# A COMPARATIVE ANALYSIS OF THE EFFICIENCY OF TAKAFUL AND CONVENTIONAL INSURANCE IN NIGERIA: A DATA ENVELOPMENT ANALYSIS APPROACH

By

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**Abstract**

*The insurance industry is vital to the development of any nation's economy. To evaluate the performance of this industry, efficiency measurement is critical as it will determine the industry's competitiveness, and companies that are likely to survive. As such, this study aims to compare takaful and conventional insurance efficiency in Nigeria. This study uses the Data Envelopment Analysis (DEA) method with input orientation to measure efficiency. The objects in this study were six (6) conventional insurance firms and two (2) takaful firms spanning from 2017 to 2021. The results showed that takaful insurance emerged on the efficient frontier in all years except 2019 and was more efficient in these years than the conventional counterpart. It concludes that regarding efficiency neither takaful nor conventional insurance firms clearly outperform the other. This study revealed the efficiency level and compared the efficiency of takaful and conventional insurance firms in Nigeria.*

**Keywords:** Conventional Insurance, Data Envelopment Analysis, DEA, Efficiency, Islamic Insurance, Level of Efficiency, Takaful

## 1. INTRODUCTION

The insurance industry is vital to any society's economic development and prosperity, which is achieved by minimizing the risk of all economic activities (Lee, 2019). Insurance is a social protection system, and it is offered in two ways: Takaful and conventional insurance.

Efficiency measurement is one of the critical areas in evaluating the performance of the insurance industry as it will determine the sector's competitiveness, how the industry responds to these challenges, and which companies are likely to survive. The efficiency measurement evaluates the level of competitiveness from both sides: input and output, expense and return. Insurance companies must consider efficiency in their operational activities (Abdin et al., 2022). Policyholders and stakeholders use the level of efficiency to determine the company's performance so that they can have more confidence in the company (Abdin Z., Prabantarikso, Wardhani, & Endri, 2021) and able to generate higher profits for the company (Endri et al., 2021). In addition, efficiency models and measures consider the importance of strategic decision-making for the company's operational activities (Benyousef & Hemrit, 2019). Therefore, measuring the efficiency level in the insurance industry is very important (Robielos & Bravante, 2020).

The existing literature has widely used the Data Envelopment Analysis (DEA) approach for efficiency measurement of takaful and conventional insurance in countries like Malaysia, Indonesia, and Bangladesh (Puspitasari & Fauziyah, 2022) in Indonesia; (Faruk & Rahaman, 2015) in Malaysia; (Rahman, 2013) in Bangladesh. However, there has yet to be a study that examines or compares the efficiency of Takaful insurance to conventional insurance in Nigeria. This paper bridges the research gap by providing empirical evidence.

This study uses DEA to compare takaful and conventional insurance efficiency in Nigeria. The DEA method is the most appropriate tool for analyzing company efficiency (Gharakhani et al.,

2018). This non-parametric approach has several advantages over other methods. First, this method can use multiple input and output variables (Benyousef & Hemrit, 2019). Second, this method does not require a functional relationship between input and output variables (Cummins et al., 1999). Given this objective, the present study will ascertain the level of efficiency of takaful and conventional insurance companies in Nigeria; and determine which insurance is more efficient in takaful and conventional insurance. The findings of the study will be of significance to stakeholders in the insurance industry enlightening them about the efficiency levels of takaful and conventional insurance and enabling them to make informed decisions. Also, it will add to the body of knowledge and inform the academia on the efficiency of insurance firms.

## 2. LITERATURE REVIEW

### 2.1 Theoretical Review

Different theories and measures of efficiency prompt the data envelopment analysis approach to the efficiency of an insurance firm. There are two relevant theories related to efficiency measurement of insurance firms and the comparison of takaful and conventional insurance. These theories are the duality theory and the economic efficiency theory.

#### 2.1.1 Duality Theory

Duality theory is a fundamental concept in optimization providing insights into the relationship between primal and dual problems for enabling a more comprehensive understanding of DEA. The dual problem provides bounds on the primal problem's objective value, and the dual variables offer economic interpretations, such as shadow prices. The integration of duality theory in DEA enhances the interpretation and robustness of efficiency analysis. Dual formulations of DEA models provide valuable insights into the performance of DMUs.

Recent advancements in DEA and duality theory have expanded the applicability and robustness of efficiency analysis. Charnes, Cooper, Wei, and Huang (1989) developed methods for sensitivity and stability analysis in DEA. Duality theory facilitates this analysis by exploring the impact of variations in inputs and outputs on efficiency scores. Olesen and Petersen (2016) leveraged duality theory to develop stochastic DEA models, accounting for random variations in inputs and outputs and enhancing the robustness of efficiency assessments.

