

# Firm Capital Structure and Financial Sector Performance in Nigeria

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**Abstract:** This study employed the two-step systems GMM and fixed-effect model to examine the relative importance and explanatory power of six (6) variables in considering the capital structure of 36 non-financial companies listed on the Nigeria Stock Exchange from 2008-2019. The study also examined the effect of the rule of law, institutional quality, macroeconomic management, financial sector performance, and accountability and corruption on firm capital structure. The findings of the study affirm the theoretical underpinnings of the pecking order theory in Nigeria. The study finds that profitability and Liquidity ratios are negatively associated with debt ratios among non-financial firms in Nigeria. Firm size and tangibility of firm assets positively affect the debt ratio of these firms. The study also concludes that the rule of law, macroeconomic management, financial sector performance, accountability, and corruption indeed matter in determining firm financing mix in Nigeria. Indeed, the rule of law, financial sector rating, accountability, and corruption forms the fundamental basis for the enforcement of contracts, registration, and protection rights. The study provides evidence to the effect that these variables are critical for both equity and debt financing. This study adds to the existing literature as all the determinants used in the study are statistically significant in determining the capital structure of non-financial firms in Nigeria.

**Keywords:** Leverage Ratio, Profitability Ratio, Liquidity Ratio, Tangibility, Asset Turnover Ratio

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## 1. Introduction

The literature on the determinants of firm capital structure has evolved and grown steadily since Myers's pioneering article on the determinants of corporate borrowing [1]. One of the most debated topics in the corporate finance literature is the theory of firm capital structure and firm financing mix [2, 3]. Still the question on how firms decide their financing mix remains a raging debate [4]. Firms issuing risky debts negatively affect the present market value of the firm's holdings of real options through suboptimal investment strategies. Firm borrowing is also negatively associated with market value accounted for by real options. The trade-off theory suggests that optimal capital structure constitutes matching corporate tax advantages of debt financing with the cost of financial distress that may arise from bankruptcy risks and agency cost [5, 6]. Firms will favor debt financing over equity because of gains from tax shields. Although the theoretical literature is very clear about the trade-off theory, the evidence from most of the empirical literature remains inconclusive. Some scholars find

no clear evidence in support of the trade-off theory [7]. Strong empirical support has however, been made for the trade-off theory based on its predictions on the substitution effect and the tax exhaustion hypothesis [8].

Firms may also use debt only when internal financing (retained earnings) is insufficient; hence external equity capital will be the last resort. The pecking order theory of capital structure is based on informational asymmetry, and scholars who favor it assume that firms have no leverage targets [4, 9]. The pecking-order theory ranks firm financing mix according to how they are affected by information asymmetry. Retained earnings are the first choice because it has the lowest financing and adverse selection cost, next is the issuance of debt, and equity is the last because it has the highest cost of adverse selection.

This study adds to the empirical literature on firm capital structure by examining the explanatory power of the determinants of capital structure of non-financial firms in Nigeria, bearing in mind firm heterogeneity and their theoretical underpinnings. This study further contributes to the

literature on the determinant's firm capital structure in Africa by examining the impact of institutional quality, financial sector development, macroeconomic management, accountability and corruption, and the rule of law on firm capital structure in Nigeria. The study employs an estimation technique (two-step systems GMM) that is robust and overcomes the problems associated with endogeneity, as may be the case in most empirical studies in Nigeria.

The study results show considerable similarities in the determinants of capital structure of non-financial firms listed on the Nigeria Stock Exchange. The study also concludes that rule of law, macroeconomic management, financial sector rating, accountability, and corruption indeed matter in determining firm financing mix in Kenya. Indeed, the rule of law, financial sector rating, accountability, and corruption form the fundamental basis for law enforcement of contracts, registration, and protection rights. The study provides a convincing evidence to the effect that these variables are key for both equity and debt financing. The findings of this study affirms the theoretical underpinnings of the pecking order theory in Nigeria. We found that profitability and Liquidity ratios are negatively associated with firm leverage among non-financial firms in Nigeria. Firm size and tangibility of firm assets positively affect the debt ratio of these firms.

