Print ISSN: 2288–4637 / Online ISSN 2288–4645
doi:10.13106/jafeb.2022.vol9.no7.0261

An Investigation of the Efficiency of Insurance Companies in Vietnam - Using Data Envelopment Analysis and Malmquist Index

Bao Ngoc NGUYEN[1], Phuong Anh NGUYEN[2]

Received: April 20, 2022 Revised: July 05, 2022 Accepted: July 15, 2022

Abstract

Over the last 20 years, the insurance industry in Vietnam has been rapidly growing with an average annual growth rate of 21%, one of the most active markets in Southeast Asia, raising the question of efficiency to managers, investors, and regulators. This article is one of the first research works using Data Envelopment Analysis combined with the Malmquist index over the period from 2016 to 2020 for 37 insurance firms in Vietnam to investigate the efficiency of this sector. The value-added approach is employed with total equity and operating expenses as inputs, finance income, and gross written premium as outputs. The findings reveal that most of Vietnam's insurance companies are operating quite effectively, and the non-life sector is more efficient than the life sector. There is also a regression in efficiency change, while there is a progression in technological change and total factor productivity change during the period examined. The goal of this research is to give a fundamental understanding of the overall efficiency of insurance firms in Vietnam, and help managers, investors, policyholders, and government agencies make better decisions regarding self-assessment, M&A activities, deregulation... Consequently, the insurance sector could improve in terms of efficiency and develop sustainably over time.

Keywords: Insurance, Data Envelopment Analysis, Malmquist Index, Vietnam

JEL Classification Code: C67, D24, G22

1. Introduction

Insurance is a risk management activity that plays an important role in ensuring consumers avoid dangers and supporting the economy from unwanted losses. According to Emamgholipour et al. (2017), insurance is one of the most crucial industries for a country's economic growth. In the financial sector, insurance activities also play an essential function (Berhe & Kaur, 2017). According to Asghar et al. (2010), insurance firms are places where the insured's risks are passed to the insurer. In addition, it also serves as a financial middleman, bringing together savers and borrowers. With this role, Berhe and Kaur (2017) showed that the insurance sector may take part in risk management as well as long-term financing. Therefore, the insurance industry as a financial institution has contributed greatly to the efficient operation of the economies of countries.

Insurance providers are separated into two categories: life and non-life insurance sectors. Life insurance is associated with comprehensive coverage of risks to health and human life in the long term. Whether there is a risk or not, the buyer still makes a profit when purchasing life insurance. If there is a risk situation such as an accident, illness, or even death, the insurance company will assist in paying the agreed-upon sum to the beneficiary. On the other hand, if the customer does not encounter any risk during the contract, the insurance company will still pay the prescribed amount of insurance at the end of the contract. Because it gathers money from policyholders and invests in finance for a longer period of time, life insurance is indeed a long-term investment instrument for the economy. In contrast to life insurance, non-life insurance involves commitments to

[1]First Author. Department of Finance and Banking, School of Business, International University, Vietnam National University - Ho Chi Minh City, Vietnam.
[2]Corresponding Author. Department of Finance and Banking, School of Business, International University, Vietnam National University - Ho Chi Minh City, Vietnam [Postal Address: Quarter 6, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, 700000, Vietnam]
Email: npanh@hcmiu.edu.vn

insure the risks of loss of property and people for a short period of time from 1 to 2 years. The non-life insurance provider will only pay the insurance amount in a risky situation happening within the policy period. Therefore, non-life insurance provides consumers with more peace x in Vietnam has always had a high average growth rate of around 21% during the last 20 years, with two primary market sectors: life insurance and non-life insurance, with average growth rates of approximately 28% and 13%, respectively. Figure 1 shows that over the last years the insurance industry has become an important factor in economic development. It aids in budget stabilization, risk mitigation, employment creation for millions of people, capital creation, and foreign investment attraction.

According to AM Best's research, non-life insurance in Vietnam has always been one of the fastest-growing markets in Southeast Asia, with an average annual growth rate of over 13% from 2016 to 2020. In 2020, there are 31 non-life insurers, with the top five holding the majority of the market share, that are all domestic companies such as Bao Viet, PTI, Pjico, PVI, and Bao Minh. Furthermore, health insurance and motor vehicle insurance have traditionally accounted for the biggest share of the total revenue premium.

In contrast to the non-life market, according to the Ministry of Finance's report, foreign enterprises are the dominant participants in the life insurance market, except Bao Viet. Bao Viet, Prudential, Manulife, Dai-ichi, and AIA are the top five firms in terms of market share. In 2020, 18 life insurance companies are operating in Vietnam. Besides, from 2005 to 2013, the growth driver mainly comes from non-life insurance, then from 2013 until now, the average growth rate of life insurance has been up to 28%, and life insurance has always had a large share of the insurance market.

The insurance business is said to be relatively developed based on the preceding data. There were many factors that led to today's results. These include economic liberalization and WTO membership, economic and political stability, the creation of an equitable and secure legal corridor, and each company's management strategies.

