and GDP growth rate has an impact on the efficiency of non-life insurance companies operating in Vietnam. From the above results, in order to increase operational efficiency in the coming time, insurance companies need to increase the size of equity capital and adjust the liabilities ratio and operating expenses reasonably, increasing return on assets and return on equity to increase efficiency.

The research results presented in the paper open up avenues for further exploration in many directions. The focus of the study is on the micro and macro factors that determine the efficiency of non-life insurance companies. In addition, future research can delve deeper into other factors such as investment efficiency, monetary policy, interest rates, exchange rates, etc. that may affect the efficiency of insurance companies. In addition, future research needs to expand the sample to include life insurance companies in many different countries to draw other interesting insights into the efficiency of other diverse factors affecting the efficiency of insurance companies.

ADDITIONAL INFORMATION

FUNDING

The Authors received no funding for this research.

CONFLICT OF INTEREST

The Authors received no funding for this research.

REFERENCES

1. Abdin, Z., Prabantarikso, R. M., Fahmy, E., & Farhan, A., (2022). Analysis of the efficiency of insurance companies in Indonesia. *Decision Science Letters*, 11(2), 105-112. <http://dx.doi.org/10.5267/j.dsl.2022.1.002>
2. Ahmad, W.M, Nawi, M.A.A, & Aleng, N.A. (2013). Relative Efficiency Analysis Industry of Life and General Insurance in Malaysia Using Stochastic Frontier Analysis (SFA). *Applied Mathematical Sciences*, 7(23), 1107 – 1118. <http://dx.doi.org/10.12988/ams.2013.13100>
3. Al-Amri, K., Gattoufi, S., & Al-Muharrami, S. (2012). Analyzing the technical efficiency of insurance companies in GCC. *Journal of Risk Finance*, 13(4), 362-380. <https://doi.org/10.1108/15265941211254471>
4. Babatunde, J.H., & Haron, R. (2015). Technical Efficiency of Nigerian Insurance Companies: A Data Envelopment Analysis and Latent Growth Curve Modelling Approach. *International Journal of Data Envelopment Analysis*, 3(2), 659- 677. http://irep.iium.edu.my/46870/1/Technical_Efficiency_of_Nigerian_Insurance_Companies.pdf
5. Banker, R.D., Charnes, A., & Cooper, W.W. (1984). Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. *Management Science*, 30(9), 1031 – 1142. <https://doi.org/10.1287/mnsc.30.9.1078>
6. Berger, A.N., & Humphrey, D.B. (1997). Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research*, 98(2), 175-212. [https://doi.org/10.1016/S0377-2217\(96\)00342-6](https://doi.org/10.1016/S0377-2217(96)00342-6)
7. Berhe, T.A., & Kaur, J. (2017). Determinants of insurance companies' profitability Analysis of insurance sector in Ethiopia. *International Journal of Research in Finance and Marketing*, 7(4), 124 – 137. <https://euroasiapub.org/wp-content/uploads/2017/05/12FMApril-4785.pdf>
8. Biener, C., Eling, M., & Wirfs, J.H. (2015). The Determinants of Efficiency and Productivity in the Swiss Insurance Industry. *European Journal of Operational Research*, 248(2), 703 – 714. <https://doi.org/10.1016/j.ejor.2015.07.055>
9. Charnes, A., Cooper, W.W., & Rhodes, E. (1978). Measuring the efficiency of decision-making units. *European Journal of Operational Research*, 2, 429-444. [https://doi.org/10.1016/0377-2217\(78\)90138-8](https://doi.org/10.1016/0377-2217(78)90138-8)
10. Coelli, T., Prasada Rao, D. S., & Battese, George E. (2005). *An Introduction to Efficiency and Productivity Analysis*. Springer Science Business Media, LLC 2nd Ed. <http://dx.doi.org/10.1007/978-1-4615-5493-6>
11. Coelli, T.J. (1996). A Guide to Frontier Version 4.1: A Computer Program for Stochastic Frontier Production and Cost Function Estimation. Center for Efficiency and Productivity Analysis. University of New England, Armidale. <http://www.uq.edu.au/economics/cepa/frontier.php>
12. Daare, W.J. (2016). Determinants of Non-Life Insurance Companies Profitability: An Empirical Study in India. *International Journal of Innovative Research and Advanced Studies*, 3(13), 6 – 11. https://www.ijiras.com/2016/Vol_3-Issue_13/paper_2.pdf