The integration of duality theory and DEA has been applied across various domains. In healthcare, Zhu (2014) applied duality theory to DEA to evaluate the performance of healthcare providers, identifying areas for improvement and setting efficiency targets. Yang, Zhang, and Zhou (2015) integrated duality theory in DEA to assess the performance of environmental policies and initiatives, promoting sustainable development.

### 2.1.2 Economic Efficiency Theory

Economic efficiency theory focuses on the optimal use of resources to achieve the maximum possible output. It encompasses two main components: technical efficiency and allocative efficiency. Data Envelopment Analysis (DEA) leverages this theory to evaluate the relative efficiency of decision-making units (DMUs), providing a non-parametric method to measure how well resources are utilized.

Economic efficiency theory enhances DEA by providing a framework to assess both technical and allocative efficiency, offering a comprehensive measure of performance. DEA combines technical and allocative efficiency measures to provide an overall economic efficiency score. This holistic approach helps identify both technical and allocative inefficiencies, guiding DMUs toward optimal performance.

Recent developments in DEA methodologies have expanded its applicability, leveraging economic efficiency theory to address various challenges. For example, Färe et al. (1985) developed a model for measuring cost efficiency, providing a framework to assess allocative and technical efficiency simultaneously. Similar to the cost efficiency DEA model leveraging on the economic efficiency theory to minimize cost given input prices, revenue efficiency DEA model maximizes revenue given output prices, and profit efficiency DEA model considers both input and output prices to minimize cost and maximize revenue.

The integration of economic efficiency theory and DEA provides valuable insights into performance improvement. Johnes (2006) utilized economic efficiency theory to evaluate the efficiency of universities, providing insights into resource utilization and academic outcomes. Sarkis (2007) integrated the economic efficiency theory in DEA to evaluate the efficiency of manufacturing systems, identifying improvement opportunities and best practices.

## 2.2 Conceptual Review

### 2.2.1 Conventional Insurance

Conventional insurance refers to traditional insurance products that individuals and businesses purchase from insurance companies to protect against various risks or losses. It involves transferring the risk of potential losses from an individual or business (the insured) to an insurance company (the insurer). In return for premiums paid by the insured, the insurer agrees to provide financial compensation if the insured suffers a covered loss.

One benefit of insurance is that it offers financial protection against unexpected events, aiding individuals and businesses in managing risk. By diversifying the risk across a large pool of policyholders, insurance reduces the financial impact of individual losses and helps mitigate potential financial setbacks.

### 2.2.2 Takaful

Takaful insurance is an alternative model to conventional insurance, which is prohibited in Islam, as it contains features such as uncertainty (gharar), gambling (maisar), and usury (riba). Unlike conventional insurance, takaful is established on mutual assistance, mutual assurance, mutual protection, and mutual security and responsibility, incorporated into the concept of tabarru' (donation) (Adawiyah & Scott, 2008). Saaty and Ansari (2008) stated that gharar, maisar, and riba have been the primary reasons for opposing conventional insurance. These features changed the essence of the simple practice of mutual help and risk sharing to one that led to Muslim doubt about its compliance with Sharia law (Salman & Htay, 2013).

