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Leverage and firm performance: New evidence on the role of firm size

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ABSTRACT

In this paper, we draw on the Hansen (1999) threshold regression model to examine the empirical links between leverage and firm performance by means of a new threshold variable, firm size. We ask whether there exists an optimal firm size for which leverage is not negatively related to firm performance. Accordingly, with a panel data of 101 listed firms in Nigeria between 2003 and 2007, we explore whether the ultimate effect of leverage on firm performance is contingent on firm size; that is, whether the type of impact that leverage has on the performance of a firm is dependent on the size of the firm. Our results show that the negative effect of leverage on firm performance is most eminent and significant for small-sized firms and that the evidence of a negative effect diminishes as a firm grows, eventually vanishing when firm size exceeds its estimated threshold level. We find that this result continues to hold, irrespective of the debt ratios utilized. In line with earlier studies, our results show that the effect of leverage on Tobin's Q is positive for Nigeria's listed firms. However, our new finding is the evidence that the strength of the positive relationship depends on the size of the firm and is mostly higher for small-sized firms.

1. Introduction

There is a widespread view that the impact of leverage on firm performance is ambiguous, with some studies finding a negative relationship (see Chen, 2004; Tian and Zeitun, 2007; Salawu, 2007) and others reporting either a positive or no significant relationship (see Azeez, 2015; Brick and Ravid, 1985). Theoretically, the divergence in previous studies can be partly explained by competing theories such as the signalling theory which posits that debt, in the presence of asymmetric information, should be positively related to firm profit performance, and the agency costs or pecking order theory which predicts a negative relationship between leverage and firm performance resulting from the agency costs between firm owners and lenders. Empirically, one plausible explanation for this ambiguity, in our view, may be the failure of existing empirical studies to model the contingent role that the size of a firm plays in the relationship between leverage and firm performance. If firm size impacts firm performance and the relationship between leverage and firm performance remains a subject of discussion, then firm size should provide some explanation for the ambiguous relationship between leverage and firm performance. This is the hypothesis advanced in this paper and forms the basis on which our empirical analysis is built. To reiterate, we ask whether the size of a firm helps to better understand and explain the ambiguous relationship between leverage and firm performance that has been documented in previous studies. As a by-product of this question, we determine whether there exists an optimal level of firm size at which leverage does not diminish firm performance.

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Table 1
Summary Statistics.

Variables	Mean	Median	Std Dev.	Minimum	Maximum
ROA	0.0804	0.0927	0.448	−6.0208	3.7104
ROE	4.5907	0.707	77.3011	−696.34	1558.61
TOB Q	0.9332	0.7038	0.9872	0.0871	7.1684
TDTA	0.735	0.521	0.9195	0.0143	6.8064
LTDTA	0.2757	0.1377	0.4704	0.000	6.5521
STDTA	0.4592	0.2642	0.6930	0.000	5.5809
SIZE	6.1719	6.3017	1.2999	0.000	8.1378

Note: ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/ equity), Tob Q (Tobins Q) equals (Market value of equity + book value of debt)/book value of assets; TDTA is the total debt divided/ total assets; LTDTA is the long-term debt/total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

In addressing the main question posed in this paper, we employ the concept of threshold analysis, à la Hansen (1999) which is most suitable when nonlinearities between financial variables are to be explored. The concept of threshold regression modelling has a wide variety of applications in economics and finance. Our motivation to draw on the framework of threshold analysis stems from our main objective – we wish to determine whether the relationship between leverage and firm performance depends on firm size. That is, whether size is an advantage for firms and whether large-sized firms in Nigeria are better able to reap the benefits of leverage than their smaller counterparts. We have focused on Nigeria's listed firms because several studies (see Akinlo and Asaolu, 2012; Jeleel and Olayiwola, 2017; Olokoyo, 2013; Patrick and Ogebe, 2013, among others) have mostly concluded that debt is generally bad for firms in the real sectors as it is responsible for the weakening firm performance that has been observed across these firms over the years. This has led many listed firms across the different real sectors of Nigeria's economy to favour corporate governance policies and business strategies that promote less debt relative to other funding sources. The danger with such policies in a frontier emerging market such as Nigeria is that it stifles the opportunity for organic growth of firms, especially in the likely instances where other funding sources are either very limited or completely absent.

Furthermore, these studies on the leverage-performance nexus in Nigeria have an important drawback. They did not consider the contingent role that other factors such as firm size might play in the leverage-performance nexus, and little is known about whether the size of a firm could be a game changer regarding the empirical relationship between leverage and firm performance. It is this specific issue that we set out to address in this paper. Moreover, Nigeria's listed firms are a special case in that the debt component of their capital structure relies on short-term debt and has a low amount of long-term debt (Nwanko, 2014), partly due to the non-existence of a robust debt capital market in the country. Thus, a study that examines the impact of leverage, particularly short-term leverage, on firm performance is crucial in this instance as it will uncover the consequences of the preference for such form of leverage and reveal conditions for it to be less or more deleterious to firm performance.

To address the problem, we will test whether the relationship between leverage and firm size is invariant to sample splitting, where the sample is split based on firm size and where the firm size represents the threshold variable. We do not impose a pre-determined estimate of firm size; instead we follow the procedure in Hansen (1999) which determines, from available data, estimates of thresholds based on minimizing the concentrated sum of squares. If we find evidence that such a split yields relationship between leverage and firm performance that is different across the split samples, then this would be an evidence for nonlinearities between leverage and firm performance, where the nonlinear agent is the firm size – that is, firm size influences the link between leverage and firm performance, so that there exists a level or 'cut-off point' for firm size such that the relationship between leverage and firm performance changes. For instance, it could be that leverage decelerates firm performance when firm size is below a certain level, say x, but accelerates firm performance when firm size is above x. On the other hand, it could also be that whether firm size is above or below x, the link between leverage and firm performance is unchanged, i.e. leverage either accelerates or decelerates firm performance irrespective of firm size. The advantage of this empirical exercise is that it provides a fresh perspective among researchers, policymakers and business managers that promotes the monitoring of not just leverage and how it affects performance but also how firm size might, positively or negatively, influence this relationship. One important consequence of this paper is its potential to inspire a tradition where firms take size into consideration before reaching a decision on the amount of debt to include on their balance sheets in a bid to unlock the positive benefits or at least mitigate the negative effects of leverage on performance.

Utilizing a panel of 101 firms listed on the Nigerian Stock Exchange from 2003 to 2007, we find compelling evidence of a difference in the impact of leverage on firm performance for different firm sizes. Specifically, our results show that the negative effects of leverage on ROA and ROE (accounting measures of firm performance) are evident and significant only when firm size is small, falling below its estimated threshold level. Beyond this level, leverage has no significant negative impact on firm performance. This seems to suggest that the much-emphasized demerits of leverage, such as exposure to greater financial distress which dampens firm performance, are more of a concern for small firms and possibly of less concern for large firms. Thus, the agency costs theory, which suggests that debt affects firm performance negatively, appears to be supported for the small size firms while the signalling theory, which posits that leverage is positively related to firm performance, garners no support. We also find that leverage is positively related to Tobin's Q, a measure of firm (market) performance, and that the strength of the positive association depends on firm size and is mostly higher for small-sized firms. These results are robust to different measures of leverage, the inclusion of other determinants of firm performance such as taxes and firm age to control for tax effects and the prolonged existence of firms.

To the best of our knowledge, no previous study has addressed the problem of determining the impact of leverage on firm performance under the threshold framework, with firm size as a threshold variable. The few related studies such as Cheng, Liu, and Chien (2010), Lin and Chang (2011) and among others, utilize leverage as a threshold variable to determine the optimal level of debt after which firm value, performance or productivity begins to drag. Instead, in this paper, we look at the impact of leverage on firm performance for firms of different sizes. Therefore, our paper provides a new contribution to the literature. The advantage of our empirical approach, the threshold framework, is that it enables us to investigate the contingent roles that other performance determinants such as firm size play in the leverage-performance nexus and to take advantage of the nonlinearities inherent in the relationship between leverage and firm performance which previous studies have mostly ignored. Most previous studies on the relationship between leverage and firm performance assume that leverage and firm performance bear a linear or monotonic relationship so that the effect of leverage on firm performance is qualitatively the same for all determinants of firm performance. In this paper, and using firm size, we show that this does not necessarily hold. Instead, we argue that the size of a firm plays a crucial contingent role in the type of relationship between leverage and firm performance. The rationale for including firm size as a threshold variable stems from the evidence of an empirical relationship between firm size and firm performance documented in the literature.

In all, our paper finds that the relationship between leverage and firm performance depends on the size of a firm and that the performance of small-sized firms is negatively affected by an increase in leverage while no such evidence exists for large firms. The rest of the paper is structured as follows. The next section presents a detailed literature review while Section 3 describes the data. Section 4 presents the empirical methodology; it briefly motivates the rationale for a threshold empirical analysis, and explains the methodology of the threshold model. Section 5 discusses the empirical results while Section 6 presents a summary and implication of results. The last section concludes, with pointers to possible future research extensions.

2. Literature review

Since this study aims to empirically investigate the relationship between leverage and firm performance, our review of the literature will focus on studies around this domain. Several previous empirical studies have examined the relationship between leverage and firm performance. The findings from these studies are, at best, mixed. On the one hand, some studies such as Abor (2005), Ruland and Zhou (2005), Robb and Robinson (2009) and Chandrakumarmangalam and Govindasamy (2010) find positive relationships between leverage and firm performance. In fact, Robb and Robinson (2009) argue that gains from leverage are significant, and the use of debt enhances firm performance because the returns earned are greater than the average interest expense incurred on leverage. Their outcome can be explained in the context of previous influential studies such as Modigliani and Miller (1958) and Jensen (1986) who argue that profitable firms signal quality by leveraging up, resulting in a positive relation between leverage and profitability. A few others such as Fama and French (1998), Negash (2001) and Phillips and Sipahioglu (2004) have identified a negative impact of leverage on firm performance while others like find no significant relationship between leverage and firm performance. Fama and French (1998) argue that the degree of leverage generates agency problems that predict a negative relationship between leverage and profit performance.

Among the few that have employed the concept of thresholds, Cheng et al. (2010), using leverage as a threshold variable, suggest that more leverage increases firm performance up to a certain point and then firm performance starts to decrease. Lin and Chang (2011) also using debt as a threshold, find that for Taiwanese listed companies, there are two threshold effects between leverage and firm performance. When the debt ratio is low, then firm performance, proxied by Tobin's Q, increases following an increase in leverage. When the leverage is high, there is no evidence of a relationship between leverage and firm performance. A similar threshold-based study on selected Vietnamese firms by uses debt ratio as a threshold, as in earlier studies, and examines the relationship between leverage and ROE, their measure of firm performance. They find that there exists a double threshold effect between leverage and firm performance such that if debt level is in the low threshold regime, it promotes firm performance but if in the high threshold regime, it dampens firm performance. Taken together, these studies suggest that there are threshold effects in the relationship between leverage and firm performance. However, their focus is on the threshold effect of leverage on the leverage-performance nexus and little is known of the threshold effect of other firm performance determinants such as firm size on the leverage-performance nexus.

In the context of Nigeria and similar developing countries, several studies have looked at the relationship between leverage and firm performance and between firm size and firm performance. Onaolapo and Kajola (2010) investigate the impact of capital structure on the performance of Nigeria's listed firms, focusing on the real sector. They find that high debt ratio has a significant negative effect on firm performance such as return on assets and return on equity and therefore their results are in support of the agency costs theory's position. Using profit efficiency of banks as an indicator for agency costs and the equity ratio of banks as an indicator for leverage, Pratomo and Ismail (2006) examine the impact of capital structure on performance in Malaysia. Their findings were also consistent with the agency hypothesis. Simon-Oke and Afolabi (2011) examine the impact of capital structure on industrial performance in Nigeria using debt financing as a proxy for capital structure and profit efficiency as a proxy for firm performance. Their results, which echo previous findings, show a negative relationship between debt financing and performance. Pratheepkanth (2011) studies the capital structure and financial performance of Sri Lanka's listed companies, proxying capital structure with debt and firm performance with return on capital employed (ROCE) and return on assets (ROA). The results show that the relationship between leverage and performance is negative so that an increase in debt weakens performance of firms. On the size and performance nexus, Mashayekhi and Bazaz (2008), Azeez (2015) and Olokoyo (2013), among others, show that firm size is positively related to firm performance as larger firms are better able to optimally utilize economies of scale. On the contrary, Klapper and Love (2004) find that larger companies may incur inefficiencies that result in poor performance. All these studies have one thing in common – they

employ linear empirical techniques and thus disregard the nonlinearities or threshold effects in the leverage-performance nexus.

Indeed, the contingent role of firm size in the relationship between leverage and firm performance has been scarcely investigated. In the few instances where an attempt has been made, the empirical modelling strategy adopted is linear and imposes an a priori restriction that the effect of leverage on firm performance is congruent across all values of firm size. However, this assumption might be too restrictive as the relationship may be nonlinear and different firm sizes may well imply different relationships between leverage and firm performance. We seek to plug this gap in the literature by adopting a more flexible empirical specification that allows different possible relationships between leverage and firm performance for different firm sizes. Thus, in this paper, we adopt an intuitive approach to empirically model the effect of leverage on firm performance by examining the role of firm size in the relationship between leverage and firm performance. We utilize Hansen (1999) threshold regression model which is based on the concept of threshold effects. We draw on an important variable– firm size – to determine the extent to which it provides a new insight into the leverage-firm performance nexus. This enables us to determine appropriate levels of firm size at which leverage might either dampen or enhance firm performance.