In conclusion, Vietnam's insurance business provides several advantages to the economy and has a big influence on the country's economic development. As a result, it is critical to assess the insurance industry's functioning and efficiency. The efficiency of the insurance industry is considered to be the result obtained from the efficiency of insurance businesses operating in the Vietnam market. To consider whether a business is operating efficiently or not, people often connect the input and the output of that business. Data Envelopment Analysis is a method commonly used by many researchers in assessing the efficiency of an industry. However, there have not been many studies and assessments on the efficiency of the insurance companies in Vietnam.

This research will analyze the efficiency of the insurance companies in Vietnam from 2016 to 2020. The goal of this study is to answer the following questions: Do the insurance firms in Vietnam operate efficiently between 2016 and 2020? How did the insurance industry's efficiency develop

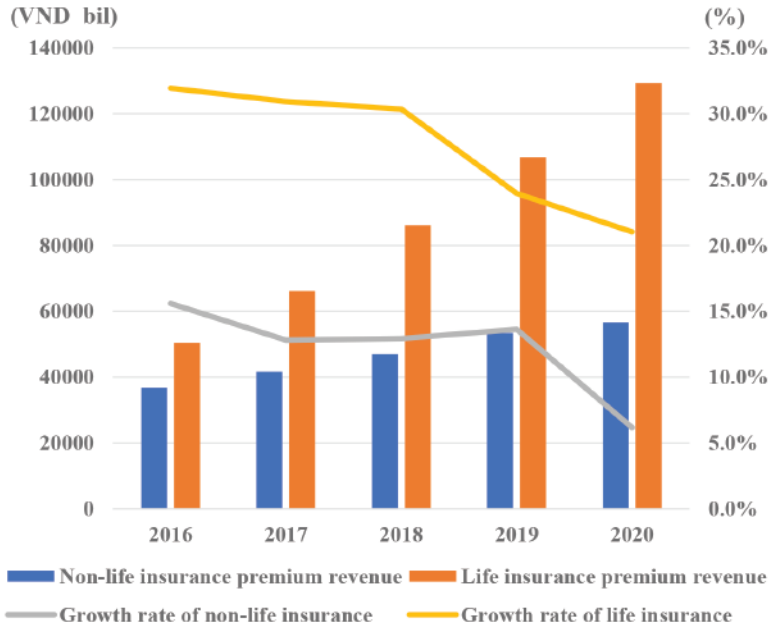

Figure 1: Total Premium Revenue and Growth in the Vietnam Market

throughout the period studied? This paper will use the DEA approach to offer an overview of the industry's efficiency. Next, the study will analyze the Malmquist index to identify factors that cause industry inefficiencies. It may then identify flaws in the company's operation and administration, as well as give empirical foundations for academics to investigate the industry's efficiency further. The study also proposes suitable solutions and policies based on the findings to improve the insurance industry's efficiency and competitiveness, as well as to assist in the growth of the industry and the economy in Vietnam.

2. Literature Review

The Malmquist index and the Data Envelopment Analysis (DEA) techniques have been widely utilized for efficiency analysis in a variety of sectors throughout the world. However, for the Vietnamese insurance market, this approach is still uncommon.

Diboky and Ubl (2007) investigated the influence of ownership on the efficiency of 90 life insurance companies between 2002 and 2005 in Germany. They showed that all types of stock, whether mutual or public, do not work across the mixed production and cost frontier. In addition, unitary joint-stock companies are more dominant in combinations, and the organizational differences between the parent and subsidiary can cause friction and inefficiency.

Eling and Luhnen (2010) used the DEA technique to conduct research on efficiency in the international insurance sector involving 6462 insurers from 36 different nations between 2002 and 2006. The factors inputs utilized in the research are labor costs, business services, and materials, loan capital, as well as equity capital. From there, they looked at the variation in connection to the outputs they picked and discovered that insurers were more efficient in mutual operations, contradicting the majority of the hypothesis that the mutual factors would be less efficient than stocks. In addition, the international insurance industry is demonstrated to develop gradually in terms of technology and cost-effectiveness during the period examined.

Ismail et al. (2011) studied the relationship between the efficiency and organizational structure and compared the efficiency of 19 Malaysian insurance businesses in the Takaful (Islamic insurance) and conventional insurance sectors between 2004 and 2009. The study estimates technical efficiency using the DEA technique with input-oriented measurement. According to the findings, there is a substantial technical efficiency gap between the two industries, with the Takaful industry having poorer technical efficiency than the traditional insurance industry. Furthermore, the organizational structure has an impact on the efficiency of the industry.

Chakraborty et al. (2012) measured the efficiency development of 14 life insurance firms by using the DEA technique and the Malmquist index between 2005 and 2009 in India. The findings demonstrate that the life insurers are efficient and developing favorably. Aside from that, the growth in total factor productivity was mainly owing to improved efficiency. On the other side, according to the research, companies that have both life and non-life activities do better than companies that exclusively deal in life insurance.

Antonio et al. (2013) performed research to assess the efficiency of the Takaful sector (Islamic insurers) and conventional insurers between 2009 and 2011 in Malaysia. The DEA technique is used in the research, which includes 7 takaful businesses and 19 conventional insurance businesses. Total premium and investment income are the two output variables, while administrative expenses, fees, and commission charges are the input factors. The research results show that Malaysia's conventional insurers are more efficient than the Takaful industry in 2011.

