RESEARCH ARTICLE

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The effect of firm size on performance of firms in Nigeria

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Abstract

This study investigates the effect of firm size on the performance of firms in Nigeria. The focus is on firm size as the modern-day phenomenon of economies of scale means this is a crucial factor in firm performance. We use a panel data set of 12 non-financial firms operating in Nigeria in the period 2005-2013. The panel data are analysed using a pooled regression model, fixed effects model and random effects model to identify the relationship between firm size and the performance of firms listed on the Nigeria Stock Exchange (NSE). Return on equity is used as a proxy for performance, which serves as the dependent variable. Total assets and total sales are the proxies for firm size, and the control variables are leverage and working capital. The results of the study reveal that firm size in terms of total assets has a negative effect on performance, while in terms of total sales, firm size has a positive effect on the performance of Nigerian non-financial companies. Meanwhile, for the control variables, a positive relationship with leverage and working capital was found. The study thus suggests that firms' focus should be on increasing their size by boosting turnover and opening up new markets for existing and new products.

Keywords:

Size, Performance, Total asset, Total sales, Leverage, Working capital, Return on equity.

JEL classification:

G32, M21.

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El efecto tamaño en el **rendimiento de las empresas nigerianas**

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Resumen

Este artículo investiga el efecto tamaño en el rendimiento de las empresas nigerianas, y más específicamente se centra en valorar si el tamaño de una compañía es determinante en el mundo actual, dado el fenómeno de economías de escala imperante. Para ello utiliza un conjunto de datos panel relativo a 12 empresas no financieras cotizadas en la Bolsa de Nigeria en el período 2005-2013. La estimación de la relación entre el rendimiento de dichas compañías y su tamaño se lleva a cabo mediante un modelo de regresión con datos agrupados, un modelo de efectos fijos y un modelo de efectos aleatorios. La variable dependiente, el rendimiento, se aproxima mediante la rentabilidad sobre recursos propios, siendo los activos totales y las ventas totales las variables utilizadas para aproximar la dimensión empresarial y el grado de apalancamiento y el capital circulante las variables de control. Los resultados de esta investigación muestran que el tamaño de la empresa, medido por el total de activos, tiene un efecto negativo en el rendimiento de las empresas no financieras nigerianas, mientras que si el tamaño se aproxima por las ventas totales dicho efecto se vuelve positivo. Por lo que respecta a las variables de control, ambas tienen un efecto positivo en el rendimiento empresarial. En consecuencia, de acuerdo con los resultados obtenidos, las compañías deberían tratar de incrementar su tamaño via impulso de su volumen de negocios, así como crear nuevos mercados tanto para los productos existentes como para los nuevos productos.

Palabras clave:

Tamaño, rendimiento, activos totales, ventas totals, apalancamiento, activo circulante, rentabilidad de los recursos propios.

1. Introduction

In today's world, the size of a firm is crucial to its success due to the phenomenon of economies of scale.Modern corporate firms look to increase their size so as to get a competitive edge over their competitors by reducing production costs and increasing their market share. Bigger firms can manufacture items at much lower costs than smaller firms can. Abdurahman *et al.* (2003) argue that the nature of the relationship that exists between firm size and profitability is a key element in business success, which may shed some light on the factors that boost profits.

Shaheen and Malik (2012) described firm size as the quantity and array of production capability and potential a firm possesses or the quantity and diversity of services a firm can concurrently make available to its clients. Firm size plays a significant and crucial role in explaining the kind of relationships the firm has within and outside its operating environment. Babalola (2013) argues that the larger a firm is, the more the influence it has on its stakeholders*, and so* large firms tend to outperform small firms.

One of the areas where the influence of firm size has been most widely studied is in relation to corporate finance. Early research, notably that of Scherer (1973) and Shepherd (1972), emphasized the importance of scale economies and other efficiencies in larger firms. On the other hand, the structure-conduct-performance paradigm highlights the importance of market concentration and conduct in explaining profitability.

The positive relationship between firm size and profitability was theoretically supported by the economies of scale model, and this justification was prominent in studies by Blease *et al*. (2010), Oladele and Adebayo (2013), Babalola (2013), Do an (2013), Kartikasari and Merianti (2016), and Kumar and Kaur (2016). However the findings of these studies have been inconsistent and controversial; while some scholars reported a positive relationship, others reported a negative relationship, thus calling for further research (Wu, 2006; Athanasoglou *et al.,* 2008; Punnose, 2008). Hence, this study's main contribution is to examine a wide range of factors that may potentially explain the influence of firm size on firm performance. It also aims to fill a methodological gap in Nigeria. To the best of our knowledge, no research to date has used fixed and random effects models to examine firm size and performance in Nigeria. To that end, we use a panel data set of 12 non-financial firms operated in Nigeria in the period 2005-2013. In addition, this paper uses two different measures of firm size—total assets and total sales—and controls for leverage and working capital.

