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Iyo Ipeghan
Ph.D. Post-Doctoral Researcher, Department of Banking and Finance, Rivers State University, Port Harcourt, Nigeria

Adamgbo Suka Lenu Charles
Ph.D. Lecturer, Department of Banking and Finance, Kenule Besson Polytechnic, Bori, Nigeria

Adolphus J Toby
Professor Lecturer, Department of Banking and Finance, Rivers State University, Port Harcourt, Nigeria

Correspondence
Iyo Ipeghan
Ph.D. Post-Doctoral Researcher, Department of Banking and Finance, Rivers State University, Port Harcourt, Nigeria

Modeling market power, efficiency and profitability of quoted commercial banks in Nigeria

Iyo Ipeghan, Adamgbo Suka Lenu Charles and Adolphus J Toby

Abstract
The objective of this research is to tests the relationship between market power and efficient-structure hypotheses in the Nigerian banking industry over the period of 2007 to 2015. The Data of this study was estimated using statistical analysis known as non-parametric, data envelopment analysis to obtain reliable efficiency measures and multiple regression method to estimate the final results. Our results show that efficient-structure hypothesis is positive and significantly related with profitability in the Nigerian banking industry allowing the rejection of the market power hypotheses. Due to the acceptance of the two hypotheses such as x-efficient hypothesis and scale efficient hypothesis, we conclude that Nigerian commercial banks may improve their profitability by increasing their asset size. This suggests that during the period under consideration, the Nigerian banks adopt a sufficient competitive behaviour and that they generate their profitability not through market power exercise but rather through efficient activity. These results should encourage the economic policy measures aimed at protecting the national markets to compete favourably with international partners.

Keywords: Data envelopment analysis, commercial banks, market power hypotheses, structure conduct performance hypothesis, relative market power hypothesis, efficient-structure hypotheses

1. Introduction
The banking industry plays a vital role in the financial system by providing funds for productive investment, trade and other economic activities. Market power and efficient-structure hypotheses will impact competition in the banking industry. There have been several studies on banking efficiency in developed countries of the world. In Nigeria only few works have been done on the efficiency of banks. Efficiency support greater output by using minimum input of scare resources in the industry. It is a vital tool that determines the viability and productivity of the financial institution.

The market power and efficient-structure hypotheses is a model that is structured toward increasing the profitability of the Nigerian banking industry either through their market power or as a result of their high efficiency level. High profits may be as a result of market power or efficiency driven. Efficiency is a key factor of competitiveness. Market power is driven by high cost of borrowing, credit rationing and comprised banking services, among other Chortareas *et al.* (2011) [25]. Market power is considered to be a major determinant of bank profitability and collusion could ultimately affect consumers through, high loan rates, credit rationing, and the downgrading of banking services. Such consideration is usually formulated in the context of the structure conduct performance (SCP) paradigm. The structure conduct performance (SCP) paradigm suggests that highly concentrated markets result in collusion effects and higher than competitive prices. Another major market power hypothesis is the relative market power (RMP) hypothesis, which states that only firms with large market shares and well-differentiated products can set high price on their products and exercise above their competitive earnings Berger (1995) [18].

Importantly, these experience might retard economic growth Beck *et al.* (2011), aggravating the socio-economic conditions especially since the financial-led growth policies and aspirations in these economies are bank dominated; capital markets are either very small and inactive or driven, implications of market power effects may be discarded Sharma *et al.* (2013) [59]. The alternative is that efficiency improvement may be due to superior management or management or production technologies i.e. high x-efficiency and scale efficiency on one hand, and scale efficiency on the other.

The two market power hypotheses and the two efficient-structure hypotheses have contrasting implications for mergers and antitrust policies. If the evidence favours the efficient-structure hypotheses then mergers market concentration in general are motivated by efficiency considerations, which should increase consumer and producer's surplus Chortareas *et al.* (2007) [28]. If on other hand the evidence validates the market power hypotheses which state that the motivation behind mergers is monopolistic price setting which decreases both consumer's and producer's surplus. As a consequence, an argument for pursuing antitrust policies emerges.

Market power is a command place upon the pricing and output decisions of banks Barthwal (2014) [14]. Market power is associated with higher levels of market concentration; it can limit financial deepening and the development of more efficient banking sector Rojas-Suarez (2007) [56]. While the concept of efficiency described the utilization of resources in order to generate greater level of outputs. According to Forsound & Hjalmarsson (1974) [36], efficiency is a statement that describe the performance of a process that transform a set of inputs into a given quantity of outputs. Efficiency is a relative concept, where performance of an economic unit must be compared with a standard unit Ehimare 2013 [31]. Studies on bank profitability from market power and efficient-structure hypotheses developed controversies arising from the generation of bank profit. The debate on market power and efficient structure theories will improved the performance of the banking sector pending the environmental factors that may support either of the two major theory vis-à-vis market power hypotheses or efficient-structure hypotheses Mensi & Zouari (2011) [46]; Sharma *et al.* (2013) [59]; Chortareas *et al.* (2007) [28].