Biener et al. (2016) conducted research from 1997 to 2013 to assess the insurance industry's productivity and efficiency in all three sectors of life, non-life, and reinsurance in Switzerland. There are two phases to this study. In the first stage, they employed an input orientation DEA and the Malmquist Indicator. And in the second stage, they analyzed eight hypotheses regarding determinants, seven of which are to evaluate the link between industrial efficiency with seven variables, including International Diversification, leverage, scope economies, scale, organizational form, business age, and senior growth. The findings revealed that only the non-life and reinsurance sectors of the Swiss insurance market gained in efficiency and productivity, while the life insurance industry remained unchanged.

Ilyas and Rajasekaran (2019) analyzed the productivity, efficiency, and profitability on economies of scale of the non-life insurance market from 2005 to 2016 in India using the bootstrapped DEA combined with the Malmquist index analysis. The study is divided into 2 stages. The efficiency score estimations were adjusted for bias in the first stage of the investigation. In the second stage, the influence of company-level on insurer efficiency was determined using the truncated bootstrapped regression. From there, the research shows that India's non-life insurers are technical, cost, and attribution efficient, as well as have improved productivity.

In general, the DEA method and the Malmquist index have been used in various studies throughout the world to assess the efficiency of insurance sectors (Coskun et al., 2021; Masud et al., 2019; Naushad et al., 2020). Although today the insurance business is becoming increasingly significant in the Vietnamese economy, to our knowledge

there is little research utilizing the DEA technique in the insurance sector. As a result, the purpose of this paper is to fill this gap, to use the DEA approach to evaluate the efficiency of the Vietnamese insurance industry.

3. Methodology

3.1. Data Envelopment Analysis

The DEA approach employs a linear program to create an efficient frontier for the units in the research sample based on their inputs and outputs combinations. Each organization or unit in the sample is referred to as a Decision-Making Unit (DMU). Then, the difference from the efficiency frontier to the company's actual efficiency will be employed to calculate each DMU's efficiency score. Each DMU has an efficiency score in the range [0, 1], with enterprises having an efficiency score of 1 operating on the efficiency frontier and being the most efficient in the sample.

Regarding the assumptions, the formal DEA method investigated by Charnes et al. (1979) with a Constant Return to Scale (CRS) model was used to evaluate the efficiency of the non-profit industry. Later, Banker et al. (1984) advanced and developed the model under the assumption of Variable Return to Scale (VRS). Researchers may use this VRS model to consider if a DMU is operating at a rising, declining, or constant return to scale. With the assumption of the CRS model, Charnes et al. (1979) developed the most basic model of DEA. The CRS-DEA model has based on the premise that firms have the size optimally. By computing the output-to-input ratio with weighting, the CRS model determines each DMU's efficiency score.

Assume that any firm j with a outputs and b inputs can use this approach with the following formula for firm efficiency j:

$$\mathrm{EF}_j = \frac{\text{virtual output}}{\text{virtual input}} = \frac{\sum_s u_s y_{sj}}{\sum_m v_m x_{mj}}$$

Subject to: $v_m \geq 0;\ m = 1, 2, \ldots b;\ u_s \geq 0;\ s = 1, 2, \ldots a$

In which:

EF_j: the efficiency of the jth DMU in a collection of n DMU(s).

u_s: is the sth output factor's weight.

v_m: is the mth input factor's weight.

y_{sj}: is the sth output factor of the jth DMU.

x_{mj}: is the mth input factor of the jth DMU.

The DEA approach analyzes each DMU's efficiency, then uses the collection of the most efficient DMUs (regarded as an efficiency score of 1) to construct an efficiency frontier. The produced frontier will be compared to the other DMUs in the sample that are regarded as less efficient (efficiency score less than 1). This method was developed by turning the maximizing (or minimization) problem into a linear program function. The determination of the efficiency EF_0 of any DMU_0 is calculated as follows:

$$\max_{u,v} \mathrm{EF}_O = \max_{u,v} \frac{\sum_s u_s y_{so}}{\sum_m v_m x_{mo}} \qquad (*)$$

Subject to:

$$\mathrm{EF}_j = \frac{\sum u_s y_{sj}}{\sum v_m x_{mj}} \leq 1;\ v_m \geq 0;\ u_s \geq 0;$$

$$1 \leq j \leq n;\ \ m = 1, 2, \ldots b;\ s = 1, 2, \ldots a$$

(The efficiency scores of all DMUs in the sample do not exceed 1, which is shown to not extend beyond the efficiency frontier)

The limitation refers to an efficiency ratio per DMUs that is less than or equal to 1. The model aims to figure out what weights u_s and v_m should be to optimize the DMUs' efficiency. From the fundamental model above, two oriented models related to the efficiency from minimizing input (Input-oriented approach) and maximizing output (Output-oriented approach) are constructed.