### 2.2.3 Efficiency Measurement

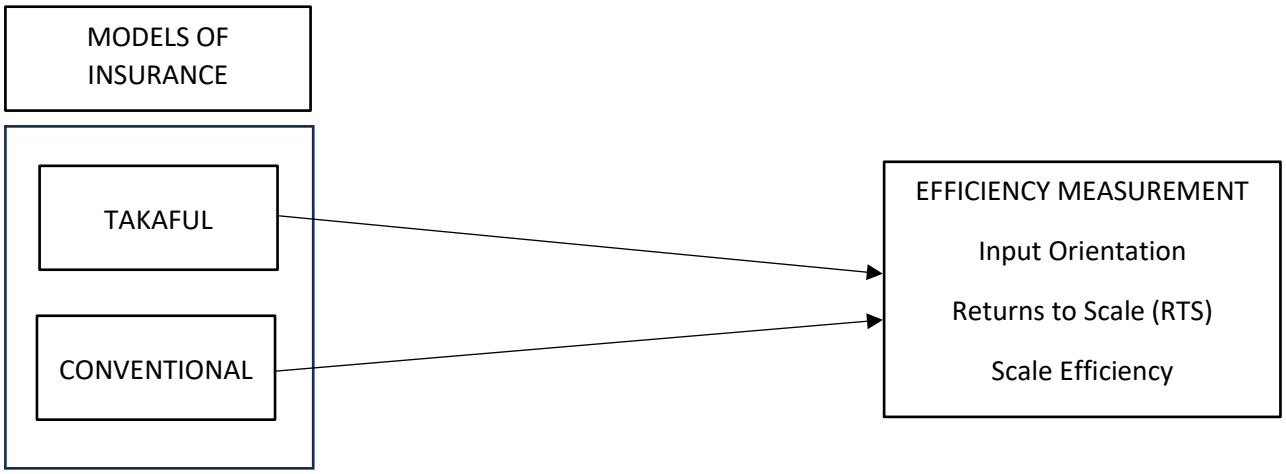
Efficiency is a microeconomic concept rooted in consumer and producer theories. The consumer theory focuses on maximizes utility from the individual's perspective and the producer theory minimizes cost or maximizes profit from the producers' perspective (Antonio at al., 2013). In measuring an entity's performance level, efficiency is closely related to productivity because efficiency describes the comparison between inputs and outputs (Abdin et al., 2022). Efficiency is a performance parameter that theoretically represents the overall performance of decision-making units (DMUs). The efficiency measurement is carried out to produce optimal output with the existing input or specific output with minimal input. (Antonio et al., 2013). Input is the expenses or resources to produce output, while output is the income or production accumulated.

According to Coelli et al. (2005), the efficiency level can be measured using input/cost-oriented or output-oriented approaches. The input-oriented approach implies that inputs may be minimized to produce the same level of output. Unlike the input-oriented approach, which focuses on cost minimization, the output-oriented approach emphasizes profit maximization.

This implies that a certain percentage of output may be increased proportionally using the same level of input. This study uses input orientation because the company can optimize profits by managing the same inputs.

### 2.2.4 Conceptual Model

The conceptual framework in Figure 2.1 below is built on the duality theory and the economic efficiency theory but modified for this study. It represents the network of interrelationships among the models of insurance (i.e., conventional insurance and takaful) and efficiency measurements that form the basis of this study. It is used to depict the plan of this study by providing an analytical structure that outlines the direction that the study takes. To achieve the aim of this study, the model is conceptualized to examine the effect of socio-demographic factors on the demand for life insurance in Nigeria.




**Source:** Researcher, 2024

*Fig 2.1 Conceptual framework illustrating the relationship between models of insurance and efficiency measurements.*

## 2.3 Empirical Review

The literature on the financial sector efficiency measurement is one of the most rapidly growing literature. Several efficiency studies for the insurance sector have been conducted and primarily employed parametric and non-parametric approaches. The most popular parametric approaches are distribution-free approach (DFA), stochastic frontier approach (SFA), and thick frontier approach (TFA). Meanwhile, the most frequently used methods for the non-parametric approach are Data Envelopment Analysis (DEA) and Free Disposable Hull (FDH) (Cummins et al., 1999). Eling and Luhnen (2009) surveyed 95 past studies on efficiency measurement for the insurance industry. The study found that DEA was the most frequently used method to measure the frontier efficiency analysis in insurance and was used in 55 out of 95 studies.

Several studies are measuring the efficiency of the insurance industry at a country level. The efficiency performance of the insurance industry in the US was studied by Cummins et al. (1999) and Meador et al. (2000). The efficiency of the insurance industry in Japan, Italy, and Spain was analyzed by Fukuyama (1997), Cummins, et al. (1996), and Cummins and Rubio-Misas (2004), respectively. The studies found that total factor productivity (TFP) growth in the Japanese life insurance industry was higher than in US life insurance companies (Fukuyama, 1997). On the other hand, Cummins, et al. (2004) concluded that the cost efficiency of insurance companies in Spain was lower than that in the US.

Barros et al. (2008) examined the technical efficiency of insurance companies in Nigeria from 1994 to 2005. Using DEA, it was found that the efficiency level of most Nigerian insurance companies during the observed period declined, which was caused by inadequacies in management, scale, and technology. Likewise, Adu et al. (2011) measured the efficiency of insurance companies in Ghana over the 2006-2008 period. The result of the DEA showed that the average efficiency score for life insurance in Ghana was higher than that of non-life

insurance companies. Meanwhile, Abidin and Cabanda (2011) evaluated the relative efficiency of 23 non-life insurance companies in Indonesia from 2005 to 2007. Having employed DEA, the study found that the larger the insurance company, the more they operated efficiently. Despite several studies on insurance efficiency, only a few studies have been done concerning the efficiency of takaful operators compared to their counterparts. Saad et al. (2006) conducted a comparative study of the efficiency of conventional life insurance and family takaful industry in Malaysia from 2002 to 2005 using DEA. The data consisted of a panel of 13 life insurance companies in Malaysia. The study concluded that the average efficiency for the whole industry declined from 2002 through 2004 but indicated a slight increase in 2005.