13. Gardener, E., Molyneux, P., & Nguyen-Linh, H. (2011). Determinants of efficiency in South East Asian Banking. *The Service Industries Journal*, 31(16), 2693–2719. <https://doi.org/10.1080/02642069.2010.512659>
14. Farrell, M. J. (1957). The Measurement of Productive Efficiency. *Journal of the Royal Statistical Society*, 12(3) 253–290. <https://doi.org/10.2307/2343100>
15. Fenn, P., Vencappa, D., Diacon, S., Klumpes, P., & O'Brien, C. (2008). Market structure and the efficiency of European insurance companies: A stochastic frontier analysis. *Journal of Banking & Finance*, 32(1), 86 – 100. <https://doi.org/10.1016/j.jbankfin.2007.09.005>
16. Gardener, E., Molyneux, P., & Nguyen, H.L. (2011). Determinants of efficiency in South East Asian Banking. *The Service Industries Journal*, 31(16), 2693–2719. <https://doi.org/10.1080/02642069.2010.512659>
17. Grmanová, E., & Strunz, H. (2017). Efficiency of insurance companies: Application of DEA and Tobit analyses. *Journal of International Studies*, 10(3), 250–263. <https://doi.org/10.14254/2071-8330.2017/10-3/18>
18. Grmanová, E., & Pukala, R. (2018). Efficiency of insurance companies in the Czech Republic and Poland. *Oeconomia Copernicana*, 9(1), 71 – 85. <https://doi.org/10.24136/oc.2018.004>
19. Jaloudi, M.M. (2019). The efficiency of Jordan insurance companies and its determinants using DEA, slacks, and logit models. *Journal of Asian Business and Economic Studies*, 26(1), 153–166. <https://doi.org/10.1108/JABES-10-2018-0072>
20. Lanfranchia, D., Grassia, L., & Giorgino, M. (2020). Stochastic Frontier Analysis of Efficiency of US Public P&L Insurance companies. *32nd EBES Conference Proceedings*, 2, 1087 – 1105.
21. Lovell, C.A. (1993). *The Measurement of Productive Efficiency: Techniques and Applications*. Oxford University Press. <http://dx.doi.org/10.1093/acprof:oso/9780195183528.001.0001>
22. Micajkova, V. (2015). Efficiency of Macedonian Insurance Companies: A DEA Approach. *Journal of Investment and Management*, 4(2), 61–67. <https://doi.org/10.11648/j.jim.20150402.11>
23. Nourani, M., Devadason, E.S., & Chandran, V.G.R. (2017). Measuring technical efficiency of insurance companies using dynamic network dea: an intermediation. *Technological and Economic Development of Economy*, 24(5), 1909–1940. <https://doi.org/10.3846/20294913.2017.1303649>
24. Rao, G.S.S., & Venkateswarlu, R. (2014). Efficiency of Indian Private Non-Life Insurance Firms using Stochastic Frontier Analysis. *IOSR Journal of Economics and Finance*, 4(1), 42–46. <http://dx.doi.org/10.9790/5933-0414246>
25. Sharew, A., & Fentie, G. (2018). Data Envelopment Analysis on Efficiency of Insurance Companies in Ethiopia. *American Academic Scientific Research Journal for Engineering, Technology, and Sciences*, 48(1), 138–170. https://asrjetsjournal.org/index.php/American_Scientific_Journal/article/view/4448
26. Siems, T.F., & Barr, R.S. (1998). Benchmarking the productive efficiency of U.S. banks. *Financial Industry Studies*, 11–24. <http://dx.doi.org/10.1108/03074350210767988>
27. Taib, C.A., Ashraf, M.S., Razimi, M.S.B.A. (2018). Technical, pure technical and scale efficiency: a non-parametric approach of pakistan's insurance and takaful industry. *Academy of Accounting and Financial Studies Journal*, 22, 1–11. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85045732986&partnerID=40&md5=b25ec7b449b1a8d66e6892ae31fd55b2>
28. Tobin, J. (1958). Estimation of Relationships for Limited Dependent Variables. *Econometrica*, 26(1), 24–36. <https://doi.org/10.2307/1907382>
29. Zanghieri, P. (2009). Efficiency of European Insurance Companies: Do Local Factors Matter? *SSRN*, 6, 1–37. <https://doi.org/10.2139/ssrn.1354108>

Трінь Л. ДТ.

ДЕТЕРМІНАНТИ ЕФЕКТИВНОСТІ КОМПАНІЙ ЗІ СТРАХУВАННЯ NON-LIFE: ДОСВІД В'ЄТНАМУ

Страхові компанії відіграють важливу роль у фінансових системах країн. Однак дослідження ефективності й факторів, що впливають на ефективність страхових компаній у В'єтнамі, поки що дуже обмежені. Метою роботи є аналіз ефективності й детермінант ефективності страхових компаній, що не займаються страхуванням життя та працюють у В'єтнамі. Методами, використаними в статті, є описова статистика, аналіз оболонки даних (DEA) та регресія Тобіта. Результати показують, що середня ефективність компаній зі страхування поп-ліфе, що працюють у В'єтнамі, за період дослідження становить 0,806, найвища середня ефективність – 1,0, а найнижча – 0,303. При цьому вітчизняні страхові компанії мають найвищу середню ефективність 0,887, тоді як страховики спільних підприємств та іноземні страховики мають нижчу ефективність із середнім ККД 0,741 і 0,702. Результати дослідження також показують, що на ефективність діяльності компаній зі страхування поп-ліфе у В'єтнамі впливають власний капітал, співвідношення боргу й активів, відношення операційних витрат до активів, ROE, ROA, відношення іноземного капіталу до загального капіталу та щорічні темпи зростання ВВП.

Ключові слова: ефективність, Тобіт-модель, не пов'язане з життям страхування, аналіз середовища функціонування, страхові компанії, технічна ефективність

JEL Класифікація: C14, F65, G22, P47