3.1.1. Output-Oriented Method

The efficiency is attained by maximizing the output while retaining a particular quantity of input, then $1/\varphi$ is the efficiency score of the j-th DMU and λ is the weight vector.

$$\max_{\phi,\lambda} \phi$$

Subject to: $-\phi y_j + Y\lambda \geq 0,\ x_j - X\lambda \geq 0,\ \lambda \geq 0.$

3.1.2. Input-Oriented Method

Similarly, the input-oriented approach is attained by minimizing input for creating a given quantity of output, then the efficiency score of each DMU is indicated by φ, being the weight vector corresponding to the model below.

$$\min_{\phi,\lambda} \phi$$

Subject to: $-y_j + Y\lambda \geq 0,\ \phi x_j - X\lambda \geq 0,\ \lambda \geq 0.$

The two methods above are used to measure DMUs' technical efficiency. The above constraints show that these DMUs are efficient at a constant scale because all of the weights λ are positive. All the efficiency points ϕ have values in the range [0, 1], indicating that a DMU with a score less than 1 is technically inefficient, while a DMU with a score of 1 is on the efficient frontier. According to Porcelli (2009), under assuming CRS, both techniques should provide the

same results. However, these two techniques will give two distinct conclusions under the premise of VRS since they are based on distinct production scale concepts and they are derived by looking in distinct ways toward various locations on the production frontier.

3.1.3. Rationale for Using Variable Return to Scale (VRS) Method

Charnes et al. (1979) introduced the CRS approach, which is based on the premise that efficiency is constant to scale. However, this assumption is only true when firms are functioning at optimal sizes, which is unusual in practice since businesses may face hurdles in their business environment or market defects. Therefore, the CRS model is no longer totally appropriate for evaluating the efficiency of organizations working in a variety of situations. As a result, Banker et al. (1984) established a model for assessing the efficiency of DMUs based on the notion that efficiency varies with scale. This model is called the DEA-VRS model (BCC). Because it is sufficient to allow more companies to lie on the efficiency frontier, the VRS method is believed to be more flexible than the CRS method.

3.1.4. Rationale for Using Input-Oriented Approach

The insurance industry's major role is to split risk and take on risk to benefit from risk diversification, which requires cost planning and risk management on the part of insurance firms. In insurance and other financial businesses, most efficiency analysis is input-oriented. As a result, this study will use two stages of the input-oriented DEA method coupled with the Malmquist index. Under VRS assumptions, an input-oriented approach is utilized in the first stage. The Malmquist Index is employed in the second stage to measure insurance firms' overall factor productivity.

3.2. Malmquist Index

The Malmquist index, which is an alternative to resolve the challenge of the DEA, was proposed by Caves et al. (1982). It examines and measures the change and development in the productivity of companies over each period (one year). This study used the Malmquist index method over five-year periods. The Malmquist index is separated into two parts: Frontier shift effect (Technological change) and Catch-up effect (Efficiency change). The Catch-up effect considers the change in the relative position of the DMU to the effective frontier of year $t + 1$ compared with the relative position of the DMU to the effective frontier of the year t. The Frontier effect, on the other hand, measures change in technology, which compares between two frontiers. The following formula is used to calculate the Catch-up and Frontier shift effect from period 1 to period 2:

$$\text{Malmquist Index} = \text{Efficiency Change} \times \text{Technological Change}$$

3.3. Specification for Outputs and Inputs

Although the DEA model has many advantages for research, there is no specific rationale for selecting the appropriate input and output variables (Berger & Humphrey, 1997) pointed out that selecting variables in the efficiency analysis model is challenging, and that there is no perfect approach for selecting variables. Financial services, risk allocation, and intermediation are the three basic tasks of insurance businesses, according to Leverty and Grace (2010). In which the insurance industry's most essential role is risk allocation, that insurance firms give services to consumers to insure risks. Based on the characteristics and nature of the insurance industry choose the most appropriate variables.

3.3.1. Input Selection

According to Zanghieri (2009), insurance businesses frequently employ three primary factors to implement the operating business: labor, business services, and capital. Furthermore, insurance firms do not employ raw materials as a key input since the nature of insurance businesses as financial services providers. In addition, according to Fenn et al. (2008), insurance corporates do not publicly disclose specific data on the number of employees, wages, and other costs. Furthermore, two factors business services and labor are included in operating expenses. As a consequence, we decided to use "operating expenses" as an input variable that the insurance business must consider to create results.

According to Shieh et al. (2020), total equity is crucial for an insurance firm since it plays as a reserve fund for meeting and paying premium loss as well as demonstrating the ability to face risk. In the study of the insurance sector, total equity has been used by many researchers (Amanti & Siregar, 2019). As a result, one of the input variables we choose is "total equity".

3.3.2. Output Selection

Up to now, there hasn't been a unified study report on the output measures utilized in the insurance business. This paper applies the value-added approach with the following inputs and outputs (Table 1):

3.4. Software

The efficiency and inefficiency scores, as well as the Malmquist Index of insurance firms, will be calculated using Tim Coelli's DEAP software version 2.1.