After this brief introduction, section 2 outlines theoretical frameworks such as the neoclassical theory, the managerial theory, the Penrose theory and the theory of optimal firm size. Section 3 is devoted to the empirical literature on the impact of firm

size on profitability. Section 4 describes the methodology, section 5 details the empirical results of this study while section 6 provides the concluding remarks.

2. Theoretical framework

While there are a range of theoretical perspectives on the firm performance (and operations), some proponents argue that a firm is a complex entity with many dimensions that simultaneously interact to determine the nature, scope, behaviour and performance of a particular firm. Thus, how a particular firm acts and performs depends on the coordination and management of these elements. Some of the core theories in the literature that explain the growth of firms and their performance include the neoclassical theory, the managerial theory, the Penrose model and the theory of optimum firm size. These theories are reviewed briefly below (Sangosanya, 2011).

2.1. The neoclassical theory

The neoclasical theory postulates that a firm is an abstraction, a perfect form of business, whose existence is explained exclusively by the purely economic motive of generating profit. The neoclassical firm's objectives as thus principally profit-maximizing or cost-minimizing. However, according to neoclassical theory, a firm is a corporate entity operating in an exogenous environment with many factors which lie beyond the firm's control. This by implication means that profit as a motivation for the firm's growth and the purpose of its existence, is determined by external factors beyond the firm's control (Sangosanya, 2011, citing Bernadette and David, 2005). The dissatisfaction in the 1930s with the neoclassical theory's simple conception of the firm as a device which transforms atomistic inputs into marketable outputs gave rise to a number of alternative perspectives. One such perspective took a legal, economic view of the firm in order to discover key aspects of its internal structure.This in turn formed the basis of the managerial theory of the firm.

2.2. The managerial theory

In an effort to shed more light on the neoclassical "black box", the managerial theory stresses the complex nature of the modern firm. However, according to Baumol (1967), one of the major reasons why managers are hired is to increase sales or maximize revenue rather than for profit maximization. The managerial theory centres on the function of a manager as revenue maximization agent. The theory holds that firms should aim to increase their output and to capture the largest market share, which in turn will result in increased sales. Critics of the managerial theory argue that cost minimization and profit maximization should be a manager's principal function, while some argue that the managerial theory is simply a modernized version of the neoclassical theory.

2.3. The Penrose theory

Another model of firm growth is based on Penrose's argument that there will likely be "managerial limits to firm growth". Penrose postulated that management is a team effort in which each employee deploys specialized, functional skills as well as more highly-efficient team-specific skills, which enable them to individually and collectively coordinate the many activities of the firm in a coherent manner.

She argued that firms had no long-run determinant or optimum size, but only a limitation on current-period growth rates. However, a major criticism of the Penrose theory is that, contrary to its postulations that the adjustment costs are variable rather than fixed, the observed and direct indications of adjustment costs show that they are fixed in nature and not variable. Furthermore, it is difficult to reconstruct Penrose's argument on managerial limits to growth, and this means that the cost of expanding the management team is independent of the number of new managers to be recruited into the team.

2.4. The theory of optimal firm size

As a response to the inadequacies of the managerial limit theory, optimal firm size hypotheses postulate that firm size is strongly dependent on a number of considerations. Such factors include the market structure in which the firm operates, in other words whether it operates in a perfectly competitive market or an imperfectly competitive one (e.g. monopoly, oligopoly, or monopolistic competition). The major conclusion of the optimal firm size theory is that small companies grow faster than larger companies until they reach the minimum efficient scale (MES) point of production. Similarly, if firms have market power (i.e. where there is imperfect competition), their optimal size may deviate from this optimal cost position, and if there are economies of scope, such deviations may be more noticeable. However, in this situation, a firm's ability to grow depends on it innovations, in other words, the limits to a firm's potential growth are largely determined by the demand for its unique product rather than by cost considerations.

3. Empirical literature

Treacy (1980) examined profitability patterns and firm size in a study of 1458 companies in 54 industries over 10 years, in order to confirm the previous results produced by Bowman (1980) which indicated that the level and variance of return on stockholders' equity tend to correlate negatively within industries. The results revealed that there is a strong significant negative correlation between firm size and variance of

return on equity (ROE), and a moderate significant correlation between firm size and average level of ROE. However, the evidence does not support the hypothesis that firm size is the major intervening variable between level and variance of return on stockholders' equity.

