MEASURING THE EFFICIENCY AND PERFORMANCE OF QUOTED INSURANCE COMPANIES IN NIGERIA: DATA ENVELOPMENT ANALYSIS (DEA) APPROACH

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ABSTRACT: *This study measures the efficiency and performance of quoted insurance companies in Nigeria. Specifically, it determines the extent to which quoted insurance companies in Nigeria are efficient (technical, allocative and scale) in terms of their resource utilization and the performance (total factor productivity growth rate) of quoted insurance companies in Nigeria. In pursuance of the above, the study employs the input oriented data envelopment analysis (DEA) model with four input and output variables. The input variables are management expenses, net premium, shareholders fund and total asset while the output variables are investment income, net claims, profit after tax and market share. These variables were used for the analysis with the aid of input oriented DEAP version 2.1 with variable return to scale assumption using multi stage DEA approach.*

The result revealed that quoted insurance companies in Nigeria are relatively inefficient. Only seven companies are technically efficient as the result indicates a mean variable returns to scale technical efficiency score of 59%. On the other hand, we observed that twenty-six companies were scale efficient with a mean scale efficiency score of 87% showing that quoted insurance companies are relatively efficient in their choice of scale or size of operations and that Standard Trust Assurance Company (STACO) has the highest peer count.

We also discovered the presence of high slacks for management expenses, net profit, shareholders fund and total asset and this shows the degree of inefficient allocation of resources in the Nigerian quoted insurance companies. On the other hand, the output fall (slack) mean of investment income, net claims, profit after tax and market share indicate what the companies would have achieved if the input variables were properly allocated. Finally, we observed that there is no total factor productivity increase in Nigerian quoted insurance companies as only 7 (seven) firms out of thirty-four recorded varying degrees of productivity progress. We therefore recommend possible merger and acquisition of the inefficient companies with the efficient ones in the insurance sector in order to strengthen the insurance companies in Nigeria.

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We also recommend that total asset and shareholders fund be depleted or upgraded because they recorded the highest input slack score while deliberate attempt should be made to increase firms total market share and profit after tax for efficiency purposes since they recorded the highest output slacks.

KEY WORDS: *Efficiency, Performance, Insurance companies, Data Envelopment Analysis.*

JEL CLASSIFICATION: *G22, C67, D67.*

1. INTRODUCTION

The financial sector is the nucleus of the productive activity of every economy. This is because it serves as the provider of the necessary lubricant that keeps the wheel of the economy turning. It consists of a notable network of institutions ranging from specialized banks, insurance companies, capital market and finance companies. Notable among these is the insurance sector. Insurance companies provide unique financial services to the growth and development of every economy. Such specialized financial services range from the underwriting of risks inherent in economic entities and the mobilization of large amounts of funds through premiums for long term investments. The risk absorption role of insurers promotes financial stability in the financial sector and provides a sense of peace to economic entities and this in turn serve as a boom for economic growth and development.

To strengthen the financial system, the Central Bank of Nigeria (CBN) increased the capital base of commercial banks from about N2 billion to N25 billion in 2004 (CBN, 2004). It is on record that following the successful recapitalization of the banking sector, the insurance industry as a component of the financial system also introduced its own reforms by increasing the capital base of insurance firms from N2billion to 10billion in 2005 (NAICOM 2005). These reforms became imperative because of the impact of globalization which has been spurred by incessant integration of the world economies, inadequate capital base of Nigerian firms, dearth of appropriate human capital, poor returns on investment, poor corporate governance structures, the absence of risk management framework and all other problems that have prevented the Nigerian insurance sector from impacting positively on the economy (Adeeko, 2013). National Insurance Commission (NAICOM) proposed recapitalization as an economic strategy that offer numerous benefits relating to higher liquidity, risk minimization, enhanced growth opportunities, increased shareholder value, greater efficiency and requisite capacity to underwrite high risk (Brito, 2006).

In spite of these reforms in the Nigeria insurance markets, research evidence has shown overtime that the Nigerian insurance industry covers only five percent of the nation's insurable population. This may be attributed to the fact that a great proportion of the firms in the insurance markets are still small due to low premium income coupled with the generally poor attitude of the people towards insurance services

especially arising from illiteracy, technical recession and communal living (Agiobenebo & Ezirim, 2002; Ahmed, Ahmed, & Ahmed, 2010; Charumathi, 2012). Besides, the performance of the insurance sector in Nigeria in terms of total factor productivity growth has been on the decline in recent times as measured by some indicators such as return on capital, return on asset and profitability to premium income ratio and leverage ratio (Barros & Obijiaku, 2007; Barros, Guglielmo & Ibiwoye, 2008; Usman, 2009).

This decline suggests that the firms may be experiencing technical, allocative and scale inefficiencies which may hinder total factor productivity growth in the insurance industry and this is of particular significance. This growth, generated and sustained from efficient operations of the insurance companies is bound to change from time to time. These are indications that quoted insurance companies in Nigeria are inefficient and underperforming. Little wonder then that the technical, scale and allocative efficiency and the performance of quoted insurance companies in Nigeria has been the focus of most research in insurance in recent times.

However, from the review of the theoretical and empirical literature, it appears that while many studies on efficiency and performance of the insurance industry have been conducted in the developed countries (Diacon, Starkey, O Brien & Odindo, 2002; Rosko, 2002; Wang & Lall, 2003; Karim & Jhantassa, 2008; Fenn, Vencappa, Diacon, Klumpes & O'Brien, 2008; Barros, Nektarios & Assaf, 2010), only a few have been conducted in developing countries like Nigeria (Barros & Obijiaku, 2007; Barros, Guglielmo & Ibiwoye, 2008; Usman, 2009). This study therefore measures the technical, scale and allocative efficiency and the performance (total factor productivity growth) of quoted insurance companies in Nigeria with the aid of Data Envelopment Analysis (DEA) using the period of 2000 to 2014.

2. LITERATURE REVIEW/ THEORETICAL FRAMEWORK

2.1. Concepts of technical, scale and allocative efficiency

Technical efficiency is the ability of a firm to maximize output level from a given input level (Farrell, 1957; Debreu 1951 & Koopman, 1951). These concepts combine to yield economic efficiency and technical efficiency is only an integral part of overall economic efficiency. Efficiency can also be considered to be input or output oriented. It is input oriented when it is seen in the light of the optimal mix of input to obtain a given level of output and it is output oriented when it is seen in light of optimal output from a given input. The measurement of a firm specific technical efficiency is based upon deviation of observed output from the best production or efficiency production frontier. If a firm's actual production point lies on the frontier, it is perfectly efficient. If it lies below the frontier then it is technically inefficient with the ratio of the actual to potential production defining the level of efficiency of the individual firm (Herero & Pascoe, 2002).

