



Technical Efficiency of Nigerian Insurance Companies: A Data Envelopment Analysis and Latent Growth Curve Modelling Approach

Jaiyeoba Haruna Babatunde^{a*}, Razali Haron^b

(a) *Department of Business Administration, International Islamic University, Malaysia*

(b) *Associate Professor, Institute of Islamic Banking and Finance, International Islamic University Malaysia*

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Abstract

The main purpose of this paper is to investigate the performance of Nigerian insurance companies using Data Envelopment Analysis (DEA). Because of the unavailability of the required data, the study is limited to ten Nigerian insurance companies for the period of five years from 2008 to 2012. The input employed were commission expenses and management expenses, while premium and investment income were used as the output. Data were sourced from the respective insurance websites and African financial websites. DEA was the main methodology used in analyzing the data of this study while ratio analysis (liquid asset to total asset, total equity to total asset and return on asset) was also used in addition to the DEA. The overall result of the Total Factor Productivity (TFP) shows that Nigerian insurance industry is less efficient and this is caused by low level of Technical efficiency (EF) change including Technological change (TECH); this is also confirmed by the result of Latent Growth Curve Modeling (LGCM) which reveals that their efficiency over the period was declining. However, some of the leading insurance companies in terms of performance (TFP) are Leadway insurance, Standard Alliance insurance and Sovereign Trust insurance, among the insurance firms. The results of the ratio on the other hand reveal that Leadway is the highest in terms of profitability, Aiico was more liquid compared to the other firms and Oasis insurance finances more of its asset with shareholder's fund compared to other insurance firms.

Keywords: DEA, Efficiency, LGCM, ROA and Nigerian insurance companies

* Corresponding Author: jaiyebab@yahoo.com

1.1. Introduction

Analyzing the efficiency of insurance companies has been of interest to researchers in recent times, this is due to the crucial role this sector of financial institution plays in the economy. Studying the efficiency of insurance companies is highly important because it helps in determining how insurance companies respond to the various challenges and how many of them are likely to survive those challenges in the event of their occurrence (Berger & Humphrey, 1993). The efficiency of Nigerian insurance companies can be ascertained by using an appropriate measure such as Data Envelopment Analysis (DEA) that analyzes their efficiency over a certain period of time. Knowing the efficiency of Nigerian insurance companies is highly important because of their important roles in the country. According to Kubai (2011), the insurance industry provides financial security as well as financial intermediation to both individuals and businesses in the economy, hence, improving the nation's financial and economic development. These important roles played by the insurance companies are not limited to an individual country but to the entire world.

Interestingly, Nigerian insurance market along with their counterparts in South Africa have been acknowledged as part of the most developed insurance market among African countries (Barros & Obijiaku, 2007). This is

due to the fact that Nigerian insurance market consists of 103 insurance companies and 350 insurance brokers at their time when their study was carried out. However, following the 2006 recapitalization of Nigerian insurance industry, their number declined from 103 to 49.[†] This recapitalization was to ensure and enhance the efficiency of the insurance industry. It is believed that companies will be able to achieve efficiency and growth if there is increment in its capital base (Orea & Kumbhakar, 2004).

Given the important role of the Nigerian insurance industry, few studies have been carried out to analyze the efficiency of this industry, especially after the recapitalization process that took place in 2005/2006. However, none of the studies uses DEA in their study to analyze the efficiency of the insurance companies in Nigeria given its robustness in analyzing the efficiency of the companies. In this regard, studying the efficiency of the Nigerian insurance companies is highly important to Nigeria because one of the main objectives of recapitalization was to improve the efficiency of the industry. Thus, this recapitalization is expected to increase the efficiency of the

[†] Adeoye T. B. (2012), Recapitalization of the Nigeria Insurance Industry, available: <http://adeoyebabatola.wordpress.com/2012/02/23/recapitalization-of-the-nigeria-insurance-industry>, accessed on 29 April, 2014.

industry. Hence, this study is among the first of its kinds that uses Data Envelopment Analysis (DEA) in analyzing the performance of Nigerian insurance companies, especially after the recapitalization of 2005/2006 as far as the researchers are concerned.

The recent recapitalization of Nigerian insurance industry is aimed at increasing the efficiency of the industry. Due to this recapitalization, the number of the insurance companies has decreased to just 29 as of 2009 according to Ibrahim and Abubakar (2012), and in 2012 increased to 49. This increase has led to the high performance of the industry, increasing competition as well as impacting the economic growth of the country (Richard & Victor, 2013). It is hope that examining the performance of the insurance industry in aggregation will certainly not reveal the individual efficiency of these insurance companies. Therefore, this study empirically investigates the efficiency of the selected companies among the Nigerian insurance companies.

The main objective of this paper is to analyze the performance of Nigerian insurance companies using Data Envelopment Analysis. As part of this performance analysis, the study also uses ratios to study the performance of the sample companies as well as Latent Growth Curve Modeling over the period covered. This study aims at making a distinctive contribution to the Nigerian insurance industry. Carrying out this research will not only improve the

performance of individual Nigerian insurance companies but also, the performance of the Nigerian insurance industry as a whole which in turn will increase their contributions to the national economic development..