Majumdar (1997) investigated the impact that firm size has on firm profitability and productivity with a sample of 1020 Indian firms. While controlling for other variables that may affect firm performance, the study provided evidence that larger firms are less productive but more profitable.

Archarungroj and Hoshino (1999) explored the influence of corporate R&D investment on a firm's subsequent profitability and also examined the differences in R&D efficiency among firms of different sizes. In addition, they attempted to determine the relationship between firm size and R&D investment. The study used regression analysis and data on 170 Japanese firms belonging to the chemical and pharmaceutical industry. Their results showed that R&D expenditure and R&D strength are positively and significantly related to profitability indicators such as return on assets (ROA), return on equity (ROE), gross profit margin (GPM), operating income margin and ordinary income margin. They also showed that larger firms proved more effective and efficient in their management of R&D for the abovementioned profitability variables. In addition, their findings revealed a significant positive relationship between firm size and R&D investment, where R&D investment was measured both as an absolute amount and as a ratio to sales.

Ramasamy *et al*. (2005) analysed the effects of market structure components and other performance measures in order to better understand the dynamics and determinants of performance within the Malaysian palm oil sector, using data from 30 plantation-based public companies listed on the Bursa Malaysia from 2000 to 2003. The panel data were analysed using ordinary regression analysis. The authors observed effects of firm size and firm ownership on the level of profitability in this sector. Their findings showed that size is negatively related to performance, and that privately-owned plantation companies are more profitably managed.

Similarly, Amato and Burson (2007) examined the size-profit relationship for firms operating in the financial services sector. They examined both the linear and cubic form of the relationship. In terms of the linear relationship, the results revealed a negative influence of firm size on its profitability, although this influence was not statistically significant. On the other hand, they found evidence of a cubic relationship between ROA and firm size.

Serrasqueiro and Nunes (2008) analysed the relationship between firm size and performance of small and medium sized enterprises (SMEs) in Portugal from 1999 to

2003. Their results revealed a statistically significant positive relationship between size and profitability of SMEs. Nevertheless, for large Portuguese firms, the relationship between size and profitability is not statistically significant.

Vlachvei and Notta (2008) examined the impact of firm-level variables on the growth of firms operating in Greece. The study was based on the financial data of 178 manufacturing and trading firms listed on the Greek Stock Market, for the period 1995-2000. Their results showed that the relationship between growth, size and the age of firms is very sensitive to the chosen methods of estimation as well as the definitions of growth and size used.

Lee (2009) examined the role that firm size plays in profitability using a fixed effects dynamic panel data model to analyse a sample of more than 7000 US publicly-held firms for the period 1987-2006. The results showed that firm size, both in terms of total assets and total sales, explains profitability and plays an important role in determining the future earnings capacity of a firm. However, it is a non-linear relationship, meaning that gains in profitability are smaller for larger firms. In addition, industry-specific fixed effects showed a negligible impact in the presence of firm-specific fixed effects.

Blease *et al*. (2010) examined the relation between firm size and profitability within 109 SIC four-digit manufacturing industries in the US. However, they found that in up to 47 industries profitability increases with size at a decreasing rate until it eventually starts to decline, and that there is no relationship between profitability and size in up to 52 industries. These two categories account for 97 of the 109 industries under study. On the contrary, in up to 11 industries profitability continues to increase as businesses become larger. The authors also revealed that profitability has a negative correlation with the number of employees for firms of a given size, when size is measured in terms of total assets and sales.

Burja (2011) stated that information about company performance, especially about its profitability, provides a useful support for managerial decisions regarding potential changes in the economic resources that the company will be able to control in the future. In her study of the Romanian chemical industry during the period between 1999 and 2009, she determined the factors that most affect firms' profitability. To this end, she used multiple regression analysis and the results revealed a strong connection between the profitability, represented by ROA, and the management of available resources.

Sangosanya (2011) examined the dynamics of manufacturing firms' growth in Nigeria using panel data analysis in a bid to evaluate factors that influence firm performance,

including adequate finance, a business-friendly environment, effective management and operation structure, and growth-oriented government policies and regulations. The panel regression model was based on 45 manufacturing firms listed on the Nigerian Stock Exchange (NSE) from 1989 to 2008. The estimated dynamic panel model revealed that firms' financing mix, utilization of assets to generate more sales, abundance of reserve funds and government intervention as indicated by Tobin's Q, operating efficiency, capital reserve and government policies are significant determinants of manufacturing firms' growth dynamics in Nigeria.