## 2. Literature Review

A review of credible and scientific evidence of the relationship between capital structure and performance provides useful insights to investors and policymakers. The capital structure of listed non-financial firms on the Vietnamese stock exchange is negatively associated with firm performance. Evidence from the pharmaceutical and medical, consumer goods, and public utility industries exhibited positive relationship between firm performance variables and their capital structure than industrial product sectors in Vietnam [10]. A related study in Kenya showed that the profitability of micro-finance institutions does not significantly influence the choice of equity capital but debt capital [11]. They, however, found that the profitability of micro-finance institutions is significantly affected by their capital structure. The Pecking order theory is contradicted by evidence from the empirical literature suggesting that firms' capital structure varies subject to information asymmetry. Their financing constraints influence the financing decisions of firms. A similar study in Kenya which examined the effect of financing constraints on the capital structure of firms found evidence contrary to the pecking order theory; financially constrained firms finance less of their investment activities through retained earnings than their counterparts. However, allowing financially constrained regimes in pecking order regimes enhanced the fitness of the model and provided consistent outcomes with the pecking order theory [12]. The wider the wedge between the cost of debt and the opportunity cost of internal funds, the higher the value transferred to debt-holders and the lower the debt utilization. The term structure of debt is crucial in the firm capital mix and is often

determined by firm size, profitability, the tangibility of assets, and asset liquidity, among other determinants. Firms shift from long-term debt financing to short-term financing as they increase in size, while the tangibility of assets leads to a shift from short-term debt financing to long-term financing. Other capital structure determinants such as firm profitability and effective tax rate were also found to reduce the use of debt [13]. In the recent literature, studies on the influences of firm-specific characteristics, including earnings, tax shield, dividend payout, interest cover, and firm size, on the capital structure of manufacturing firms include [14]. The study shows that firm characteristics such as earnings, tax shield, dividend payout, and firm size positively and significantly affect firm capital structure in Kenya. He further found interest coverage to negatively and significantly affect capital structure whilst firm size significantly moderates the relationship between firm characteristics and capital structure of private manufacturing firms in Kenya. Private manufacturing firms in Kenya finance their investment first with retained earnings before debt. This finding provides evidence of the pecking order theory among private manufacturing firms in Kenya. The literature on firm performance and capital structure in Africa was also extended by [15]. They explored the capital structure and financial performance nexus of manufacturing and Allied firms listed on the Nairobi bourse. They found that retained earnings and equity financing negatively influence the financial performance of the firms under consideration. However, financial performance was found to respond positively to long-term debt. Other studies have also explored the relationship between the determinants of capital structure and firm characteristics and the mediating roles of capital structure on corporate diversification, institutional and foreign ownership of listed firms on the Nairobi Exchange [16]. They show that the capital structure of a firm significantly mediated the association between institutional ownership and corporate diversification. The study however, found no significant effect from the moderating roles of capital structure in the relationship between foreign ownership and corporate diversification. In Vietnam, firm size and profitability positively affect enterprise value, whilst capital structure negatively affects firm value as found by [17]. Organizational performance positively and significantly affects strategy implementation [18]. They found evidence anchored on the expectancy and the pecking order theory among energy sector firms in Kenya. They further examined the effect of growth opportunities, firm size, capital structure, and firm profitability on firm value. Firm capital structure also showed a strong and significant relationship with the performance of energy sector firms. They also find that the joint effect of strategy implementation and capital structure on performance was more than their separate effects.

The GMM estimation technique and the stochastic frontier analysis (SFA) was used to examine the determinants and speed of firm capital structure adjustment in Nigeria [19]. They found that, the efficiency of the estimation underlines the capital structure of Nigerian firms. Short-term debts have a

higher speed of adjustment among firms in Nigeria. Other studies have also found similar and significant relationship between firm capital structure and performance when debt financing is fairly employed in Nigeria [20]. They, however, found that the relationship between firm capital structure and firm performance is non-monotonic when firms in Nigeria use excessive debt financing, which adversely affects firm performance. Cross-country studies in the recent literature on the determinants of firm leverage in Africa include [21]. Using the two-step GMM technique and quadratic methods, their evidence predicted the pecking order theory and the trade-off theory. In Ghana, quoted and large unquoted firms show very high debt ratios than SMEs [22]. He also found no significant difference between the capital structure of publicly traded firms and larger untraded firms. Short-term debts were found to be a relatively high proportion of total debts. The study further revealed that firm age, profitability, size, asset structure, risk, and managerial ownership are crucial factors determining the capital structure mix of firms in Ghana. Studies examining the effect of institutional quality on firms' capital structure in a microfinance environment include [23]. They found that institutional quality demonstrates a negative and significant association with firm capital structure in the short and long run. Their results, by implication, suggest that microfinance institutions in countries with strong institutions are less likely to employ more debt financing.