1.2 Overview of Nigerian Insurance Industry

The concept of insurance in its modern form was introduced to Nigeria through the establishment of what was known as a Nigerian agent by the British in the 19th century, Badejo (1998) (as cited by Richard & Victor, 2013). Richard and Victor argue further that the first indigenous insurance company (African insurance company) was established in 1958. The paramount reason for the establishment of this insurance was to provide both life and non-life insurance cover in the country. Life insurance offered covers those that are related to risk of life, pension funds administration services and annuities, while non-life insurance provides risk of damage or loss of property (Hamadu & Mojekwu, 2010).

The promulgation of the Nigerian Insurance Decree 1976 and creation of the National Insurance Commission (NAICOM) 1997 were some of the main developments that took place in the Nigerian insurance industry since it was established. Section 86 of the Insurance Acts of 2003 states that NAICOM shall be responsible for the enforcement and the administration of the Insurance Act. In 2003, recapitalization was introduced by Section 9(4) of Insurance Acts 2003. Based on this

recapitalization, capital based requirement for life insurance was ₦15m, ₦200m for general insurance and ₦350m for composite insurance and reinsurance. Following 2003 the recapitalization exercise, the capital based requirement was raised to ₦2 billion for the Life insurance, ₦3 billion for the non-life insurance and ₦10billion for reinsurance (Richard & Victor, 2013).

Merger and acquisition were used for the recapitalization which eventually caused the decrease in the number of Nigerian insurance companies from over 100 to 49 and reinsurance from 4 to 2. This despite the fact that, Nigerian insurance industry has contributed to the development of economic growth through managing the risks of firms as well as the households including mobilization of funds from the surplus unit to the deficit unit.

This study is structured into five main sections including this introduction. Various literatures reviewed by the researchers are discussed in Section Two; Section Three contains the methodology adopted for this study including the data gathering process. Section Four presents the analyses and findings of this study, while the last section concludes this study.

2. Literature Review

This section discusses the previous studies that are pertinent and are within the scope of this study. These discussions cover both conventional insurance as well as Takaful

because Takaful is not new to Nigerian insurance companies as most of them are now offering Takaful products in order to satisfy the demands of Muslims in the country. Many researchers all over the world have been using Data Envelopment Analysis (DEA) to analyze the performance of insurance companies across the world. Before delving into the empirical review on insurance industries, it is pertinent to discuss the theoretical review that underpins efficiency.

Previously, many researchers have defined the concept of efficiency according to the objective of their study. For instance, according to Farrell (1957), efficiency refers to the proper use of the available resources in order to maximize firms' production of goods and services; this efficiency measures the relationship between the inputs employed to generate the outputs. There are two types of efficiency and these are technical efficiency and allocative efficiency. Technical efficiency, which is further composed into scale efficiency and pure technical efficiency, refers to the firm's ability to maximize the output given as a set of input with lower cost and no waste of materials. Allocative efficiency, on the other hand, deals with optimal use of the input given their respective prices.

The findings from various literatures on the efficiency of insurance companies from different parts of the world have significant implication on insurance operators in the area of their competitive strength, policy-makers,

insurance industry's regulators and efficient financial institutions (Saad, 2012). Obviously, the two methods that are used widely to measure the insurance industry's efficiency are Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA) (Aigner, Lovell, & Schmidt, 1977). Some of the studies that use these methods across the countries are discussed in this section.

Saad (2012) compares the efficiency of Takaful and insurance companies in Malaysia using DEA. His study covers 2007 to 2009 and includes 28 general or non-life insurance and Takaful operators. The outputs employed by his study are premium and net investment income while the inputs are commission and management expenses. He found that insurance companies out-performed the Takaful operators over the period of his study and that only one Takaful operator (Prudential BSN Takaful Bhd) recorded total factor productivity (TFP) performances over the industrial average.

Also, Abduh, Omar, and Tarmizi (2012) measured the performance of the insurance industry in Malaysia between 2008 to 2010, using both ratio analysis and the DEA in analysing the performance of 12 Takaful and insurance companies. Liquid asset to total asset, return on asset, total equity to total asset and premium and reinsurance receivables to total asset were all used in their ratio analyses. However, premium and net investment income were employed as outputs while commission

and management expenses were used as inputs.

Meanwhile, Arif, Nawawi, Muhamad, Ahmad, and Aleng (2012) focused on the stochastic frontier analysis approach (SFA) in analyzing the efficiency of 26 general insurance companies in Malaysia from 2007 to 2009. They argued that the relative efficiency of the general insurance companies increased from year to year over the period of their study. It was reiterated in their study that Oriental Capital Assurance Bhd (OCA) posted the highest relative efficiency among the general insurance companies included in their study.

Owusu-Ansah, Dontwi, Seidu, Abudulai, and Sebil (2010) studied the technical efficiencies of ten Ghanaian general insurers using DEA between 2002 to 2007. They used premium earned, and claims and investment income as their outputs while the debt capital, equity capital and management expenses were used in their study as the inputs. Their results show that Ghanaian general insurers on average were operating at 68% overall efficiency, 78% technical efficiency and 78% scale efficiency. They concluded that a good number of Ghanaian insurance companies were operating with high level of managerial skills.

Barros and Obijaku (2007) studied the technical efficiency of ten Nigerian insurance companies from 2001 to 2005 using DEA. They used profit or loss for the year, net premiums, settled claims, outstanding claims

and investment income as the outputs while total capital, total operative costs, total number of employees and total investment as their inputs. Their result show that some of the Nigerian insurance companies were inefficient, although there was a just a margin for them to upgrade their efficiency. They also argue that all the companies considered in their study did not display equivalent efficiencies.