3. Data samples

This section describes the data employed for the empirical analysis. The data samples comprise different measures of leverage being total debt-to-asset ratio, long-term debt-to-asset ratio and short-term debt-to-asset ratio. Firm performance is represented by accounting performance measures (ROA and ROE) and market performance measure (Tobin's Q). We also include other variables such as firm size (the threshold variable), tax rate and firm age. The leverage variables are the independent variables of interest, while firm performance is the dependent variable. We utilize the same data samples as in Olokoyo (2013). The data samples have been sourced from the Nigerian Stock Exchange (NSE) Factbook and the published annual reports of listed companies in Nigeria. The samples cover 101 non-financial firms from 26 subsectors for period 2003 – 2007.

3.1. Descriptive statistics

The summary statistics are presented below. The overall mean ROA across the listed firms from 2003 to 2007 is 8.04% while for ROE and Tobin's Q, it is 459.07% and 93.32% respectively. ROA ranges from −602.08% to 371.04% while ROE and Tobin's Q range from −69634% to 155861% and 8.71% to 716.84% respectively. The unusually large and volatile ROE, which is several times the average inflation rate of below 20% in the period, is driven by the high and volatile operating profit, operating efficiency and, to some extent, financial leverage that characterized the listed nonfinancial firms in Nigeria pre- 2007 recession. A cursory look at the data suggests that the supernormal ROE emanates from the few large cap corporations, many of which have medium to high levels of profit margins and are known to be operationally efficient and employ a sizable amount of financial leverage to expand ROE. In a related study, Olokoyo (2013) notes that the very high ROE may reflect the lower corporate tax rate imposed on listed firms in Nigeria. This lower tax rate drives higher margins, the result being a decent level of operating profit even in cost-burdened industries.

We note that the story is quite different for ROA which is more or less at normal levels and reflects the series of organic expansion drives that some of Nigeria's major firms had embarked on. This stabilized the ROA as returns from capacity expansion have a lagged effect which materialized only after several years, post capacity expansion, when production got ramped up and plants began to work at higher capacities. Finally, Tobin's Q, which measures the market performance of firms, averaged over 90% in the period under consideration and is less volatile. As the estimation of Tobin's Q involves the market value of the listed firms, and given that most listed firms in Nigeria rallied significantly prior to the recession commencing in late 2007, it is realistic to posit that the high Tobin's Q for the period reflects the significant wealth that listed firms created in the period, because of the frequent rally of share prices.

Meanwhile, it is seen from Table 1 that the measures of leverage, total debt-total asset (TDTA), long-term debt-total asset (LTDTA) and short-term debt-to-total asset (STDTA), have mean values of 73.5%, 27.6% and 45.9%. The figures reveal that for the firms in our sample, short-term debt is about twice as large as long-term debt, implying either short-term debt has been more accessible in relation to long-term debt and/or firms have had an elevated need to fund large deficits in working capital and thus resorted to employing short-term debt. Meanwhile, Table 2 shows the cross correlations among the selected variables, revealing that the magnitudes of most

Table 2
Cross Correlation Matrix.

	ROE	TOB	TDTA	LTDTA	STDTA	SIZE
ROA						
ROE	1					
TOB Q	−0.0688	1				
TDTA	−0.0623	0.9663	1			
LTDTA	−0.0584	0.6705	0.6781	1		
STDTA	−0.0429	0.8271	0.8666	0.2209	1	
SIZE	0.0155	0.336	−0.2697	−0.2521	−0.1867	1

Note: ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/ equity), Tob Q (Tobins Q) equals (Market value of equity + book value of debt)/book value of assets; TDTA is the total debt divided/total assets; LTDTA is the long-term debt/total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA

correlation coefficients are moderate. We analyse a cross-correlation matrix to obtain a preliminary view of the bivariate associations between variables in the study before a more formal empirical analysis or investigation is performed. The cross correlation also helps to objectively determine how much similarity there are between variables to ensure that we are including appropriate variables in the regression model and that multicollinearity is not a big issue in our empirical analysis.

4. Empirical methodology

In this section, we first motivate the need for a threshold analysis and then we provide a brief description of the Hansen (1999) threshold regression model on which the empirical analysis presented in this paper is based.

4.1. Why threshold analysis of the impact of leverage on firm performance?

A weakness of existing empirical analysis, and a potential reason for the sometimes-ambiguous findings on the effects of leverage on firm performance, is the assumption of complete linearity of the regression models on which the findings are based. To be clear, most existing empirical strategies (see literature) impose an ex ante assumption that the relationship between leverage and firm performance is either increasing or decreasing monotonically/linearly with the regressors in the regression model, so that whenever high leverage implies either a decline or an increase in firm performance, then this must be true for all values of $C < c_1$ and $C > c_1$ where C is a member or subset of the vector containing the other regressors and c_1, which is any real number, is a value of C at some point in time. However, in general, this assumption is not always supported empirically. There are cases where, for instance, leverage weakens firm performance only for some C, i.e. either for $C < c_1$ or $C > c_1$, but not both, i.e. not for all $C > c_1$ and $C < c_1$. This implies it is plausible to have a combination of high leverage and weakened firm performance for $C < c_1$ but then obtain either a combination of high leverage and improved firm performance or no evidence of a combination of high leverage and weakened firm performance for $C > c_1$ or other possible combinations that connote different kinds of relationships between leverage and firm performance along the range of different values of C. These are plausible scenarios which most empirical strategies employed in previous studies investigating the leverage-firm performance nexus fail to acknowledge. Accordingly, we draw on the threshold regression model, to address this concern.

The threshold regression model is a nonlinear approach that allows for instances in which the relationships between two variables, say leverage and firm performance, can be different at some sections of the data. In this model, samples are split into regimes $C > c_1$ and $C < c_1$ for all values of leverage. This allows one to study the impact of leverage on firm performance by considering all possible scenarios. The variable $C \in V$, where V is the vector of all possible regressors in the model, is called the threshold variable that divides samples into different regimes, while c_1 is the threshold value associated with$C$, where c_1, which is usually estimated from data, is an element of the support of C. This empirical framework provides a more generalized and flexible specification as it accommodates different kinds of relationships between leverage and firm performance for different levels of thresholds and allows for the study of the relationship between leverage and firm performance in a more holistic manner. We use firm size as the threshold variable as we aim to study how leverage weakens firm performance for different firm sizes.

4.2. The threshold model

The model has a dependent variable, focus regressor, threshold and control variables. The focus regressor in this paper, the regressor of interest, is the debt ratio (leverage) – total debt-total asset (TDTA), long-term debt-total asset (LTDTA) and short-term debt-to-total asset (STDTA). In general, different forms of the model are possible. In this paper, we follow Hansen (1999) and consider the form in which the focus regressor, threshold and control variables are exogenous. The structural threshold regression model is given by

$$y_{it} = \beta_1' x_{it} I(q_{it} \leqslant \gamma) + \beta_2' x_{it} I(q_{it} > \gamma) + \nu_{it}, \tag{1.1}$$

where $\nu_{it} = \mu_i + e_{it}$

The observed data samples are drawn from a panel $\{y_{it}, q_{it}, x_{it}: 1 \leqslant i \leqslant n, 1 \leqslant t \leqslant T\}$, where i and t represent firm and time indexes respectively, x_{it} is a set of regressors which contain the focus regressor while q_{it} is the threshold variable which can be a member of x_{it} and is assumed to follow a continuous distribution, μ_i constitutes firms' unobserved time invariant fixed effects.

The above structural equation can be written as

$$y_{it} = \mu_i + \beta_1' x_{it} I(q_{it} \leqslant \gamma) + \beta_2' x_{it} I(q_{it} > \gamma) + e_{it} \tag{1.2}$$

where y_{it} is a real-valued scalar variable, x_{it} is an $m \times 1$ vector of regressors, q_{it} is a scalar threshold variable, with $Dim(y_{it}) = Dim(q_{it})$, γ is the unobserved threshold value which needs to be estimated, β_1' and β_2' are vectors of slope parameters associated with the different regimes $A = \{q_{it} | (q_{it} \leqslant \gamma)\}$ and $B = \{q_{it} | (q_{it} > \gamma)\}$ and $I(.)$ is the indicator function defined for an arbitrary element d in a set $A \cup B$ as

$$I(d) = \begin{cases} 1 & d \in A \cup B \\ 0 & otherwise \end{cases} \tag{1.3}$$

where $A = \{q_{it} | (q_{it} \leqslant \gamma)\}$, $B = \{q_{it} | (q_{it} > \gamma)\}$ and $A \cap B = \varnothing$ since A and B are disjoint. The vector of regressors x_{it} contains both the focus regressor and control variables, both of which are assumed exogenous.

From above, two scenarios are possible, depending on whether $d \in \{q_{it} | (q_{it} \leqslant \gamma)\}$ or $d \in \{q_{it} | (q_{it} > \gamma)\}$. This yields the two different regimes as given below

$$y_{it} = \begin{cases} \mu_i + \beta_1' x_{it} + e_{it} q_{it} \leqslant \gamma \\ \mu_i + \beta_2' x_{it} + e_{it} q_{it} > \gamma \end{cases}. \tag{1.4}$$

An alternative representation of the model is obtained when both regimes are written compactly, so that the slope parameters are set in a row vector, while the regressors and thresholds are represented in a column vector, i.e.

$$y_{it} = \mu_i + (\beta_1', \beta_2') \begin{pmatrix} x_{it} I(q_{it} \leqslant \gamma) \\ x_{it} I(q_{it} > \gamma) \end{pmatrix} + e_{it} \tag{1.5}$$

$$y_{it} = \mu_i + \beta' x_{it}(\gamma) + e_{it}, \tag{1.6}$$

where $\beta = (\beta_1', \beta_2')'$ and $x_{it}(\gamma) = \begin{pmatrix} x_{it} I(q_{it} \leqslant \gamma) \\ x_{it} I(q_{it} > \gamma) \end{pmatrix}$The observations from the data samples are divided into regimes – 1) when the threshold variable is at most its threshold value, i.e. $q_{it} \leqslant \gamma$, and 2) when the threshold variable is above its threshold value, i.e. $q_{it} > \gamma$. The slopes β_1' and β_2' associated with 1 and 2 are then estimated. For identification of β_1' andβ_2', both x_{it} and q_{it} cannot be time invariant.

Notice that the error component ν_{it} has been split into two parts $\nu_{it} = \mu_i + e_{it}$, where e_{it} is assumed to be an independent and identically distributed (iid) zero mean idiosyncratic random disturbance with constant and finite variance σ^2 i.e. $e_{it} \sim iid\, N(0, \sigma^2)$. The iid assumption requires that the regressors x_{it} and threshold variable q_{it} exclude endogenous variables, which can correlate with the error term. Thus, e_{it} is a martingale difference sequence $\{e_{it}, \mathscr{F}_t\}$ on the probability space $(\Omega, \mathscr{F}, \mathbb{P})$ for each i since $\mathbb{E}(e_{it}) = 0 < \infty$ and $\mathbb{E}(e_{it} | \mathscr{F}_{t-1}) = 0$, where $\mathscr{F}_t$ is a natural filtration at time t. Similarly, $\mathbb{E}(e_{it} | q_{it}) = \mathbb{E}(e_{it} | x_{it}) = 0$ and (x_{it}, q_{it}) are measurable with respect to $\mathscr{F}_{t-1}$, i.e. $(x_{it}, q_{it}) \in \mathscr{F}_{t-1}$, where $\mathscr{F}_{t-1}$ is the sigma field generated by $\aleph = \{x_{(i-j)t}, q_{(i-j)t}, e_{(i-1-j)t} : j \geqslant 0\}$. These assumptions ensure results from the model cannot be extended to models with endogenous regressors and/or heteroscedastic and serially correlated errors.

4.2.1. Estimating the model

In estimating the above model, the first step is to eliminate firm specific effects, μ_i. Since the panel is balanced, we follow Hansen (1999) and eliminate μ_i using the within transformation wherein contemporaneous observations are subtracted from the within group average for each variable. This transformation yields an idempotent matrix of the transformed error terms which in turn ensures that the distributional assumption of the original threshold model is preserved and serial correlation is avoided.