From the empirical and theoretical review, the study identifies that the key determinants of firms' capital structure include but are not limited to the following; firm size, profitability, liquidity, tangibility, growth, age, and volatility. This study focuses on examining the factors influencing the capital structure of non-financial firms listed on the Nigeria Stock Exchange using the following selected variables tangibility ratio, effective tax rate, total assets, profitability ratio, asset turnover, and liquidity that are related to the capital structure theories of firm financing in Nigeria.

### 3. Data Sources and Description

The data for this study was obtained from the published annual audited financial reports of listed firms (non-financial companies) on the Nairobi Stock Exchange from 2008 to 2019. The sample size of the study is 36 non-financial firms over 12 years. The study is directed by the literature and constructs the following financial ratios based on the available information.

In measuring the indebtedness of a firm, previous studies adopted different proxies of the capital structure [24, 25]. While some studies measure leverage as the total capital ratio minus the value of equity to total assets, other studies measure leverage as the total debt to total asset ratio. However, due to the availability of data and for robustness checks, this study employs both leverage ratios

$$\text{Book - Lev (Debt ratio)}_t = \frac{\text{Total Debt}_t}{\text{Total Assets}_t} \quad (1)$$

$$\text{BMkt/Debt ratio}_t = \frac{\text{Total Equity}_t}{\text{Total Assets}_t} \quad (2)$$

We examine the firm-specific characteristics of the firms' capital structure through conventional explanatory variables based on previous studies. According to the empirical and theoretical literature, firms' capital structure is influenced by Profitability ratio, Size  $\ln(\text{Total assets})$ , Tangibility ratio, Effective tax rate, Liquidity ratio, Asset turnover, growth opportunities, risk factors (volatility), and ownership structure among others. The study will, however, examine the relationship between firm leverage and the following financial multiples.

$$\text{Firm Profitability ratio}_t = \frac{\text{EBIT}_t}{\text{TA}_t} \quad (3)$$

Where  $\text{EBIT}_t$  is earning before interest payments and tax and  $\text{TA}_t$  is total assets.

According to the pecking order theory, firms will primarily rely on internal financing sources (retained profits) before any debt and equity financing attempt. The theory, therefore, predicts a negative relationship between firm profitability and firm leverage [9]. However, the Trade-off theory of corporate finance assumes a positive relationship between firm leverage and profitability [5]. The literature favors the pecking order theory as shown in previous and recent studies including [13, 14, 26]:

$$\text{Firm Size}_t = \ln(\text{Total Assets})_t \quad (4)$$

Firm size is also identified to influence the capital and debt structure of firms. For instance, large companies are more diverse and less at risk of bankruptcy, which allows them to maintain high debt levels [3]. They find a positive relationship between firm size (measured by the natural logarithm of total assets)

$$\text{Tangibility - ratio}_t = \frac{\text{Non - Current Tangible Assets}_t}{\text{Total Assets}_t} \quad (5)$$

Firms with visible fixed assets are considered more creditworthy by creditors as it guarantees creditors that in the event of bankruptcy, their funds can be recovered according to [24, 28]. Increasing the proportion of a firms' tangible assets induces investors and creditors to extend more credit to the firm. However, the positive relationship expected between tangibility of assets and firm leverage disappears in developing countries, especially where the rule of law and contract enforceability is weak [29]. The study, therefore, expects a negative relationship between asset tangibility and firm leverage

$$\text{Effective tax rate}_t = \frac{\text{Tax Revenue}_t}{\text{Taxable Income}_t} \quad (6)$$

The effective tax rate is the ratio of tax revenue to taxable income. The study expects a positive relationship between the effective tax rate and the firm leverage level.

$$\text{- Liquidity of Assets}_t = \frac{\text{Cash} + \text{Bank}_t}{\text{Total Assets}_t} \quad (7)$$

Findings from [24, 30] collaborate on the literary arguments that there is a negative relationship between a company's liquidity and its debt ratio. In addition, the pecking order

theory suggests that firms with high liquidity resources to internal financing.

$$\text{Asset Turnover}_t = \frac{\text{Total Sales}_t}{\text{Total Assets}_t} \quad (8)$$

According to the literature, the firms' efficiency is captured by the ratio of total sales to total assets. This ratio represents the velocity at which the capital invested into fixed assets rotates to achieve a given level of sales. Studies including [24, 31, 32].