Bawa and Ruchita (2011) analysed the efficiencies of health insurance business in India for ten general insurance companies and four public sector companies from 2003 to 2010 using DEA. The inputs of their study were equity capital and labour (including agent's fees, commission and other expenditure, while the output is net premium). They found that on average, the technical efficiency of the health insurance business was 73%, the scale efficiency was 78% and pure technical efficiency was 92%. They argued that public sector companies were becoming mature and now having the decrease return to scale because of the competition with the private sector companies given the improvement in the private sector.

Another study by Dalkılıç and Ada (2014) looks at the efficiency of Life/Pension Insurance Industry in Turkey from 2010 to 2011 using DEA. There were 20 sample companies and the input used were operating expenses, shareholders' equity, number of agencies and number of staff employed by

insurance companies while the output were net gross written premiums, net claims incurred and net technical provisions. There was a decrease in the average scale efficiency of 20 companies included in their study from 92% in 2010 to 87.7% in 2011. However, the life insurance companies average scale efficiency increased from 94.8% in 2010 to 98.6% in 2011.

The study by Eling and Luhnen (2010) compares the efficiency of 3,831 companies across 91 countries from 2002 to 2006 using DEA and SFA. Labour, debt capital business services and material and equity capital were used as the inputs while net incurred claims plus additions to reserves were used as proxy for the outputs. By employing different methodologies for different countries, organizational forms and company sizes, life and non-life insurers were compared for the stated period. They reveal that there was a steady growth in the technical and cost efficiency in the international insurance market starting from 2002 to 2006. Based on ranking, Denmark and Japan were on the top in terms of average efficiency whereas Philippines was ranked as the lowest country.

Thus, literature reveals that DEA has been employed in different countries to study the efficiency of the insurance industry, but there is no study that uses this method to study the efficiency of the Nigerian insurance companies after the 2005/2006 recapitalization that took place in this industry as far as the

researchers are aware. Moreover, studying the efficiency of the Nigerian insurance industry the recent times is of paramount interest of Nigerians in order to evaluate the effectiveness of the industry after recapitalization. This study is indeed carried out in order to reveal the efficiency of Nigerian insurance industry especially, after the industry's recapitalization.

3. Data and Methodology

This study adopted non-parametric approach in evaluating the performance of Nigerian insurance companies as well as ratio analysis. The non-parametric used was Data Envelopment Analysis (DEA), it also used Latent Growth Curve Modeling (LGCM) and the ratios used were liquid asset to total asset, total equity to total asset and return on asset (ROA) in addition to DEA. The researchers believe that using these three approaches will reveal the efficiency of the selected insurance companies. These sets of ratio analysis were employed in order to be in line with previous studies such as Akhter and Zia-ur-Rehman (2011) and Abduh et al. (2012). The mean and standard deviation are presented for each company for the entire period in the next section. Following the discussion by Abduh et al. (2012), these ratio analyses are discussed as follows:

1. Liquid asset to total asset ratio: This ratio was used to identify the liquidity level of each of the company over the period of the study compared with the firm total assets. It was measured by dividing cash in hand and bank

and financial assets with total asset of the firms.

2. Total equity to total asset ratio: This ratio was used to measure the amount of the shareholders' equity that was used in financing the firm's asset over the period of study, and it was arrived at by dividing the total equity by the firm's total asset.

3. Return on asset (ROA): This was used to determine the ability of the firm's management in generating profit from its investment in assets; it was calculated by dividing the return of the firms by the total asset of the firms.

Another ratio used in the previous study mentioned above was premium and reinsurance receivable to total asset ratio which is not included in this study. This ratio was excluded because the required data needed to calculate it were not specifically mentioned by most of the selected companies.

As mentioned, DEA is one of the frequently used methods to analyze the effectiveness of the insurance companies around the world. Since 1978 when DEA was first introduced, researchers from different fields have recognized it as an excellent method for modeling operational process in evaluating performance because the method requires a few assumptions and it is friendly (simple) (Cooper, Seiford, & Zhu, 2011). In using DEA for performance evaluation, the appropriate input and output choices play a significant role, both for the insurance industry as well as other industries (Owusu-Ansah et al., 2010).

The input and output choices for this study is discussed next.

In accordance with the study by Ismail, Alhabshi, and Bacha (2011), Saad (2012), Abduh et al., (2012) and many others, this study uses two inputs and two outputs. The inputs are commission and management expense while the outputs are earned premium and investment income. In order for this study to be consistent with that by Färe, Grosskopf, Norris, and Zhang (1994), it uses an enhanced composition of the Malmquist index, efficiency change component composition, calculated relative to constant returns to scale technology into pure efficiency component (calculated relative to the variable returns to scale (VRS) technology) and a scale-efficiency change component which captures changes in the deviation between the VRS and constant-returns-to-scale (CRS) technology. Also, the subset of pure efficiency change measures the relative ability of operators to convert inputs into outputs, while scale efficiency measures the extent to which the operators can take advantage of returns to scale, by altering its size in the direction of the optimal scale (Saad, 2012)

1.1. Data Source and Sample Size

The sample for this study comprises ten companies from the Nigerian insurance industry. These companies were selected because of two import reasons. Firstly, they are currently part of the leading insurance companies in the country, and secondly, their

data were available for the period covered. Initially, the researchers selected 20 insurance companies from National Insurance Commission (NAICOM) and study their efficiency for the ten-year period from 2003 to 2012.