Scale efficiency captures departure of a firm from optimal scale. The measure of scale efficiency provides the ability of the management to choose the optimum size of resources, meaning to decide on the insurance company's size or in other words to

choose the scale of production that will attain the expected production level. Put differently, it measures inefficiencies due to the input/output configuration as well as the size of operations. Inappropriate size of an insurance company (too large or too small) may sometimes be a cause of technical inefficiency. This is referred to as scale inefficiency and takes two forms: decreasing returns-to-scale (DRS) and increasing returns-to-scale (IRS). Decreasing returns-to-scale (also known as diseconomies of scale) implies that a company is too large to take full advantage of scale and has supra-optimum scale size. In contrast, an insurance company experiencing increasing returns-to-scale (also known as economies of scale) is too small for its scale of operations and thus operates at sub-optimum scale size. An insurance company is scale efficient if it operates at constant returns-to-scale (CRS).

Allocative efficiency implies the ability of the firm to optimize input at given prices and at available technology. Farrell (1957) introduced a method to decompose the overall efficiency of a production unit into its technical and allocative components. He characterized the different ways in which a productive unit can be inefficient either by obtaining less than the maximum output available from a determined group of inputs (technically inefficient) or by not purchasing the best package of inputs given their prices and marginal productivities (allocatively inefficient). The allocative efficiency of a firm is manifested in the form of input and output slacks. Input slack shows the deficiency in potential input consumption by the affected firm showing the degree of input over usage. An input slack is the proportion by which input could be reduced and still be able to produce at the same level of output while output slack on the other hand is the proportion by which output could be increased at current level of input. It shows the deficiency in potential output yield of the affected firm, being the amount by which output is under produced by the affected firm. The objective of producers is to reduce or avoid wastage (Simone, 2008).

2.2. Concept of performance

Performance is mostly used as a general wording which involves productivity and efficiency. Performance represents a very general description and could be described as the degree of success which the business has attained in a given period. In other words, performance is a qualitative and quantitative narration of where an individual or a group or an enterprise that is on a work has been able to reach on the way to the goal aimed at, which is related to that work (Ramanathan, 2003).

Favourable performance reflects the effective business model and industrial investment environment of the enterprise as well as the effectiveness of governmental policies. Many indicators have been utilized for measuring performance of an enterprise, such as return on investment, growth rate, turnover rate, and even stock market index. Weng (2009) proposed technological innovation as part of performance including product innovation performance and process innovation performance which mainly measures research and development expenses, new product listing ratio, product cost reduction or profit creation. Kang and Liao (2009) pointed out the indicators for measuring the performance of an enterprise being return on investment, growth rate, turnover rate, liquidity ratio and risk diversification capacity where the

higher return on investment, growth rate, turnover rate, and liquidity ratio presented the better performance of an enterprise while the risks should be the smaller the better. Ma (2009) evaluated the performance of an industry with revenue, stability and operating capacity where the major evaluation indicators focused on earning power, productivity, and management performance, covering profit rate, net profit margin, gearing ratio, total asset turnover rate, and employee productivity. Chen (2010) measured performance with earnings per share, sales growth rate and yield rate. Chiu (2010) evaluated the investment strategies and performance of enterprises in Taiwan with sales growth rate, profit rate and employee turnover rate. Performance is considered as an effectiveness indicator especially as it relates to competitiveness of an enterprise (Hu & Shieh, 2013).

The concept of performance is closely linked to the issue of productivity. The productivity of a firm is generally defined as the ratio of the output that it produces to the inputs that it uses. Rising productivity implies either more output is produced with the same amount of inputs or that fewer inputs are required to produce the same level of output hence rising efficiency with the outward shift of a production frontier signalling productivity growth. There is a subtle distinction between measuring productivity of a firm and that of measuring change in productivity. In the case of firms producing multiple outputs using multiple inputs, we represent change or growth (or decrease) of productivity by a *total factor productivity* (TFP) or *multifactor productivity index* (MFP). We use TFP and MFP interchangeably although there is a subtle difference between what each of them may include. If we consider the problem of measuring productivity change for a firm period (or year) *s* to period *t*, we assume that the firm makes use of the state of knowledge as represented by production technologies S^s and S^t in period *s and t.*

Suppose the firm produces outputs q_s and q_t using inputs x_s and x_t respectively. In some cases, we may have information on output and input prices which represented by output price vectors p_s and p_t and input vectors, w_s and w_t periods *s* and *t* respectively. Given these data on this firm, one way to measure its productivity change is by comparing the observed outputs in period *s and t* with the maximum level of outputs (keeping the output mix constant) that can be produced using $x_{s \text{ and }} x_t$ operating under the reference technology. This is the malmquist productivity index advocated by Caves, Christensen and Diewert (1982). The mathematical model of this index is clearly explained in chapter three.

Production efficiency lies at the base of productivity. Efficiency is part of productivity. Productivity is not a relative concept because productivity of every unit can be measured alone. Because efficiencies of decision units cannot be determined independent from each other in the production system where there are a lot of outputs and inputs, it becomes a relative concept. It is not necessary to make comparisons with other decision unit to measure productivity. However other decision units that will be taken as a reference to calculate efficiency are necessary. One of the important stages of productive efficiency measurements is to decide on correct reference units. At institutional (or micro) level, there are two approaches for measuring the productive efficiency of a firm: parametric and nonparametric. Each approach has its own advantages and shortcomings compare to the other. The parametric approach tends to

focus on production function or cost function of firms in which the estimated function through regression model can be viewed as an optimal function of the firm's system and can be used as the benchmarking frontier (Banker & Maindiratta, 1988). Although this parametric estimation can provide information on confidence intervals and deviations, however, it faces the problem of misspecification in choosing the right functional form and requires large sample (Berger & Humphrey, 1997). In contrast, the nonparametric approach tends to envelop data collected from sampled financial institutions in order to estimate the optimal frontier of the whole sample and then scores each institution by comparing its current level with the optimal one. This approach therefore, is more flexible compare to the parametric approach (Charnes, Cooper & Rhodes, 1978; Färe, Grosskopf & Lovell, 1994; Farrel, 1957) and suitable for non-production institutions. In term of time trend analysis, most scholars tend to refer to efficiency as total factor productivity (TFP) and use distance function (Shephard, 1970) to measure the productivity changes.