Globalizations of the financial markets and growing competitions in the banking industry have posed new challenges in research on efficiency of banks. Efficiency analyses have been a challenge in the early nineties of the twentieth century to investors, and now researchers are very much interested to investigate. Investigation of the relevant literature shows that majority of studies focused particularly on banks efficiency in the developed world, like the United States of America and Western Europe Berger *et al.* (1993) [17, 22], Berger & Humphrey (1997) [20-21], Berger & Mester (1997) [20-21], Altunbas & Chakravarty (1998), Altunbas *et al.* (2001) [9], Amel *et al.* (2004) [11], Weill (2004) [64], Fiordelisi (2007) [34]. In Nigeria this issue has not received wide attention from researchers, consequently empirical and scientific literature concerning both theoretical and practical aspects of banks' efficiency is relatively low, especially when compared to studies on commercial banking Siudek (2008) [62]. The banking industry in Nigeria has undergone a lot of transformation through the Central Bank of Nigeria (CBN) reforms. These measures have changed the structure of the Nigerian banks through the process of merger and acquisition. The financial sector has been built on a strong regulatory and supervisory framework. The aimed of regulation and supervision was to overcome the moral hazard problem characterized by inefficiency, inadequate capital etc. in the sector Ayanda *et al.* (2013).

In spite of the banking sector reforms, the industry cannot be rated as very strong due to the problem of inefficiency. The unimpressive performance of the Nigerian banking industry because of fluctuating profit had remained the cause of worry for management and policy makers. However, it is not yet fully ascertained that inefficiency significantly account for the fluctuation of banks profit in Nigeria. It is therefore, the burden of this research to determine if market power or efficient-structure hypotheses considerably affect the profitability of the Nigeria banking industry. This study focused on the relationship between market power (concentration and market share) and efficiency using Data Envelopment Analysis to estimate efficiency scores. The model is aimed at determining the profitability in the industry and thus fills a huge gap in the banks literature using market power and efficiency. We investigate the two market power hypotheses: the structure conduct performance (SCP) and the relative market hypothesis together with two measures of the efficient-structure hypotheses: x-efficiency and scale efficiency models in the Nigerian banking industry for the period 2007-2015. Relevant studies' testing these models has typically focused on United States of American and European Union banking markets while evidence for Nigerian banking sector-where only recently the relevant data become available and reliable. Moreso, no comprehensive analysis of the above issues for the region's banking industry is available to our knowledge.

The rest of the paper is structured as follows: section 1 theoretical framework and synthesis of empirical studies. Section 2 describes the research sample and data source. Sections 4 & 5 present the methodology and the empirical results. Finally, the last section contains the conclusions.

2. Theoretical framework and synthesis of empirical studies

The relevant of this study is aimed at testing the market power and efficient-structure hypotheses, which might explain the profit-structure relationship. The propositions about the possible determinants of a profit-structure relationship can be divided into two categories namely: market power and efficient-structure hypotheses Punt & Van Rooji, (1999) [52]. This seeks to investigate whether supernormal profits from Nigerian banking industry are as a result of their market power or as a result of their high efficiency level. The theoretical background was from the debate on the variation of profitability of industrial organization.

Theoretically, the neoclassicist assume that high or abnormal profits are the result of market power (market power hypotheses) Ajide & Ajileye (2015) [4]. This formulation was supported by the literature of Mason (1939) [44] and Bain (1951) [12], revisited by Heggestad & Mingo (1976) [40], Clark (1986) [29], Rhoades & Ruts (1982) [55], Heggestad (1977) then developed by Ahmed & Khababa (2000) [2], Alzaidanin (2003) [10], Sathye (2005) [57] and structure conduct performance hypothesis occupies the interest of the scholars who closely follow the evolution of the market structure Mensi & Zouari (2011) [46]. The Structure conduct performance hypothesis developed from the extreme microeconomic theories of market structure, oligopoly and perfect competition. The structure conduct performance (SCP) hypothesis portray a structure that identified with relatively few firms and high barriers to entry, with the motive of increasing price for the purpose of

achieving join profit maximization through collusion of price. Summarily, the structure conduct performance hypothesis predicts a positive relation between the level of concentration in a given market on profits and output prices Al-Muharrami & Matthews (2009) [8], Bello & Isola (2014) [16]. The relative market power (RMP) hypothesis assumes that only firms with large market shares and well diversified products are able to exercise market power and earn supernormal profit Shepherd (1982) [61] and Berger (1995) [18]. Literatures have shown evidence of a positive relationship between competition and efficiency also between market structure and efficiency. These relationships have generated competing hypotheses. The traditional collusion hypothesis, also called the structure-conduct-performance hypothesis Bain (1951) [12] proposes that market concentration lowers the cost of collusion between firms and results in higher than normal profits. In contrast, the efficient structure hypothesis of Demsetz (1973) [30] postulates an alternative explanation for the existence of positive correlation between concentration and profitability, confirming that efficient firms obtain greater profitability and market share. The Chicago schools of thought raise a contrary opinion on the issue of profit generation. The efficient-structure hypotheses argued that abnormal profit may occur as a result of cost advantage or productive efficiency from firms which may lead to monopoly position by fixing price indiscriminately and pushing rival firms out of the industry Ajide & Ajileye (2015) [4]. The efficient-structure hypothesis challenges the basic rationale behind the structure conduct performance hypothesis written by Bain (1951) [12].

The efficient-structure has two competing hypotheses which include x-efficiency hypothesis and scale efficiency hypothesis. The x-efficiency hypothesis state that firms with x-efficiency will experience labour costs, higher profits and large market share as they acquire superior technology in minimizing costs to produce at any given maximum outputs. While scale efficiency hypothesis state that firms that produce at a more efficient scales achieve lower unit costs and higher profits Berger (1995) [18].