#### 4. Two-steps Systems GMM Estimation Technique

In this section, the study adopts the two-step system Generalized Method of Moment (GMM) estimation strategy of [33, 34] an extension of [35]. The choice of the GMM estimator is premised on four main justifying arguments. First, as a baseline requirement, the GMM estimation technique

requires the number of cross-sections (N=36) to be greater than the number of time series (T=12). The correlation coefficients between the dependent variables and their corresponding first lags exceed the threshold that is critical for the establishment of persistence. The GMM estimation technique is also robust to the extent that it accounts for endogeneity by controlling simultaneity through instrumentation and time-invariant omitted variables. The GMM method also controls for cross-sectional dependence and restricts the proliferation of instruments [36]–[39].

Moreover, all the necessary elements have been incorporated in the specification following [40]. Finally, the application of a panel data structure is consistent with the GMM technique, which does not eliminate cross-country variations. The effectiveness of the two-step systems GMM from the fact that it controls for heteroscedasticity while the one-step only controls for homoscedasticity. In what follows the study presents a summary of the equations in levels (8) and first difference (9).

$$\text{Book/Lev}_{i,t} = \delta_0 + \delta_1 \text{Book/Lev}_{i,t-\tau} + \sum_{n=1}^n \theta_j W_{n,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \quad (9)$$

$$\text{Book/Lev}_{i,t} - \text{Book/Lev}_{i,t-\tau} = \delta_1 (\text{Book/Lev}_{i,t-\tau} - \text{Book/Lev}_{i,t-2\tau}) + \sum_{n=1}^n \theta_j (W_{n,i,t-\tau} - W_{n,i,t-2\tau}) + (\xi_t - \xi_{t-\tau}) + \varepsilon_{i,t-\tau} \quad (10)$$

Where  $\text{Book/Lev}_{i,t}$  Is the Book value of assets to leverage ratio of country  $i$  at period  $t$ .  $\delta_0$  is a constant, and  $\tau$  is the autoregression coefficient.  $W$  is also a vector of independent control variables (Tangibility ratio, Effective tax rate, Size

$\ln(\text{total assets})$ , Profitability ratio, Asset turnover, and Liquidity ratio).  $\eta_i$  represents country-specific effect,  $\xi_t$  is also the time-specific effect and  $\varepsilon_{i,t}$  is the error term.

$$\text{Mkt/Lev}_{i,t} = \delta_0 + \delta_1 \text{Mkt/Lev}_{i,t-\tau} + \sum_{n=1}^n \theta_j W_{n,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \quad (11)$$

$$\text{Mkt/Lev}_{i,t} - \text{Mkt/Lev}_{i,t-\tau} = \delta_1 (\text{Mkt/Lev}_{i,t-\tau} - \text{Mkt/Lev}_{i,t-2\tau}) + \sum_{n=1}^n \theta_j (W_{n,i,t-\tau} - W_{n,i,t-2\tau}) + (\xi_t - \xi_{t-\tau}) + \varepsilon_{i,t-\tau} \quad (12)$$

Where  $\text{Mkt/Lev}_{i,t}$  Is Book value of equity to leverage ratio of country  $i$  at period  $t$ .  $\delta_0$  is a constant, and  $\tau$  is the autoregression coefficient.  $W$  is also a vector of independent control variables (Tangibility ratio, Effective tax rate, Size  $\ln(\text{total assets})$ , Profitability ratio, Asset turnover, and Liquidity ratio).  $\eta_i$  represents country-specific effect,  $\xi_t$  is also the time-specific effect and  $\varepsilon_{i,t}$  is the error term.  $j$

Space is devoted to briefly engage identification, simultaneity, and exclusion restrictions [38]. Recent literature assumes that all explanatory variables are predetermined (or suspected endogenous) while only time-invariant variables (or years) are supposed to be strictly exogenous [41]. The is so because years cannot be endogenous in the first difference

[33]. The study examines and validates the appropriateness of the instrument sets using the Difference in Hansen Test and Sargan Over-identifying Restrictions following [42].