The within transformation of (1.1) yields

$$y_{it}^{\perp} = \beta' x_{it}^{\perp}(\gamma) + e_{it}^{\perp}, \tag{1.7}$$

where

$$y_{it}^{\perp} = \left(y_{it} - \frac{1}{T} \sum_{t=1}^{T} y_{it} \right), e_{it}^{\perp} = \left(e_{it} - \frac{1}{T} \sum_{t=1}^{T} e_{it} \right) \text{and} \beta' = (\beta_1', \beta_2') \tag{1.8}$$

and

$$\mathrm{x}_{\mathrm{it}}^{\perp}(\gamma) = \begin{pmatrix} \mathrm{x}_{\mathrm{it}} I(\mathrm{q}_{\mathrm{it}} \leqslant \gamma) - \frac{1}{\mathrm{T}} \sum_{\mathrm{t}=1}^{\mathrm{T}} \mathrm{x}_{\mathrm{it}} \mathrm{I}(\mathrm{q}_{\mathrm{it}} \leqslant \gamma) \\ \mathrm{x}_{\mathrm{it}} I(\mathrm{q}_{\mathrm{it}} > \gamma) - \frac{1}{\mathrm{T}} \sum_{\mathrm{t}=1}^{\mathrm{T}} \mathrm{x}_{\mathrm{it}} \mathrm{I}(\mathrm{q}_{\mathrm{it}} > \gamma) \end{pmatrix} \tag{1.9}$$

Let

$$y_i^{\perp} = \begin{pmatrix} y_{i2}^{\perp} \\ \vdots \\ y_{iT}^{\perp} \end{pmatrix}, x_i^{\perp}(\gamma) = \begin{pmatrix} x_{i2}^{\perp}(\gamma)' \\ \vdots \\ x_{iT}^{\perp}(\gamma)' \end{pmatrix}, e_i^{\perp} = \begin{pmatrix} e_{i2}^{\perp} \\ \vdots \\ e_{iT}^{\perp} \end{pmatrix} \tag{1.10}$$

denote the stacked data and errors associated with firm i, with one-time period deleted as in Hansen (1999). Furthermore, let $Y^{\perp}, X^{\perp}$and $\varepsilon^{\perp}$ denote the data stacked over all firms in the usual way of panel estimation,

$$Y^{\perp} = \begin{pmatrix} y_1^{\perp} \\ \vdots \\ y_i^{\perp} \\ \vdots \\ y_n^{\perp} \end{pmatrix}, X^{\perp}(\gamma) = \begin{pmatrix} x_1^{\perp}(\gamma) \\ \vdots \\ x_i^{\perp}(\gamma) \\ \vdots \\ x_n^{\perp}(\gamma) \end{pmatrix}, e^{\perp} = \begin{pmatrix} e_1^{\perp} \\ \vdots \\ e_i^{\perp} \\ \vdots \\ e_n^{\perp} \end{pmatrix}, \tag{1.11}$$

then the threshold regression model in terms of the stacked data is equivalent to

$$Y^{\perp} = X^{\perp}(\gamma)\beta + e^{\perp}. \tag{1.12}$$

The transformed equation preserves all assumptions made in the original structural equation. Thus, for any γ, the slope parameter β can be estimated by least squares, giving

$$\widehat{\beta}(\gamma) = (X^{\perp}(\gamma)'X^{\perp}(\gamma))^{-1}X^{\perp}(\gamma)'Y^{\perp} \tag{1.13}$$

Once estimated, the vector of regression residuals is obtained from the threshold dependent slope parameter as

$$\hat{e}^{\perp}(\gamma) = Y^{\perp} - X^{\perp}(\gamma)\widehat{\beta}(\gamma) = Y^{\perp} - X^{\perp}(\gamma)(X^{\perp}(\gamma)'X^{\perp}(\gamma))^{-1}X^{\perp}(\gamma)'Y^{\perp}). \tag{1.14}$$

The regression residual is then used to compute the sum of squared errors as $S_1(\gamma) = \widehat{e^{\perp}}(\gamma)'\widehat{e^{\perp}}(\gamma)$where$S_1(\gamma) = Y^{\perp}(I - X^{\perp}(\gamma)'(X^{\perp}(\gamma)'X^{\perp}(\gamma))^{-1}X^{\perp}(\gamma)')Y^{\perp}$. Since the threshold variables are each exogenous, the threshold value γ, which determines the sample split, can be estimated by least squares in line with Hansen (1999). This implies finding $\hat{\gamma}$ γ that minimizes the concentrated sum of squared errors, so that the least squares estimator of γ is $\hat{\gamma} =_{\gamma} \operatorname{argmin} S_1(\gamma)$[1].

After $\hat{\gamma}$ is obtained, the slope parameter estimate is $\widehat{\beta} = \widehat{\beta}(\hat{\gamma})$. It is β important to note that $\widehat{\beta}(\hat{\gamma})$ represents the slope parameters computed at the different regimes partitioned by $\hat{\gamma}$. Thus, the vector of slopes associated with the regimes $I(q_{it} \leqslant \hat{\gamma})$ and $I(q_{it} > \hat{\gamma})$ are given by $\widehat{\beta}_1$ and $\widehat{\beta}_2$. In this instance, β is consistently estimated using least squares as all variables on the right-hand side of the regression are exogenous and the error term satisfies the usual assumptions. Once the estimate $\hat{\gamma}$ of the threshold value γ is obtained, the data sample is partitioned into regimes or groups, based on whether the threshold variables are more or less than the corresponding estimates of their threshold values. The final slope parameters β_1 and β_2 associated with the regimes $I(q_i \leqslant \hat{\gamma})$ and $I(q_i > \hat{\gamma})$ are then estimated, giving $\widehat{\beta}_1 = \widehat{\beta}_1(\hat{\gamma})$ for $I(q_i \leqslant \hat{\gamma})$ and $\widehat{\beta}_2(\hat{\gamma})$ for $I(q_i > \hat{\gamma})$.

4.3. Empirical specification

The purpose of our empirical analysis is to examine whether the relationship between leverage and firm performance is dependent on firm size. Our benchmark threshold model has a vector of debt ratios $LEV = (Lev1, Lev2, Lev3)'$ as the focus regressors, a vector of performance measures $PER = (ROA, ROE, Tobin's\ Q)'$ and control variables. There is one threshold variable, firm size, selected from the set of control variables, so we have a panel threshold regression model which will be estimated to determine the effect of leverage on firm performance for different firm sizes. The threshold regression model is

$$PER_{it} = \mu_i + \beta_1^s LEV_{it} \boldsymbol{I}(C_{it} \leqslant c_1) + \beta_2^s LEV_{it} \boldsymbol{I}(C_{it} > c_1) + \phi^s Controls_{it} + \varepsilon_{it}^s \tag{1.15}$$

where $i = 1,...,n = 101$ represents individual firms, $t = 2003,....T = 2007$, represents time period, μ_i is the time invariant firm-specific fixed effect, PER_{it} represents firm performance defined above, ε_{it}^s is the error term associated with the threshold regression model generated by threshold variable a, where a is firm size and $\boldsymbol{I}(.)$ is the indicator function. To estimate the model, we implement the procedure described in section 4.2 above.

5. Empirical results of threshold analysis of the effect of leverage on firm performance in Nigeria

We estimate the threshold regression model in Eq. (1.15) by fitting it to data as in Hansen (1999). The results are presented in the tables below. For each table, the first row displays the threshold variable, its estimated threshold value and the corresponding 95% confidence interval, where $\hat{c}_1$ represents the estimated threshold value. The second Section, A1, shows the imp $\widehat{\beta}_U$ act of leverage on firm performance; that is, the regime-dependent coefficients of each measure of leverage on each measure of firm performance. In particular, $C_{it} \leqslant \hat{c}_1$ and $C_{it} > \hat{c}_1$ represent low and high threshold regimes, respectively, for the threshold variable (firm size) while $\widehat{\beta}_L$ and $\widehat{\beta}_U$ denote the effects of leverage on growth in the low and high threshold regimes. The third Section A2 show the effect of non-regime dependent regressors on performance while the fourth Section A3 presents the diagnostics.

5.1. Leverage and ROA

In this section, we present and discuss results of the impact of the three leverage measures on firm performance, ROA. The results, shown in Tables 3.1–3.3, are the effects of total debt-to-asset ratio, long-term debt-to-asset ratio and short-term debt-to-asset ratio on ROA, respectively.

Table 3.1 shows the results of estimating the benchmark threshold regression model in Eq. (1.15) using total debt-to-asset ratio and ROA as our measure of leverage and firm performance, respectively. The threshold variable is firm size. As shown in the table, the

Table 3.1
Threshold value estimates and regime dependent slope coefficients–dependent variable is ROA.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	6.202	[6.200, 6.206]
A1. Impact of total debt to asset ratio on firm performance – ROA		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
C_{it}	-0.407^{***}	0.047
	(12.58)	(1.21)
A2. Impact of other covariates on firm performance – ROA		
Size		-0.078^{**}
		(2.41)
Tax		0.032
		(1.46)
A3. Threshold Regression Diagnostics		
No of Observations		505
Adjusted R^2		0.2265
F-Stat		42.81
Prob (F-Stat)		0.0000

Note: Results are obtained using Hansen (1999) estimation where regressors are taken as exogenous. The threshold variables are assumed to be exogenous, in line with Hansen (1999). Firm size is the threshold variables. Significance is denoted by $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$. ROA is the return on assets (EBIT/ total assets), ROE is the return on equity (EBIT/equity), Tob Q (Tobin's Q) = (Market value of equity + book value of debt)/book value of assets, TDTA is the total debt divided/ total assets; LTDTA is the long-term debt/total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

Table 3.2
Threshold value estimates and regime dependent slope coefficients –dependent variable is ROA.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	6.211	[6.197, 6.228]
A1. Impact of long-term debt to asset ratio on firm performance – ROA		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
C_{it}	-0.792^{***}	-0.118
	(15.50)	(1.20)
A2. Impact of other covariates on firm performance – ROA		
Size		-0.059^{**}
		(1.99)
Tax		0.020
		(0.99)
A3. Threshold Regression Diagnostics		
No of Observations		505
Adjusted R^2		0.2825
F-Stat		63.52
Prob (F-Stat)		0.0000

Note: Results are obtained using Hansen (1999) estimation where regressors are taken as exogenous. . The threshold variables are assumed to be exogenous, in line with Hansen (1999). Firm size is the threshold variables. Significance is denoted by $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$. ROA is the return on assets (EBIT/ total assets), ROE is the return on equity (EBIT/ equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/ book value of assets, TDTA is the total debt divided/ total assets; LTDTA is the long-term debt/total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

threshold estimate (in log) is 6.202. Thus, firms with size of more than 6.202 are classified as high-SIZE group (i.e. large-sized firms) while firms with size below this level are classified as low-SIZE group (i.e. small-sized firms). The coefficient of leverage is negative and significant for the low-SIZE group but not for the high-SIZE group. This finding sets the stage in support of our initial hypothesis as it indicates the presence of a threshold effect such that the impact of leverage on ROA is contingent on firm size and changes as we move from low to high firm size. Leverage has a negative effect on ROA when firm size is small, below the threshold level. For firms with size larger than the estimated threshold level, there is no evidence that leverage dampens firm performance.

Tables 3.2 and 3.3 also report the results when the measures of leverage are long-run and short-run debt- to-asset ratios respectively. The results continue to show that leverage has a significantly negative impact on firm performance only when firm size is low. For large-sized firms, we cannot find any significant evidence that an increase in leverage weakens ROA. Thus, we find empirical

Table 3.3
Threshold value estimates and regime dependent slope coefficients –dependent variable is ROA.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	6.202	[6.120, 6.206]
A1. Impact of short-run debt to asset ratio on firm performance − ROA		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
	-0.236^{***}	0.079
	(4.62)	(1.47)
A2. Impact of other covariates on firm performance – ROA		
Size		0.022
		(0.60)
Tax		0.029
		(1.16)
A3. Threshold Regression Diagnostics		
No of Observations		505
Adjusted R^2		0.1002
F-Stat		7.28
Prob (F-Stat)		0.0000

Note: Results are obtained using Hansen (1999) estimation where regressors are taken as exogenous. The threshold variables are assumed to be exogenous, in line with Hansen (1999). Firm size is the threshold variables. Significance is denoted by $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$. ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/ equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/book value of assets, TDTA is the total debt divided/ total assets; LTDTA is the long-term debt/total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

evidence that firm size provides insights into the reason for an ambiguous relationship between leverage and firm performance. In all, the magnitude of the negative effects of leverage on ROA for small-sized firms is generally higher than the magnitude of the insignificant impact of leverage on ROA for large-sized firms. This suggests that when leverage has a negative impact on ROA, the impact is more pronounced on small-sized companies.

5.2. Leverage and ROE

Turning now to the effect of the three measures of leverage on the second accounting measure of firm performance, ROE, we see that, like the magnitude of ROE from the summary statistics, the coefficient of the effect of each leverage measure on ROE is very high in magnitude. However, as in the case for ROA, we find that the three measures of leverage – total debt to asset, long-term debt to asset and short-term debt to asset ratios – all have a negative effect on ROE for firms in the small-SIZE group. The results are shown in Tables 3.4–3.6, and represent the effects of total debt-to-asset ratio, long-term debt-to-asset ratio and short-term debt-to-asset ratio on ROA, respectively.

The negative effect of leverage on ROE for small-sized firms is highest when short-term debt to asset ratio is the measure of leverage and least when the leverage measure is total debt to asset ratio. Therefore, small-sized firms are better positioned to lessen ROE declines if the amount of short-term debt in their capital structure is optimally minimized. To the extent that our results are supported, this evidence is only true for small-sized firms and does not extend to large-sized firms. In fact, as with the case of ROA, we continue to find evidence that leverage has no significant effect on firm performance for large-sized firms, and the magnitude of the negative effect of leverage on firm performance for small-sized firms is several times higher than the magnitude of the insignificant effect of leverage on firm performance for large-sized firms. The threshold estimates for firm size, which splits the sample into high-SIZE and low-SIZE regimes, are 5.236, 5.346 and 5.236 when the leverage measures are total debt to asset, long-term debt to asset and short-term debt to asset ratios respectively.