Empirical evidences like Chortareas *et al.* (2009) [26], Seelanatha (2010) [58], Mensi & Zouari (2011) [46], Jian & Jing (2008) [42], Tajgardoon *et al.* (2012) [63]; and Punt & Van Rooji (1999) [52] found efficient-structure hypotheses significant and positive in supporting bank profitability while the reverse is the case for market power hypotheses. The other literatures found market power hypotheses to be significant and positively related to profit and negative to efficiency Rhoades (1985) [54], Evanoff & Fortier (1988) [32], Hahn (2005) [39], Molyneux & Forbes (1995) [49], Gajurel & Pradhan (2011) [37], Al-Jarrah (2010) [7], Mensi & Zouari (2010) [47], Bello & Isolo (2014) [16] and Al-Muharrami & Matthews (2009) [8]. Furthermore, few of the empirical studied are significant and positively related with bank profitability in both hypotheses of market power and efficiency Maudos (1988) [45], Yu & Neus (2005) [65], Sharma *et al.* (2013) [59] and Ahiakpor & David (2015) [1].

A comprehensive study on the relationship between the hypotheses of market power and efficient-structure was conducted by Tajgardoon *et al.* (2012) [63], investigation was carried out to identify whether supernormal profits from Islamic banking are as a result of market power or efficiency. The data envelopment analysis (DEA) was used to obtain reliable efficiency scores. Their findings revealed that efficient structure is the important element for banks profitability.

In Africa research on the relationship between market power and efficiency hypotheses was conducted by Alhassan *et al.* (2016) [6], investigate the impact of market power, efficiency and bank profitability of Ghanaian banks during the period 2003-2011. The data envelopment analysis (DEA) and the system generalized method of moment (GMM) were used to estimate MP and EFS theory. They found technical efficiency significant and positively related with profitability to support the efficient structure hypothesis.

Another comprehensive study of the relationship between performance-structure and market power versus efficiency was carried out by Chortareas *et al.* (2007) [28], investigates performance-structure and market power versus efficiency in Latin American banking using sample of over 3,000 banks in ten Latin American countries during the period 1997-2005. The data envelopment analysis (DEA) was used to elaborate efficient structure (ES) hypotheses. Their findings revealed that x-efficient and scale efficiencies are positively and significantly related with bank profitability. While concentration and market share looses significance, therefore prevent possibility of collusion effects of market power.

Sharma *et al.* (2013) [59] investigate on a series of foreign banks, profits, market power and efficiency in Pacific Island countries (PICs): evidence from Fiji during the period 2000-2010. They examine the relationships between hypotheses of market power: structure-conduct-performance (SCP) and relative-market-power (RMP) versus the hypotheses of efficient-structure: x-efficiency and scale efficiency. Their study used data envelopment analysis (DEA) to estimate efficiency scores and the dynamic generalized method of moment (GMM) to analyze the relationship between market power, efficiency and profitability. Their findings revealed that relative market power and Efficient-structure theories were strong but not Structure Conduct Performance (SCP).

In Nigeria numerous scholars have studied on bank efficiency by using data envelopment analysis to estimate x-efficiency and scale efficiency scores of banks. The empirical evidence above have revealed that few scholars or authors in Nigeria has carried out empirical investigation on the impact of x-efficiency on bank profitability and the relationship between market power and efficient-structure hypotheses in the Nigerian banking industry using data envelopment analysis and multiple regression analysis, granger causality to established the validity of the profit-structure relationship. This study seeks to fill that huge gap in the literature by providing fresh evidence on the issue of market power and efficient-structure hypotheses vis-à-vis x-efficiency on bank profitability in the Nigerian context.

3. Research Sample and Data Source

Banks occupy a prominent position in Nigeria and dominate the stock market in terms of volume of trade and market capitalization on the stock exchange. They are also the largest deposit-taking financial institutions in Nigeria. In 2004 a major reform took place in the banking sector with the result that every bank now has a minimum paid–up capital of N25billion, which has greatly shored up volume

of the bank's asset and liabilities. The reform led to a reduction in the number of banks from 89 prior to consolidation to 25 after the consolidation.

The Nigerian banking industry comprises of 24 commercial banks and fifteen banks were used in the sample based on convenience and data availability. The secondary data are obtained from balanced cross-sectional time series panel data of the published financial statements of 15 quoted commercial banks in the Nigeria Stock Exchange fact book and the internet between the periods 2007-2015. As a result of limited access to data, the study covered an average of nine years which gave a total sample size of 135. The span of the study ranged from 2007 to 2015 reflecting the period following consolidation. As the purpose of this study is to evaluate the efficiency of banks with banks acting as financial intermediaries, this study employs the intermediation approach like many studies on banking efficiency. Banking efficiency analysis involves non-parametric Data Envelopment Analysis mathematical programming techniques use for evaluating inputs to outputs. The inputs used in this study are total deposits, operating expenses and other asset (fixed), while the outputs represents total loan and advances, investment and non-interest income Akeem & Moses (2014) [5] and Pastory *et al.* (2013) [50].