However, due to the availability of data required for the inputs and outputs, the study was limited to ten insurance companies[‡] for five years (50 observations) from 2008 to 2012. Data for selected companies were sourced from the respective annual reports downloaded from the each company's website but in a situation where annual reports were not available from the company's website, the researchers proceeded to download it from the African financial website[§], and all data were in Naira (N) values.

3.2. Latent Growth Modelling (LGCM)

This study also employed latent growth curve model in order to investigate the trend or changes in the efficiency of Nigerian insurance companies. The researchers used this model (LGCM) because the dynamic associations among multiple causes and effects of insurance company's efficiency cannot be sufficiently elucidated by conventional regression methods but this can be best assessed by growth curve modeling (Marathe, Wan, Zhang, & Sherin, 2007). This model assumes that the two growth components; intercept (the initial status) and slope (the

[‡] Find the lists of selected companies under the Appendix I

[§] At http://www.africanfinancials.com/Company_list.aspx?countryUID=11

change) in the efficiency measures are not independent and are related (Marathe et al., 2007). Under this analysis, the outputs of the constant return to scale (CRS) and variable return to scale (VRS) presented in the above section were used. Also, it was assumed that the efficiency measurement will increase linearly with time for each firm with separate slope and intercept for each firm.

4. Data Analysis and Findings

The analysis for both ratio analysis and DEA results are presented in this section. It was previously mentioned that the researchers used three ratios in complementing the DEA analysis. The result for the ratio analysis are first of all presented then followed by the main focus of the analysis (Data Envelopment Analysis).

4.1. Ratio Analysis

Based on vivid discussion in the previous section, it can be said that liquid asset to total asset was calculated by dividing liquid asset (cash, bank and financial assets) by the total asset. LA/TA represents this ratio in Table 1, Aiico insurance PLC has more liquid asset with a mean of 28.35%, followed by Leadway Assurance with 26.32% mean. However, the least in terms of this ratio was African Alliance insurance with 8.8% mean. Based on the information from the Table 4.1, Aiico insurance also has the highest standard deviation of 29.73% which means that this company was more volatile during the period covered in this study (2008-2010).

TE/TA in Table 1 represents total equity to total asset ratio and it was calculated by dividing the total equity by the total asset for each company over the period of the study. Oasis insurance has the highest with 339.65% mean compared with other Nigerian insurance companies, follow by Unity Kapital assurance with 89.69% mean and Consolidated Hallmark insurance with 73.46% mean, while the least insurance company is Aiico insurance with 44.49%. These two former insurance companies financed their assets more with shareholders' funds compared with other companies. Therefore, this ratio indicates that the higher this ratio, the less risky the firm compared to other insurance companies.

Finally, the ROA in Table 1 represents the return on asset and it was calculated by dividing the annual return by the total asset of each company throughout the period of study. This ratio measured the overall profitability of each company over the period of study and the leading insurance company using this ratio was Leadway Assurance with 10.8% mean, followed by Standard Alliance insurance with 7.26% mean and Mansard insurance with 5.33% mean. The least in terms of this ratio was Oasis insurance with -39.77% mean. Most of these companies have very low ROA may be because of the competition with other growing insurance companies in the country or the management was less efficient in managing the asset investment.

Table4.1. Ratio analysis for 2008-2012 IN (%)

S/N	COMPANY'S NAME		LA/TA	TE/TA	ROA
1	Consolidated Hallmark Ins	Mean	14.18	73.46	5.08
		Std. Deviation	15.73	6.54	1.12
2	Aiico Insurance	Mean	28.35	44.49	3.87
		Std. Deviation	29.73	10.22	0.57
3	Cornerstone Insurance	Mean	23.19	56.42	1.01
		Std. Deviation	27.66	6.86	4.6
4	Leadway Assurance	Mean	26.32	29.52	10.8
		Std. Deviation	27.83	8.65	2.23
5	Mansard Insurance	Mean	22.09	63.33	5.33
		Std. Deviation	27.17	12.55	3.47
6	Oasis Insurance	Mean	18.66	339.65	-39.77
		Std. Deviation	18.14	349.39	82.23
7	Sovereign Trust Insurance	Mean	17.97	55.13	4.84
		Std. Deviation	22.07	15.97	10.8
8	Unity Kapital Assurance	Mean	19.04	89.69	1.7
		Std. Deviation	21.72	2.05	2.51
9	Standard Alliance Insurance	Mean	14.44	58.6	7.26
		Std. Deviation	15.74	3.99	9.19
10	African Alliance Insurance	Mean	8.8	60.29	-5.27
		Std. Deviation	11	14.73	27.45

4.2. Data Envelopment Analysis (DEA)

There are two inputs and two outputs used in this study and they are commissions and management expenses for the inputs, while premium earned and investment income were used for the outputs. These inputs and outputs were employed in order to study the efficiency of the Nigerian insurance companies. Under this heading, descriptive analysis is presented first in order to describe sample companies.