5.3. Leverage and Tobin's Q

Finally, Tables 3.7–3.9 report the results of the impact of the three leverage measures – total debt-to-asset ratio, long-term debt-to-asset ratio and short-term debt-to-asset ratio – on Tobin's Q, a measure of firm market performance. Contrary to results for ROA and ROE, and in line with Olokoyo (2013) and several other studies, we find that the three measures of leverage are positively linked with Tobin's Q and the relationship is significant, suggesting that higher levels of leverage in the capital structure of listed firms in Nigeria are associated with a stronger firm market performance. Our results however indicate that the positive effect is mostly much stronger in the low-SIZE regime for all measures of leverage.

To be clear, the estimated threshold levels for firm size are 6.578, 7.533 and 3.978 when the measures of leverage are total debt to asset, long-term debt to asset and short-term debt to asset ratios respectively. The coefficient of leverage is positive and strongly significant in both regimes for all of the three measures of leverage. However, the strength of the positive relationship depends on the size of the firm and is mostly higher for small-sized firms. The positive effect of leverage on firm market performance for small-sized

Table 3.4
Threshold value estimates and regime dependent slope coefficients –dependent variable is ROE.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	5.236	[5.154, 5.236]
A1. Impact of total debt to asset ratio on firm performance – ROE		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
	-100.407^{***}	0.334
	(6.72)	(0.05)
A2. Impact of other covariates on firm performance – ROE		
Size		-42.833^{***}
		(4.56)
Tax		0.799
		(0.17)
A3. Threshold Regression Diagnostics		
No of Observations		505
Adjusted R^2		0.0111
F-Stat		11.39
Prob (F-Stat)		0.0000

Note: Results are obtained using Hansen (1999) where regressors are taken as exogenous.The threshold variables are assumed to be exogenous, in line with Hansen (1999). Firm size is the threshold variables. Significance is denoted by $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$. ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/book value of assets, TDTA is the total debt divided/ total assets; LTDTA is the long-term debt/ total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

Table 3.5
Threshold value estimates and regime dependent slope coefficients –dependent variable is ROE.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	5.346	[5.214, 5.358]
A1. Impact of long-run debt to asset ratio on firm performance – ROE		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
	-103.882^{***}	-3.791
	(3.16)	(0.29)
A2. Impact of other covariates on firm performance – ROE		
Size		-16.729^{*}
		(-1.88)
Tax		0.6233
		(0.12)
A3. Threshold Regression Diagnostics		
No of Observations		505
Adjusted R^2		0.0034
F-Stat		2.51
Prob (F-Sta)		0.0417

Note: Results are obtained using Hansen (1999) where regressors are taken as exogenous.The threshold variables are assumed to be exogenous, in line with Hansen (1999). Firm size is the threshold variables. Significance is denoted by $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$. ROA is the return on assets (EBIT/ total assets), ROE is the return on equity (EBIT/ equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/book value of assets, TDTA is the total debt divided/ total assets; LTDTA is the long-term debt/ total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

firms is highest when short-term debt to asset ratio is the measure of leverage and least when the leverage measure is total debt to asset ratio. For firms in the high-size group, i.e. the large-sized firms, the positive effect is strongest when long-term debt to asset ratio is the measure of leverage and weakest when the measure of leverage is total debt to asset ratio. Accordingly, large-sized firms can boost their market performance if they favour a higher portion of long-term debt in their capital structure whereas small-sized firms can boost market performance by embracing a higher proportion of short-term debt in their capital structure.

In all, our result suggests that irrespective of the measure of leverage, when the effect of leverage is positive or negative on firm performance, the effects are mostly magnified in the small-SIZE group, meaning the extent of positive or negative effect of leverage on firm performance is mostly higher and more pronounced for small-sized companies in comparison to large-sized companies. Meanwhile, as a by-product, our results consistently find that tax does not impact firm performance, and the positive relationship

Table 3.6
Threshold value estimates and regime dependent slope coefficients –dependent variable is ROE.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	5.236	[5.179, 5.236]
A1. Impact of short-run debt to asset ratio on firm performance – ROE		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
	-178.37^{***}	2.971
	(8.04)	(0.40)
A2. Impact of other covariates on firm performance – ROE		
Size		-42.22^{***}
		(4.98)
Tax		0.665
		(0.14)
A3. Threshold Regression Diagnostics		
No of Observations		505
Adjusted R^2		0.0178
F-Stat		16.36
Prob (F-Stat)		0.0000

Note: Results are obtained using Hansen (1999) where regressors are taken as exogenous. The threshold variables are assumed to be exogenous, in line with Hansen (1999). Firm size is the threshold variables. Significance is denoted by $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$. ROA is the return on assets (EBIT/ total assets), ROE is the return on equity (EBIT/ equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/book value of assets, TDTA is the total debt divided/ total assets; LTDTA is the long-term debt/ total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

Table 3.7
Threshold value estimates and regime dependent slope coefficients –dependent variable is Tobin's Q.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	6.578	[6.571, 6.581]
A1. Impact of total debt to asset ratio on firm performance – Tobin's Q		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
	1.0146^{***}	0.980^{***}
	(95.48)	(75.57)
A2. Impact of other covariates on firm performance – Tobin's Q		
Size		−0.005
		(0.45)
Tax		−0.0002
		(0.03)
A3. Threshold Regression Diagnostics		
No of Observations		505
Adjusted R^2		0.9368
F-Stat		3483.64
Prob (F-Stat)		0.0000

Note: Results are obtained using Hansen (1999) where regressors are taken as exogenous. The threshold variables are assumed to be exogenous, in line with Hansen (1999). Firm size is the threshold variables. Significance is denoted by $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$. ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/ book value of assets, TDTA is the total debt divided/total assets; LTDTA is the long-term debt/ total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

between firm size and performance is not robust or consistently supported in our analysis.

Putting everything together, our results suggest that leverage boosts the market performance of all sizes of firms, though the positive impact varies, to a considerable extent, with firm size. However, leverage dampens the accounting performance of firms in the small-SIZE regime. The results also suggest that there is a trade-off on the type of leverage to adopt for firms in the small-SIZE regime. This is because while such firms are better positioned to boost ROE if the amount of short-term debt in their capital structure is optimally minimized, they stand to benefit more from an improved market performance (Tobin's Q) if they increase the size of short-term debt in their capital mix. Thus, it appears that small-sized firms cannot simultaneously achieve both goals of improving accounting performance and market performance via leverage. If they minimize short-term debt in order to limit the fall in accounting performance, they would lose out on maximizing the gain in market performance. We find no evidence that this trade-off

Table 3.8
Threshold value estimates and regime dependent slope coefficients –dependent variable is Tobin's Q.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	7.533	[7.523, 7.537]
A1. Impact of long-run debt to asset ratio on firm performance – Tobin's Q		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
C_{it}	1.152***	4.489***
	(14.82)	(9.78)
A2. Impact of other covariates on firm performance – Tobin's Q		
Size		−0.134***
		(2.91)
Tax		0.016
		(0.50)
A3. Threshold Regression Diagnostics		
No of Observations		505
Adjusted R^2		0.4287
F-Stat		88.09
Prob (F-Stat)		0.0000

Note: Results are obtained using Hansen (1999) where regressors are taken as exogenous. The threshold variables are assumed to be exogenous, in line with Hansen (1999). Firm size is the threshold variables. Significance is denoted by *p < .10; **p < .05; ***p < .01. ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/ equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/book value of assets, TDTA is the total debt divided/ total assets; LTDTA is the long-term debt/ total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

Table 3.9
Threshold value estimates and regime dependent slope coefficients –dependent variable is Tobin's Q.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	3.978	[3.963, 4.024]
A1. Impact of short-run debt to asset ratio on firm performance – Tobin's Q		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
	1.679***	1.085***
	(12.86)	(34.24)
A2. Impact of other covariates on firm performance – Tobin's Q		
Size		0.001
		(0.03)
Tax		−0.010
		(0.49)
A3. Threshold Regression Diagnostics		
No of Observations		505
Adjusted R^2		0.7234
F-Stat		335.53
Prob (F-Stat)		0.0000

Note: Results are obtained using Hansen (1999) where regressors are taken as exogenous. The threshold variables are assumed to be exogenous, in line with Hansen (1999). Firm size is the threshold variables. Significance is denoted by *p < .10; **p < .05; ***p < .01. ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/ equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/book value of assets, TDTA is the total debt divided/total assets; LTDTA is the long-term debt/ total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

extends to firms in the high-SIZE regime. We perform further robustness checks by including to our set of regressors the ages of the firms in our sample. The results, reported in the appendices, continue to reiterate most of the above findings.

An important question that naturally follows considering the findings in this paper is 'why is the impact of leverage on firm performance different for different firm sizes and why does leverage weaken the accounting performance of small-sized firms but not so for large-sized firms?' We believe that compared to small-sized firms, large-sized firms in Nigeria's real sectors are better able to position themselves and utilize economies of scale to their advantage. Thus, compared to their small-sized counterparts, they are better able to generate earnings or returns on assets that offset their average cost of leverage. The large-sized firms are also able to attract significantly more favourable debt deals, with favourable borrowing terms than their smaller counterparts, due to their perceived superiority over their smaller counterparts. All these explain why financial leverage relates negatively with the accounting

performance of small firms but has no evidence of a negative influence on the performance of large firms. A major policy or corporate governance implication of our findings is the suggestion that Nigeria's listed real-sector firms can improve performance by either decreasing leverage and/or increasing non– debt financing in their capital mix. If they increase leverage, this should be done on the back of an increase in their sizes to help lessen the negative influence of leverage on performance.

6. Summary of results and implications for firm corporate governance and policymakers

Our results show that the negative effect of leverage on firm performance is most eminent and significant for small-sized firms; however, the effect diminishes as a firm grows, eventually vanishing when firm size exceeds its estimated threshold level. This implies firm size does influence the link between leverage and firm performance, so that there exists a level or 'cut-off point' of firm size such that the relationship between leverage and firm performance changes. We find that this outcome continues to hold, irrespective of the debt ratios utilized. Our results also show that the effect of leverage on Tobin's Q is positive for Nigeria's listed firms and that the strength of the positive relationship depends on firm size; it is mostly higher for small-sized firms.

Given this, a plausible empirical explanation for the differences in the effect of leverage on firm performance documented in the literature could be the failure of existing empirical studies to model the contingent role that firm size plays in the leverage-performance nexus. Our results confirm that firm size provides some explanation for the ambiguous relationship between leverage and firm performance. That is, there exists an optimal level of firm size at which leverage does not diminish firm performance.

This finding suggests that size is a crucial factor as large-sized firms in Nigeria are better able to reap the benefits of leverage than their smaller counterparts. Thus, when deciding whether increasing leverage is a viable option for firms, management and policymakers should particularly consider the influence of firm size in their decision-making process as it could be the 'game changer' and deciding factor on the impact that leverage will ultimately have on firm performance. The evidence of threshold effects implies the existence of nonlinearities between leverage and firm performance, where the nonlinear agent is the firm size. The much-emphasized demerits of leverage, such as exposure to greater financial distress which dampens firm performance, seem to be more of a concern for small firms and less concern for large firms.

One important consequence of our finding is its potential to inspire a tradition where firms take size into consideration before reaching a decision on the amount of debt to include on their balance sheets in a bid to mitigate the negative influence of leverage on performance. This is a fresh perspective that researchers, policymakers and business managers can benefit from and to the best of our knowledge, no previous study has addressed the problem of determining the impact of leverage on firm performance under the threshold framework, with firm size as a threshold variable, for Nigeria's listed firms. Most previous studies on the relationship between leverage and firm performance assume that leverage and firm performance bear a linear or monotonic relationship, an assumption which this paper has shown to be very fragile

7. Conclusion

We present new evidence on the contingent role of firm size in determining the relationship between leverage and firm performance, using data from 101 listed firms in Nigeria over the period 2003 – 2007. We use three measures of leverage – total debt to asset ratio, long-term debt to asset ratio and short-term debt to asset ratio – and three measures of firm performance – ROA and ROE which are firm accounting performance measures and Tobin's Q which represents firm market performance measure. One major contribution of the paper is the use of a new threshold, firm size, and the adoption of the threshold regression model of Hansen (1999) to comprehensively uncover the role of firm size in the relationship between leverage and firm performance. In order words, we ask the question – does size matter in the relationship between leverage and firm performance?