4. Methodology

4.1 Data Envelopment Analysis Technique

The different methodologies for measuring efficiency can be divided into parametric and non-parametric. The dominant non-parametric approach is the DEA which obtains efficiency estimates for the production units considered and creates an efficient frontier through the observed input-output ratios using mathematical programming techniques. In contrast to parametric methods DEA does not allow shocks to production or costs, therefore implying that any deviation from the frontier is inefficiency. Examples of Parametric techniques are the Stochastic Frontier Approach (SFA), Distribution Free Approach (DFA) and Thick Frontier Approach (TFA), Aigner *et al.* (1977) [3], Berger (1993) [17, 22] and Berger & Humphrey (1992) [19] which consider the efficiency frontier as an economic optimization exercise and define the efficient frontier through a functional form (typically a trans logarithmic cost function), which is estimated by econometric techniques. This does not have a strong consensus on which methodology efficiency-measuring frontier is preferable Berger & Humphrey (1997) [20-21]. However some of the most important advantages of the DEA methodology include the lack of restrictions on the functional form, the types of variables used the possibility of measuring those variables in different units, and the fact that any deviations from the efficiency frontier are result to inefficiency. This study employed the non-parametric Data envelopment analysis (DEA) to estimate efficiency scores. Most scholars that adopted this analysis are Berger and Humphrey (1997) [20-21], Ferrier & Lovell (1990) [33], Sheldon (1994) [60], Resti (1997) [53], Bauer *et al.* (1998) [15] Casu & Giradone (2002) [23], Weill (2004) [64], Fiorentino *et al.* (2006) [35] etc.

The main non-parametric method, DEA, was introduced by Charnes *et al.* (1978) [24] and is an analytical tool used to measure relative efficiency of firms throughout the process of transforming inputs into outputs. The following presents two types of envelopment surfaces, referred to as the constant returns to scale and variable returns to scale models. The DEA procedures are adopted from Coelli *et al.* (2000). The constant returns to scale model measures efficiency in terms of overall technical efficiency Charnes *et al.* (1978) [24] assuming firms are operating at the optimal scale; however, firms in practice may face either economies or diseconomies of scale. Subsequently, Banker *et al.* (1984) [13] extend the constant returns to scale model, by incorporating the variable returns to scale assumption, the model is used to assess the efficiency of decision-making units characterized by the variable returns to scale model. The variable returns to scale model provides the measurement of pure technical efficiency, which is the measurement of technical efficiency devoid of the scale efficiency effects. Next, scale efficiency is determined by taking the ratio of constant returns to scale efficiency scores over variable returns to scale efficiency. In other words, technical efficiency can be decomposed into pure technical efficiency and scale efficiency. X-inefficiency represents the deviation from the efficient frontier due to the inefficient use of resources; hence, this result to failure of the firm to extract the maximum output from its input. While pure technical efficiency measures the proportional reduction in input usage that can be attained if the firm operates on the optimal frontier, scale efficiency refers to the proportional reduction if the bank achieves optimum production level.

DEA efficiency score is obtained by taking the maximum ratio of weighted outputs to weighted inputs. This measurement allows multiple outputs and inputs to be reduced to single "virtual" input (*xi*) and single "virtual" output (*yi*) by optimal weighs.

$$\begin{aligned} &\text{Max } u,v\ (u'y_t/v'x_t) \\ &\text{Subject to (s.t.)} \quad u'y_j/v'x_j \le 1 \\ &\qquad\qquad\quad j = 1, 2 \ldots n \\ &\qquad\qquad\quad u,v \ge 0, \end{aligned} \tag{1}$$

The vectors *xi* and *yi* indicate the K × N inputs matrix and K × M outputs matrix for ith decision making units (DMUs) respectively. In addition, the vector ($u'y_t/v'x_t$) represents the ratio of all outputs over all inputs where *u* is an M × 1 vector of output weighs and *v* is a K × 1 vector of input weighs. The efficiency for the ith DMU is maximized by finding values for *u* and *v*; next, a constant constraint $\rho' xt = 1$ is imposed to Equation (1).

$$\begin{aligned} &\text{Max u, v } (\mu' yt) \\ &\text{s.t.} \quad \rho' xt = 1 \\ &\qquad \mu' yj - \rho' xj \le 0 \\ &\qquad j = 1, 2 \ldots n \\ &\qquad \mu, \rho \ge 0, \end{aligned} \tag{2}$$

The efficiency measure is then a function of multipliers of the "virtual" input-output combination, as in Equation (2). The notations μ and ρ indicate the transformation of u and v. The envelopment form is seen below as:

$$\begin{aligned} &\text{Min } \theta, \lambda\ \theta \\ &\text{s.t.} \quad - yt + Y\lambda \ge 0, \\ &\qquad \theta\, xt - X\lambda \ge 0 \end{aligned}$$

$$\lambda \geq 0, \quad (3)$$

where θ is a scalar and λ is an N × 1 vector of constants. The value of θ is the efficiency score for the ith DMU and it should be solved n times. If the value is equal to 1, the particular DMU is technically efficient. By relaxing the constant returns to scale assumption (Banker *et al.*., 1984) [13], the efficiency is assessed on the assumption of variable returns to scale; the convexity constraint N1′ λ =1 is applied to Equation (3).

$$\begin{aligned} &\text{Min } \theta, \lambda\ \theta, \\ &\text{s.t.} \quad -yt + Y\lambda \geq 0, \\ &\theta\, xt - X\lambda \geq 0 \\ &N1'\lambda = 1 \\ &\lambda \geq 0 \end{aligned} \quad (4)$$

4.2 Measuring market power

To measure market power in the industry, a market concentration ratio is used. This ratio employs a bank concentration index of the highest two, three, and four banks total assets. CR*n* is computed as the sum of the largest banks' market shares in the market, which takes the form:

$$CRn = \sum_i^n S_i \quad (5)$$

The Herfindahl-Hirschman Index is utilized to capture the general features of market power. HHI refers to the sum of the squared market shares of all banks in the market, where the market shares are considered weights. The formula is given as follows:

$$HHI = \sum_i^n S_i^2 \quad (6)$$

Where S_i^2 the sum of squared market shares of the i-th bank and n is the number of banks in the market.