Ismail, Othman, and Bacha (2011) investigated the takaful and conventional insurance industries' cost efficiency and investment performance using DEA between 2004 and 2009. The study consisted of 18 firms, 7 takaful companies, and 11 conventional insurance. The study found that Takaful had a lower significant return than its conventional insurance counterpart. On the other hand, Yusop et al. (2011) found that the efficiency level of life insurance and takaful operators in Malaysia regarding risk management over 2003-2007 was relatively high.

There are studies on the international comparison of the efficiency of insurance companies. Rees and Kessner (2000) showed that the average efficiency of German firms was about 48 percent, and British firms were higher, around 57 percent, with a median of 52 percent. However, Diacon et al. (2002) discovered when comparing insurance companies in Denmark, Spain, Sweden, and the U.K. that U.K. insurers appear to have shallow scale and mixed efficiencies. The measurement of insurance efficiency is mainly focused on the efficient frontier approach. This approach allows multiple inputs and outputs to develop an efficiency frontier and ascertain the efficiency of a DMU relative to other DMUs in the sample.

To conclude, many studies have utilized DEA to measure the efficiency of insurance industries in many countries. However, a study on the efficiency of takaful insurance in Nigeria still needs to be done. The existing literature measures the efficiency of conventional and Islamic banking in Nigeria. The present study, therefore, compares the cost efficiency of Takaful and conventional insurance in Nigeria from 2017 to 2021.

## 3. RESEARCH METHOD

The study applied a non-parametric Data Envelopment Analysis (DEA) using an input orientation approach. DEA Frontier Software was used to examine the efficiency of takaful and conventional insurance firms in Nigeria. The selected input variables are management expenses, claims expenses, and underwriting expenses while the output variables are premium, investment income, fees plus commission income, and underwriting income. The selected input and output variables are similar to the studies by Antonio et al. (2013), Rahman (2013), and Faruk and Rahaman (2015). The study assumed that conventional and takaful insurance are financial institutions that produce investment income, premium income, fees/commission income, and underwriting income using three expense variables; management expenses, claims expenses, and underwriting expenses.

DEA as a linear programming methodology evaluates the relative efficiency of decision-making units (DMUs) using selected inputs and outputs such that the correlation function from inputs to outputs is unidentified (Antonio et al., 2013). It measures, relative to another, the efficiency of each firm with similar attributes. The measure of efficiency is between 0 and 1. The value of 1 represents an efficient frontier and lower values represent a less efficient firm. Abraham Charnes (1978) as cited by Almumani (2013) has coined the term data envelopment analysis (DEA) as

$$Maximize\ E_k = \sum_{j=1}^{n} Q_{jk} Z_{jk}$$

Subject to

$$\sum_{i=1}^{m} P_{ik} Y_{ik} = 1$$

$$\sum_{j=1}^{n} Q_{jk} Z_{jk} - \sum_{i=1}^{m} P_{ik} Y_{ik} \leq 0$$

$$P_{ik} \geq 0 \qquad i = 1,2,3, \dots, m$$

$$Q_{jk} \geq 0 \qquad j = 1,2,3, \dots, n$$

$$\sum_{j=1}^{n} Q_{jk} = \sum_{i=1}^{m} P_{ik}$$

where,

$Q_{jk}$ = the weight placed on jth output ($Z_j$) of the kth DMU.

$P_{ik}$ = the weight placed on ith input ($Y_i$) of the kth DMU.

$Y_{ik}$ = the ith input parameter (Y) of the kth DMU.

$Z_{jk}$ = the jth output parameter (Z) of the kth DMU.

$E_k$ = the relative efficiency score of kth DMU.

According to Charnes et al. (1978), the Charnes–Cooper–Rhodes (CCR) model measures the relative efficiency of DMUs from 0 to 1 by assuming constant returns to scale (CRS). The model determines if a DMU is constant, decreasing, or increasing returns to scale. Banker et al. (1984) extended the CCR model to account for variable returns to scale (VRS). This extended model is called the Banker-Charnes-Cooper (BCC) model.