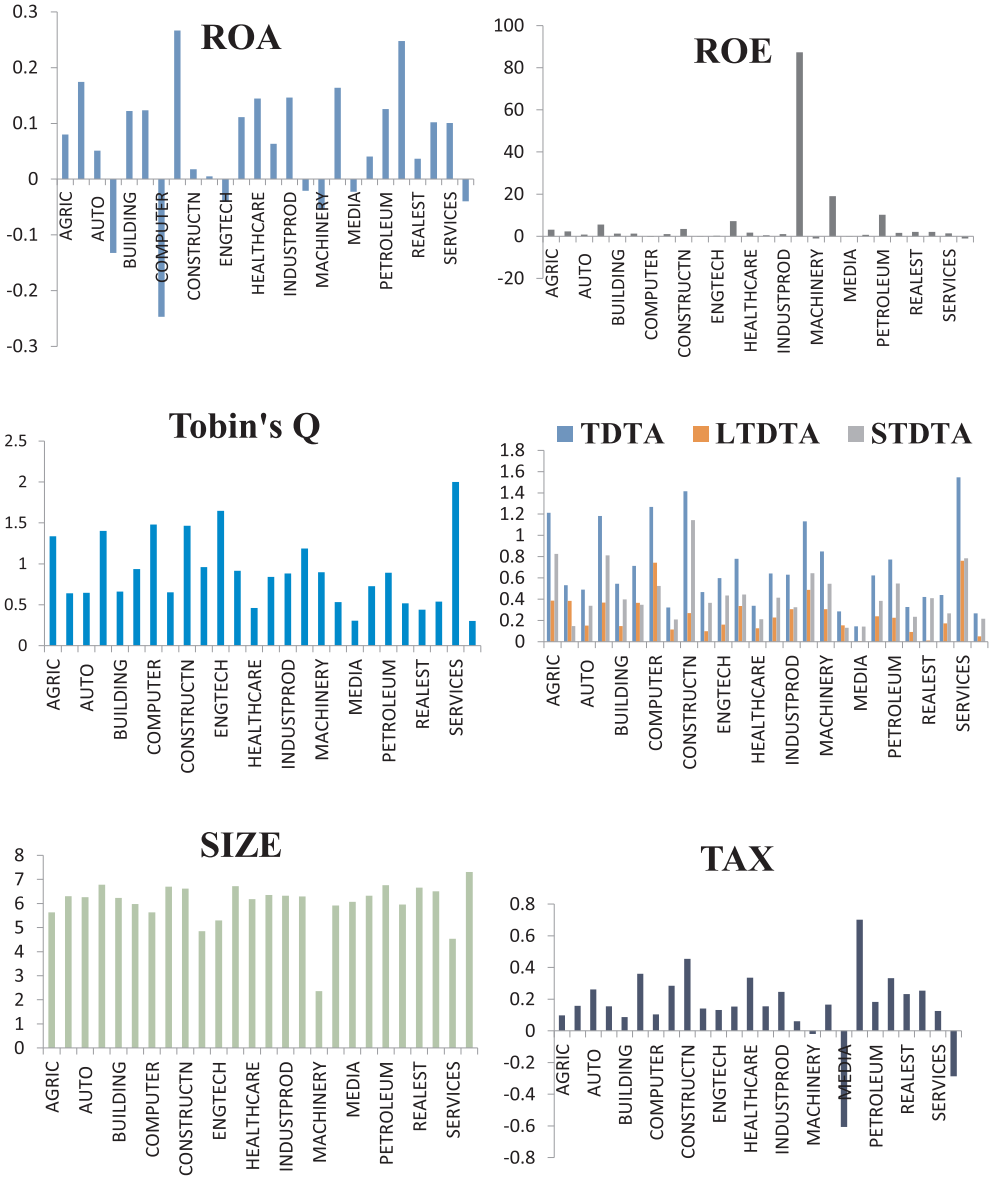
We find that the answer to the above question is yes. Particularly, our results suggest that much of the negative effects of leverage on firm performance are borne by small-sized firms while no evidence exists that the same is true for large-sized firms; this finding holds for the three measures of leverage employed. In the case of Tobin's Q where the impact of leverage on firm performance is positive in both low- and high-SIZE regimes, we find that the positive effect is mostly much stronger in the low-SIZE regime for all measures of leverage. Furthermore, we find that the negative effect of leverage on ROE and ROA for small-sized firms is highest when short-term debt to asset ratio is the measure of leverage while the positive effect of leverage on firm market performance measure (Tobin's Q) for small-sized firms is highest when short-term debt to asset ratio is the measure of leverage, leading to a trade-off between maximizing gains in market performance and minimizing loss in accounting performance via leverage for small-sized firms in Nigeria.

Overall, the highest positive impact of leverage on Tobin's Q occurs when the leverage measure is long-term debt to asset ratio and firms belong to the high-SIZE regime. Thus, we find evidence that less reliance on short-term debt and more reliance on long-term debt appear to be an optimal strategy for large-sized companies but not necessarily for small-sized companies as the highlighted trade-off has revealed. Our evidence of a threshold effect of firm size in the leverage-firm performance nexus is a revealing highlight of this paper because the contingent role of firm size in the leverage-firm performance relationship has never been investigated in the literature.

A weakness of this research, mostly due to data issues, is that we have been unable to control for many other plausible determinants of firm performance because of the difficulty in getting data on listed firms in Nigeria. Our near-term research agenda will be to expand the control variables and extend the current analysis to the few SSA countries with functional stock exchanges. We also aim to include a wider array of plausible thresholds and controls in the threshold model, leading to a system of estimable simultaneous threshold models. Finally, future research will involve an extension of our data to include firms listed on the major stock exchanges of emerging and developed markets.

Appendix A

1. Charts of average values of variables, by industry



Note: ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/book value of assets TDTA is the total debt divided/total assets; LTDTA is the long-term debt/total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

2. Average Values of Variables, by Industry

	ROA	ROE	Tobin's Q	TDTA	LTDTA	STDTA	SIZE	TAX
AGRIC	0.080043	3.13982	1.337703	1.213503	0.387073	0.826427	5.633987	0.098116
AIRLINE	0.174539	2.329095	0.63924	0.531119	0.383448	0.14767	6.301574	0.157308
AUTO	0.051253	0.77824	0.645522	0.489164	0.151518	0.337652	6.257843	0.260625

BREWERIES	−0.13219	5.529585	1.40321	1.18173	0.368927	0.812803	6.774649	0.155296
BUILDING	0.12226	1.270133	0.66265	0.546277	0.147062	0.399217	6.229009	0.086025
CHEMICALS	0.123473	1.307208	0.937644	0.714037	0.365516	0.348521	5.97982	0.359768
COMPUTER	−0.24699	−0.26481	1.48072	1.267828	0.743772	0.524056	5.626481	0.103066
CONGLOMERATE	0.266649	1.085452	0.652039	0.323076	0.114408	0.208668	6.693661	0.284089
CONSTRUCTN	0.017802	3.429023	1.464224	1.414017	0.26972	1.144289	6.618492	0.454161
EMERGMKT	0.004804	0.034567	0.960814	0.466999	0.099956	0.367044	4.84845	0.140622
ENGTECH	−0.04028	0.188296	1.647893	0.597884	0.161951	0.435933	5.299827	0.131951
FOODBEV	0.111354	7.161461	0.916088	0.780976	0.336074	0.444893	6.716195	0.153792
HEALTHCARE	0.144383	1.735351	0.461552	0.337817	0.126062	0.211755	6.174185	0.334677
HOTEL	0.063434	0.452596	0.8412	0.642628	0.227662	0.414966	6.350634	0.154674
INDUSTPROD	0.14643	1.003962	0.881245	0.630398	0.305627	0.32477	6.324612	0.246319
INFOTECH	−0.02069	87.2838	1.186247	1.132811	0.48793	0.64488	6.286231	0.060278
MACHINERY	−0.05477	−1.07663	0.896602	0.849806	0.305221	0.544584	2.355918	−0.02
MARITIME	0.163739	19.02517	0.53202	0.285562	0.154602	0.130961	5.914158	0.164908
MEDIA	−0.02265	0.004973	0.305781	0.14585	0.004018	0.141832	6.070665	−0.60595
PACKAGING	0.040595	0.711619	0.725736	0.622755	0.238425	0.384404	6.322713	0.701972
PETROLEUM	0.125759	10.25365	0.890582	0.773446	0.225662	0.547784	6.756288	0.182107
PRINTING	0.247874	1.612649	0.516285	0.325752	0.091931	0.233821	5.954017	0.332438
REALEST	0.036687	2.067574	0.440202	0.421687	0.012541	0.409146	6.653794	0.231819
ROADTRANS	0.101781	2.023542	0.537719	0.438884	0.171725	0.267159	6.506034	0.253863
SERVICES	0.10057	1.362767	2.000318	1.545987	0.761827	0.78416	4.529318	0.124776
TEXTILES	−0.03958	−1.01166	0.301165	0.26696	0.051106	0.215854	7.30364	−0.28707

Note: ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/book value of assets; TDTA is the total debt divided/total assets; LTDTA is the long − term debt/total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

3. Largest and smallest average values of variables, by Industry

	ROA	ROE	Tobin's Q	TDTA	LTDTA	STDTA	SIZE	TAX
LARGEST	CONGLOMERATE	INFOTECH	SERVICES	SERVICES	SERVICES	CONSTRUCTN	TEXTILES	PACKAGING
LEAST	COMPUTER	MACHINERY	TEXTILES	MEDIA	MEDIA	MARITIME	MACHINERY	MEDIA

Note: ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/equity), Tob Q (Tobins Q) =(Market value of equity + book value of debt)/book value of assets; TDTA is the total debt divided/total assets; LTDTA is the long-term debt/total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

4. Estimated threshold value of firm size and significance level for different measures of leverage

	ROA				ROE				Tobin's Q		
	Thresh Val.	F-stat	P-value		Thresh Val.	F-stat	P-value		Thresh Val.	F-stat	P-value
TDTA	6.2016***	111.69	.000	TDTA	5.2355**	51.74	.013	TDTA	5.1476	6.62	.485
LDTA	6.211	–	–	LDTA	5.1072*	9.73	.090	LDTA	7.5332***	64.52	.000
SDTA	6.2050*	23.66	.088	SDTA	5.2360**	75.88	.020	SDTA	4.1235*	26.01	.070

Note: ROA is the return on assets, ROE is the return on equity; LTDTA is the long-term debt/total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover. Leverage is TDTA, LTDTA or STDTA. Stata threshold regression code fails to return f-stat and p-val. for estimated threshold when leverage is LTDA.

5. Results obtained after controlling for firm age

5.1. Dependent variable is ROA

Table 5.1. Threshold value estimates and regime dependent slope coefficients –dependent variable is ROA.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	6.211	[6.203, 6.215]
A1. Impact of total debt to asset ratio on firm performance – ROA		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
	-0.419^{***}	0.047
	(12.50)	(1.19)
A2. Impact of other covariates on firm performance – ROA		
Size		-0.113^{***}
		(2.41)
Tax		0.086^{**}
		(2.08)
Age		0.014
		(1.16)
A3. Threshold Regression Diagnostics		
No of Observations		480
Adjusted R^2		0.1661
F-Stat		33.98
Prob (F-Stat)		0.0000

Table 5.2. Threshold value estimates and regime dependent slope coefficients –dependent variable is ROA.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	6.211	[6.197, 6.222]
A1. Impact of total debt to asset ratio on firm performance – ROA		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
	-0.803^{***}	-0.129
	(15.24)	(1.28)
A2. Impact of other covariates on firm performance – ROA		
Size		-0.076^{**}
		(2.10)
Tax		0.032
		(0.82)
Age		0.013
		(1.13)
A3. Threshold Regression Diagnostics		
No of Observations		480
Adjusted R^2		0.2190
F-Stat		33.98
Prob (F-Stat)		0.0000

Table 5.3. Threshold value estimates and regime dependent slope coefficients –dependent variable is ROA.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	6.205	[6.124, 6.206]
A1. Impact of short-run debt to asset ratio on firm performance – ROA		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
	-0.242^{***}	0.079
	(4.53)	(1.44)
A2. Impact of other covariates on firm performance – ROA		
Size		0.020
		(0.45)
Tax		0.075
		(1.55)
Age		0.004
		(0.28)
A3. Threshold Regression Diagnostics		
No of Observations		480
Adjusted R^2		0.0916
F-Stat		7.28
Prob (F-Stat)		0.0000

5.2. Dependent variable is ROE

Table 5.4. Threshold value estimates and regime dependent slope coefficients –dependent variable is ROE.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	5.236	[5.165, 5.254]
A1. Impact of total debt to asset ratio on firm performance – ROE		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
C_{it}	-121.45^{***}	-0.1437
	(7.27)	(0.02)
A2. Impact of other covariates on firm performance – ROE		
Size		-64.34^{***}
		(5.33)
Tax		1.874
		(0.20)
Age		2.538
		(0.92)
A3. Threshold Regression Diagnostics		
No of Observations		480
Adjusted R^2		0.0091
F-Stat		10.66
Prob (F-Stat)		0.0000

Table 5.5. Threshold value estimates and regime dependent slope coefficients –dependent variable is ROE.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	5.346	[5.224, 5.3577]
A1. Impact of long-run debt to asset ratio on firm performance – ROE		

	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\widehat{\beta}_L$	$\widehat{\beta}_U$
	-117.47^{***}	-3.98
	(3.27)	(0.30)
A2. Impact of other covariates on firm performance – ROE		
Size		-22.31^{**}
		(2.01)
Tax		1.617
		(0.17)
Age		0.789
		(0.27)
A3. Threshold Regression Diagnostics		
No of Observations		480
Adjusted R^2		0.0033
F-Stat		2.15
Prob (F-Stat)		0.0592