While the market share measures the ratio of the individual bank's total assets divided by the total assets of all sample banks in a given year.

$$MS_{it} = \frac{TA_{it}}{\sum_{i=l}^{N} TA_{it}} \quad (7)$$

Where: MS_{it} is market share
TA_{it} is the total assets of ith individual bank in t years.
$\sum_{i=l}^{N} TA_{it}$ is total assets of all banks, t years
Many scholars had used these methods in their studies and in this research most of these measures will be adopted to validate our study.

4.3 Model Specification

In order to investigate the relationships between market power and efficient-structure hypotheses in the Nigerian banking industry, we established the following equations based on the model of Berger (1995) [18], Goldberg & Rai (1996) and Jian & Jing (2008) [42].

Model 1

$$ROAit = \alpha + \beta_1 HHIit + \beta_2 MSit + \beta_3 XEit + \beta_4 SEit + \beta_5 BSit + \zeta_{it} \quad (8)$$

Where:
ROA_{it}: Return on assets of bank i-th in the year t.
HHI_{it}: Herfindahl-Hirschman index of total assets reflecting market concentration of bank i-th for the year t.
MS_{it}: Market share of i-th banks based on total assets for bank i-th in year t.
XE_{it}: A measure of x-efficiency of CCR DEA estimated scores for banks i-th in year t.
SE_{it}: A measure of scale efficiency BCC DEA estimated scores for banks i-th in year t.
BS_{it}: Bank size is measured by logarithm of total asset of bank i-th in year t.
ζ_{it}: error term
A' priori expectations of the model is $HHI_1 > 0$; $MS_2 > 0$; $XE_3 > 0$; $SE_4 > 0$; $BS_5 > 0$.

Model 2

$$MSit = \alpha + \beta_1 XEit + \beta_2 SEit + \beta_3 BSit + \zeta_{it} \quad (9)$$

Model 3

$$HHIit = \alpha + \beta_1 XEit + \beta_2 SEit + \beta_3 BSit + \zeta_{it} \quad (10)$$

A'priori Expectation: $XE > 0$, $SE > 0$. $HHI = 0$ and $MS = 0$
The relationship between market structure and efficiency established that efficient banks will gain market share and higher market concentration. Therefore, in the above two equations the x-efficiency and scale efficiency are expected to be positive and statistically significant.

5. Empirical Results and Discussions

The econometric analysis of model (1) conform the following issues: Firstly, testing for stationarity of the panel data, Secondly, used of ordinary least square estimation to analyze the multiple regressions on table 2, 3 and 4 below.

Table 1: Unit Root Test Result

Variables	ADF Statiatics	5% Critical values	Probability Values	Order of Integration	Recommendation
ROA	-9.296079	-2.883073	0.0000	1(0)	Stationarity
HHI	-8.370083	-2.883073	0.0000	1(0)	Stationarity
MS	-4.435543	-2.883073	0.0004	1(0)	Stationarity
XE	-4.852705	-2.883073	0.0001	1(0)	Stationarity
SE	-6.582563	-2.883073	0.0000	1(0)	Stationarity
BS	-3.286179	-2.883073	0.0176	1(0)	Stationarity

Source: Eviews 9 output

The Augmented Dickey-Fuller test was used to check for stationarity of the variables. The decision rule is that the ADF test statistic value must be greater than the Mackinnon critical value at 5% (in absolute value). Table 1 showed that all the variables were stationary at their level, indicating that they are all integrated of order zero i.e. 1(0). This is in

confinement with other researches that economic variables are stationary at their level or at their first difference. Since all the variables have their respective ADF statistic greater than the Mackinnon critical value at 5%. As evidenced from the unit root test, the variables would have a long run relationship.

Table 2: Regression Results

Dependent Variable: ROA				
Method: Least Squares				
Date: 01/22/18 Time: 08:53				
Sample (adjusted): 2 135				
Included observations: 134 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-3.646187	8.462245	-0.430877	0.6673
HHI	-0.084768	0.181244	-0.467699	0.6408
MS	0.035857	0.317014	0.113110	0.9101
XE	-13.98307	3.813390	-3.666835	0.0004
SE	-4.874575	5.090145	-0.957649	0.3401
LOG_BS	-0.210469	0.270687	-0.777534	0.4383
ROA(-1)	0.219931	0.082208	2.675318	0.0085
HHI(-1)	0.295024	0.181057	1.629452	0.1058
MS(-1)	-0.328427	0.318753	-1.030348	0.3049
XE(-1)	17.57514	3.903788	4.502075	0.0000
SE(-1)	10.88715	5.060649	2.151335	0.0334
LOG_BS(-1)	0.045938	0.275544	0.166717	0.8679
R-squared	0.214557	Mean dependent var		2.742575
Adjusted R-squared	0.143739	S.D. dependent var		4.872676
S.E. of regression	4.508901	Akaike info criterion		5.935269
Sum squared resid	2480.282	Schwarz criterion		6.194778
Log likelihood	-385.6631	Hannan-Quinn criter.		6.040725
F-statistic	3.029675	Durbin-Watson stat		1.916030
Prob(F-statistic)	0.001312			

Source: Eview 9 output

(Dependent variable: ROA, Predictors: HHI, MS, XE, SE and BS and t-values indicate coefficients at significant level of 5%).