Caves, Christensen and Diewert (1982) applied the productivity indexes derived from Shephard's distance function to provide the theoretical framework for the measurement of productivity and its changes, which later became the Malmquist productivity index number approach. In the banking industry, this approach was popularly applied to calculate the technological changes and productivity growth (Berg, Forsund & Jansen, 1992; Berger & Mester 1997; Grifell-Tatje & Lovell, 1997). However, as they all used institutional data for banks or bank branches, their studies can analyze individual bank but not the system as a whole entity.

2.3. Empirical literature on efficiency and performance of insurance companies

Whether or not there are economies of scale in the production of various goods has long been a subject of dispute (Johnston, 1965). This represents the contention of many scholars in the 1970's. However, the production engineers, economist and accountants have in the recent past renewed interest and elicited a number of research studies along the line of production function, cost minimization, scope and scale economies not only in the manufacturing industries but also in the service industries. An attempt to measure firm efficiency started with stochastic frontier analysis (SFA) developed by Aigner, Lovell and Schmidt, (1977) and data envelopment analysis (DEA) developed by Charnes, Cooper and Rhodes (1978).

The stochastic frontier model requires the specifications of the form of the efficient frontier by assuming a specific functional form. SFA specifies an efficient frontier form usually trans-log and assumes a composed error model where inefficiencies follow an asymmetric distribution and the random error term follows a symmetric distribution, usually normal. DEA puts less structure on the specification of the efficient frontier and does not decompose the inefficiency and error terms. The same characteristics that make DEA a useful analysis tool can also create problems. It is deterministic and gives point estimates that do not provide information about uncertainty in estimation and depends on the correctness of frontier units. Most outcomes of these researches have been able to demonstrate that larger amount of

tangible goods and non-tangible goods (services) could apparently be produced at lower unit costs.

It is also important to state that most studies on economies of scale have been based on cost functions (Clark, 1984; Asthon, 2001). The Cobb-Douglas production function has been extensively used in so many empirical analyses of product and factor markets for a study of Du Pont Rayon plants on production characteristics of Insurance Industry in Nigeria among a host of other works (Afolabi & Osota, 2001). Hardwick (1997) examines the effects of increasing competition on the structure of the UK life assurance industry over 1989-1993 by employing a stochastic frontier approach. He reports high levels of economic inefficiency (costs are on average about 30% above the estimated cost frontier) and significant positive economies of scale. Since DEA is a non-parametric technique, statistical hypothesis testing is difficult. Jajri and Ismail (2006) analyzed the trends of technical efficiency, technological change and total factor productivity growth in the Malaysian manufacturing sector for which the data was taken from the Industrial Manufacturing Survey of 1985 to 2000 collected by the Department of Statistics Malaysia using Data Envelopment Analysis.

Friedman and Sinuany-Stern (1998) used the ranking method in DEA to rank industrial branches in Israel according to their level of efficiency and performance. Researchers used two methods based on multivariate statistics, such as canonical correlation analysis (CCA) and discriminant analysis of ratio (DR/DEA). Chandra, Cooper, Shanling and Rahman (1998) used DEA to evaluate the performance of 29 Canadian textile companies using the Cooper and Rhodes model. The inputs used in the study were assets, labor cost and average wage gained by employees per hour of work; the outputs were the revenue and export revenue. The used inputs were the number of labor and average annual investment; whereas the used outputs were the annual sales values. Application of the model has also involved an efficiency assessment of the public sector (schools and hospital) because of their given inputs and outputs which are not measureable in unified units (Friedman & Sinuany-Stern, 1998).

Barros and Dieke (2007) evaluated the operational performance of 31 Italian airports using four data envelopment models. The types of model included: DEA-CCR, DEA-BCC, the cross- efficiency DEA model, and the super-efficiency DEA model. The outputs were measured by the number of planes, number of passengers, cargo, aeronautical receipts, handling receipts, and commercial receipts, and the inputs were labor costs, capital invested and operational costs. Yao and Sumiter (2007) studied the impact of the WTO accession in 2001 by China on technical efficiency of China's insurance industry using DEA. They used a panel data set of 22 firms the period of 1999-2004, to evaluate their technical efficiency scores. An econometric model was then applied to identify the key determinants of technical efficiency. The results indicated that firm's size, ownership structure, mode of business and human capital are important factors affecting firm's efficiency.

Mwangi and Murigu (2015) investigated the determinants of financial Performance in general insurance Companies in Kenya using multiple linear regressions, with return on assets as the dependent variable for the period 2009-2012. They found that Profitability was positively related to leverage, equity capital, management competence index and negatively related to size and ownership structure.

The study did not find a relationship between performance and retention ratio, liquidity, underwriting risk and age. The study recommends that for general insurers in Kenya to perform better they should increase leverage equity capital and quality of staff.

Osamwonyi and Imafidon (2016) studied the technical efficiency of manufacturing companies in Nigeria using data envelopment analysis and found out that quoted manufacturing companies in Nigeria are relatively efficient with thirty-one companies operating on the production possibility frontiers and twenty-seven not operating on it. The results show an average variable returns to scale mean score of 85% and scale efficiency mean score of 76%. They recommended that companies operating in the region of decreasing returns to scale should scale down their inputs while those that are in the region of increasing return to scale should scale up their inputs.

3. METHODOLOGY

This study measures the efficiency and performance of quoted insurance companies in Nigeria, hence we employ a longitudinal research design. This is based on the fact that the variables under consideration are historical in nature and so the researcher lacks the ability to manipulate the input and output variables due to the fact that they have already occurred. The population of the study consists of all insurance firms that exist and operate in Nigeria as at December, 2016. It is on record that fifty-eight (58) insurance companies exist while thirty-four (34) of them are quoted in the Nigerian stock Exchange (NSE, 2016). All quoted (34) insurance companies constitute our sample for this study.