4.3. Descriptive Statistics

Table 2 reports the descriptive statistics of the inputs and outputs of the ten insurance companies that were selected for this study over the study period. For the outputs, it seems

that Aiico insurance has the highest amount of the premium and Leadway insurance has the highest amount of investment income. Sovereign Trust insurance has the highest amount in terms of commission expenses whereas Leadway assurance has the highest amount in terms of management expenses as in inputs. On average, the amount of the commissions and the management expenses were ₦1, 929,404 and ₦2, 582,153, respectively. Meanwhile, the average premium and investment income were ₦4, 038,978 and ₦1, 213,441, respectively. Overall, the total premium, total investment, total commission expenses and total management expenses used

in this study were ₦323, 118,270, ₦49, 144,342, ₦78, 140,869 and ₦104, 557,185 respectively.

4.4. Production Frontier and Efficiency

Since measuring efficiency is the basic component of the Malmquist productivity index, the efficiency of the ten insurance companies that were selected for this study were reported in Tables 3 and 4 under the constant returns to scale (CRS) and variable return to scale (VRS) over the period of the study. According to Färe et al. (1994), feasible output under the constant return to scale is achieved when the average productivity which is output divided by the input is maximized. Any value under the CRS and VRS that is greater than 1 indicates efficient, while the less than 1 indicates that the firm is below the frontier or technically inefficient. Therefore, the smaller the value is from 1, the more inefficient the firm is compared with the value closer to 1 (Saad, 2012).

As reported in Tables 3 and 4 for the period covered, Leadway Assurance and Mansard

insurance were more efficient compared to others under the CRS as they demonstrated efficiency four times over the period of study.

Under the VRS, Leadway Assurance was consistently efficient over the period of study. Other insurance companies that were efficient in recent period were Aiico insurance in 2011 and 2012, both under CRS and VRS, Unity capital insurance in 2010 and 2011 under CRS and 2008, 2010 and 2011 under VRS, and Consolidated Hallmark in 2011 and 2012 under VRS.

The weighted geometric means in Tables 3 and 4 represent the average efficiency for these insurance companies. This average efficiency decreased in 2009 to 42.6% from 77.5% in the previous year but increased to 65% in 2011; it decreased again to 47.6% in 2012. Under the VRS, the geometric mean decrease to 49% from 83% in 2008, increased through 2010 and 2011 but there was a slight decrease to 67% in 2012 from 70.1% in the previous year. On average, the efficiency of the Nigerian insurance companies is relatively higher under the VRS than the CRS.

Table 2

	OUTPUT		INPUT	
	Premiums (₦ mill.)	Investment income (₦ mill.)	Commissions (₦ mill.)	Mgt expenses (₦ mill.)
Total	323,118,270	49,144,342	78,140,869	104,577,185
Mean	4,038,978	1,213,441	1,929,404	2,582,153
Median	3,104,014	429,693	620,558	1,171,403
Std. Deviation	3,547,918	631,690	1,262,430	709,110

Table 3:Efficiency of the Insurance Companies, 2008-2012 (Constant Returns to Scale)

S/N	Insurance Company	Year				
		2008	2009	2010	2011	2012
1	Consolidated Hallmark Ins	0.691	0.2170	0.1380	1.0000	0.3350
2	Aiico Insurance	1.000	0.6360	0.0540	1.0000	1.0000
3	Cornerstone Insurance	1.000	0.0470	1.0000	0.3790	0.0920
4	Leadway Assurance	1.000	1.0000	1.0000	1.0000	0.3610
5	Mansard Insurance	1.000	1.0000	0.1000	0.1060	1.0000
6	Oasis Insurance	1.000	1.0000	0.5340	0.8760	0.3130
7	Sovereign Trust Insurance	0.091	0.2810	0.2200	0.3040	0.3810
8	Unity Kapital Assurance	0.961	0.0310	1.0000	1.0000	0.1030
9	Standard Alliance Insurance	0.009	0.0320	0.5300	0.3470	0.9180
10	African Alliance Insurance	1.000	0.0150	0.2480	0.4820	0.2620
	<i>Mean</i>	0.775	0.4260	0.4820	0.6490	0.4760
	<i>Standard deviation</i>	0.394	0.4373	0.3917	0.3575	0.3385

Table 4: Efficiency of the Insurance Companies, 2008-2012 (Variable Returns to Scale)

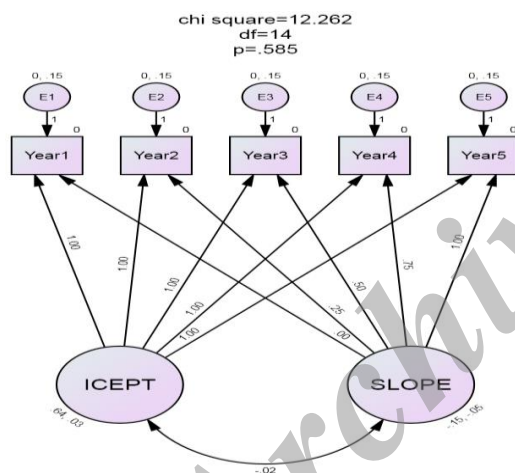
S/N	Insurance Company	Year				
		2008	2009	2010	2011	2012
1	Consolidated Hallmark Ins	0.781	0.273	0.203	1.000	1.000
2	Aiico Insurance	1.000	1.000	0.074	1.000	1.000
3	Cornerstone Insurance	1.000	0.117	1.000	0.379	0.094
4	Leadway Assurance	1.000	1.000	1.000	1.000	1.000
5	Mansard Insurance	1.000	1.000	0.145	0.111	1.000
6	Oasis Insurance	1.000	1.000	1.000	0.905	0.753
7	Sovereign Trust Insurance	0.299	0.314	0.220	0.310	0.421
8	Unity Kapital Assurance	1.000	0.046	1.000	1.000	0.110
9	Standard Alliance Insurance	0.227	0.037	1.000	0.362	1.000
10	African Alliance Insurance	1.000	0.068	0.274	1.000	0.282
	<i>Mean</i>	0.831	0.485	0.592	0.707	0.666
	<i>Standard deviation</i>	0.307	0.452	0.434	0.366	0.375