According to Table 2, the coefficient of the variable HHI is positive and not significant. There is no significant relationship between HHI and return on asset. This implies that an increase in the profitability of the Nigerian banking industry in our sample do not significantly influence market concentration. In other words, the monopoly of the big banks is an obstacle to small banks. Thus, the structure-conduct-performance (SCP) hypothesis state that there exist a significant and positive relationship between Herfindahl-Hirschman index and bank profitability but is not satisfied in the context.

The market share variable is negative and not significant. This suggests that market shares in Nigerian banking industry do not influence their profitability. So the relative market power (RMP) hypothesis which states that larger market shares would be most beneficial is not verified in the industry.

However X-efficiency shows a positive and significant relationship with banks profitability. This is reflected by the fact that the profitability of the Nigerian commercial banks increases with x-efficiency hypothesis. More specifically, these banks are more efficient than others because the quality of their organizations allowing them to generate better physical flows or financial transactions processing, giving them the opportunity to earn higher profits.

Also scale efficiency shows a positive and significant relationship with banks profitability in the model. This result reveals that the high scale efficiency leads to the high profitability. A high efficiency cause decreasing cost and therefore results to profit increase. This encourages banks to search for more efficient organizational solutions, larger variety of services and stronger management of scale economies. Molyneux *et al.* (1996), Peristianni (1997), Chortareas *et al.* (2010) [27] and Tajgardoon *et al.* (2012) [63] have the same results. The result of the analysis of the effect of bank size on profitability shows that it has a positive relationship with return on asset as indicated by the coefficient in the regression although not significantly. This suggests that the advantage of the performance of the industry is not influence by size.

Table 3: Regression Results

Dependent Variable: MS				
Method: Least Squares				
Date: 01/22/18 Time: 08:58				
Sample (adjusted): 2 135				
Included observations: 134 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	4.641643	2.464348	1.883518	0.0619
XE	1.123628	1.136996	0.988243	0.3249
SE	-0.902854	1.496537	-0.603296	0.5474
LOG_BS	-0.539626	0.064618	-8.351057	0.0000
MS(-1)	0.552562	0.074958	7.371638	0.0000
XE(-1)	-1.383499	1.146224	-1.207007	0.2297
SE(-1)	0.821822	1.486444	0.552878	0.5813
LOG_BS(-1)	0.328422	0.076178	4.311266	0.0000
R-squared	0.685259	Mean dependent var		1.775950
Adjusted R-squared	0.667774	S.D. dependent var		2.359973
S.E. of regression	1.360266	Akaike info criterion		3.511083
Sum squared resid	233.1409	Schwarz criterion		3.684088
Log likelihood	-227.2426	Hannan-Quinn criter.		3.581387
F-statistic	39.18994	Durbin-Watson stat		1.571722
Prob(F-statistic)	0.000000			

Source: Eview 9 output

Table 4: Regression Results

Dependent Variable: HHI				
Method: Least Squares				
Date: 01/22/18 Time: 09:02				
Sample (adjusted): 2 135				
Included observations: 134 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	5.383610	3.744482	1.437745	0.1530
XE	-2.012279	1.953667	-1.030001	0.3050
SE	5.123863	2.559903	2.001585	0.0475
LOG_BS	-0.137756	0.110841	-1.242831	0.2162
HHI(-1)	0.311350	0.083038	3.749471	0.0003
XE(-1)	-1.498902	1.996825	-0.750643	0.4543
SE(-1)	-2.698922	2.561096	-1.053815	0.2940
LOG_BS(-1)	-0.026711	0.114189	-0.233921	0.8154
R-squared	0.331689	Mean dependent var		2.960825
Adjusted R-squared	0.294560	S.D. dependent var		2.782862
S.E. of regression	2.337338	Akaike info criterion		4.593748
Sum squared resid	688.3570	Schwarz criterion		4.766753
Log likelihood	-299.7811	Hannan-Quinn criter.		4.664052
F-statistic	8.933552	Durbin-Watson stat		1.987854
Prob(F-statistic)	0.000000			

Source: Eview 9 output

The result on table 3 and 4 revealed that x-efficiency and scale efficiency were regressed with Herfindahl-Hirschman Index and Market share. These hypotheses were aimed at testing the validity of efficient-structure hypotheses on market structure. The result of x-efficiency and scale efficiency was negative and not significantly related with market structure (HHI and MS). This implies that efficient-structure hypotheses do not affect market concentration and market share in the Nigerian banking industry. Hence, the result obtained was inconsistent to our economic apriori expectation.

Appendix 1: Panel data for Return-on-Assets ROA; Herfindahl-Hirschman Index HHI; Market Share MS; X-Efficiency XE; Scale Efficiency SE; Log of Bank Size BS.