Table 5.6. Threshold value estimates and regime dependent slope coefficients –dependent variable is ROE.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	5.236	[5.179, 5.236]
A1. Impact of short-run debt to asset ratio on firm performance – ROE		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\widehat{\beta}_L$	$\widehat{\beta}_U$
	-178.37^{***}	2.971
	(8.04)	(0.40)
A2. Impact of other covariates on firm performance – ROE		
Size		-64.852^{***}
		(5.90)
Tax		1.146
		(0.13)
Age		2.659
		(0.99)
A3. Threshold Regression Diagnostics		
No of Observations		480
Adjusted R^2		0.0148
F-Stat		15.00
Prob (F-Stat)		0.0000

5.3. Dependent variable is Tobin's Q

Table 5.7. Threshold value estimates and regime dependent slope coefficients –dependent variable is Tobin's Q.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	6.573	[6.571, 6.578]
A1. Impact of total debt to asset ratio on firm performance – Tobin's Q		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\widehat{\beta}_L$	$\widehat{\beta}_U$
	1.0122^{***}	0.9806^{***}
	(94.63)	(76.32)
A2. Impact of other covariates on firm performance – Tobin's Q		

Size	0.003
	(0.22)
Tax	−0.002
	(0.15)
Age	0.003
	(0.86)
A3. Threshold Regression Diagnostics	
No of Observations	480
Adjusted R^2	0.9319
F-Stat	2826.06
Prob (F-Stat)	0.0000

Table 5.8. Threshold value estimates and regime dependent slope coefficients –dependent variable is Tobin's Q.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	7.531	[7.514, 7.533]
A1. Impact of long-run debt to asset ratio on firm performance– Tobin's Q		
	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
	1.113^{***}	4.447^{***}
	(14.11)	(9.56)
A2. Impact of other covariates on firm performance – Tobin's Q		
Size		-0.1911^{***}
		(3.42)
Tax		0.076
		(1.26)
Age		0.0294
		(1.62)
A3. Threshold Regression Diagnostics		
No of Observations		480
Adjusted R^2		0.2959
F-Stat		67.84
Prob (F-Stat)		0.0000

Table 5.9. Threshold value estimates and regime dependent slope coefficients –dependent variable is Tobin's Q.

Threshold Variable	Estimated Thresholds	95% Confidence Intervals
C_{it}	4.1235	[4.1030, 4.1283]
A1. Impact of short-run debt to asset ratio on firm performance – Tobin's Q		
Threshold variable	Lower regime ($C_{it} \leqslant \hat{c}_1$)	Upper regime ($C_{it} > \hat{c}_1$)
	$\hat{\beta}_L$	$\hat{\beta}_U$
	1.848^{***}	1.089^{***}
	(11.24)	(34.08)
A2. Impact of other covariates on firm performance – Tobin's Q		
Size		0.078
		(1.23)
Tax		−0.039
		(0.99)
Age		0.0069
		(0.56)

A3. Threshold Regression Diagnostics	
No of Observations	480
Adjusted R^2	0.6817
F-Stat	266.46
Prob (F-Stat)	0.0000

Note: ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/book value of assets; TDTA is the total debt divided/ total assets; LTDTA is the long-term debt/total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA. We found information on firm age for 96 out of 101 countries for the 5-year period. Consequently, the overall sample size or number of observations NT decreased to 480 from 505 for each regression in Tables 5.1–5.9.

6. Mean and standard deviation of variables by firm

Firm	Mean of variables							
	ROA	ROE	Tob	TDTA	LTDTA	STDTA	SIZE	TAX
AFPRINT	−0.030	−0.334	0.594	0.485	0.236	0.250	6.801	−0.544
ELLAH LAKES PLC	0.003	9.496	0.509	0.415	0.238	0.177	4.236	0.141
LIVESTOCK	0.169	4.269	2.633	2.468	0.167	2.301	5.773	0.569
OKITIPUPA	0.089	0.392	3.292	3.021	1.049	1.972	4.250	0.178
OKOMU	0.108	3.038	0.349	0.313	0.239	0.074	6.394	0.036
PRESCO	0.142	1.978	0.650	0.578	0.393	0.185	6.350	0.209
AIRLINE SER	0.162	2.388	0.685	0.553	0.438	0.115	6.148	0.030
NAHCO	0.187	2.270	0.594	0.510	0.329	0.180	6.455	0.285
DUNLOP	−0.064	−1.012	0.636	0.567	0.286	0.282	6.723	−0.112
INCAR	−0.048	−0.098	1.152	0.833	0.118	0.716	5.133	0.619
R.T. BRISCO	0.266	3.445	0.149	0.067	0.051	0.016	6.918	0.274
GUINNESS	0.290	19.598	0.364	0.349	0.200	0.149	7.690	0.302
INT BREWERIES	−0.306	−0.611	2.743	2.244	0.403	1.841	5.656	−0.100
JOS INT BREW	−0.795	−1.541	2.075	1.766	0.777	0.989	5.842	0.061
NIGERIAN BREW	0.283	4.673	0.431	0.368	0.095	0.273	7.911	0.358
ASHAKA CEM	0.614	7.485	0.196	0.111	0.057	0.054	7.118	0.334
BENUE CEMENT	−0.116	−0.814	1.297	1.257	0.070	1.187	4.744	0.118
CEM. CO. NORTH	0.045	0.501	0.907	0.811	0.065	0.747	6.749	−0.376
LAFARGE WAPCO	0.115	2.432	0.748	0.703	0.456	0.247	7.410	0.027
NIGERIAN ROPES	0.084	0.230	0.544	0.175	0.131	0.044	5.600	0.295
NIGERIAN WIRE	−0.042	−2.678	0.390	0.325	0.116	0.209	5.354	0.076
BERGER PAINTS	0.153	1.083	0.331	0.206	0.074	0.132	6.309	0.226
CHEM and ALLIED	0.398	3.417	0.231	0.109	0.104	0.005	6.210	0.338
DN MEYER PLC	−0.003	0.381	0.630	0.342	0.162	0.180	6.236	0.273
IPWA	−0.069	−0.176	2.784	2.260	1.732	0.529	5.479	−0.003
NIG-GERMAN CHEM	0.126	2.370	0.249	0.195	0.090	0.105	6.347	0.391
PREMIER PAINTS	0.136	0.768	1.400	1.171	0.031	1.141	5.297	0.933
NAT. SPORTS LOTTERY	−0.335	−0.631	4.645	4.046	2.046	2.000	1.943	−0.100
RED STAR	0.424	4.322	0.242	0.095	0.039	0.055	6.361	0.354
TRANS-NAT. EXPRESS	0.213	0.397	1.113	0.497	0.200	0.297	5.284	0.120
NCR NIGERIA PLC	−0.921	−1.987	2.895	2.341	2.123	0.218	6.073	0.188
OMATEK	0.030	1.608	0.653	0.632	0.228	0.404	5.851	0.100
THOMAS WYATT	−0.147	−1.064	1.489	1.339	0.184	1.155	4.882	−0.084
TRIPPLE GEE	0.049	0.384	0.886	0.760	0.439	0.320	5.700	0.209
A.G. LEVENTIS	0.107	0.606	0.291	0.102	0.044	0.058	6.819	0.324
CHELLARAMS	0.075	1.137	0.157	0.091	0.053	0.038	6.874	0.337
JOHN HOLT	−0.011	−0.158	0.358	0.299	0.059	0.240	4.111	0.215
P.Z. CUSSONS	0.164	3.915	0.157	0.115	0.046	0.068	7.632	0.328

SCOA	1.046	1.386	1.142	0.613	0.118	0.494	6.576	0.128
UAC	0.158	0.202	1.038	0.257	0.174	0.083	7.421	0.337
UNILEVER	0.327	0.509	1.422	0.785	0.307	0.478	7.423	0.319
CAPPA and D'ALBERTO	0.303	5.794	3.053	2.997	0.181	2.816	6.618	0.347
COSTAIN WEST AFR.	−0.415	−4.361	1.229	1.172	0.569	0.603	6.311	0.003
JULIUS BERGER	0.090	11.157	0.767	0.757	0.088	0.669	7.641	0.462
ROADS NIGERIA PLC	0.093	1.126	0.808	0.731	0.241	0.490	5.904	1.005
ADSWITCH PLC	0.059	0.050	1.251	0.576	0.047	0.529	4.565	0.265
CAPITAL OIL	−0.005	0.013	0.965	0.644	0.066	0.577	5.111	0.190
JULI PLC	−0.076	−0.110	0.934	0.171	0.050	0.121	5.222	−0.215
SMART PRODUCTS	0.042	0.186	0.693	0.478	0.237	0.241	4.496	0.322
CUTIX PLC	0.441	0.861	0.691	0.155	0.068	0.087	5.879	0.307
INTERLINKED TECH	−0.522	−0.484	2.605	1.041	0.256	0.785	4.721	−0.043
7-UP BOTTLING CO.	0.257	8.283	0.412	0.382	0.233	0.149	7.269	0.340
BIG TREAT PLC	0.036	0.228	1.346	1.198	0.726	0.472	5.636	0.437
CADBURY NIG. PLC	0.097	1.784	0.734	0.703	0.151	0.552	7.342	0.073
FLOUR MILLS	0.192	8.964	0.992	0.969	0.512	0.457	7.924	0.281
NORTH. NIG. FLOUR	0.082	2.461	0.626	0.590	0.020	0.570	6.662	−0.018
NAT. SALT CO. OF NIG.	−0.053	−0.037	1.498	1.071	0.378	0.693	4.498	0.078
NESTLE	0.449	26.360	0.684	0.667	0.249	0.418	7.522	0.340
NIG. BOTTLING CO	0.097	6.874	0.856	0.841	0.493	0.348	7.735	0.241
TANTALIZERS	0.089	16.891	0.923	0.837	0.456	0.381	6.493	0.160
UTC NIG. PLC	−0.133	−0.193	1.089	0.552	0.144	0.408	6.081	−0.394
FIDSON HEALTHCARE	0.245	3.403	0.256	0.174	0.055	0.119	6.198	0.089
GLAXOSMITHKLINE	0.183	2.912	0.619	0.556	0.086	0.470	6.911	0.303
MAY and BAKER	0.130	1.240	0.312	0.206	0.145	0.061	6.354	0.343
MORRISON IND.	0.070	0.290	0.655	0.419	0.103	0.316	5.280	0.586
NEIMETH	0.094	0.831	0.466	0.335	0.242	0.093	6.128	0.353
CAPITAL HOTELS	0.086	0.227	0.769	0.375	0.235	0.140	6.391	0.321
IKEJA HOTEL	0.107	1.168	0.760	0.659	0.088	0.571	6.604	0.309
THE TOURIST CO.	−0.003	−0.037	0.994	0.894	0.360	0.534	6.057	−0.166
ALEX IND. PLC	0.013	0.065	1.294	0.897	0.696	0.201	5.854	0.000
B.O.C GASES	0.270	0.744	0.945	0.589	0.169	0.420	6.012	0.262
FIRST ALUMINIUM	0.047	0.087	1.033	0.741	0.244	0.498	6.856	0.232
NIG. ENAMELWARE	0.224	2.188	0.561	0.456	0.304	0.152	6.221	0.344
VITAFOAM NIG. PLC	0.178	1.936	0.574	0.468	0.116	0.353	6.680	0.393
CHAMS PLC	0.136	221.828	1.085	0.994	0.190	0.804	5.681	0.085
STARCOMMS	−0.178	−47.261	1.288	1.272	0.786	0.486	6.892	0.036
STOKVIS NIG. PLC	−0.055	−1.077	0.897	0.850	0.305	0.545	2.356	−0.020
JAPAUL OIL	0.164	19.025	0.532	0.286	0.155	0.131	5.914	0.165
DAAR COMM.	−0.023	0.005	0.306	0.146	0.004	0.142	6.071	−0.606
AVON	0.054	0.785	0.739	0.668	0.053	0.615	6.757	0.388
BETA GLASS	0.169	2.377	0.684	0.599	0.222	0.377	6.751	0.262
GREIF NIG. PLC	−0.142	−2.273	0.274	0.213	0.047	0.166	5.706	2.729
NAMPAK NIG. PLC	0.139	1.072	0.266	0.132	0.102	0.030	6.349	0.354
NIG. BAG. MANU. CO.	0.083	3.892	0.998	0.921	0.617	0.304	6.933	0.441
POLY PRODUCTS	0.053	0.185	0.737	0.450	0.032	0.418	6.148	1.235
STUDIO PRESS	0.026	0.753	0.875	0.832	0.598	0.235	5.823	0.219
WEST AFRICAN GLASS	−0.059	−1.099	1.234	1.166	0.236	0.930	6.115	−0.012
AP PLC	0.187	5.347	2.140	2.106	0.415	1.692	7.771	0.101
AFROIL	−0.101	−0.359	1.058	0.654	0.495	0.159	0.967	−0.095
CHEVRON	0.102	14.097	0.820	0.813	0.060	0.752	7.707	0.360
CONOIL	0.322	10.805	0.234	0.204	0.087	0.117	7.818	0.324
ETERNA OIL	−0.459	−1.286	1.334	0.919	0.087	0.833	6.069	−0.051
MOBIL	0.369	19.708	0.727	0.709	0.261	0.447	7.677	0.282
OANDO	0.066	7.393	0.327	0.317	0.124	0.194	8.012	0.224
TOTAL NIG PLC	0.519	26.323	0.485	0.466	0.277	0.189	8.029	0.313
ACADEMY PRESS	0.222	0.823	0.647	0.355	0.155	0.200	6.003	0.306