Constant return to Scale (CRS) assumes that every increase in input will result in an exact proportional increase in output. This is only possible if the observed DMU is optimal. However, other factors such as competition can at most times result in a firm's inefficiency. To resolve

this, Banker et al. (1984) proposed variable returns to scale (VRS) approach to DEA modeling. The VRS approach assumes that every additional input may not result in an exact proportional output. Hence, the increment can be higher or lower.

This study adopted the methods of Almumani (2013) by using the input-orientation approach to examine the efficiency for each year. These efficiencies were obtained using constant returns-to-scale (CRS) and variable returns-to-scale (VRS) assumptions and the overall technical efficiency and pure technical efficiency were obtained. Scale efficiency was obtained by computing the ratio of overall technical efficiency to pure technical efficiency.

## 4. RESULTS AND DISCUSSIONS

### 4.1 Measure of Descriptive Statistics

Based on the descriptive statistics in Appendix 1, Leadway Insurance Plc has the highest mean in all input and output variables considered among the takaful and conventional insurance firms, while Hilal takaful insurance has the lowest mean in all input and output variables except for investment income variable where Jaiz takaful insurance has the lowest mean.

The standard deviation for the takaful and conventional insurance firms showed profound variability. Cornerstone, AIICO, AXA Mansard, and Jaiz takaful investment income values are positively skewed but Leadway, Mutual Benefits, NEM, and Hilal takaful are negatively skewed. The majority of the firms' premium income values are positively skewed except for AIICO and Leadway. Many of the firms' fees & commission income values are positively skewed except for Leadway, AXA Mansard, and Mutual Benefits firms. The majority of the firms' underwriting income values are positively skewed except for AIICO, Leadway, and AXA Mansard. Most of the management expense values are positively skewed except for AIICO and Leadway. Cornerstone, AIICO, Mutual Benefits, and Hilal takaful claims expense

values are positively skewed but Leadway, AXA Mansard, NEM, and Jaiz takaful are negatively skewed. All underwriting expenses for all the firms are positively skewed. In addition, Leadway assurance is negatively skewed in all input-output variables except for underwriting expenses. In the same vein, the two takaful firms, Hilal and Jaiz are positively skewed in all input-output variables except in investment income and Claims expenses respectively.

The input-output variables for most of the firms have a platykurtic distribution (kurtosis < 3) except for underwriting expenses that have Cornerstone, Leadway, AXA Mansard, and Mutual Benefits firms with a Leptokurtic distribution (kurtosis > 3).

Table 1: Measure of Data

| | ***Cornerstone Insurance Plc.*** | | | | | | |
|---|---|---|---|---|---|---|---|
| **STATISTICS** | ***Investment Income*** | ***Premium Income (Net)*** | ***Fees & Commission Income*** | ***Underwriting Income (Net)*** | ***Management Expenses*** | ***Claims expenses (Net)*** | ***Underwriting expenses*** |
| | | | | | | | |
| Mean | 764,368.00 | 5,609,584.80 | 1,128,072.20 | 6,737,657.00 | 2,720,145.00 | 3,288,294.60 | 1,800,785.20 |
| Standard Deviation | 205,669.56 | 1,163,919.99 | 579,485.15 | 1,645,204.66 | 197,891.98 | 1,358,809.65 | 417,643.23 |
| Sample Variance | 4.23E+10 | 1.35E+12 | 3.36E+11 | 2.71E+12 | 3.92E+10 | 1.85E+12 | 1.74E+11 |
| Kurtosis | 2.29 | 2.43 | -0.93 | 2.96 | 1.31 | 2.49 | 3.52 |
| Skewness | 1.02 | 1.60 | 0.67 | 1.63 | 1.21 | 1.61 | 1.82 |
| | ***AIICO Insurance Plc.*** | | | | | | |
| **STATISTICS** | ***Investment Income*** | ***Premium Income (Net)*** | ***Fees & Commission Income*** | ***Underwriting Income (Net)*** | ***Management Expenses*** | ***Claims expenses (Net)*** | ***Underwriting expenses*** |
| | | | | | | | |
| Mean | 10,180,427.00 | 42,154,167.00 | 1,436,499.00 | 43,590,666.00 | 8,391,834.20 | 27,634,791.20 | 6,357,752.80 |
| Standard Deviation | 1,998,259.64 | 13,381,034.64 | 567,053.79 | 13,913,758.10 | 1,600,153.35 | 7,850,835.95 | 2,942,798.82 |
| Sample Variance | 3.99E+12 | 1.79E+14 | 3.22E+11 | 1.94E+14 | 2.56E+12 | 6.16E+13 | 8.66E+12 |
| Kurtosis | -2.38 | -2.25 | 1.08 | -2.15 | -2.83 | 0.08 | -0.52 |
| Skewness | 0.65 | -0.06 | 0.60 | -0.05 | -0.64 | 0.86 | 0.48 |