Vithessonthi and Tongurai (2011) examined whether firm size affects the relationship between leverage and operating performance during the global financial crisis of 2007–2009, using information corresponding to 170,013 firms in Thailand, most of which were private. The estimation of the panel regressions was carried out using fixed and random effects models. The results indicated that leverage has a negative effect on performance across firm-size subsamples; the year-by-year cross-sectional regression results revealed that the effect of leverage on performance is positive for small firms but negative for large firms. Their findings show that about 75% of Thai firms in their sample appear to have managed to get through the global financial crisis on the basis that they do not have to simultaneously deleverage and liquidate their assets.

Akinlo (2012) investigated the long-run relationship and causality between firm size and profitability in 66 firms in Nigeria for the period 1999-2007, using the panel cointegration method. The results showed that there is long—run steady-state relationship between firm size and profitability, while the short run causal relationship revealed that there is bidirectional relationship between firm size and profitability. The author asserted that firm size Granger causes profitability and profitability Granger causes firm size.

Pervan and Viši (2012) evaluated the impact of firm size on profitability using data from 2,050 Croatian firms for the period 2002-2010. They used a fixed effects panel data model. The results showed that size has a significant (but weak) positive influence on firm profitability. They also showed that the asset turnover ratio and the debt ratio also have a statistically significantly influence on firms' performance, while the current ratio did not prove to be an important explanatory variable of firms' profitability.

Halil and Hasan (2012) carried out their study of the effect of firm size on profitability with evidence from 143 Turkish manufacturing companies for the period 2005-2011. Profitability was measured by ROA, while total assets and total sales were used as proxies for firm size after controlling for liquidity, leverage and the ratio of inventories to total assets. According to the results, firm size, both in terms of total assets and

in terms of total sales, has a positive impact on the profitability of Turkish manufacturing companies, while the control variables showed a negative relationship with the ratio of total liabilities to total assets and profitability.

Kouser *et al*. (2012) carried out an in-depth evaluation of the relationships between firm size, growth, and profitability of 700 non-financial companies listed on the Karachi stock exchange, Pakistan, for the period 2001-2010. Panel data analysis was applied, using size (natural log of total assets), and growth (sustainable growth rate for firm) as independent variables and profitability (ROA) as the dependent variable. The results revealed that profitability has a significant positive relationship with the growth of the firm, while size has a significant negative impact on profitability.

Monteiro (2013) aimed to contribute to a better understanding of the impact of firm size on export performance in Portuguese firms, from different industries. She explicitly controlled for sectorial factors that could potentially influence the relationship under analysis and found that, using the same sample of companies but varying the proxies used to measure firm size, even while the proxy for export performance remained fixed, resulted in opposite signs for the effect of the determining variable on export performance.

Dogan (2013) investigated the effect of firm size on profitability for 200 companies active on the Istanbul Stock Exchange (ISE) between the years 2008 and 2011. ROA was used as a proxy for firm profitability while total assets, total sales and number of employees were used as proxies for firm size. Multiple regression and correlation methods were used in the analyses. The results of the analyses showed a positive relation between firm size and profitability. The control variables such as age of the firms and leverage rate showed a negative relation with ROA, while liquidity ratio and ROA displayed a positive relation.

Akinyomi and Olagunju (2013) used panel data analysis to estimate the effect of firm size on the profitability of firms belonging to the Nigerian manufacturing sector for the period 2005-2012. ROA was used as a proxy for profitability while size was proxied by the log of total assets and the log of turnover. Inventory, liquidity and leverage were used as control variables. The results of the study showed that firm size, in terms of total assets and in terms of total sales, has a positive significant effect on the profitability of Nigerian manufacturing companies. As for the control variables, inventory has a negative relationship with profitability, while in the case of liquidity and leverage the relationship is negative.

Babalola (2013) examined the effect of firm size on the profitability of 60 manufacturing companies listed on the Nigerian Stock Exchange for the period 2000-

2009. The panel data model estimated showed that firm size, both in terms of total assets and in terms of total sales, has a positive relationship with the profitability of manufacturing companies in Nigeria.

Dahmash (2015) examined the effect of firm size on the profitability of 1538 firms listed on the Amman Security Exchange, Jordan, for the period 2005-2011. Panel data analysis (pooled estimator) was used for the main sample of the study and the sub-samples corresponding to the economic sectors considered. The results indicated a highly significant positive relationship between firm size and profitability for the three main sectors of the sample. The highest significant coefficient value was for the industrial firms, followed by the services sector firms, and lastly, the financial firms. The results of the detailed industry analysis rfor entire subsectors were similar, with the highest values for food and beverages firms, commercial and educational services firms, and insurance firms. The results showed that the effect of total assets on firm size is insignificant for the firms in the banking sector, diversified financial firms and real estate firms.