Table 1*:* Summary of Inputs and Outputs

Variable	Definition	Source
Inputs		
Total equity	Total equity, which is the business's net assets, is defined as the remaining worth of the firm's assets after subtracting its obligations.	Financial statements
Operating Expenses	Total expenses from insurance operating costs, selling expenses, and administrative expenses.	Financial statements
Outputs		
Finance income	The total income from financial investing operations over a year.	Financial statements
Gross Written Premium	The entire sum of the premium received from the policyholder, before subtracting ceded premium in the year.	Financial statements

4. Results and Interpretation

4.1. Data Collection

The data set consists of 37 insurance companies with the total gross written premiums accounting for more than 98% of the total, implying that this sample may be representative of Vietnam's insurance industry. The data set is gathered from insurance company balance sheets and income statements on websites, which are panel data sets.

4.2. Descriptive Statistics

For the industry average, the amounts of financial income, gross written premium, total equity, and operating expenses during the period studied were 626.53 billion VND, 3487.23 billion VND, 2137.95 billion VND, and 3789.35 billion VND respectively. In general, the variables increase over time, and the average input and output of the non-life sector are lower than that of the life sector and the whole industry.

4.3. Data Envelopment Analysis

The findings of the DEA approach with an input-oriented approach are obtained for efficiency scores under CRS and VRS of Vietnamese insurers over the period 2016 to 2020. Insurers with technically efficient operations (efficiency scores of 100%) show optimization of inputs without altering outputs.

4.3.1. The TE Scores for the Whole Insurance Industry

For the CRS case, the average TE score of the insurance industry in 5 years is 77.9% (2016), 76.5% (2017), 76.8% (2018), 81.7% (2019) and 77% (2020). Although the average TE scores have fluctuated slightly over the last five years, overall, they are relatively high for an emerging industry in the Vietnamese market. For the case of VRS, the number of companies with technical efficiency is relatively high with the highest number of 14 companies (2018 and 2019) and the lowest number of 11 companies (2017) out of the total of 37 companies examined.

4.3.2. The TE Scores for Life Insurance Sector

From 2016 to 2020, the number of effective life insurance companies under CRS decreased by 4 to 3 companies and decreased by 5 to 4 companies under VRS. Along with that, the average efficiency score also decreased from 72% to 70.7% according to CRS and 83.2% to 80.5% according to VRS.

4.3.3. The TE Scores for Non-Life Insurance Sector

Like life insurance, the average TE score of the non-life insurance sector decreased slightly from 82.9% to 82.4% under CRS and 92.7% to 90.4% under VRS. Meanwhile, the number of efficient firms increased from 2 to 3 under CRS and remained unchanged under VRS (8 firms) from 2016 to 2020, indicating the digression in the efficiency of the non-life sector.

4.3.4. Overlook

Figures 2 and 3 show the average TE scores of the insurance firms from 2016 to 2020. The insurance industry is represented by 37 firms, 17 of which are life insurance companies and 20 of which are non-life insurers. The average TE score of the non-life sector is higher than the average TE score of the life sector during 5 years. This shows that the non-life insurance market in Vietnam seems to be more efficient than the life insurance market.

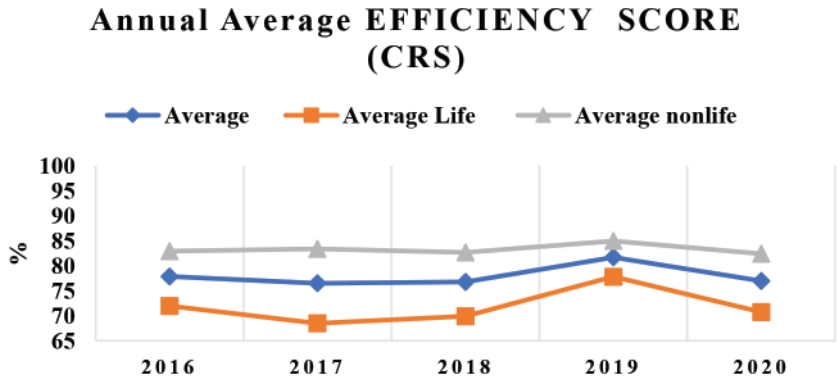

Figure 2: Summary of Average CRS Efficiency Score Over 5 Years

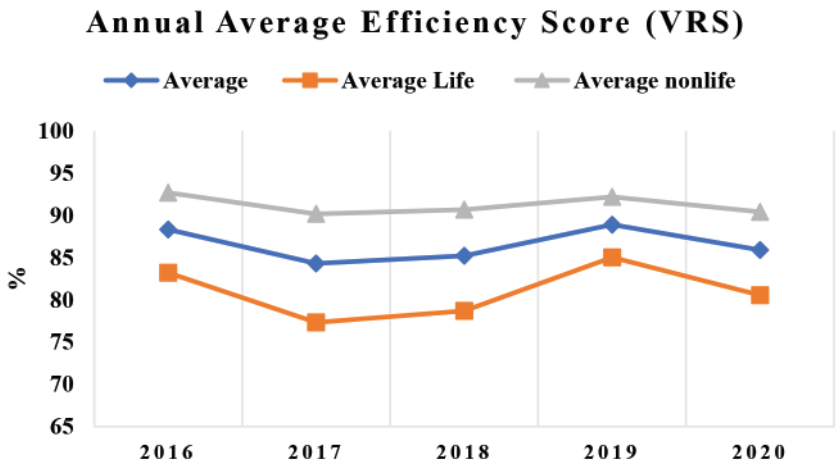

Figure 3: Summary of Average VRS Efficiency Score Over 5 Years

To further compare the efficiency average between the two groups, we use a *t*-test with the following null hypothesis and alternative hypotheses:

$$H0: \mu_1 \leq \mu_2$$
$$H1: \mu_1 \leq \mu_2$$

The *p*-value in the *t*-test of the CRS case is 0.02016266. This means that the null hypothesis is rejected at a 5% significance level. Therefore, the average CRS efficiency score of the non-life sector is higher than that of the life sector.