DEA is a non-parametric technique that uses mathematical programming to estimate the relative efficiency of the decision making units (DMU) by determining a production frontier which is made up of the most efficient companies. The relative effectiveness of a decision unit in DEA is defined as the ratio of the weighted sum of the outputs to weighted sum of the inputs and is also referred to as technical efficiency

The inputs and outputs in this study are then set to measure the efficiency and performance of quoted insurance companies, where the input variables include operating/management expenses (labor, business services and materials in the form of management expenses plus commissions), net premiums earned (total premium earned less reinsurance ceded), total assets (fixed and current assets) and shareholders fund (capital and surplus represented as shareholders' funds on the annual report). On the other hand, the output variables are investment income (portfolio of invested assets, premiums, reinsurance and other assets), net incurred claims (total incurred claims less transaction costs / expenses), total market share (percentage of the total market for insurance that is being controlled by individual companies) and profit after tax (total profit earned after tax deductions). Annual data of (34) thirty-four insurance companies for the period 2000-2014 was considered. Thus, a total of five hundred and ten (510) observations are obtained. Therefore, the choice of input and output variables ensures conformity to the DEA convention that the total number of Decision Making Units (DMUs) be more than three times the number of inputs and outputs while the case mix

index is adopted to standardize the data values so that all data values are redenominated to the same units in order to ensure uniformity and reliability of estimates.

In the present study, the multi-stage DEA input-oriented VRS (variable returns to scale) approach was used to measure the efficiency and performance of quoted insurance companies in Nigeria because managers of these quoted insurance companies through their activities can exercise some level of control over their input compared to their output. Besides, the varying sizes of these companies make them to operate on variable returns to scale. This is determined by the Banker, Charnes and Cooper's (1984) model stated below

$$Max\ Q_o = \sum_{r=1}^{S} u_r y_r \text{ o}$$

Subject to

$$\sum_{i=1}^{m} v_i x_i \text{ o} = 1$$

$$\sum_{r=1}^{s} u_r Y_{rj} - \sum_{i=1}^{m} v_i x_{ij}; \quad j = 1\ldots\ldots\text{n} \quad r = 1\ldots\ldots s$$

$$i = 1\ldots\ldots..\text{m}$$

$$u_r, v_i \geq 0$$

where: Q_0 = the efficiency score of the DMU that is under consideration. Its value ranges between 0% - 100%. n = number of DMUs in the data set; s = number of outputs; m = number of inputs; y_{rj}, x_{ij} = known outputs and inputs of the *j*-th DMU and they are all positive. u_r, $vi > 0$ = variable (outputs and inputs) weights to be determined by the solution of the optimization problem if convexity constraint,

$$\sum_{i=1}^{m} v_i x_i \text{ o} = 1$$

It implies that the DMU" Q_0"is currently operating at the most productive scale size for the discretionary inputs, given the fixed level of non-discretionary inputs. However, if

$$\sum_{i=1}^{m} v_i x_i \text{ o} > 1$$

It implies that DMU" Q_0" is operating at a scale greater than the most productive scale size for the discretionary inputs. Conversely, if

$$\sum_{i=1}^{m} v_i x_i \, o < 1$$

then DMU" Q_0" is operating in the increasing return to scale region, at a scale smaller than the most productive scale size for the discretionary inputs, given the fixed level of non-discretionary inputs (Banker, 1984).

To measure the total factor productivity growth, Malmquist Productivity Index (MI) has been developed and used. MI has been used to measure time dependent efficiency of financial institutions by various researchers (Melchor, 1999; Tongzon, 2001). This is determined by the mathematical equation below

$$MI = \frac{\Theta_j^{t+1}}{\Theta_j^{t}} \times \sqrt{\frac{\delta^{t}(x_i, y_r)^{t}}{\delta^{t+1}(x_i, y_r)^{t}} \times \frac{\delta^{t}(x_i, y_r)^{t+1}}{\delta^{t+1}(x_i, y_r)^{t+1}}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 5$$

In this study, to evaluate the changes in efficiency scores of thirty-four quoted insurance companies in a fifteen-year period, DEA based Malmquist productivity index was utilized. After mathematical modelling of the problem, the input oriented DEAP version written by Coelli (1996) software was used to analyse and solve the problem.

4. DATA ENVELOPMENT ANALYSIS RESULTS

The results of the DEA analysed include; technical, scale and allocative efficiency, benchmarking and total factor productivity analysis of the company.

Table 1 shows the constant technical efficiency scores (CRS), variable efficiency scores (VRS) and scale efficiency scores as stated in the methodology. The industry has mean constant returns to scale technical efficiency score of 58% and mean variable returns to scale technical efficiency score of 59% suggesting that quoted insurance companies in Nigeria are relatively inefficient. On the other hand, the mean scale efficiency score of 87% suggests that quoted insurance companies in Nigeria are relatively efficient in their choice of scale or size of operations. Based on variable returns to scale, the industry could reduce input by 41% and still produce at current level of output. This spells a technical inefficiency of 41%. The result also shows a scale inefficiency of 13% which reflects the amount of inefficiency in the industry due to poor technology.

From the technical efficiency column of table 1, seven companies (21%) out of the thirty-four insurance companies were technically efficient while twenty- seven (79%) insurance companies were technically inefficient because they had a technical efficiency score below100% under variable return to scale assumption. The technical inefficiency score among the inefficient companies ranged from 18% in Regency Alliance Company plc to 99% in Royal Exchange Assurance Company. This implies that these companies need to scale down input by 82% and 1% respectively to produce the same level of output. This inefficiency could be attributed to inadequacy of

management skill in converting input to output which may be due to inappropriate management practices, selection of incorrect input combinations, lack of technical knowhow, increased idle periods, management and staffs' incompetence and deficiency in input materials especially arising from low premium income from individuals and private firms compounded by the generally poor attitude of the people towards insurance services.