As reported in Table 1 below, the descriptive statistics have 432 observations for all variables. The mean values of the variables; book leverage, market leverage ratio, profitability ratio, size  $\ln(\text{total assets})$ , tangibility ratio, effective tax rate, liquidity ratio, asset turnover, rule of law, financial sector rating, institutional quality, macroeconomic management, accountability and corruption and profit tax is 0.736, 0.572, 0.098, 24.005, 0.601, -30.842, 3.388, 2.302, 2.5, 3.201, 2.705, 3.745, 3, and 21.268 respectively.

Table 1. Descriptive Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Book Leverage ratio	432	.736	3.653	-2.03	70.061
Mkt value/Debt ratio	432	.572	.287	.108	2.457
Profitability ratio	432	.098	.139	-.378	1.384
Size $\ln(\text{total assets})$	432	24.005	2.352	18.032	34.055
Tangibility of assets	432	.601	2.604	.001	49.752
Effective tax rate	432	-30.842	595.236	-11412.168	238.88
Liquidity ratio	432	3.388	35.138	-.898	674.51
Asset turnover	432	2.302	3.845	.105	58.85
Rule of law	432	2.5	0	2.5	2.5
Financial sector rating	432	3.201	.436	2.5	3.5
Institutional quality	432	2.705	.246	2.5	3

Variable	Obs	Mean	Std. Dev.	Min	Max
Macroeconomic Mgt.	432	3.745	.6	3	4.5
Account & corruption	432	3	0	3	3
Profit Tax	432	21.268	.364	20.9	21.8

The pairwise correlation matrix of the variables is reported in Table 2 below. The results show that the variables are weakly correlated. The correlation coefficients are less than 0.5 except for the correlation between book leverage and

tangibility ratio. The weak correlation between the variables suffices that our models are less likely to suffer from multi-collinearity.

*Table 2. Pairwise correlations.*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Book/Leverage ratio	1.000							
(2) Mkt value/Debt	0.115	1.000						
(3) Profitability ratio	0.162	-0.176	1.000					
(4) Size ln(total assets)	-0.132	0.052	0.131	1.000				
(5) Tangibility ratio	0.983	0.084	0.167	-0.139	1.000			
(6) Effective tax rate	0.003	0.004	0.012	-0.222	0.012	1.000		
(7) Liquidity ratio	-0.024	0.105	-0.036	-0.030	0.005	0.005	1.000	
(8) Asset turnover	-0.031	0.083	-0.275	-0.022	-0.020	-0.011	0.008	1.000

The pairwise correlation matrix for the macro-level variables, i.e., the rule of law, financial sector rating, institutional quality, macroeconomic management, accountability and corruption, and the corporate tax rate, is reported in Table 3 below. The table shows that the variables

are highly correlated, and employing more than one variable in one model will pose the challenge of multi-collinearity. The study, therefore, employs each of these macro-variables independent of the others in the main GMM estimation models.

*Table 3. Pairwise correlations.*

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Rule of law						
(2) Financial sector rating		1.000				
(3) Institutional quality		0.573	1.000			
(4) Macroeconomic Mgt.		0.854	0.503	1.000		
(5) Accountability & co.					1.000	
(6) Profit tax		0.847		0.986		1.000

## 5. Methodology and Model Specification

The study adopts two estimation techniques to examine the characteristics and capital structure of non-financial (listed) firms in Kenya. This section will employ a panel fixed effect model (in a step-wise regression effort) to examine the relative importance of the explanatory variables in determining firms' capital structure while the second section will deploy the two-steps system GMM model.

$$y_{it} = \alpha_i + \beta_c x_{kit} + \varepsilon_{it} \text{ model (A)}$$

Where  $i = 1, \dots, 36$  representing the number of companies,  $t = \text{time}$ ,  $y_{it}$  is the leverage level of firm  $i$  at time  $t$ .  $x_{kit}$  is a set of dependent variables of firm  $i$  at time  $t$ .  $\varepsilon_{it}$  is the stochastic random error term. The choice of the fixed effect model is to control for the firm, industry, and year heterogeneity.

Base on the main model above (model A), the study will examine six (6) panel fixed-effect models for each explanatory variable against the dependent variable (Book-Lev (Debt ratio)). We compare the statistical

significance and the coefficient of determination (R-squared) for each model. The explanatory variable in the model with the maximum coefficient of determination (R-squared) has the highest explanatory effect. The variable is then added to the next series of regression equations. The study makes mention of the fact that, the coefficient of determination (R-squared) increases steadily as new variables are added. The mechanics of the above algorithm arrive at regression equations consisting of 2, 3, 4, and 5 explanatory variables. The regression equation with the highest number of explanatory variables and explanatory power (coefficient of determination (R-squared)) is selected.