4.5. Latent Growth Modeling on CSR and VRS

The output of constant returns to scale was used under this section. Using this model (LGCM), the efficiency measurement is assumed to increase linearly with time for each firm with separate slope and intercept for each firm. Figure 1 presents the output of LGCM under CRS and as evidenced, the chi-square test for the overall model fit was statistically

insignificant, this means that the model is an absolute fit well (chi-square = 12.262, df= 14, p = .585). Also, the value of intercept mean of 0.64 indicates that the average starting point for the efficiency of each firm is 64% while the value of slope mean of -0.15 on the other hand reveals that efficiency of MFIs declined by 15% on average. More clearly, the efficiency of the Nigerian insurance companies under this study is expected to have

declined by 15% for each period of time starting from 64%. As shown in Table 1 of Appendix 2, the variances of the intercepts were statistically significant which means that there was a non-trivial variation in the efficiency of this firm at the starting point. However, the variation in the slope value was statistically insignificant and this suggests that efficiency of these companies was not varied over the period of study. Report of this model under the VRS is not presented here because it is very similar to the one presented here under CRS.



4.6. Productivity Performance of Individual Insurance Companies

From Table 5 to Table 7, the performance of the individual companies from 2008-2012 is reported in terms of Total Factor Productivity (TFP) change and its components {Technical Efficiency change (EFFCH) and Technological change (TECHCH)}. The value of the Malmquist TFP productivity index and its componests that are greater than 1 indicate an improvement of productivity in the relevant aspect, whereas any value less than 1 implies a deterioration or decrease in productivity. In addition to the relevant time period and relevant perfomance measures, these measures also capture the performance relative to the best practice in the sample.

Table 5 presents the calculated changes in the Total Factor Productivity index based on Malmquist. The results show that Unity Kapital Assurance and African Alliance Insurance displayed a positive trend up to

Table 5.Insurance Firms Relative Malmquist TFP Change between Time Period t and t + 1-2008-2012

S/N	Insurance Company	Year			
		2008-2009	2009-2010	2010-2011	2011-2012
1	Consolidated Hallmark Ins	2.396	1.000	0.180	1.000
2	Aiico Insurance	1.734	1.000	0.057	1.000
3	Cornerstone Insurance	0.261	1.000	0.000	1.000
4	Leadway Assurance	2.544	1.000	1.206	1.000
5	Mansard Insurance	6.375	1.000	0.028	1.000
6	Oasis Insurance	4.182	1.000	0.093	1.000
7	Sovereign Trust Insurance	15.479	1.000	0.222	1.000
8	Unity Kapital Assurance	0.059	1.000	14.570	1.000
9	Standard Alliance Insurance	14.906	1.000	4.648	1.000
10	African Alliance Insurance	0.040	1.000	4.698	1.000
	<i>Mean</i>	1.446	1.000	0.000	1.000

2011 in productivity changes before deteriorating in 2012. In contrast, Consolidated Hallmark, Aiico, Cornerstone, Mansard, Oasis and Sovereign Trust insurance deteriorated up to 2011 in productivity before improved in 2012. More so, Sovereign Trust had the highest average TFP growth in 2009 with an annual average rate of 1,447.9% while Unity Kapital experienced highest average TFP growth in 2011 with an annual growth

rate of 1,357% but none in 2012. More importantly, the overall geometric mean shows that all firms had not increased their TFP on average during the period of study (2008-2012).

As part of the above, the Malmquist TFP index is further composed into technical change as well as technological change. The results for both technical and efficiency changes are reported in Table 6 and Table 7.

Table 4.6. Insurance Firms Relative Technical Change between Time Period t and t + 1, 2008-2012

S/N	Insurance Company	Years			
		2008-2009	2009-2010	2010-2011	2011-2012
1	Consolidated Hallmark Ins	0.315	1.000	0.635	1.000
2	Aiico Insurance	0.636	1.000	0.085	1.000
3	Cornerstone Insurance	0.047	1.000	21.374	1.000
4	Leadway Assurance	1.000	1.000	1.000	1.000
5	Mansard Insurance	1.000	1.000	0.100	1.000
6	Oasis Insurance	1.000	1.000	0.534	1.000
7	Sovereign Trust Insurance	3.075	1.000	0.782	1.000
8	Unity Kapital Assurance	0.033	1.000	31.857	1.000
9	Standard Alliance Insurance	3.493	1.000	16.361	1.000
10	African Alliance Insurance	0.015	1.000	16.538	1.000
	Mean	0.371	1.000	1.827	1.000

Table 4.7. Changes in Firms Relative Efficiency Change between Time Period t and t + 1- 2008-2010