LONGMAN	0.370	2.601	0.425	0.255	0.087	0.168	6.129	0.359
UNIVERSITY PRESS	0.151	1.414	0.477	0.367	0.034	0.334	5.730	0.331
UACN PROPERTY	0.037	2.068	0.440	0.422	0.013	0.409	6.654	0.232
ASSOCIATED BUS	0.127	2.587	0.592	0.480	0.197	0.283	6.336	0.322
UNITED NIG. TEXTILES	−0.040	−1.012	0.301	0.267	0.051	0.216	7.304	−0.287
MINIMUM	−0.921	−47.261	0.149	0.067	0.004	0.005	0.967	−0.606
MAXIMUM	1.046	221.828	4.645	4.046	2.123	2.816	8.029	2.729

Firm	Standard deviation							
	ROA	ROE	Tob	TDTA	LTDTA	STDTA	SIZE	TAX
AFPRINT	0.021	0.272	0.165	0.139	0.051	0.171	0.022	0.147
ELLAH LAKES PLC	0.002	12.755	0.113	0.167	0.098	0.070	0.170	0.129
LIVESTOCK	1.103	28.637	1.191	1.365	0.067	1.306	0.114	1.042
OKITIPUPA	0.018	0.189	1.734	1.625	0.585	1.359	2.125	0.164
OKOMU	0.049	1.398	0.081	0.079	0.076	0.045	0.045	0.021
PRESCO	0.028	0.377	0.096	0.096	0.034	0.067	0.020	0.141
AIRLINE SER	0.095	2.783	0.114	0.165	0.213	0.148	0.269	0.031
NAHCO	0.076	1.008	0.127	0.135	0.155	0.250	0.084	0.077
DUNLOP	0.039	0.390	0.146	0.171	0.158	0.050	0.030	0.095
INCAR	0.122	0.440	0.698	0.595	0.058	0.587	0.082	0.782
R.T. BRISCO	0.121	1.784	0.012	0.013	0.013	0.009	0.220	0.094
GUINNESS	0.072	5.493	0.080	0.079	0.075	0.006	0.071	0.044
INT BREWERIES	0.163	0.293	0.737	0.760	0.377	0.470	0.101	0.000
JOS INT BREW	1.140	2.723	1.799	1.713	0.240	1.658	0.138	0.135
NIGERIAN BREW	0.101	1.753	0.060	0.063	0.022	0.083	0.082	0.045
ASHAKA CEM	0.176	2.549	0.016	0.010	0.009	0.010	0.119	0.169
BENUE CEMENT	0.220	4.661	0.413	0.401	0.077	0.472	2.776	0.178
CEM. CO. NORTH	0.067	0.689	0.095	0.094	0.021	0.095	0.127	1.004
LAFARGE WAPCO	0.229	5.149	0.549	0.550	0.309	0.275	0.182	0.036
NIGERIAN ROPES	0.017	0.054	0.037	0.034	0.030	0.016	0.039	0.116
NIGERIAN WIRE	0.068	2.132	0.212	0.134	0.042	0.132	0.086	0.338
BERGER PAINTS	0.128	0.906	0.062	0.058	0.027	0.074	0.042	0.292
CHEM and ALLIED	0.068	1.131	0.038	0.020	0.020	0.001	0.089	0.036
DN MEYER PLC	0.418	1.118	0.293	0.187	0.171	0.052	0.071	0.149
IPWA	0.138	0.261	0.716	0.634	0.518	0.267	0.113	0.037
NIG-GERMAN CHEM	0.019	0.463	0.071	0.081	0.093	0.015	0.079	0.075
PREMIER PAINTS	0.074	0.588	1.453	1.461	0.016	1.461	0.054	1.190
NAT. SPORTS LOTTERY	0.375	0.730	2.029	2.093	1.027	1.068	2.382	0.000
RED STAR	0.190	2.779	0.122	0.043	0.045	0.009	0.094	0.063
TRANS-NAT. EXPRESS	0.205	0.361	0.375	0.393	0.101	0.334	0.201	0.099
NCR NIGERIA PLC	2.565	4.780	2.292	2.347	2.402	0.216	0.312	0.348
OMATEK	0.033	1.723	0.056	0.055	0.133	0.112	0.128	0.000
THOMAS WYATT	0.175	1.250	0.522	0.555	0.020	0.559	0.249	0.471
TRIPPLE GEE	0.030	0.213	0.125	0.122	0.042	0.145	0.122	0.043
A.G. LEVENTIS	0.023	0.201	0.041	0.018	0.014	0.010	0.044	0.049
CHELLARAMS	0.012	0.067	0.040	0.035	0.021	0.018	0.128	0.182
JOHN HOLT	0.061	1.084	0.043	0.047	0.005	0.048	0.096	0.559
P.Z. CUSSONS	0.012	0.177	0.021	0.019	0.016	0.005	0.134	0.037
SCOA	1.374	1.001	1.351	0.884	0.088	0.797	0.158	0.120
UAC	0.027	0.026	0.075	0.115	0.066	0.052	0.060	0.037
UNILEVER	0.094	0.113	0.448	0.380	0.030	0.398	0.095	0.034
CAPPA and D'ALBERTO	0.143	3.432	2.157	2.155	0.066	2.118	0.155	0.208

COSTAIN WEST AFR.	0.537	8.036	0.605	0.592	0.335	0.448	0.208	0.007
JULIUS BERGER	0.024	5.839	0.098	0.104	0.064	0.166	0.164	0.027
ROADS NIGERIA PLC	0.102	1.438	0.156	0.162	0.306	0.179	0.322	1.735
ADSWITCH PLC	0.233	0.397	0.099	0.069	0.023	0.065	0.207	0.479
CAPITAL OIL	0.031	0.085	0.320	0.214	0.026	0.191	0.141	0.493
JULI PLC	0.071	0.103	0.170	0.086	0.083	0.081	0.149	0.488
SMART PRODUCTS	0.032	0.139	0.190	0.206	0.159	0.091	0.409	0.211
CUTIX PLC	0.100	0.289	0.115	0.033	0.050	0.048	0.174	0.077
INTERLINKED TECH	1.079	0.764	0.687	0.446	0.152	0.447	0.287	0.402
7 – UP BOTTLING CO.	0.112	0.831	0.086	0.095	0.102	0.015	0.107	0.029
BIG TREAT PLC	0.038	0.081	0.346	0.477	0.234	0.244	0.597	0.190
CADBURY NIG. PLC	0.312	9.396	0.670	0.673	0.158	0.532	0.067	0.248
FLOUR MILLS	0.066	3.880	0.603	0.605	0.199	0.418	0.135	0.040
NORTH. NIG. FLOUR	0.077	2.413	0.057	0.054	0.006	0.049	0.054	0.552
NAT. SALT CO. OF NIG.	0.198	0.590	0.320	0.218	0.197	0.178	1.164	0.156
NESTLE	0.032	3.568	0.022	0.023	0.044	0.026	0.090	0.018
NIG. BOTTLING CO	0.045	3.090	0.009	0.009	0.049	0.055	0.069	0.086
TANTALIZERS	0.035	12.512	0.397	0.413	0.121	0.341	0.092	0.079
UTC NIG. PLC	0.233	0.289	0.386	0.229	0.032	0.234	0.179	0.604
FIDSON HEALTHCARE	0.036	1.493	0.289	0.261	0.020	0.243	0.250	0.087
GLAXOSMITHKLINE	0.033	0.325	0.059	0.051	0.012	0.049	0.097	0.028
MAY and BAKER	0.030	0.268	0.107	0.124	0.123	0.023	0.121	0.096
MORRISON IND.	0.028	0.077	0.076	0.105	0.013	0.092	0.057	0.341
NEIMETH	0.031	0.481	0.122	0.158	0.173	0.029	0.098	0.028
CAPITAL HOTELS	0.061	0.167	0.095	0.115	0.010	0.108	0.059	0.002
IKEJA HOTEL	0.094	0.323	0.219	0.318	0.060	0.297	0.088	0.079
THE TOURIST CO.	0.027	0.290	0.283	0.292	0.030	0.266	0.062	0.556
ALEX IND. PLC	0.108	0.279	0.122	0.080	0.255	0.191	0.139	0.000
B.O.C GASES	0.092	0.156	0.262	0.327	0.120	0.227	0.068	0.105
FIRST ALUMINIUM	0.083	0.321	0.730	0.799	0.249	0.736	0.099	0.364
NIG. ENAMELWARE	0.014	0.325	0.256	0.254	0.216	0.124	0.024	0.057
VITAFOAM NIG. PLC	0.045	0.826	0.215	0.197	0.039	0.180	0.145	0.336
CHAMS PLC	0.277	738.449	0.992	1.053	0.256	0.810	0.590	0.089
STARCOMMS	0.119	25.143	0.255	0.276	0.262	0.178	0.293	0.630
STOKVIS NIG. PLC	0.082	1.734	0.123	0.117	0.019	0.101	1.228	0.098
JAPAUL OIL	0.010	36.905	0.219	0.198	0.206	0.072	0.290	0.059
DAAR COMM.	0.062	0.256	0.148	0.076	0.001	0.075	0.235	0.866
AVON	0.009	0.176	0.032	0.038	0.018	0.038	0.066	0.113
BETA GLASS	0.116	1.498	0.202	0.169	0.087	0.132	0.057	0.143
GREIF NIG. PLC	0.127	2.022	0.104	0.100	0.022	0.092	0.066	6.110
NAMPAK NIG. PLC	0.050	0.445	0.048	0.062	0.053	0.022	0.091	0.182
NIG. BAG. MANU. CO.	0.061	4.289	0.198	0.249	0.237	0.066	0.130	0.324
POLY PRODUCTS	0.031	0.109	0.029	0.048	0.014	0.044	0.056	1.302
STUDIO PRESS	0.009	0.420	0.344	0.352	0.266	0.117	0.323	0.145
WEST AFRICAN GLASS	0.073	1.418	0.388	0.400	0.440	0.080	0.051	0.059
AP PLC	0.340	8.393	2.397	2.400	0.410	1.992	0.174	0.084
AFROIL	0.042	0.201	0.616	0.361	0.329	0.083	1.934	0.009
CHEVRON	0.031	5.330	0.021	0.022	0.010	0.030	0.126	0.040
ZCONOIL	0.048	0.703	0.033	0.035	0.031	0.013	0.153	0.012
ETERNA OIL	0.477	1.412	0.340	0.263	0.033	0.273	0.533	0.180
MOBIL	0.117	4.753	0.155	0.154	0.037	0.186	0.058	0.087
OANDO	0.020	2.436	0.215	0.216	0.069	0.166	0.125	0.085
TOTAL NIG PLC	0.148	3.692	0.058	0.059	0.021	0.058	0.116	0.065
ACADEMY PRESS	0.058	0.304	0.085	0.108	0.124	0.032	0.115	0.125
LONGMAN	0.123	1.546	0.245	0.255	0.028	0.247	0.162	0.057
UNIVERSITY PRESS	0.040	0.498	0.029	0.035	0.012	0.025	0.170	0.016
UACN PROPERTY	0.011	0.448	0.095	0.101	0.006	0.105	0.088	0.069

ASSOCIATED BUS	0.062	2.310	0.117	0.022	0.136	0.152	0.121	0.100
UNITED NIG. TEXTILES	0.083	2.160	0.043	0.042	0.008	0.036	0.041	1.191
MINIMUM	0.002	0.026	0.009	0.009	0.001	0.001	0.020	0.000
MAXIMUM	2.565	738.449	2.397	2.400	2.402	2.118	2.776	6.110

Note: ROA is the return on assets (EBIT/total assets), ROE is the return on equity (EBIT/equity), Tob Q (Tobins Q) = (Market value of equity + book value of debt)/book value of assets; TDTA is the total debt divided/total assets; LTDTA is the long − term debt/total assets; STDTA is the short-term debt/total assets; Size represented as log of turnover, Tax = total tax to earnings before interest and tax (EBIT). Leverage is TDTA, LTDTA or STDTA.

7. Theories and empirical relations between leverage and firm performance

Variables	Predicted signs by the theory	Modal empirical evidence reported in the literatures	Some Empirical Evidence
ROA	− (pecking order, agency costs) + (trade-off, signalling)	–	
ROE	− (pecking order, agency costs) + (trade-off, signalling)	–	Chen(2004), Tian and Zeitun (2007)
Size	− (pecking order) + (trade-off, signalling)	+	Tian and Zeitun (2007)
Tax	− (pecking order) + (trade-off, signalling)	+	Tian and Zeitun (2007)

Source: Olokoyo (2012) and Kebewar (2013).