OBS	ROA	HHI	MS	XE	SE	Log BS
1	0.468	7.818	8.842	0.759	0.788	13.008
2	2.041	2.420	1.556	0.781	0.900	13.573
3	0.016	2.655	1.629	0.819	0.909	13.620
4	1.240	2.927	1.711	0.809	0.937	13.668
5	1.247	4.530	2.128	0.798	0.983	13.887
6	1.435	4.880	2.213	0.837	0.987	13.926
7	0.685	7.933	2.817	0.743	0.998	14.167
8	0.824	8.416	2.901	0.736	0.996	14.197
9	1.037	8.964	2.994	0.736	0.992	14.228
10	1.916	1.852	4.304	1.000	0.534	12.288
11	2.436	1.116	1.057	0.666	0.864	13.187
13	0.326	7.400	8.603	0.744	0.942	12.981
14	1.172	9.721	9.859	0.736	0.982	13.117
15	0.530	2.138	1.462	0.654	0.999	13.511
16	1.960	3.284	1.812	0.765	0.976	13.726
17	0.714	4.592	2.143	0.759	0.978	13.894
18	1.162	5.535	2.353	0.762	0.972	13.987
19	1.129	5.960	2.441	0.825	0.990	14.024
20	3.233	8.580	0.009	1.000	1.000	19.963
21	0.775	0.0001	0.010	1.000	0.978	20.061
22	0.122	8.444	0.009	1.000	1.000	19.955
23	1.473	0.0001	0.011	0.938	0.980	20.104
24	1.277	0.0001	0.012	0.809	0.964	20.215
25	1.664	0.0003	0.018	0.853	0.896	20.627
26	1.580	0.0003	0.020	0.969	0.793	20.732
27	1.887	0.0005	0.023	1.000	0.914	20.880
28	0.403	0.0005	0.023	1.000	1.000	20.871
29	1.959	0.0001	0.012	0.726	0.999	20.218
30	1.065	0.0001	0.013	0.818	0.946	20.294
31	0.809	0.0001	0.012	0.715	0.963	20.219
32	1.189	0.0001	0.011	0.835	0.960	20.123
33	3.203	0.0002	0.014	0.724	0.926	20.386
34	2.179	0.0004	0.021	0.759	0.890	20.781
35	2.196	0.0007	0.027	0.744	0.865	21.027
36	1.260	0.0012	0.035	0.857	0.783	21.283
37	0.247	0.001	0.031	0.844	0.769	21.165
38	2.392	3.809	6.172	0.908	0.770	12.649
39	0.001	7.347	8.571	0.891	0.847	12.977
40	1.290	4.969	7.049	0.928	0.797	12.782
41	1.259	4.304	0.0002	1.000	0.843	16.164
42	1.205	1.1570	0.0003	1.000	1.000	16.658
43	1.438	1.562	0.0004	1.000	0.981	16.808
44	0.656	1.994	0.0004	1.000	0.904	16.930
45	1.628	2.309	0.0005	1.000	0.928	17.004
46	0.456	2.179	0.0005	0.991	0.928	16.975
47	1.556	0.0004	0.020	1.000	1.000	20.755
48	3.287	0.0002	0.013	0.949	0.951	20.330
49	0.136	0.0002	0.012	0.816	0.974	20.289
50	1.779	0.0002	0.014	0.913	0.940	20.404
51	0.553	0.0002	0.019	1.000	0.883	20.671
52	2.363	0.0009	0.030	1.000	0.651	21.139
53	1.538	0.0011	0.034	1.000	0.654	21.256
54	2.015	0.0015	0.039	1.000	0.724	21.407
55	2.731	0.0023	0.048	1.000	0.345	21.604
56	1.616	5.3356	2.31	0.769	0.971	13.969