The first set of six (6) models are presented below, and the regression estimates are reported in table 3.

Model 1:  $y_{it} = \alpha_i + \beta_1 x_{1it} + \varepsilon_{it}$ ; where  $x_1$  is Firm Profitability.

Model 2:  $y_{it} = \alpha_i + \beta_1 x_{2it} + \varepsilon_{it}$ ; where  $x_2$  is Firm Size (natural logarithm of sales).

Model 3:  $y_{it} = \alpha_i + \beta_1 x_{3it} + \varepsilon_{it}$ ; where  $x_3$  is Liquidity ratio.

Model 4:  $y_{it} = \alpha_i + \beta_1 x_{4it} + \varepsilon_{it}$ ; where  $x_4$  is tangibility of assets.

Model 5:  $y_{it} = \alpha_i + \beta_1 x_{5it} + \varepsilon_{it}$ ; where  $x_5$  is Asset turnover ratio.

Model 6:  $y_{it} = \alpha_i + \beta_1 x_{6it} + \varepsilon_{it}$ ; where  $x_6$  is Effective tax rate

From table 3, we compared the coefficient of determination (R-squared) and conclude that, the model with the highest coefficient of determination (R-squared) is *Model 3*. The coefficient of determination is 0.981. The study, therefore, concludes that the explanatory variable with the highest explanatory power is the tangibility of assets. ( $x_{4it}$ ), hence at this stage, *Model 4* is the most representative.

The study follows the procedure above to set up the next five (5) regressions with explanatory variables for each. We report the regression estimates in table 4. Again, we find that the models have the same explanatory powers. However, in models 1a and 2a, the coefficients of profitability ratio and size (ln(total assets)) are not statistically significant. The remaining three (3) models have the highest and same coefficient of determination (R-squared) is *Model 3a, 4a, 5a*. The coefficient of determination (R-squared) for these *Models* is 0.981. The empirical meaning is that effective tax rate, liquidity ratio, and asset turnover have the same marginal effect in explaining firm leverage at this stage.

Model 2a:  $y_{it} = \alpha_i + \beta_1 x_{2it} + \beta_1 x_{3it} + \varepsilon_{it}$ ; where  $x_2$  is Firm Size (natural logarithm of sales) and  $x_3$  is the tangibility of assets.

Model 3a:  $y_{it} = \alpha_i + \beta_1 x_{3it} + \beta_1 x_{1it} + \varepsilon_{it}$ ; where  $x_3$  is the tangibility of assets and  $x_1$  is Firm Profitability.

Model 4a:  $y_{it} = \alpha_i + \beta_1 x_{4it} + \beta_1 x_{3it} + \varepsilon_{it}$ ; where  $x_4$  is Liquidity ratio and  $x_3$  is Liquidity ratio.

Model 5a:  $y_{it} = \alpha_i + \beta_1 x_{5it} + \beta_1 x_{3it} + \varepsilon_{it}$ ; where  $x_5$

is Asset turnover ratio  $x_5$  is Asset turnover ratio.

Model 6a:  $y_{it} = \alpha_i + \beta_1 x_{6it} + \beta_1 x_{3it} + \varepsilon_{it}$ ; where  $x_6$  is Effective tax rate and  $x_3$  is tangibility of assets.

Again, we construct the next set of regressions with 6 explanatory variables taking the forms below. The results of the regression estimates are reported in *table 5*. The study finds both *models* in *table 5* to have the same coefficient of determination (R-squared) of 0.981. Firm size (natural logarithm of sale) and profitability ratio are not statistically significant and add nothing to the explanatory power of the models at this stage.

Model 2:  $y_{it} = \alpha_i + \beta_1 x_{1it} + \beta_1 x_{3it} + \beta_1 x_{4it} + \beta_1 x_{5it} + \beta_1 x_{6it} + \varepsilon_{it}$ ; where  $x_3$  is the tangibility of assets,  $x_6$  is Effective tax rate,  $x_1$  is Firm Profitability,  $x_4$  is Liquidity ratio,  $x_5$  is Asset turnover ratio.