Danaei and Abdi (2015) evaluated the relationship between different measures of company growth and the sustainability of the capital structure for 101 companies listed on the Tehran Stock Exchange during the period 2006-2011. The results showed an inverse and significant relationship between firms' profitability and the change in their debt ratio. Similarly, the results revealed that there is a direct and significant relationship between firm size and the change in their debt ratio, and also that there is an inverse and significant relationship between a company's growth opportunities and changes in their retained earnings ratio.

Kartikasari and Merianti (2016) analysed the effect of leverage and the size of a company on its profitability using 100 qualified manufacturing companies listed on the Indonesia Stock Exchange in the period 2009-2014. To that end, they used panel data regression analysis, with the most suitable panel data regression model being the fixed effects model. Leverage was measured by the debt-to-equity ratio, while firm size was measured by total assets and total sales, and profitability by ROA. The study revealed that the debt ratio has a significant positive effect on profitability while total assets has a significant negative impact. Total sales, however, does not have a statistically significant effect on the profitability of the companies.

Kumar and Kaur (2016) studied the relationship between size and profitability in the Indian automobile industry from 1998 to 2014. To analyse this relationship, they employed a linear regression model over the years 1998 to 2014, as well as a corresponding cross-sectional analysis. The study yielded mixed results; time-series analysis showed a positive relationship but cross-section analysis indicated that there is no relationship between firm size and profitability.

4. Research methodology

This study examines the effect of firm size on the performance of 12 non-financial companies listed on the Nigeria Stock Exchange (NSE) for the period 2005-2013. The analysis uses a quantitative research method and secondary data from the selected firms' financial statements. We estimate the pooled, fixed effects and random effects panel data models in order to identify the relationship between the performance of firms listed on the Nigeria Stock Exchange (NSE) and firm size. The data are analysed with ROE as a proxy for performance, which serves as the dependent variable, while total assets and total sales are the proxies for firm size. Leverage and working capital act as control variables.

The study population consists of all firms listed on Nigeria Stock Exchange during the period 2005-2013. We exclude the financial sector due to its unique treatment of liquidity and profit, as well as the fact that they are highly regulated. However, we have deliberately selected 12 companies from five different sectors, according to data availability. Table 1 shows the descriptions of the variables used in the analysis.

Table 1. **Descriptions of variables used in the analysis**

Variables	Description
Dependent variable	
Return on Equity (ROE)	The ratio of net profit after tax to total equity (shareholders' funds)
Independent variables	
Size in terms of total assets (S_TA)	Natural logarithm of total assets
Size in terms of total sales (S_TS)	Natural logarithm of total sales
Control variables	
Leverage (LEV)	The ratio of non-current liabilities to total assets
Working Capital (WC)	Natural logarithm of current assets minus liabilities

Model specification

The study aims to examine the effect of firm size on the performance of listed firms in Nigeria. The main independent variables of the study are firm size indicators, which are total assets and total sales. Previous studies such as Friend and Lang (1988), Gönenç and Arslan (2003), Deesomsak (2004), Saliha and Abdessatar (2011) used "total assets" as a firm size indicator. Researchers such as Rajan and Zingales (1995), Wiwattanakantang (1999), Serrasqueiro and Nunes (2008), Akba and Karaduman (2012), and Shubita and Alsawalhah (2012), on the other hand, used "total sales" as their firm size indicator. Blease, Kaen, Etebari and Baumann (2010), Oladele and Adebayo (2013), Babalola (2013), Do an (2013), Kartikasari and Merianti (2016), Kumar and Kaur (2016), used both 'total assets" and "total sales" as firm size indicators.

The control variables in this study are the leverage ratio and working capital. These variables have been included in the study according to the assumption of their relevancy to firm performance.

The models used are in line with past studies on the impact of firm size and performance (Serrasqueiro and Nunes, 2008; Dogan, 2013; Akinyomi and Olagunju, 2013; Babalola, 2013; Kumar and Kaur, 2016).