Table 1(cont'd.): Measure of Data

| | *Leadway Assurance Plc.* | | | | | | |
|---|---|---|---|---|---|---|---|
| **STATISTICS** | ***Investment Income*** | ***Premium Income (Net)*** | ***Fees & Commission Income*** | ***Underwriting Income (Net)*** | ***Management Expenses*** | ***Claims expenses (Net)*** | ***Underwriting expenses*** |
| | | | | | | | |
| Mean | 27,149,475.60 | 59,193,561.40 | 2,572,856.00 | 61,766,417.40 | 8,822,405.20 | 38,199,953.60 | 8,259,757.80 |
| Standard Deviation | 7,876,459.53 | 16,044,435.42 | 478,255.05 | 15,987,442.67 | 1,258,592.54 | 7,950,189.87 | 2,939,968.98 |
| Sample Variance | 6.20E+13 | 2.57E+14 | 2.29E+11 | 2.56E+14 | 1.58E+12 | 6.32E+13 | 8.64E+12 |
| Kurtosis | -0.75 | -2.07 | -0.52 | -1.88 | 1.39 | -0.90 | 3.17 |
| Skewness | -0.06 | -0.82 | -0.69 | -0.86 | -1.17 | -0.27 | 1.72 |
| | *AXA Mansard Plc.* | | | | | | |
| **STATISTICS** | ***Investment Income*** | ***Premium Income (Net)*** | ***Fees & Commission Income*** | ***Underwriting Income (Net)*** | ***Management Expenses*** | ***Claims expenses (Net)*** | ***Underwriting expenses*** |
| | | | | | | | |
| Mean | 3,646,504.20 | 12,255,986.40 | 1,744,316.00 | 14,000,302.40 | 6,017,057.80 | 6,349,342.00 | 3,197,450.40 |
| Standard Deviation | 1,124,002.04 | 2,649,663.93 | 140,728.28 | 2,740,740.18 | 792,227.61 | 1,461,125.38 | 473,299.16 |
| Sample Variance | 1.26E+12 | 7.02E+12 | 1.98E+10 | 7.51E+12 | 6.28E+11 | 2.13E+12 | 2.24E+11 |
| Kurtosis | 1.12 | -0.92 | -1.30 | -0.70 | 3.32 | -2.30 | 3.43 |
| Skewness | 1.28 | 0.04 | -0.69 | -0.01 | 1.57 | -0.56 | 1.69 |
| | *Mutual Benefits Assurance Plc.* | | | | | | |
| **STATISTICS** | ***Investment Income*** | ***Premium Income (Net)*** | ***Fees & Commission Income*** | ***Underwriting Income (Net)*** | ***Management Expenses*** | ***Claims expenses (Net)*** | ***Underwriting expenses*** |
| | | | | | | | |
| Mean | 1,018,974.60 | 6,913,323.20 | 413,202.00 | 7,326,525.20 | 1,984,246.20 | 2,930,534.80 | 2,371,258.20 |
| Standard Deviation | 224,452.10 | 1,564,030.32 | 199,739.76 | 1,721,565.26 | 93,141.98 | 1,151,349.05 | 1,007,003.86 |
| Sample Variance | 5.04E+10 | 2.45E+12 | 3.99E+10 | 2.96E+12 | 8.68E+09 | 1.33E+12 | 1.01E+12 |
| Kurtosis | -0.49 | 4.56 | 0.14 | 4.41 | 1.53 | -0.52 | 4.15 |
| Skewness | -0.50 | 2.12 | -0.04 | 2.06 | 1.43 | 1.02 | 1.98 |
| | *NEM Insurance Plc.* | | | | | | |
| **STATISTICS** | ***Investment Income*** | ***Premium Income (Net)*** | ***Fees & Commission Income*** | ***Underwriting Income (Net)*** | ***Management Expenses*** | ***Claims expenses (Net)*** | ***Underwriting expenses*** |
| | | | | | | | |
| Mean | 935,953.00 | 13,656,434.00 | 1,032,523.80 | 14,688,957.80 | 3,321,893.80 | 3,978,099.80 | 5,418,833.40 |
| Standard Deviation | 157,163.06 | 3,921,111.84 | 328,547.50 | 4,226,223.23 | 547,453.99 | 1,848,070.91 | 1,650,481.96 |
| Sample Variance | 2.47E+10 | 1.54E+13 | 1.08E+11 | 1.79E+13 | 3.00E+11 | 3.42E+12 | 2.72E+12 |
| Kurtosis | 0.60 | -0.91 | -1.68 | -0.87 | 0.63 | -2.41 | 2.87 |
| Skewness | -0.38 | 0.74 | 0.03 | 0.69 | 1.07 | -0.04 | 1.67 |