For the case of VRS, with a significance level of 0.05, the *p*-value in the *t*-test is 0.00953919 smaller than the significance level. Therefore, the average VRS efficiency score of the non-life sector is higher than that of the life sector.

4.4. Malmquist Total Factor Productivity Index

To make the research more extensive, the TFP Malmquist index will be employed to examine the change in the efficiency of 37 Vietnamese insurers each year. In this thesis, the Malmquist index is utilized to show the geometric mean of TFP Change as well as its split into Efficiency Change (Catch-up effect) and Technology Change (Frontier effect) over 5 years.

4.4.1. Malmquist Index for The Whole Industry

Figure 4 shows the geometric mean of TFP Change as well as Efficiency Change and Technological Change over each year. From the above information, it can be seen that the period 2016–2017 is the only period of regression (value < 1) in both efficiencies, technology as well as TFP change. Meanwhile, the period 2017–2018 is also the only period with the simultaneous progression of all 3 indexes (value > 1). Total Factor Productivity increased most in the two periods 2017–2018 and 2018–2019, of which the main reason for this increase in the period 2017–2018 was the growth of technological progress shown by the Technological Change index. Technological change is the development of new products or technologies that allow for improvements in production methods. Specifically, the period 2017–2018 is the period when Vietnam's insurance industry begins to apply modern technology to sales and customer care services.

On the other hand, from 2018 to 2019, efficiency growth was the main reason for the increase in TFP. This proves that the insurance industry in this period has effectively used its inputs. These inputs can be used less while still producing a certain amount of output. Specifically, the operating expenses of the insurance industry in the period 2018–2019 increased by only 6.94% compared to the average growth in 5 years of 22.44%.

Table 2 shows the geometric mean of TFP Change, Efficiency Change, and Technological Change in each life and non-life sector during the period 2016 to 2020. Overall, both sectors have experienced regression in efficiency change (value < 1) and progression in technological change (value > 1). However, the life sector had a regression in terms of TFP change, while the non-life sector made progress. In addition, it can be seen that the life sector has a slower progression in technological change and a greater regression in efficiency change than the non-life sector.

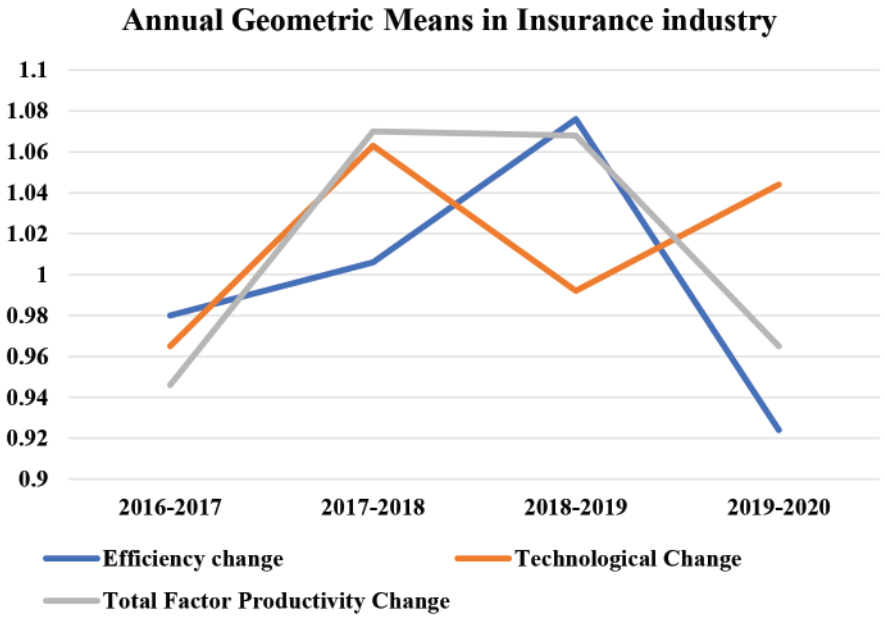

Figure 4: Malmquist Index Summary of Annual Geometric Means in the Insurance Industry

Table 2: Malmquist Index Summary of Geometric Mean over 5 Years

	Efficiency Change	Technological Change	Total Factor Productivity Change
Mean Life	0.993	1.001	0.993
Mean Non-life	0.997	1.028	1.025
Mean	**0.995**	**1.015**	**1.01**

4.4.2. Malmquist Index for The Life Sector

With 12/37 companies operating with regression in TFP change, 8 out of 12 are in the life insurance firms. In general, the geometric mean of all three indexes of the life sector is lower than the non-life sector as well as the whole industry.