Thus, the econometric models used in this study are the following:

$$ROE_{it} = \beta_{0it} + \beta_1 S\_TA_{it} + e_{it} \quad (1)$$
$$ROE_{it} = \beta_{0it} + \beta_1 S\_TA_{it} + \beta_2 S\_TS_{it} + e_{it} \quad (2)$$
$$ROE_{it} = \beta_{0it} + \beta_1 S\_TA_{it} + \beta_2 LEV_{it} + e_{it} \quad (3)$$
$$ROE_{it} = \beta_{0it} + \beta_1 S\_TA_{it} + \beta_2 WC_{it} + e_{it} \quad (4)$$
$$ROE_{it} = \beta_{0it} + \beta_1 S\_TA_{it} + \beta_2 LEV_{it} + e_{it} \quad (5)$$
$$ROE_{it} = \beta_{0it} + \beta_1 S\_TA_{it} + \beta_2 WC_{it} + e_{it} \quad (6)$$
$$ROE_{it} = \beta_{0it} + \beta_1 S\_TA_{it} + \beta_2 S\_TS_{it} + \beta_3 LEV_{it} + e_{it} \quad (7)$$

and the final model is;

$$ROE_{it} = \beta_{0it} + \beta_1 S\_TA_{it} + \beta_2 S\_TS_{it} + \beta_3 LEV_{it} + \beta_4 WC_{it} + e_{it} \quad (8)$$

5. Results

Table 2. **Descriptive statistics**

	Number	Mean		Std. Deviation (billions)	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
ROE	108	.26	.026	.266	.623	.233	.149	.461
S_TA	108	7.42	.071	.743	1.253	.233	4.550	.461
S_TS	108	7.66	.069	.713	1.234	.233	5.136	.461
WC	108	-.02	.642	6.668	-.063	.233	-1.952	.461
LEV	108	.21	.018	.185	3.407	.233	17.760	.461

SOURCE: AUTHORS' COMPUTATION, 2016.

Table 2 shows the descriptive statistics of the dependent and independent variables. ROE shows a mean of 0.26 billion with a standard deviation of the same value. It also shows very low skewness (0.623) and kurtosis (0.149). S_TA shows a mean value of 7.42 billion with a standard deviation of 0.743, a skewness coefficient of

1.253 and a high degree of kurtosis (4.550). Similarly, S_TS shows a mean value of 7.66 billion with a standard deviation of 0.713, a skewness coefficient of 1.234 and a kurtosis of 5.136 (indicating a leptokurtic distribution).

For the control variables, WC shows a negative mean value of 0.02 billion with a very large standard deviation (6.668). Its distribution is practically symmetric and platykurtic. LEV has a mean value of 0.21 billion with a standard deviation of 0.185. Its distribution, however, is highly asymmetric (to the right) and leptokurtic.

Table 3. **Correlation matrix**

Correlations						
		ROE	LEV	S_TA	S_TS	WC
ROE	Pearson correlation	1				
	Sig. (1-tailed)					
	N	108				
LEV	Pearson correlation	.365**	1			
	Sig. (1-tailed)	.000				
	N	108	108			
S_TA	Pearson correlation	.257**	.142	1		
	Sig. (1-tailed)	.004	.071			
	N	108	108	108		
S_TS	Pearson correlation	.491**	.171*	.849**	1	
	Sig. (1-tailed)	.000	.039	.000		
	N	108	108	108	108	
WC	Pearson correlation	-.089	.069	-.253**	-.335**	1
	Sig. (1-tailed)	.179	.238	.004	.000	
	N	108	108	108	108	108

***Correlation is significant at the 0.01 level (1-tailed).*
**Correlation is significant at the 0.05 level (1-tailed).*

Table 3 reports the correlation between the variables used in this study. It is clear that the correlations between ROE and all other variables except WC are positive and statistically significant. LEV and S_TS are weakly but significantly correlated (positively). However, LEV does not have a significant correlation with S_TA, leverage and working capital. Size in terms of total assets and in terms of total sales shows a negative significant correlation with WC. The results regarding these correlations are in line with past research, such as that of Babalola (2013), whose results showed that size both in terms of total assets and total sales are positively correlated with ROA, while leverage and inventory are negatively correlated with it.

Table 4. **Regression coefficients: The pooled regression models**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
C	-0.420	-1.007	-0.396	-0.402	-1.088	-1.221	-0.956	-1.018
	(0.250)***	(0.231)*	(0.236)***	(0.260)	(0.231)*	(0.257)*	(0.218)*	(0.231)*
S_TA	0.091	-0.205	0.074	0.089			-0.204	-0.207
	(0.033)*	(0.054)*	(0.032)**	(0.034)**			(0.050)*	(0.051)*
S_TS		0.364			0.164	0.193	0.345	0.356
		(0.056)*			(0.030)*	(0.033)*	(0.053)*	(0.055)*
LEV			0.482		0.417		0.415	0.402
			(0.128)*		(0.117)*		(0.109)*	(0.110)*
WC				-0.001		0.003		0.002
				(0.003)		(0.003)		(0.003)
R-squared	0.06	0.33	0.17	0.06	0.32	0.24	0.41	0.41
Adj. *R*-squared	0.05	0.32	0.16	0.04	0.30	0.23	0.39	0.39
F-statistic	7.48	26.19	11.21	3.74	24.99	17.26	18.43	18.43
S.E of regression	0.25	0.21	0.24	0.24	0.22	0.23	0.21	0.21
Prob. value	0.007	0.000	0.0000	0.026	0.000	0.000	0.000	0.000
	108	108	108	108	108	108	108	108