Table 1. Technical and Scale Efficiency Scores of Quoted Insurance Companies in Nigeria

Firm	Constant return to scale Technical efficiency	Variable return to scale Technical efficiency	Scale Efficiency	
African Alliance Insurance Company PLC	0.718	0.718	1.000	Crs
AIICO Insurance PLC.	0.665	0.665	1.000	Crs
Armlife PLC	0.000	0.000	0.000	Crs
Axamansard Insurance PLC	0.000	0.000	0.000	Crs
Consolidated Hallmark Insurance PLC	1.000	1.000	1.000	Crs
Continental Reinsurance PLC	0.000	0.000	0.000	Crs
Cornerstone Insurance Company PLC.	0.917	0.917	1.000	Crs
Custodian And Allied PLC	0.242	0.242	1.000	Crs
Ensure Insurance PLC	0.000	0.000	0.000	Crs
Equity Assurance PLC	0.210	0.210	1.000	Crs
Goldlink Insurance PLC	1.000	1.000	1.000	Crs
Great Nigerian Insurance PLC	0.456	0.456	1.000	Crs
Guinea Insurance PLC	0.264	0.264	1.000	Crs
Industrial And General Insurance PLC	1.000	1.000	1.000	Crs
Investment And Allied Insurance PLC	0.374	0.374	1.000	Crs
International Energy Insurance PLC	0.676	0.676	1.000	Crs
Lasaco Assurance PLC	0.309	0.309	1.000	Crs
Law Union And Rock Insurance PLC.	0.917	0.917	1.000	Crs
Linkage Assurance PLC	1.000	1.000	1.000	Crs
Mutual Benefits Assurance PLC.	0.946	0.946	1.000	Crs
N.E.M Insurance CO (NIG) PLC.	0.498	0.498	1.000	Crs
Niger Insurance CO. PLC.	0.228	0.228	1.000	Crs
Oasis Insurance PLC	0.930	1.000	0.930	Drs
Prestige Assurance CO. PLC.	0.515	0.515	1.000	Crs
Regency Alliance PLC.	0.189	0.189	1.000	Crs
Royal Exchange Assurance PLC	0.998	0.998	1.000	Crs
Sovereign Trust Insurance PLC	0.716	0.726	0.986	Drs
Springlife Assurance PLC	0.501	0.698	0.717	Drs
Standard Alliance Insurance PLC.	0.783	0.783	1.000	Crs
Standard Trust Assurance PLC (STACO)	1.000	1.000	1.000	Crs
Unic Insurance PLC	1.000	1.000	1.000	Crs
Unity(Kapital Assurance PLC)	0.539	0.617	0.873	Drs
Universal Insurance Company PLC	0.577	0.577	1.000	Crs
Wapic Insurance PLC	0.478	0.478	1.000	Crs
Mean	0.578	0.588	0.868	

Source: DEA print out

Scale inefficiency occurs when there is a difference between constant return to scale technical efficiency scores and variable returns to scale technical efficiency scores. When both are equal for any decision making unit it then means global constant returns to scale which implies an efficiency score of 100% suggesting that both frontiers are tangential on the global efficiency frontier. From the scale efficiency

column of table 1, (twenty-six) 26 out of the (thirty-four) 34 sampled firms had scale efficiency score of 100%, while eight (8) had scale efficiency scores of less than 100%.

This infers that 76% of the sampled firms had most productive size for the particular input-output mix while the remaining 24% are scale inefficient and this may be attributed to the input/output configuration as well as inappropriate scale or size of insurance companies' operations. Of the seven companies that operated on the production possibility frontiers, six companies exhibited constant returns to scale. This shows that they operated at their most productive scale size while the remaining one company (Oasis plc) exhibited decreasing returns to scale which means that the input factors were over employed despite the fact that it is efficient.

Among the inefficient firms, three (3) exhibited decreasing returns to scale (DRS) while none exhibited increasing returns to scale (IRS). A DMU (companies) is said to be operating under decreasing returns to scale if changing all the inputs by the same proportion results in a smaller proportional change in outputs. What this shows is that the input factors are numerically over employed which results in capacity underutilization. Put lucidly, these firms are producing at a smaller level than what their size and input demands, thus no economy in factor input usage. These firms can produce more than they are producing now with even lower input.

A DMU (companies) is said to be operating under increasing returns to scale if changing all the inputs by the same proportion results in a greater proportional change in outputs. What this shows is that the input factors are numerically under employed. These companies need to increase their quantity of factors input employment. This also shows that the inefficiency in the affected companies could be attributed to inadequate factor input and hence serious need for employment of more factor inputs. This also implies the tendency of these companies to overuse their current input factors. To operate on the most productive scale the DRS companies should reduce input consumption while IRS companies should increase their use of input and expand output to arrive at the most productive scale.

4.1. Input and Output Slack Scores of Quoted Insurance Companies in Nigeria (Allocative Efficiency)

Input slack shows the deficiency in potential input consumption by the affected firm, showing the degree of input over usage. An input slack is the proportion by which input could be reduced and still be able to produce at the same level of output while output slack on the other hand is the proportion by which output could be increased at current level of input. It shows the deficiency in potential output yield of the affected firm, being the amount by which output is under produced by the affected firm. This is another basis by which the technical efficiency of a typical firm could be viewed.

From the results in table 2 above, the inefficient firms showed input slacks of varied proportions in the different inputs consumed in the course of their production activities. Overall 11(32%) of the sampled firms were efficient in that there was no input slack incurred by them in any input among the listed inputs for the study.

Meanwhile, 23 (68%) of the sampled firms were inefficient, with the majority recording slack in Shareholders' Funds.