S/N	Insurance Company	Year			
		2008-2009	2009-2010	2010-2011	2011-2012
1	Consolidated Hallmark Ins	7.617	1.000	0.283	1.000
2	Aiico Insurance	2.728	1.000	0.674	1.000
3	Cornerstone Insurance	5.587	1.000	0.000	1.000
4	Leadway Assurance	2.544	1.000	1.206	1.000
5	Mansard Insurance	6.375	1.000	0.280	1.000
6	Oasis Insurance	4.182	1.000	0.174	1.000
7	Sovereign Trust Insurance	5.035	1.000	0.284	1.000
8	Unity Kapital Assurance	1.804	1.000	0.457	1.000
9	Standard Alliance Insurance	4.267	1.000	0.284	1.000
10	African Alliance Insurance	2.663	1.000	0.284	1.000
	Mean	3.899	1.000	0.000	1.000

Starting with Table 6, it reports the index values of technical progress or regress of these firms as measured by the average shifts in the best-practice frontier beginning from period t to $t+1$. The firms that experienced technical progress over the period of this study were Leadway, Mansard and Standard Alliance insurance, whereas other firms experienced both technical progress as well as regress. Standard Alliance recorded the highest technical growth rate in 2008-2009 with 249.3%, while Unity Kapital recorded the highest technical growth rate in 2010-2011 with 3,085.7% but none in 2012.

Another noticeable thing from this table is the technical progress for the grouped periods, three firms experienced technical progress for the period of 2008-2009, all firms in 2009-2010, five in 2010-2011 while all experienced it during the period of 2011-2012. Overall, the average technical progress for these firms was -63% for the period 2008-2009, 83% for the period 2010-2011 while there was neither technical progress nor regress for the periods of 2009-2010 and 2011-2012.

The second component of the TFP (technological change) is reported in Table 7 for individual companies. Over the period of the study, only Leadway experienced technological progress while others experienced both technological progress as well as regress. For the period 2008-2009, Sovereign Trust recorded the highest technological progress with 403.5% while

Leadway recorded the highest technological progress for the periods 2010-2011 with 20.6%. All the sample firms experienced technological progress in the periods 2008-2009, 2009-2010 and 2011-2012 but only one firm experienced it during 2010-2011. Overall, there was 289.9% technological progress in 2008-2009, none in 2009-2010, 2011-2012 and inefficient in 2010-2011

Technical efficiency change was further decomposed into pure efficiency change and scale efficiency change in order to determine the change in scale efficiency over the period of the study. The results for these decompositions are reported in Table 8. As presented in Table 8, one firm (Leadway insurance plc) experienced no change in both scale and pure efficiency annual growth over the period of study compared to others, follow by Oasis with a deterioration in annual growth under scale efficiency change within the period of the 2010-2011. Specifically, four firms experienced annual growth in both scale and pure efficiency in 2008-2009, three firms in 2010-2011, while all firms recorded annual growth in both scale and pure efficiency for the periods of 2009-2010 and 2011-2012. Over the period of the study, year 2010-2011 is identified as the year of improvement in both pure and scale efficiency.

4.7.Productivity Performance of the Industry

The performance of Nigerian insurance companies is summarized in Table 9 covering the period of study (2008-2012). On average,

Table 8.Changes in Efficiency Components by Firms between Time Period t and t + 1, 2008-2012

S/N	Insurance Company	Year							
		2008-2009		2009-2010		2010-2011		2011-2012	
		Pech	Sech	Pech	Sech	Pech	Sech	Pech	Sech
1	Consolidated Hallmark Ins	0.350	0.899	1.000	1.000	0.744	0.853	1.000	1.000
2	Aiico Insurance	1.000	0.636	1.000	1.000	0.074	1.143	1.000	1.000
3	Cornerstone Insurance	0.117	0.400	1.000	1.000	8.549	2.500	1.000	1.000
4	Leadway Assurance	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
5	Mansard Insurance	1.000	1.000	1.000	1.000	0.145	0.690	1.000	1.000
6	Oasis Insurance	1.000	1.000	1.000	1.000	1.000	0.534	1.000	1.000
7	Sovereign Trust Insurance	1.050	2.929	1.000	1.000	0.702	1.114	1.000	1.000
8	Unity Kapital Assurance	0.046	0.705	1.000	1.000	21.581	1.476	1.000	1.000
9	Standard Alliance Insurance	0.162	21.537	1.000	1.000	27.170	0.602	1.000	1.000
10	African Alliance Insurance	0.068	0.221	1.000	1.000	4.051	4.082	1.000	1.000
	Mean	0.342	1.085	1.000	1.000	1.606	1.137	1.000	1.000

Table 9.Malmquist Index Summary of Insurance Firm Means (2008-2012)

S/N	Insurance Company	TFPch	EFFch	TECHch	PEch	SEch
1	Consolidated Hallmark Ins	0.810	0.669	1.212	0.714	0.936
2	Aiico Insurance	0.561	0.482	1.164	0.522	0.923
3	Cornerstone Insurance	0.000	1.000	0.000	1.000	1.000
4	Leadway Assurance	1.324	1.000	1.324	1.000	1.000
5	Mansard Insurance	0.650	0.563	1.155	0.617	0.911
6	Oasis Insurance	0.789	0.855	0.923	1.000	0.855
7	Sovereign Trust Insurance	1.362	1.245	1.094	0.927	1.344
8	Unity Kapital Assurance	0.963	1.010	0.953	1.000	1.010
9	Standard Alliance Insurance	2.885	2.750	1.049	1.449	1.898
10	African Alliance Insurance	0.658	0.706	0.933	0.724	0.975
	Mean	0.012	0.907	0.013	0.861	1.054

Standard Alliance insurance recorded the highest growth in TFP, EFF, PE and SE with 186%, 175%, 45 percent and 90%, respectively, while other firms were Leadway Assurance and Sovereign Trust insurance. Moreover, Leadway Assurance had the highest growth in TECH with 32.4%. On average, the TFP of the Nigerian insurance industry was mainly affected due to the -9.3% contributed by the efficiency change and -98.7% contributed by the technical change. More so, the efficiency was mainly affected because of the -13.9 contributed by pure efficiency and close to 1 due to the 5.4% contributed by the scale efficiency.