**Significant at 1%, **Significant at 5%, and ***Significant at 10%*
Figures in parentheses represent the standard error of the independent variables.

As for the results obtained from the pooled regression models, in model 1, size in terms of S_TA shows a positive significant relationship with performance (ROE), in line with the results of Amota *et al*. (2007). From the estimation of model 2, which shows the effect of size both in terms of S_TA and S_TS on ROE, it can be deduced that S_TA has a significant negative relationship with ROE whereas the corresponding relationship with S_TS is significant and positive. Thus, the inclusion of S_TS in a model containing S_TA as an explanatory variable changes the sign of the latter. In model 3, size in terms of S_TA is the only explanatory variable, with the control variable being LEV. In this model, both S_TA and LEV show a positive significant relationship with ROE. This result is in line with the findings of Halil *et al*. (2012). Similarly, in model 4, S_TA was used as the only explanatory variable, with the control variable being WC. The estimation of the model indicates that S_TA has a positive significant relationship with ROE, while the impact of WC on performance (with a negative sign) is insignificant.

In model 5, size in terms of S_TS was used as the only explanatory variable, with the control variable being LEV. S_TS and LEV show a positive significant relationship with ROE. This result is in line with that of Serrasqueiro and Nunes (2008). In model 6, where size in terms of S_TS is the only explanatory variable and WC the only control variable, both show a positive significant impact on ROE.

In model 7, where size is proxied by both S_TA and S_TS and where the only control covariate is LEV, the pooled estimation indicates that S_TA shows a negative significant relationship with ROE while the impact of S_TS (and of LEV) on it is positive (and significant). In the same vein, the pooled estimation of the final model, model 8, which considers the two explanatory variables and the two control variables, confirms the results of model 7, with the impact of WC on ROE being insignificant. This result is in line with previous studies such as those of Treacy (1980) and Amato *et al*. (2007), among others.

It should be noted that, as mentioned above, the inclusion of S_TS in a model containing S_TA changes the sign of the estimated impact of S_TA on ROE. It is also of note that the adjusted R-squared of model 8, the most complete model, is not as high as desired: only 0.39.

● Table 5. **Regression coefficients: Random effects model**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
C	0.185	-0.265	0.122	0.121	-0.277	-0.346	-0.282	-0.327
	(0.189)	(0.192)	(0.183)	(0.193)	(0.196)*	(0.207)*	(0.187)	(0.193)***
S_TA	0.010	-0.202	0.010	0.018			-0.184	-0.183
	(0.024)	(0.049)*	(0.023)	(0.024)			(0.048)*	(0.048)*
S_TS		0.264			0.062	0.079	0.243	0.248
		(0.054)*			(0.024)*	(0.026)*	(0.053)*	(0.053)*
LEV			0.302		0.297		0.252	0.218
			(0.094)*		(0.092)*		(0.088)*	(0.092)*
WC				0.004		0.005		0.003
				(0.002)		(0.002)**		(0.002)
R-squared	0.001	0.18	0.089	0.023	0.13	0.08	0.24	0.24
Adj. *R*-squared	-0.007	0.16	0.072	0.004	0.12	0.07	0.21	0.21
F-statistic	0.18	11.78	5.15	1.24	8.44	5.18	11..01	8.50
S.E of regression	0.14	0.13	0.14	0.14	0.14	0.14	0.13	0.13
Prob. value	0.66	0.000	0.007	0.29	0.000	0.000	0.000	0.000
	108	108	108	108	108	108	108	108

**Significant at 1%, **Significant at 5%, and ***Significant at 10%*
Figures in parentheses represent the standard error of the independent variables.

The estimates of the random effects regression models (1)-(8) have the same sign as those of the pooled regression specifications, and those that were significant using the pooled estimator continue to be significant when using random effects modelling. Thus, the estimation of the random effects model (8) confirms that, contrary to S_TS, S_TA has a negative (significant) impact on ROE, and that the impact of LEV is significant and positive while that of WC is insignificant.