Table 2. Input Slacks

Firm	Management Expenses	Net Premium	Shareholders fund	Total Assets
African Alliance Insurance Company PLC	0.000	0.000	6750380.510	8648841.521
Aiico Insurance PLC.	0.000	74451.892	1380838.048	0.000
Armlife PLC	0.000	0.000	0.000	0.000
Axamansard Insurance PLC	0.000	0.000	0.000	0.000
Consolidated Hallmark Insurance PLC	0.000	0.000	0.000	0.000
Continental Reinsurance PLC	0.000	0.000	0.000	0.000
Cornerstone Insurance Company PLC.	0.000	0.000	2079600.146	427258.765
Custodian And Allied PLC	0.000	0.000	350541.79	0.000
Ensure Insurance PLC	0.000	0.000	0.000	0.000
Equity Assurance PLC.	0.000	0.000	615487.793	0.000
Goldlink Insurance PLC	0.000	0.000	0.000	0.000
Great Nigerian Insurance PLC	0.000	718274.824	522375.723	0.000
Guinea Insurance PLC.	0.000	0.000	538073.729	0.000
Industrial And General Insurance PLC	0.000	0.000	0.000	0.000
Investment And Allied Insurance PLC	0.000	0.000	1043617.879	531288.007
International Energy Insurance PLC	0.000	0.000	8763875.969	8810280.109
Lasaco Assurance PLC	0.000	78887.917	338035.610	0.000
Law Union And Rock Ins. PLC.	0.000	1266334.237	6952921.121	10985644.989
Linkage Assurance PLC	0.000	0.000	0.000	0.000
Mutual Benefits Assurance PLC.	0.000	0.000	1488673.357	1211539.703
N.E.M Insurance Co (Nig) PLC.	0.000	585330.429	2817583.521	3579585.019
Niger Insurance Co. PLC.	0.000	1401.020	862799.756	0.000
Oasis Insurance PLC	0.000	0.000	0.000	0.000
Prestige Assurance Co. PLC.	0.000	1119687.584	1665335.372	3299786.520
Regency Alliance PLC.	0.000	74021.949	549525.530	0.000
Royal Exchange Assurance PLC	0.000	700130.056	3984711.266	3287765.139
Sovereign Trust Insurance PLC	301301.371	0.000	1566842.548	1698249.297
Springlife Assurance PLC	534248.712	0.000	6115913.977	10699134.512
Standard Alliance Insurance PLC.	0.000	472796.887	825043.509	0.000
Standard Trust Assurance PLC (STACO)	0.000	0.000	0.000	0.000
Unic Insurance PLC	0.000	0.000	0.000	0.000
Unity(Kapital Assurance PLC)	1177093.970	0.000	2964275.832	3239067.032
Universal Insurance Company PLC	0.000	1067622.034	5339977.414	0.000
Wapic Insurance PLC	0.000	0.000	2549965.626	2309955.525
Mean	59195.413	181145.260	1766658.707	1727305.769

See table 2 for details. The sampled firms performed relatively well in terms of management expenses except for 3 (9%) which are: Sovereign Trust Insurance plc, Springlife Assurance plc and Unity (Kapital Assurance plc). Thus for Sovereign Trust Insurance plc, management expenses can be reduced by ₦301,301,371 and still produce at current level of output. This result also shows that Springlife Assurance plc and Unity (Kapital Assurance plc) could reduce management expenses by ₦534,248,712 and ₦1,177,093,970 respectively and still produce at current level of output. This interpretation goes for the other input slacks. Results for input slacks on net premium shows that 11 (32%) of the sampled firms recorded input slacks of varied amounts with Law Union and Rock Insurance plc and Niger Insurance Company plc

incurring the highest and lowest slacks of ₦1,266,334,237 and ₦1,401,020 on this input respectively.

Results for input slacks on shareholder's fund show that twenty-three (23) of the firms are inefficient in the utilization of the fund. This result reveals the highest mean input slack of ₦1,766,658,707 for the 34 firms. Still on this result, International Energy Insurance plc incurred the highest slack of ₦8,763,875,969. This is closely followed by African Alliance Company plc with ₦6,750,380,510

Table 3. Output Slacks

Firm	Investment income	Net claims	Profit after tax	Market share
African Alliance Insurance Company PLC	1200745.491	1679573.695	0.000	1010634.108
Aiico Insurance PLC.	0.000	155778.750	0.000	0.000
Armlife PLC	0.000	0.000	0.000	0.000
Axamansard Insurance PLC	0.000	0.000	0.000	0.000
Consolidated Hallmark Insurance PLC	0.000	0.000	0.000	0.000
Continental Reinsurance PLC	0.000	0.000	0.000	0.000
Cornerstone Insurance Company PLC.	0.000	224238.090	0.000	0.000
Custodian and Allied PLC	0.000	0.000	0.000	119956.908
Ensure Insurance PLC	0.0009	0.000	0.000	0.000
Equity Assurance PLC.	129021.797	0.000	0.000	103192.407
Goldlink Insurance PLC	0.000	0.000	0.000	0.000
Great Nigerian Insurance PLC	344369.214	36645.809	0.000	357968.166
Guinea Insurance PLC.	134657.792	0.000	0.000	51071.802
Industrial and General Insurance PLC	0.000	0.000	0.000	0.000
Investment and Allied Insurance PLC	101491.749	0.000	784748.825	0.000
International Energy Insurance PLC	0.000	70613.820	13705.254	196401.449
Lasaco Assurance PLC	0.000	0.000	386617.857	84083.357
Law Union and Rock Ins. PLC.	215201.990	0.000	742104.558	0.000
Linkage Assurance PLC	0.000	0.000	0.000	0.000
Mutual Benefits Assurance PLC.	0.000	838967.059	0.000	0.000
N.E.M Insurance Co (Nig) PLC.	48095.517	33391.560	510325.217	0.000
Niger Insurance Co. PLC.	261113.821	0.000	138356.674	351378.713
Oasis Insurance PLC	0.000	0.000	0.000	0.000
Prestige Assurance Co. PLC.	0.000	482988.181	432442.416	0.000
Regency Alliance PLC.	0.000	0.000	23757.742	139759.066
Royal Exchange Assurance PLC	0.000	0.000	450201.265	0.000
Sovereign Trust Insurance PLC	68429.605	0.000	586435.049	94631.906
Springlife Assurance PLC	0.000	0.000	85904.457	1210711.796
Standard Alliance Insurance PLC.	0.000	0.000	287136.553	0.000
Standard Trust Assurance PLC	0.000	0.000	0.000	0.000
Unic Insurance PLC	0.000	0.000	0.000	0.000
Unity(Kapital Assurance PLC)	538327.433	0.000	233233.359	572506.889
Universal Insurance Company PLC	789393.143	795361.948	0.000	973376.329
Wapic Insurance PLC	0.000	98469.482	0.000	265018.482
Mean	112671.987	129883.188	137499.095	162667.393

The next in the series is Springlife Assurance with ₦6,115,913,977 inefficient consumption of shareholders' fund. For total asset input, 13 (38%) of sampled firms recorded slacks which culminated in the mean input slacks of ₦1,727,305,769. The highest slack in input is incurred by Law Union and Rock Insurance plc followed by Springlife Assurance plc. The least amount of ₦427,258,765 slack is incurred by Cornerstone Insurance Company plc. Thus results of input (management expenses, net

premium, shareholders fund and total assets) utilization show very high level of inefficiency especially for certain firms as Springlife Assurance plc which ranked herself among the highest uneconomic consumers of shareholders' fund and total assets.