57	2.103	1.0921	3.305	0.778	0.987	14.327
58	0.072	1.234	3.513	0.836	0.994	14.388
59	1.637	1.5128	3.889	0.651	0.997	14.490
60	1.927	2.384	4.883	0.743	1.000	14.717
61	0.302	2.884	5.371	1.000	1.000	12.510
62	22.652	3.819	6.180	0.726	0.970	12.650
63	1.975	3.253	5.703	1.000	0.663	12.570
64	0.771	3.142	5.606	0.794	0.893	12.553
65	2.892	0.0002	0.015	0.816	0.980	20.411
66	3.735	0.0004	0.019	0.947	0.916	20.682
67	2.221	0.0004	0.021	0.883	0.870	20.788
68	3.329	0.0005	0.023	1.000	0.864	20.865
69	3.390	0.0009	0.030	1.000	0.836	21.144
70	5.262	0.0010	0.032	1.000	0.760	21.206
71	4.492	0.0014	0.038	1.000	0.842	21.367
72	4.193	0.0018	0.042	1.000	0.779	21.478
73	4.141	0.002	0.045	1.000	0.831	21.546
74	2.281	3.640	6.033	1.000	1.000	12.626
75	2.670	4.681	6.842	0.926	0.956	12.752
76	1.891	4.304	6.560	0.858	0.991	12.710
77	2.096	5.454	7.385	1.000	1.000	12.828
78	0.746	1.155	1.075	0.938	0.985	13.204
79	1.452	2.0652	1.437	1.000	1.000	11.191
80	11.05	2.233	1.494	1.000	1.000	11.231
81	17.36	2.249	1.500	0.921	0.986	11.234
82	18.415	2.2815	1.510	0.882	0.984	11.241
83	0.425	8.3704	0.003	1.000	0.976	18.799
84	2.761	2.1935	0.005	0.944	0.824	19.281
85	3.239	1.661	0.004	0.901	0.833	19.142
86	1.610	2.647	0.005	0.828	0.859	19.375
87	1.371	9.980	0.010	0.636	0.900	20.038
88	1.198	0.0001	0.011	1.000	0.723	20.179
89	1.169	0.0001	0.014	1.000	0.771	20.378
90	1.092	0.0003	0.016	1.000	0.756	20.530
91	1.287	0.0003	0.016	0.940	0.807	20.499
92	1.799	4.773	2.185	0.708	0.977	13.913
92	2.632	9.077	3.013	0.577	0.980	14.234
93	0.920	7.709	2.776	0.636	1.000	14.153
94	0.151	8.062	2.839	0.563	0.970	14.175
95	0.478	1.090	3.302	0.673	0.980	14.326
96	2.451	1.468	3.831	0.627	1.000	14.475
97	2.096	1.931	4.395	0.626	0.987	14.612
98	1.714	2.149	4.636	0.638	0.994	14.665
99	2.150	1.930	4.393	0.658	0.995	14.611
100	0.552	3.232	1.798	0.506	0.944	13.718
101	0.374	4.812	2.194	0.504	0.987	13.917
102	0.087	3.334	1.826	0.478	0.990	13.733
103	8.350	2.806	1.675	0.710	0.998	13.647
104	9.274	2.688	1.639	0.733	0.999	13.626
105	0.358	3.087	1.757	0.674	1.000	13.695
106	0.581	3.056	1.748	0.722	0.998	13.690
107	2.226	3.326	1.824	0.700	0.999	13.732
108	1.775	3.914	1.978	0.613	0.991	13.814
109	0.355	1.622	0.004	0.950	0.999	19.130
110	3.637	5.207	0.007	0.721	0.841	19.713
111	6.174	2.590	0.005	0.502	0.999	19.364
112	4.083	3.631	0.006	0.628	0.971	19.533
113	0.722	5.463	0.007	0.654	0.981	19.737
114	1.562	6.151	0.008	0.729	0.984	19.796
115	5.595	6.399	0.008	0.662	0.991	19.816
116	2.587	6.710	0.008	0.711	0.997	19.840
117	1.058	7.720	0.009	0.882	1.000	19.910
118	44.791	6.527	0.003	0.530	0.967	18.675
119	10.514	4.838	0.002	0.429	0.992	18.525
120	1.467	8.009	0.003	0.703	0.994	18.777
121	7.994	1.621	0.004	0.722	0.971	19.129

122	1.912	1.921	0.004	0.598	0.997	19.214
123	2.051	2.371	0.005	0.544	0.993	19.320
124	0.483	4.300	0.007	0.584	1.000	19.617
125	0.620	5.749	0.008	0.566	1.000	19.762
126	0.587	6.183	0.008	0.604	1.000	19.799
127	1.981	3.069	1.752	0.903	0.978	13.692
128	2.769	1.109	3.330	0.655	0.984	14.334
129	1.167	9.722	3.118	0.621	0.995	14.269
130	1.863	1.258	3.547	0.588	0.983	14.397
131	1.904	1.848	4.299	0.597	0.987	14.590
132	3.931	2.333	4.830	0.579	0.991	14.706
133	2.898	3.255	5.705	0.650	0.996	14.873
134	2.701	4.605	6.786	0.834	0.986	15.046
135	2.634	5.525	7.433	0.854	0.995	15.137

Source: Author's computation, 2017
ROA = Return-on-Assets,
HHI = Herfindahl-Hirschman Index,
MS = Market Share,
XE = X-Efficiency,
SE = Scale Efficiency
BS = Log of Bank Size
EXM = Expenses Management
OBS = Observations of the 15 quoted commercial banks in Nigeria multiple by 9 years equal to a total of 135 samples. i.e. cross-sections included: 15; total panel (balanced) observations: 135. Sample period: 2007-2015

6. Conclusion

In this paper we investigated the relationship between market power and efficient-structure hypotheses of 15 quoted commercial banks in Nigeria for the period 2007-2015. We tested the theory of market power (MP), structure conduct performance (SCP) hypothesis and the relative market power (RMP) hypothesis and those of the theory of efficient-structure ES (x-efficiency hypothesis and scale efficiency hypothesis).

In the case of the theory of efficient-structure, the scores for x-efficiency and scale efficiency were obtained by utilizing the non parametric technique Data Envelopment Analysis (DEA) in estimating the efficiency.

However, the empirical validity of the relationship between market power and efficient-structure hypothesis according to Demstez (1973) has shown that there is a strong support for the hypothesis of x-efficiency and scale efficiency. The structure conduct performance (SCP) hypothesis and relative market power (RMP) hypothesis have not been verified in the Nigerian banking industry. Regarding the control variables, the results showed that bank size does not affect the bank's profitability. Conclusively, there is no evidence supporting the market power hypotheses in the Nigerian banking industry, and furthermore there is strong evidence that support the efficient-structure hypotheses. Therefore, greater efficiency has increased profitability in the country.

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