4.4.3. Malmquist Index for Non-Life Sector

In contrast to life insurance, the number of non-life insurers with a progression in TFP changes accounted for 16 companies in the sample. The mean of the non-life sector is higher than the overall industry.

5. Discussion

Despite double-digit growth in gross premium for the insurance industry in general and the life and non-life sectors in particular from 2016 to 2020, there was only a small improvement in productivity growth of the whole industry and the non-life sector. This finding can be derived from a variety of elements in the Vietnamese insurance market: cost management and investment channels. Gross insurance premiums and financial income from diversified investment portfolios such as loans, government bonds, stocks, and so on are used in this study. According to Decree 46/2007 ND-CP, insurance firms are permitted to invest in the following three domestic channels.

The first investment channel is from government-guaranteed bonds, government bonds, and deposits at credit institutions. With the unique characteristics of the insurance business, which is to constantly assure financial ability to satisfy the long-term commitments of insurance contracts (especially in the life insurance sector), insurance companies always prioritize choosing financial assets with a high level of safety and long-term stability, such as government bonds and bank deposits. In Vietnam, bank deposits are the primary source of financial income, accounting for about 45% of the investment portfolio structure of insurance companies in 2020, thereby the bank's lending interest rate has a significant impact on this income.

The average lending interest rate in Vietnam from 1993 to 2020 is relatively high at about 11.84%, which shows that interest income is a good investment channel for Vietnamese insurance companies. However, lending interest rates dropped substantially from 17% in 2011 to 6.96% in 2016, the lowest figure in nearly 3 decades. And from 2016 until now, interest rates have only fluctuated slightly with an average of about 7%. This is understandable due to the government's policy to encourage loans to help the economy grow. As a result, the insurance industry's productivity growth may be hampered by income from financial investments.

Another investment channel is stock and unsecured corporate bonds. However, the stock market has its own growth cycle, so there are many potential risks to consider, including uncertain volatility, information risk, and so on. Insurers are unable to consider more for this channel, in fact, 2020 accounts for less than 10% of the investment portfolio structure. Besides, currently, only about 10% of the population participates in life insurance, but the life insurance sector now has 895,438 insurance agents in 2020, a number too large compared to the current market size.

According to the Ministry of Finance, the ability of an agent to create value for life insurers is limited to around 3 contracts each year from 2016 to 2020. This figure shows, that despite increasing costs to boost gross insurance premium, there has not been an improvement in cost minimization as well as the quality of insurance agents. This has resulted in the inefficiency of the insurance industry despite the growth in premium revenue. In addition, when the corona pandemic broke out, insurance businesses increased the compensation cost, but it was not too high because most of the medical expenses would be covered by social insurance. And the actual payment of compensation costs may occur only 1–2 months after the incident. In addition, insurers have quickly grasped consumer demand to provide products during the pandemic such as nCoV Shield, Corona Care insurance programs, etc. In 2020, the insurance market is still growing. This proves that the insurance industry still retains its advantages and is less affected by the Covid-19 epidemic.

6. Conclusion and Recommendation

The efficiency and productivity scores of Vietnamese insurance businesses between 2016 and 2020 are calculated utilizing Data Envelopment Analysis and the Malmquist index in this research. This thesis's aims and research questions may be summarized as follows.

The insurance industry operates at a degree of efficiency with the average technical efficiency scores of over 70% and there are 12/37 companies on the production frontier in 2020. Furthermore, the average efficiency score of the non-life sector was higher than that of the life sector during the period 2016 to 2020. The productivity of insurance companies improved slightly during the period examined. Specifically, up to 25/37 companies experienced a progression in productivity change.

This is one of the first papers to utilize the DEA method and the Malmquist index to assess the insurance industry's efficiency in Vietnam. The goal of this research is to give investors a fundamental understanding of the efficiency of Vietnamese insurance firms and their overall efficiency, to help management, investors, policyholders, and government agencies make better decisions. According to the perspective

of insurance managers, the findings of this study will point to the company's position for improved self-assessment and decision-making in the highly competitive insurance market. Besides, according to the researchers, finding the relative efficiency score across insurance businesses would provide fundamental empirical data for an intensive study on evaluating the efficiency and its factors, such as scale, M&A, policy, deregulation, and so on. From the research results, this paper proposes some solutions to develop Vietnam's insurance market.

The government and the Ministry of Finance should focus on researching and expanding the Insurance Law (amended) as well as facilitating international integration and collaboration to create a healthy competitive environment. In addition, the government should require insurance businesses to make adequate information disclosure to improve information transparency for Vietnam's insurance industry, which assists insurance purchasers and related organizations understand clearly understanding the company's organizational structure and financial status in detail.

Over 25 years of establishment and development, the percentage of persons having life insurance contracts in Vietnam has not surpassed 10%. Therefore, life insurance companies need to improve their propaganda, advertising, and introduction not only the products of the companies but also to elicit and assess the suitable demands for each individual as well as family. In addition, insurance businesses should enhance the quality of insurance agents, and monitor, and check the agent's operation regularly to provide timely assistance and improve expertise. Finally, as a result of natural catastrophes and epidemics, people's sense of insurance ownership grows in importance, and firms do market research to develop appropriate products.