Table 3 above shows the results of output slacks which denotes the amount by which current output levels could be expanded with current technology (input consumption). Thus from the results, it can be seen that investment income has a mean output slack of ₦112,671,987 for the sampled firms in the study. This is a serious loss in welfare to the economy at large. Details here show that firms such Universal Insurance Company plc incurred the highest deficit in this output that amounts to ₦789,393,987 while N.E.M insurance plc incurred the lowest amount of ₦48,095,517. Net claims slack averages at ₦129,883,188. This shows the amount by which net claims could have been increased at current technology. Here, Mutual Benefit Assurance plc incurred the highest amount of ₦838,967,059 followed by Universal Insurance plc with ₦795,361,948 among the listed firms for the study. Profit after tax has a mean output slack of ₦137,499,095 showing that the sampled 34 firms in the study could expand output by ₦137,499,095 given current technology.

This again shows the colossal amount of avoidable social loss to the entire economy. Details show that Investment and Allied Insurance plc incurred the highest amount of ₦784,748,825. This is closely followed by Law Union and Rock Insurance plc with an amount of ₦742,104,558. International Energy Insurance plc incurred the lowest amount of output slack here. This amounts to ₦13,705,254. Market share incurred a mean output slack of ₦162,667,393. This is even the highest among the output slacks. Its details show that Springlife Assurance plc incurred the highest amount here of ₦1,210,711,796. This is followed by African Alliance Insurance Company plc with ₦1,010,634,108. Guinea Insurance plc incurred lowest amount here which is ₦51,071,802. On the whole, 11(32%), 10 (29%), 13 (38%), and 14 (41%) firms have output slacks in Investment income, Net Claims, Profit after Tax and Market share respectively. This result shows that although there is gross technical inefficiency in output production. Market share followed by profit after tax are the worse managed output by decision making units (DMUs) under study. This calls for policy attention by the management of the affected DMUs.

4.2. Total Factor Productivity Growth Results

The Malmquist Total Factor Productivity Growth indices are presented and discussed in this section. The Total Factor Productivity (TFP) scores were derived through the assumption of Input Oriented Data Envelopment Analysis. This is so because the firms can only influence their input but cannot determine the volume of output at any time. The TFP is an index of change showing the relative position of a given production point (x_{i+1}, y_{i+1}) in relation to its immediate previous production unit (x_i, y_i). The mean TFP indices vary based on the specified input oriented Malmquist productivity. The estimated indices imply that if TFP score is less than unity it connotes productivity progress because such results show that the affected Decision Making Units (DMUs) are currently producing the same units of outputs with less units

of inputs than was used in the previous period (x_i, y_i); implying that such DMUs are efficient relative to their previous points of production (x_i, y_i). However the reverse is the case when TFP is greater than unity, this indicates productivity regress because it indicates that production at current point (x_{i+1},y_{i+1}) uses more factor input than was used at a previous point (x_i,y_i). Conversely, when TFP is equal to unity, it shows constant growth. That is to say the DMU is consuming the same unit of factor input in both periods and producing the same unit output. At this point, the DMU records no efficiency.

Table 4. Malmquist TFP Index of the Sampled Firms

Firm	Technical Efficiency Change	Technological Change	Pure Efficiency Change	Scale Efficiency Change	Total Factor Productivity Change
African Alliance Insurance Company PLC	1.011	0.000	1.005	1.006	0.000
Aiico Insurance PLC.	1.030	0.918	1.028	1.002	0.945
Armlife PLC	0.000	0.000	0.000	0.000	0.000
Axamansard Insurance PLC	0.000	0.000	0.000	0.000	0.000
Consolidated Hallmark Insurance PLC	0.966	0.958	0.969	0.997	0.925
Continental Reinsurance PLC	0.000	0.000	0.000	0.000	0.000
Cornerstone Insurance Company PLC	0.980	0.000	0.981	0.999	0.000
Custodian and Allied PLC	1.107	0.000	1.107	1.000	0.000
Ensure Insurance PLC	0.000	0.000	0.000	0.000	0.000
Equity Assurance PLC	1.011	0.955	1.011	1.000	0.966
Goldlink Insurance PLC	1.000	1.041	1.000	1.000	1.041
Great Nigerian Insurance PLC	1.029	1.010	1.029	1.000	1.039
Guinea Insurance PLC.	1.028	0.992	1.029	0.999	1.020
Industrial and General Insurance PLC	0.987	0.989	0.997	0.990	0.976
Investment and Allied Insurance PLC	1.073	0.000	1.020	1.051	0.000
International Energy Insurance PLC	1.008	1.057	1.010	0.999	1.066
Lasaco Assurance PLC	1.014	0.000	0.972	1.043	0.000
Law Union and Rock Ins. PLC.	0.962	0.000	0.964	0.998	0.000
Linkage Assurance PLC	0.978	0.000	0.979	1.000	0.000
Mutual Benefits Assurance PLC.	1.004	1.115	1.004	1.000	1.119
N.E.M Insurance Co (Nig) PLC.	1.051	0.967	1.049	1.002	1.017
Niger Insurance Co. PLC.	1.090	0.000	1.057	1.031	0.000
Oasis Insurance PLC	0.926	0.000	1.000	0.926	0.000
Prestige Assurance Co. PLC.	1.048	1.025	1.048	1.000	1.074
Regency Alliance PLC.	1.067	0.000	1.056	1.010	0.000
Royal Exchange Assurance PLC	0.955	0.860	0.957	0.997	0.821
Sovereign Trust Insurance PLC	1.013	1.016	1.005	1.009	1.030
Springlife Assurance PLC	0.000	0.000	0.000	0.000	0.000
Standard Alliance Insurance PLC.	0.997	0.829	0.998	0.999	0.826
Standard Trust Assurance PLC	0.929	0.000	0.929	1.000	0.000
Unic Insurance PLC	1.000	0.954	1.000	1.000	0.954
Unity(Kapital Assurance PLC)	0.000	0.000	0.000	0.000	0.000
Universal Insurance Company PLC	1.039	0.973	1.031	1.007	1.011
Wapic Insurance PLC	0.995	0.000	1.007	0.988	0.000
MEAN	0.832	0.461	0.831	0.825	0.466

Table 4 above shows the summary of the Malmquist TFP indices for the sampled firms in the period (2000 - 2014). From the table, there is a mean Total Factor Productivity progress of 53.4%. This could be attributed to the outweighing influence of technological change as seen from the result. Details from the results show that 18 (eighteen) of the sampled firms record zero TFP growth. This means that the affected firms are stagnant in output growth. This could be attributed to poor technology resulting in lack of innovation in resource combination, inefficient resource utilization and inappropriate record keeping. The result also shows that 9 (nine) firms have productivity regress with six (6) firms (Goldlink, Great Nigerian, International Energy, Mutual Benefits, Prestige and Sovereign Trust) among them recording technical and technological inefficiencies. The remaining three (3) firms (Ginea, N.E.M and Universal) have mixed results of technical inefficiencies and technological efficiency. It can thus be seen that technical inefficiencies in these firms are largely responsible for the productivity regress in these firms.