Table 1(cont'd.): Measure of Data

| STATISTICS | *Hilal Takaful Insurance* | | | | | | |
|---|---|---|---|---|---|---|---|
| | ***Investment Income*** | ***Premium Income (Net)*** | ***Fees & Commission Income*** | ***Underwriting Income (Net)*** | ***Management Expenses*** | ***Claims expenses (Net)*** | ***Underwriting expenses*** |
| Mean | 82,729.00 | 176,207.80 | 11,656.20 | 187,864.00 | 91,169.20 | 94,982.60 | 67,208.40 |
| Standard Deviation | 21,954.94 | 75,254.22 | 10,164.45 | 73,560.42 | 36,373.78 | 64,191.75 | 26,133.36 |
| Sample Variance | 4.82E+08 | 5.66E+09 | 1.03E+08 | 5.41E+09 | 1.32E+09 | 4.12E+09 | 6.83E+08 |
| Kurtosis | -0.80 | -0.14 | -1.94 | -0.62 | 4.58 | 1.28 | -0.12 |
| Skewness | -0.15 | 0.44 | 0.40 | 0.02 | 2.13 | 1.15 | 0.12 |
| **STATISTICS** | ***Jaiz Takaful Insurance*** | | | | | | |
| | ***Investment Income*** | ***Premium Income (Net)*** | ***Fees & Commission Income*** | ***Underwriting Income (Net)*** | ***Management Expenses*** | ***Claims expenses (Net)*** | ***Underwriting expenses*** |
| Mean | 23,665.77 | 571,584.97 | 28,788.19 | 600,373.16 | 397,334.39 | 213,381.10 | 79,653.69 |
| Standard Deviation | 20,298.17 | 497,452.84 | 20,797.21 | 515,840.63 | 185,029.62 | 149,178.02 | 74,058.50 |
| Sample Variance | 4.12E+08 | 2.47E+11 | 4.33E+08 | 2.66E+11 | 3.42E+10 | 2.23E+10 | 5.48E+09 |
| Kurtosis | 1.78 | 1.45 | -2.24 | 1.32 | 3.73 | -1.94 | 0.43 |
| Skewness | 1.39 | 1.07 | 0.19 | 1.03 | 1.87 | -0.13 | 1.07 |

Source: Authors' computation

## 4.2 Efficiency Results

The section represents the DEA Efficiency Scores of some insurance companies based on constant returns to scale (CRS), variables returns to scale (VRS), and scale efficiency. The input orientation approach was used in computing the DEA model for each year. Using the same data, the overall and pure technical efficiency were obtained based on constant returns-to-scale (CRS) and variable returns-to-scale (VRS) assumptions. To obtain scale efficiency, the ratio of the overall technical efficiency to the pure technical efficiency was obtained.

The result in the table below shows the DEA efficiency scores based on constant returns to scale (CRS) for each of the five years. Based on the average efficiency score, Leadway assurance, NEM insurance, and Jaiz takaful insurance emerged on the efficient frontier, indicating efficient management of their financial resources. Aside from these three insurance

companies that emerged on the efficient frontier and from the remaining, AXA Mansard emerged as the most efficient with a mean score of 0.988, followed by Hilal Takaful (0.971), AIICO (0.935), Mutual Benefits (0.932), and the least is Cornerstone Insurance (0.913).

Table 2: Efficiency of the insurance companies based on constant returns to scale (CRS)

| Type of Insurance | Insurance Companies | 2017 | 2018 | 2019 | 2020 | 2021 | Average | Rank |
|---|---|---|---|---|---|---|---|---|
| Conventional | Cornerstone Insurance Plc. | 0.688 | 0.877 | 1.000 | 1.000 | 1.000 | 0.913 | 8 |
| | AIICO Insurance Plc. | 1.000 | 0.761 | 0.912 | 1.000 | 1.000 | 0.935 | 6 |
| | Leadway Assurance Plc. | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1 |
| | AXA Mansard Plc. | 1.000 | 1.000 | 1.000 | 0.940 | 1.000 | 0.988 | 4 |
| | Mutual Benefits Assurance Plc. | 0.908 | 0.926 | 1.000 | 0.826 | 1.000 | 0.932 | 7 |
| | NEM Insurance Plc. | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1 |
| Takaful | Hilal Takaful Insurance | 1.000 | 1.000 | 0.857 | 1.000 | 1.000 | 0.971 | 5 |
| | Jaiz Takaful Insurance | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1 |