In addition, the *R*-squared values of the random effects models are lower than those of the corresponding pooled regression ones.

● Table 6. **Regression coefficients: Fixed effects models**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
C	0.237	-0.165	0.169	0.161	-0.150	-0.224	-0.185	-0.240
	(0.181)	(0.191)	(0.176)	(0.871)	(0.197)	(0.206)	(0.186)	(0.190)
S_TA	0.003	-0.195	0.004	0.013			-0.177	-0.174
	(0.024)	(0.051)*	(0.023)	(0.543)			(0.050)*	(0.050)*
S_TS		0.245			0.046	0.063	0.223	0.229
		(0.057)*			(0.025)*	(0.026)*	(0.056)*	(0.056)*
LEV			0.283		0.274		0.229	0.190
			(0.096)*		(0.095)*		(0.090)**	(0.095)**
WC				0.005		0.006		0.003
				(1.683)***		(0.002)**		(0.002)
R-squared	0.72	0.77	0.75	0.73	0.75	0.74	0.78	0.79
Adj. *R*-squared	0.69	0.74	0.71	0.69	0.72	0.71	0.75	0.75
F-statistic	21.08	24.46	21.70	20.06	22.68	21.59	24.48	23.10
S.E of regression	0.14	0.13	0.14	0.14	0.13	0.14	0.13	0.13
Prob. value	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.000
	108	108	108	108	108	108	108	108

**Significant at 1%, **Significant at 5%, and ***Significant at 10%*
Figures in parentheses represent the standard error of the independent variables.

Finally, Table 6 lists the estimates corresponding to the fixed effects models (1)-(8). The Hausman test is used to differentiate between fixed effects and random effects, rejecting the random effects model in favour of the fixed effects estimator. In fact, the *R*-squared values rise sharply for all 8 models (0.69 for model 1, the lowest value, and 0.79 for model 8, the highest value).

In model 1, where S_TA is the only covariate, its impact on ROE becomes insignificant. In model 2, the sign and significance of the estimates corresponding to S_TA and S_TS are the same as in the pooled and random effects models, in line with the findings of Oladele *et al*. (2013) and Babalola (2013) for Nigeria. Kouser *et al*. (2013) also report a negative relationship between profitability and size in terms of total assets. In model 3, when controlling S_TA for LEV, the only explanatory variable continues to be insignificant; however, the control variable shows a positive relationship with ROE at the 1% level of significance. Similarly, in model 4, S_TA has positive insignificant relationship with ROE while the impact of the control variable, WC, is positive and significant at the 10% level of significance.

In models 5 and 6, the impact of the size proxy (S_TS) on ROE is positive and significant, as is the impact of the control variables (LEV in model 5 and WC in model 6). These results are in line with those of Babalola (2013) and Danaei *et al.* (2015). Model 7, where both S_TA and S_TS are considered as explanatory variables with LEV as control variable, shows that S_TA negatively impacts on ROE (with this effect being significant at the 1% level of significance) while STS and LEV show a positive relationship with ROE (at the 1% and the 5% level of significance, respectively). Model 8, the final model, confirms the results obtained from model 7 and, in addition, shows an insignificant impact of WC on ROE. More specifically, according to the estimates of model 8, a 1% increase in S_TA leads to a decrease of 0.00177 units (billion) of ROE, while a 1% increase in S_TS results in an increase of 0.00229 units (billion) of ROE. As for the only significant control variable, a one-unit increase in LEV results in an increase of 0.19 units for ROE. These findings are in line with those of Kartikasari *et al*. (2016).

6. Conclusions

In this article, we have used data from non-financial firms in Nigeria to investigate whether firm size affects firm performance, when controlling for the level of debt and working capital. To this end, we have applied panel data analysis and, more specifically, fixed effects modelling (although the estimates produced with pooled and random effects modelling are also presented). A panel data set for the period 2005-2013, obtained from the audited annual reports of the selected firms listed on the Stock Exchange, was used to estimate eight models containing different combinations of the independent and control variables. ROE was used as a proxy for performance, while the log of total assets and the log of total sales were used as proxies for firm size. Leverage and working capital were used as control variables.

According to the fixed effects estimation (as indicated by the Hausman test), firm size in terms of total assets has a negative effect on the performance of Nigerian non-financial companies, while in terms of total sales this impact becomes positive. As for the control variables, a positive relationship between ROE and leverage was found; however, the impact of working capital on ROE is statistically insignificant. This study therefore suggests that firms' focus should be on increasing their size by boosting turnover and opening up new markets for existing and new products.

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