On the whole, 7 (seven) firms recorded varying degrees of productivity progress. They are; AIICO Insurance plc with productivity progress of 5.5%, Consolidated Hallmark Insurance plc with 7.5% productivity progress, Equity Assurance plc with 3.4% productivity progress, Industrial and General Insurance plc with 2.4% productivity progress, Royal Exchange Assurance plc with 7.9% productivity progress, Standard Alliance Insurance plc with 7.4% productivity progress and UNIC plc with 4.6% productivity progress. Of these seven firms AIICO Insurance plc, Equity Assurance plc and UNIC Insurance plc have technical efficiency change regress of 3%, 1.1% and zero progress respectively. It is the surpassing effect of technological change that neutralizes this productivity negation that culminates into productivity growth for the two firms. The remaining four have productivity progress in both technical efficiency change and technological change. Thus the sum of the issue is that most of the firms in the studied DMUs have productivity regress and the source of this is technical efficiency change.

5. SUMMARY OF FINDINGS

The findings of the study are summarized below:

1. Quoted insurance companies in Nigeria are relatively inefficient with only seven companies being technically efficient as the result indicates a mean variable returns to scale technical efficiency score of 59%. On the other hand, we observed that twenty-six companies were scale efficient with a mean scale efficiency score of 87% showing that quoted insurance companies are relatively efficient in their choice of scale or size of operations.
2. Quoted insurance companies in Nigeria are allocatively inefficient. The presence of high slacks means for management expenses (₦59195.413), net profit (₦181145.260), shareholders fund (₦1766658.707) and total asset (₦1727305.769) in the production process shows the degree of inefficient allocation of resources in the Nigerian quoted insurance companies. On the other hand, the output fall (slacks) mean are; (₦112671.987) of investment income, (₦129883.188) of net claims, (₦137499.095) of profit after tax and

(₦162667.393) of market share. These indicate what the companies would have achieved if the input variables were properly allocated.

3. Generally, there is no total factor productivity increase in Nigerian quoted insurance companies as only seven (7) firms out of thirty-four recording varying degrees of productivity progress. AIICO Insurance plc with productivity progress of 5.5%, Consolidated Hallmark Insurance plc with 7.5% productivity progress, Equity Assurance plc which has 3.4% productivity progress, Industrial and General Insurance plc with 2.4% productivity progress, Royal Exchange Assurance plc with 7.9% productivity progress, Standard Alliance Insurance plc having productivity progress of 7.4% and UNIC Insurance plc with 4.6% productivity progress.

6. POLICY RECOMMENDATIONS

The findings of this study gave impetus for the following recommendations:

1. The companies operating in the region of decreasing return to scale should scale down their inputs in order to become efficient while those that are operating in the region of increasing return to scale should increase their inputs in order to become efficient and remain on the production possibility frontier.
2. We recommend that total asset and shareholders fund be depleted or upgraded because they recorded the highest input slack score. This should be done by formulating policy and guidelines for the effective use of total assets and shareholder's equity by stakeholders in the insurance sector. Deliberate attempt should also be made to increase firms total market share and profit after tax for efficiency purposes since they recorded the highest output slacks. This is possible if quoted insurance companies improve their creation of awareness by engaging in aggressive advertizing using proper and effective promotional tools. These may include electronics marketing, media advertisement, exhibitions, publicity, sales promotion with appropriate incentives and effective personal door to door selling so as to enhance feedback. These will encourage large insurance patronage which will in the long run lead to high market share and profit after tax.
3. Managers of insurance companies should improve technology. This includes updating their production technology if possible. They should also reduce their overhead cost, employ competent workers that are productive and also engage in training and retraining of staffs for efficiency and effectiveness. The companies should improve management practices to international competitiveness. Asset management should be given a priority by the managers of those companies. The companies need to seek alliances and synergies because it will enable the efficient companies to assist the inefficient ones. This will enable the companies to provide quality insurance services and make the general public have access to those services at reasonable prices.
4. Finally, we recommend possible merger and acquisition of the inefficient companies with the efficient ones in the insurance sector in order to strengthen the insurance companies in Nigeria. Generally, government should provide a conducive environment for insurance companies to operate such as granting tax

relief, tax holiday and providing the necessary infrastructures such as good roads, electricity, transportation services, telecommunication that will enhance the performance of these companies. Government should come up with a policy package aimed at assisting insurance companies to expand domestic market and access foreign markets so that they can increase their level of investment and proper funding.

7. CONCLUSION

In this study, we utilize a strictly input orientated multi stage DEA methodology to measure the efficiency and performance of quoted insurance companies in Nigeria under the assumption of variable return to scale. Four input variables; management expenses, net premium, shareholders fund and total asset and four output variables; investment income, net claims, profit after tax and market share return on equity were used for the measurement. The results revealed that out of thirty-four companies, seven companies were relatively efficient under variable return to scale assumption while six companies were technically efficient under constant return to scale assumption. Twenty-six companies were scale efficient with multiple most productive scale size. The study also reveals the fact that quoted insurance companies in Nigeria are inefficient in the allocation of resources as the result shows varying degree of input and output slacks in twenty-three different companies. The study finally shows that seven quoted insurance companies in Nigeria had a total factor productivity progress while nine had a total factor productivity regress while the remaining eighteen companies had zero productivity growth. The findings of this study can hopefully benefit managers of inefficient companies to help them restructure their organizational scope and business style and review resource utilization for improving their performance and efficiency. However, it should be noted that though frontier analysis enables us to estimate the target for measuring and explaining the determinants of each firm performance, assessing the effect of economies of scale and an overall objective numerical score, it also has its inherent drawbacks. We therefore suggest that further research be conducted with other input and output variable that are being utilized by quoted insurance companies in Nigeria.

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