Source: Authors' computation

The result in the table below shows the DEA efficiency scores based on variable returns to scale (VRS) for each year. The average efficiency score revealed that Leadway Assurance, AXA Mansard, NEM Insurance, Hilal Takaful, and Jaiz Takaful emerged on the efficient frontier, indicating efficient management of their financial resources. Others are Mutual Benefits with a mean score of 0.938, followed by AIICO (0.935), and the least is Cornerstone Insurance (0.918).

Table 3: Efficiency of the insurance companies based on variable returns to scale (VRS)

| Type of Insurance | Insurance Companies | 2017 | 2018 | 2019 | 2020 | 2021 | Average | Rank |
|---|---|---|---|---|---|---|---|---|
| Conventional | Cornerstone Insurance Plc. | 0.708 | 0.883 | 1.000 | 1.000 | 1.000 | 0.918 | 8 |
| | AIICO Insurance Plc. | 1.000 | 0.763 | 0.913 | 1.000 | 1.000 | 0.935 | 7 |
| | Leadway Assurance Plc. | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1 |
| | AXA Mansard Plc. | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1 |
| | Mutual Benefits Assurance Plc. | 0.908 | 0.926 | 1.000 | 0.855 | 1.000 | 0.938 | 6 |
| | NEM Insurance Plc. | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1 |
| Takaful | Hilal Takaful Insurance | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1 |
| | Jaiz Takaful Insurance | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1 |

Source: Authors' computation

The result in the table below shows the DEA efficiency scores based on scale efficiency. The average efficiency score revealed that Leadway assurance, NEM insurance, and Jaiz takaful insurance emerged on the efficient frontier, indicating efficient management of their financial resources. The efficiency of the remaining insurance firms is AIICO (0.999), Cornerstone (0.993), Mutual Benefits (0.993), AXA Mansard (0.988), and the least is Hilal takaful (0.971).

Table 4: Efficiency of the insurance companies based on scale efficiency.

| Type of Insurance | Insurance Companies | 2017 | 2018 | 2019 | 2020 | 2021 | Average | Rank |
|---|---|---|---|---|---|---|---|---|
| Conventional | Cornerstone Insurance Plc. | 0.972 | 0.994 | 1.000 | 1.000 | 1.000 | 0.993 | 5 |
| | AIICO Insurance Plc. | 1.000 | 0.997 | 0.998 | 1.000 | 1.000 | 0.999 | 4 |
| | Leadway Assurance Plc. | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1 |
| | AXA Mansard Plc. | 1.000 | 1.000 | 1.000 | 0.940 | 1.000 | 0.988 | 7 |
| | Mutual Benefits Assurance Plc. | 0.999 | 0.999 | 1.000 | 0.966 | 1.000 | 0.993 | 6 |
| | NEM Insurance Plc. | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1 |
| Takaful | Hilal Takaful Insurance | 1.000 | 1.000 | 0.857 | 1.000 | 1.000 | 0.971 | 8 |
| | Jaiz Takaful Insurance | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1 |

Source: Authors' computation

## 5. CONCLUSION

The study examined the efficiency of conventional and takaful insurance firms in Nigeria from 2017 to 2021 using Data Envelopment Analysis (DEA). To measure the efficiency of the conventional and takaful insurance firms, the input and output data were examined using the input approach to DEA. The DEA method revealed that scale efficiency was higher than the overall and pure technical efficiency. The low score of the overall and pure technical efficiency is due to the ineffectiveness of the management and operation of the firms in efficiently utilizing the firm's inputs to optimize its outputs. The scale efficiency high scores were determined by advantageous situations such as the customers' loyalty. This study showed that takaful insurance emerged on the efficient frontier in all years except 2019 and takaful

insurance in comparison to the conventional counterpart was more efficient in these years except for 2019. To this extent, this study concludes that in terms of efficiency, neither takaful nor conventional insurance firms clearly outperform the other. However, takaful firms are more likely to be more efficient if considered yearly.

This study proposes that takaful and conventional insurance firms in Nigeria should allocate inputs efficiently to optimize outputs and improve their customer service delivery. Furthermore, conventional insurance should be dynamic in their approach because of the changing times and should be more aware of their customers' needs and produce products to meet these needs and earn customers' trust. It recommends that takaful firms should be considered in the search for economic growth and stability.

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