References

Amanti, P. G., & Siregar, A. A. (2019). The efficiency of general insurance companies in Indonesia. *Paper presented at the 12th International Conference on Business and Management Research (ICBMR 2018),* Bali, Indonesia, November 7–8, 2018 (pp. 314–320). Paris: Atlantis Press. https://doi.org/10.2991/icbmr-18.2019.51

Antonio, M. S., Ali, M. M., & Akbar, N. (2013). A comparative analysis of the efficiency of takaful and conventional insurance in Malaysia. *International Journal of Excellence in Islamic Banking and Finance*, *3*(1), 1–13. https://doi.org/10.12816/0001416

Asghar, A., Kausar, M. J., & Afza, T. (2010). The efficiency of the insurance industry in Pakistan: An Application of Non-Parametric Approach. *Interdisciplinary Journal of Contemporary Research in Business*, *2*(8).

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), 1078–1092. https://doi.org/10.1287/mnsc.30.9.1078

Berger, A. N., & Humphrey, D. B. (1997). The 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

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 (IJRFM)*, *7*(4), 124–137.

Biener, C., Eling, M., & Wirfs, J. H. (2016). 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

Caves, D. W., Christensen, L. R., & Diewert, W. E. (1982). Multilateral comparisons of output, input, and productivity using superlative index numbers. *Economic Journal*, *92*(365), 73–86. https://doi.org/10.2307/2232257

Chakraborty, K., Dutta, A., & SenGupta, P. P. (2012). Efficiency and productivity of the Indian life insurance industry. *Asia-Pacific Journal of Risk and Insurance*, *7*(1). https://doi.org/10.1515/2153–3792.1164

Charnes, A., Cooper, W. W., & Rhodes, E. (1979). Measuring the efficiency of decision-making units. *European Journal of Operational Research*, *3*(4), 339–338. https://doi.org/10.1016/0377–2217(79)90229–7

Coskun, A., Habibniya, H., & Keceli, Y. (2021). Efficiency analysis of takaful insurance industry: A comparative study. *Journal of Asian Finance, Economics, and Business*, *8*(7), 111–120. https://doi.org/10.13106/jafeb.2021.vol8.no7.0111

Diboky, F., & Ubl, E. (2007). Ownership and efficiency in the German life insurance market: A DEA bootstrap approach. *Paper presented at the 34th Seminar of the European Group of Risk and Insurance Economists (EGRIE),* Cologne, Germany, 17–19 September 2007 (pp. 116–136). https://www.aria.org/meetings/2007papers.pdf

Eling, M., & Luhnen, M. (2010). Efficiency in the international insurance industry: A cross-country comparison. *Journal of Banking and Finance*, *34*(7), 1497–1509. https://doi.org/10.1016/j.jbankfin.2009.08.026

Emamgholipour, S., Arab, M., & Mohajerzadeh, Z. (2017). Life insurance demand: The Middle East and North Africa. *International Journal of Social Economics*, *44*(4), 521–529. https://doi.org/10.1108/IJSE-04–2015–0106

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 and Finance*, *32*(1), 86–100. https://doi.org/10.1016/j.jbankfin.2007.09.005

Ilyas, A. M., & Rajasekaran, S. (2019). An empirical investigation of efficiency and productivity in the Indian non-life insurance market. *Benchmarking*, *26*(7), 2343–2371. https://doi.org/10.1108/BIJ-01–2019–0039

Ismail, N., Alhabshi, D. S. O., & Bacha, O. (2011). Organizational form and efficiency: The coexistence of family takaful and life insurance in Malaysia. *Journal of Global Business and Economics*, *3*(1), 122–137.

Leverty, J. T., & Grace, M. F. (2010). The robustness of output measures in property-liability insurance efficiency studies. *Journal of Banking and Finance*, *34*(7), 1510–1524. https://doi.org/10.1016/j.jbankfin.2009.08.015

Masud, M. M., Rana, S., Mia, A., & Saifullah, K. (2019). How productive are life insurance institutions in Malaysia? A Malmquist approach. *Journal of Asian Finance, Economics, and Business*, *6*(1), 241–248. https://doi.org/10.13106/jafeb.2019.vol6.no1.241

Naushad, M., Faridi, M. R., & Faisal, S. (2020). Measuring the managerial efficiency of insurance companies in Saudi Arabia: A data envelopment analysis approach. *Journal of Asian Finance, Economics, and Business*, *7*(6), 297–304. https://doi.org/10.13106/jafeb.2020.vol7.no6.297

Porcelli, F. (2009). *Measurement of technical efficiency. A brief survey on parametric and non-parametric techniques*. Coventry, UK: University of Warwick*, 11*.

Shieh, H. S., Hu, J. L., & Ang, Y. Z. (2020). The efficiency of life insurance companies: An empirical study in Mainland China and Taiwan. *SAGE Open*, *10*(1), 60. https://doi.org/10.1177/2158244020902060

Zanghieri, P. (2009). The efficiency of European insurance companies: Do local factors matter? *SSRN Journal, 21,* 108. https://doi.org/10.2139/ssrn.1354108