5. Conclusion

The main purpose of this paper was to investigate the performance of Nigerian insurance industry. Because of unavailability of the required data, the study was limited to ten insurance companies for the period of five years (2008 to 2012). Researchers used DEA, LGCM as well as the ratio analysis (liquid asset to total asset, total equity to total asset and return on asset) in analyzing the performance of these companies. As discussed, studying the performance of Nigerian insurance industry is highly important especially during this period in order to see the effectiveness of the 2005/2006 Nigerian insurance industry recapitalization.

The result of the ratio analysis reveals that Aiico insurance was the highest on average in terms of liquidity asset to total asset, Oasis

insurance in terms of total equity to total asset, while Leadway Assurance led with regard to return on asset. The interpretation of the ratio results is that, Aiico insurance was on average more liquid compared to the other sample firms, Oasis used more shareholders' funds to finance its asset and Leadway Assurance was the most profitable on average compared to other firms included in this study for the period under study.

DEA analysis is the main analysis used for this study. As mentioned, DEA has been proven to be one of the most frequently used in analyzing the performance of the insurance industry due to its robustness. This analysis as comprehensively discussed in the previous section, reveals on average some insurance firms were progressing while others were regressing. Some of the leading insurance companies in terms of performance are Leadway insurance, Standard Alliance insurance and Sovereign Trust insurance in terms of TFP.

Overall, the efficiency of Nigerian insurance companies was found to be very low throughout the period of this study and this suggests that they are not very efficient. Also, LGCM result using CRS output suggests that the efficiency of each firm deteriorated over the period of the study. The results of this study should help the insurance companies in improving their efficiency in order to compete favourably both at the local level as well as internationally. Also, improving the Nigerian

efficiency will help in attracting investors both within the country as well as from the foreign nations. Nevertheless, the findings of this study support the study of Barros and Obijiaku (2007) which found that Nigerian insurance companies were less efficient.

Research Implication

Therefore, the findings of this study have significant implications for Nigerian insurance companies and the government. As the TFP had deteriorated for these companies, the Nigerian insurance companies need to improve their technical components as well as the technological efficiencies in order to maximize the output and so as to improve their performance. The implication of this study to the government is to ensure an enabling environment as well as support for the insurance industry in the country.

Finally, this study was limited to the ten insurance companies because the data for the intended number of companies within the industry as well as the period proposed to study were not available. Hence, more studies are required in the near future that will study the performance of Nigerian insurance industry as a whole as soon as the data are found available for more firms in this industry.

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Appendix 1

S/N	List of Nigerian Insurance Company
1	Consolidated Hallmark Ins
2	Aiico Insurance
3	Cornerstone Insurance
4	Leadway Assurance
5	Mansard Insurance
6	Oasis Insurance
7	Sovereign Trust Insurance
8	Unity Kapital Assurance
9	Standard Alliance Insurance
10	African Alliance Insurance

Appendix 2

Means: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P
ICEPT	.637	.118	5.394	***
SLOPE	-.150	.147	-1.019	.308

Technical Efficiency of Nigerian Insurance Companies: A DEA and LGCM Approach

Jaiyeoba Haruna Babatunde

کارایی تکنیکی شرکت های بیمه نیجریه: رویکرد DEA و LGCM

چکیده: هدف اصلی این مقاله تخمین عملکرد شرکت های بیمه نیجریه با کمک تحلیل پوششی داده ها می باشد. به دلیل عدم دسترسی به داده های مورد نیاز این مطالعه به ده شرکت بیمه نیجریه برای پنج دوره زمانی سال های 2008 و 2012 محدود شده است. ورودی ها شامل مخارج حق الزحمه و هزینه مدیریت و خروجی ها شامل حقوق و درآمد حاصل از سرمایه گذاری می باشد. داده ها از وب سایت های بیمه مرتبط و وب سایت های اقتصادی آفریقا جمع آوری شده است. DEA در تحلیل داده های این مطالعه به کار رفته است در حالیکه داده ها نسبی هم در DEA به کار برده شده. نتایج کلی از فاکتورهای بهره وری جامع (TFP) نشان می دهد که کارایی صنعت بیمه نیجریه کمتر است و علت آن سطح پایین تغییرات کارایی تکنیکی (EF) شامل تغییرات تکنولوژی (TECH) می باشد. همچنین با نتایج LGCM تایید و تثبیت شده است که نشان می دهد که کارایی دوره ها نزولی است. شرکت های بیمه Leadway و Alliance و Sovereign از شرکت های بیمه پیشرو در زمینه عملکرد (TFP) هستند. از طرفی دیگر نتایج مقایسه بیانگر این است که بیمه leadway از همه سودمتر و Aiico در مقایسه با دیگر شرکت ها نقدینگی بالاتر دارد و بیمه Oasis بیشتر دارایی خود را با سرمایه گذاری shareholder به دست می آورد.