8. Addition of industry dummies to control for potential industry effects, Olokoyo (2012).

	TDTA		LTDTA		STDTA	
	ROA	TOB Q	ROA	TOB Q	ROA	TOB Q
Constant	−0.5058	0.4349	−0.0819	0.8937	−0.9221	1.9251
	(−1.1388)	(2.6330)***	(−0.2032)	(1.2850)	(−1.9731)**	(4.1897)***
Leverage	−0.1802	1.0057	−0.5416	1.2471	−0.0645	1.1057
	(−7.6307)***	(118.85)***	(−12.915)***	(16.776)***	(−2.0356)**	(35.851)***
Size	0.0448	−0.0226	0.0292	−0.1394	0.0786	−0.1365
	(2.2494)**	(−2.4671)**	(1.5888)	(−3.754)***	(3.867)***	(−5.416)***
Tax	0.0276	−0.0011	0.0177	0.0122	0.0319	−0.0153
	(1.2114)	(−0.1625)	(0.8668)	(0.3680)	(1.3179)	(−0.7218)
Dum-Agric	0.5494	−0.1902	0.2056	0.7455	0.6095	−0.7308
	(1.2476)	(−1.1015)	(0.5156)	(1.0667)	(1.3045)	(−1.5364)
Dum-Airline	0.4895	−0.1872	0.2776	0.1439	0.6058	−0.5868
	(1.0623)	(−0.9374)	(0.6633)	(0.1874)	(0.6437)	(−1.0916)
Dum-Auto	0.3578	−0.1396	0.0282	0.4321	0.4950	−0.7950
	(0.7929)	(−0.7476)	(0.0687)	(0.5874)	(1.0369)	(−1.5664)
Dum-Breweries	0.2788	−0.0669	−0.0507	0.9919	0.3049	−0.4938
	(0.6242)	(−0.3710)	(−0.1254)	(1.3806)	(0.6438)	(−1.0002)
Dum-Building	0.4451	−0.1808	0.1006	0.4528	0.5778	−0.8525
	(1.0088)	(−1.0461)	(0.2518)	(0.1874)	(1.2359)	(−1.7916)*
Dum-Chemicals	0.4802	−0.0798	0.2226	0.4173	0.5866	−0.5513
	(1.0891)	(−0.4621)	(0.5580)	(0.5968)	(1.2554)	(−1.1594)
Dum-Computer	0.2324	−0.1020	0.0719	0.4426	0.2634	−0.2545
	(0.5604)	(−0.7752)	(0.1932)	(0.7358)	(0.5966)	(−0.6623)
Dum-Conglomerate	0.5230	0.0438	0.2103	0.5453	0.6670	−0.5860
	(1.1872)	(0.2560)	(0.5272)	(0.7828)	(1.4291)	(−1.2420)

Dum-Construction	0.4694	−0.2427	0.0448	1.1513	0.4790	−0.8160
	(1.0512)	(−1.3458)	(0.1107)	(1.6022)	(1.0104)	(−1.6516)*
Dum-Emergmkt	0.3737	0.1660	−0.0030	0.6166	0.5650	−0.7063
	(0.8384)	(0.9232)	(−0.0074)	(0.8583)	(1.1983)	(−1.4380)
Dum-Engtech	0.3322	0.7316	−0.0275	1.2894	0.4892	−0.0340
	(0.7221)	(3.6671)***	(−0.0657)	(1.6784)*	(1.0062)	(−0.0633)
Dum-Foodbev	0.4528	−0.1523	0.1767	0.5377	0.5294	−0.5821
	(1.0345)	(−0.9107)	(0.4467)	(0.7834)	(1.1401)	(−1.2559)
Dum-Healthcare	0.4253	−0.1732	0.1086	0.2673	0.5842	−0.8501
	(0.9592)	(−0.9857)	(0.2702)	(0.3776)	(1.2445)	(−1.7628)*
Dum-Hotel	0.3963	−0.0963	0.0808	0.5470	0.5082	−0.6738
	(0.8786)	(−0.5156)	(0.1972)	(0.7439)	(1.0644)	(−1.3265)
Dum-Industprod	0.4758	−0.0445	0.2051	0.4851	0.5845	−0.5361
	(1.0733)	(−.0.2529)	(0.5110)	(0.6859)	(1.2447)	(−1.1112)
Dum-Infotech	0.4061	−0.2458	0.1411	0.5597	0.4470	−0.5931
	(0.8817)	(−1.2304)	(0.3375)	(0.7290)	(0.9176)	(−1.1025)
Dum-Machinery	0.4992	−0.3397	0.1241	−0.0490	0.7179	−1.3094
	(1.0177)	(−1.4421)	(0.2763)	(−0.0565)	(1.3912)	(−2.1051)**
Dum-Maritime	0.4516	−0.0563	0.1541	0.2680	0.6242	−0.7283
	(0.9246)	(−0.2402)	(0.3450)	(0.3113)	(1.2136)	(−1.1776)
Dum-Media	0.2543	−0.1394	−0.1049	0.2607	0.4508	− −0.9570
	(0.5200)	(−0.5947)	(−0.2343)	(0.3025)	(0.8758)	(−1.5466)
Dum-Packaging	0.3561	−0.1918	0.0549	0.4076	0.4681	−0.7509
	(0.8111)	(−1.1329)	(0.1381)	(0.5893)	(1.0059)	(−1.6049)
Dum-Petroleum	0.4633	−0.1693	0.1297	0.6551	0.5463	−0.7155
	(1.0547)	(−0.9988)	(0.3262)	(0.9462)	(1.1725)	(−1.5263)
Dum-Printing	0.5365	−0.1113	0.2001	0.3339	0.7065	−0.8498
	(1.1895)	(−0.5962)	(0.4884)	(0.4540)	(1.4811)	(−1.6752)*
Dum-Realest	0.3141	−0.2682	−0.0728	0.4556	0.4548	−1.0258
	(0.6423)	(−1.1437)	(−0.1625)	(0.5283)	(0.8827)	(−1.6558)*
Dum-Roadtrans	0.4272	−0.1822	0.1254	0.3324	0.5596	−0.7770
	(0.8742)	(−0.7775)	(0.2808)	(0.3861)	(1.0870)	(−1.2553)
Dum-Services	0.6631	0.1199	0.4560	0.7570	0.6957	−0.1549
	(1.5614)	(0.6641)	(1.1837)	(0.0803)	(1.5478)	(−0.3171)
Dum-Textiles	0.1951	−0.2375	−0.1379	0.3654	0.3315	−0.8703
	(0.3981)	(−1.0113)	(−0.3076)	(0.4230)	(0.6421)	(−1.4023)
No. of Observations	505	505	505	505	505	505
R-Square	0.1782	0.9697	0.3048	0.5367	0.0908	0.7589
F-Stat	3.5539	525.13	7.1825	13.5146	1.6375	51.5730

Note: *** Significant at 1% level; ** Significant at 5% level and * Significant at 10% level. The source of this result is Olokoyo (2012). Estimation was done using the random effects model. The Hansen (1999) could not be applied with industry dummies because it is based on the fixed effect model that has limited application when variables have values that mostly do not change across both time and units, violating a requirement of the Hansen (1999) model which requires variables have values that vary with time for the purposes of identification. The industry dummies do not change over time and thus not reported in a model based on fixed effects. Numbers in parentheses are the asymptotic t-values of the co-efficient. ROA = the return on assets (EBIT/total assets); Tob Q (Tobin"s Q) = Market value of equity + book value of debt/book value of assets; TDTA = total debt divided by total assets; LTDTA = long-term debt divided by total assets; STDTA = short term debt divided by total assets; Size = log of turnover, Tax = total tax to earnings before interest and tax (EBIT), Dum refers to the dummy variables for industry, Leverage refers to TDTA, LTDTAs or STDTAs.

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.najef.2018.02.002.

References

Azeez, A. A. (2015). Corporate governance and firm performance: Evidence from Sri Lanka. *Journal of Finance and Bank Management, 3*, 180–189.

Abor, J. (2005). The effect of capital structure on profitability: An empirical analysis of listed firms in Ghana. *Journal of Risk Finance, 6*(5), 16–30.
Akinlo, O., & Asaolu, T. (2012). Profitability and leverage: Evidence from Nigerian firms. *Global Journal of Business Research, 6*(1), 17–25.
Brick, I. E., & Ravid, S. A. (1985). On the relevance of debt maturity structure. *Journal of Finance, 40*, 1423–1437.
Chandrakumarmangalam, S., & Govindasamy, P. (2010). Leverage- an analysis and its impact on profitability with reference to selected cement companies in India. *European Journal of Economics, Finance and Administrative Sciences, 27*, 1450–2275.
Chen, J. J. (2004). Determinants of capital structure of chinese listed companies. *Journal of Business Research, 57*, 1341–1351.
Cheng, Y., Liu, Y., & Chien, C. (2010). Capital structure and firm value in china panel threshold regression analysis. *African Journal of Business Management, 4*(12), 2500–2507.
Fama, E. F., & French, K. R. (1998). Taxes, financing decision and firm value. *The Journal of Finance, 53*.
Hansen, B. E. (1999). Threshold effects in non-dynamic panels: estimation, testing, and inference. *Journal of Econometrics, 93*, 345–368.
Jeleel, A., & Olayiwola, B. (2017). Effect of leverage on firm performance in nigeria: A case of listed chemicals and paints firms in Nigeria. *Global Journal of Management and Business Research: Accounting and Auditing*.
Jensen, M. (1986). Agency costs of free cash flow, corporate finance and takeovers. *American Economic Review, 76*(2), 323–329.
Kebewar, M. (2013). The effect of debt on corporate profitability: Evidence from French service sector. *Brussels Economic Review, 56*(1), 43–59.
Klapper, L. F., & Love, I. (2004). Corporate governance, investor protection, and performance in emerging markets. *Journal of Corporate Finance, 10*(5), 703–728.
Lin, F., & Chang, T. (2011). Does debt affect firm value in taiwan? a panel threshold regression analysis. *Applied Economics, 43*, 117–128.
Mashayekhi, B., & Bazaz, M. S. (2008). Corporate governance and firm performance in Iran. *Journal of Contemporary Accounting and Economics, 4*(2), 156–172.
Modigliani, F., & Miller, M. (1958). The cost of capital, corporate finance and the theory of investment. *American Economic Review, 48*, 261–297.
Negash, M. (2001). Debt, Tax shield and bankruptcy costs: some evidence from johannesburg stock exchange. *Investment Analysis Journal, 54*(3), 114–128.
Nwankwo, Odi (2014). Effect of capital structure of nigeria firms on economic growth. *Mediterranean Journal of Social Sciences, 5*(1), 515–519.
Olokoyo, F. O. (2013). Capital structure and corporate performance of nigerian quoted firms: A panel data approach. *African Development Review, 25*(3), 358–369.
Olokoyo, F. O. (2012). Capital structure and corporate performance of nigerian quoted firms: A panel data approach. *African Development Review, 25*(3), 358–369.
Onaolapo, A., & Kajola, S. (2010). Capital structure and firm performance: evidence from Nigeria. *European Journal of Economics, Finance and Administrative Sciences* ISSN 1450.
Patrick. O., & Ogebe, J. O. (2013), The Impact of Capital Structure on Firms' Performance in Nigeria. http://mpra.ub.uni-muenchen.de/45986/.
Phillips, P. A., & Sipahioglu, M. A. (2004). Performance implications of capital structure; evidence from quoted U. K. organisations with hotel interests. *The Services Industry Journal, 24*(5), 1–21.
Pratheepkanth, P. (2011). Capital structure and financial performance: evidence from selected business companies in colombo stock exchange Sri Lanka. *Journal of Arts, Science and Commerce, 23*.
Pratomo, W. A., & Ismail, A. G. (2006) Islamic bank performance and capital structure. MPRA Paper No 6012.
Robb, A., & Robinson, D. T. (2009), The capital structure decision of new firms [Online] Available: http://papers.ssrn.com/so13/papers.cfm?abstract-id=1345895 [Accesssed: 17 October 2009].
Ruland, W., & Zhou, P. (2005). Debt, diversification and valuation. *Review of Quantitative. Financial. Accounting, 25*(3), 277–291.
Salawu, R. O. (2007). An empirical analysis of the capital structure of selected quoted companies in Nigeria. *The International Journal of Applied Economics and Finance, 1*(1), 16–28.
Simon-Oke, O. O., & Afolabi, B. (2011). Capital structure and industrial performance in Nigeria (1997–2007). *International Business and Management, 2*(1), 100–106.
Tian, G. G., & Zeitun, R. (2007). Capital structure and corporate performance: Evidence from Jordan. *Australasian Accounting Business and Finance Journal, 1*(4), 40–61.

Further reading

Cuong, N. T. (2012). Threshold effect of capital structure on firm value: evidence from seafood processing enterprises in the south-central region of Vietnam. *International Journal of Finance and Banking Studies, 3*(3), 14–29.

Vo, D., & Phan, T. (2013). Corporate governance and firm performance: Empirical evidence from Vietnam. http://www.murdoch.edu.au/School-of-Management-andGovernance/_document/Australian-Conference-ofEconomists/Corporate-governance-and-firm-performance.pdf, 03.12.2013.