Model 4:  $y_{it} = \alpha_i + \beta_1 x_{2it} + \beta_1 x_{3it} + \beta_1 x_{4it} + \beta_1 x_{5it} + \beta_1 x_{6it} + \varepsilon_{it}$ ; where  $x_4$  is Liquidity ratio,  $x_6$  is Effective tax rate,  $x_2$  is Firm Size (natural logarithm of sales),  $x_3$  is the tangibility of assets,  $x_5$  is Asset turnover ratio.

Following the same algorithm, we arrived at the regression results in *table 6*. We show that asset turnover and liquidity of assets meet the expected relationship with the dependent variable (leverage), but they are both not statistically significant for non-financial firms in Nigeria. As reported in *table 6*, the results suggest that the main determinants of firm capital structure among non-financial firms in Nigeria are tangibility ratio, effective tax rate, firm size ln(total assets), and profitability ratio. Even though asset turnover and liquidity are important and improve the explanatory power of the models, they are not statistically significant, as shown in the table.

**Table 4. Fixed Effect Estimation.**

VARIABLES	The Dependent Variable is Book - Leverage ratio (Debt ratio)					
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
Profitability ratio	8.584 (7.510)					
Size ln(total assets)		-2.293 (1.944)				
Tangibility ratio			1.393*** (0.0301)			
Effective tax rate				-1.32e-06** (5.30e-07)		
Liquidity ratio					0.000262 (0.000319)	
Asset turnover						-0.290*** (0.0402)
Constant	-0.104 (0.735)	55.79 (46.67)	-0.102*** (0.0181)	0.736*** (1.63e-05)	0.735*** (0.00108)	1.403*** (0.0926)
Observations	432	432	432	432	432	432
R-squared	0.068	0.144	0.981	0.504	0.101	0.562
Number of Companies	36	36	36	36	36	36

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 4 above is the results from the fixed-effect model. We find that the model with the highest explanatory power is model 3, where tangibility of asset ratio is the explanatory variable. The tangibility ratio explains 98% of the variation in

the leverage ratio. The coefficient is positive and statistically significant at 1%; and meets the expectation of the study. The presence of physical assets serves as collateral for firms to borrow. In other words, creditors consider firms with more

physical assets to be creditworthy than their counterparts.

*Table 5. Fixed Effect Estimation.*

VARIABLES	The Dependent Variable is Book - Leverage ratio (Debt ratio)				
	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)
Tangibility ratio	1.401*** (0.0267)	1.396*** (0.0292)	1.393*** (0.0300)	1.393*** (0.0302)	1.398*** (0.0282)
Profitability ratio	-0.700 (0.448)				
Size ln(total assets)		0.0378 (0.0605)			
Effective tax rate			-7.98e-05*** (2.93e-06)		
Liquidity ratio				0.000319*** (3.30e-05)	
Asset turnover					0.0163* (0.00807)
Constant	-0.0382 (0.0508)	-1.010 (1.452)	-0.104*** (0.0181)	-0.103*** (0.0181)	-0.142*** (0.0138)
Observations	432	432	432	432	432
R-squared	0.981	0.981	0.981	0.981	0.981
Number of Companies	36	36	36	36	36

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The study builds upon the results in table 4 by adding more explanatory variables to the original model. We report the effect of the build-up model in table 5. The study finds that the effect of tangibility ratio remains positive and statistically significant at 1% in all (5) models. Significantly, all the models have the same explanatory power. The coefficient of determination is 98% across, except that profitability ratio and Size ln(total assets) are not statistically significant. A unit increase in tangibility ratio will cause firm leverage to increase by 1.401, 1.396, 1.393, and 1.398 in models 1, 2, 3,

and 5, respectively. The effective tax rate is also negative and statistically significant at 1%. Liquidity ratio and asset turnover are both positive and statistically significant at 1% and 10%, respectively. The study, however, reports that firm profitability ratio and Size ln(total assets) meet the expectation of the study and the pecking order theory in terms of direction but are not statistically significant. Table 5 shows that a unit increase in asset turnover will cause firm leverage to increase by 0.0163. Similarly, firms will have the capacity to borrow more as their liquidity ratio increases.

*Table 6. Fixed Effect Estimation.*

VARIABLES	The Dependent Variable is Book - Leverage ratio (Debt ratio)	
	Model	Model
	(1)	(2)
Tangibility ratio	1.405*** (0.0255)	1.400*** (0.0272)
Effective tax rate	-7.71e-05*** (3.72e-06)	-7.76e-05*** (6.48e-06)
Liquidity ratio	0.000377*** (3.81e-05)	0.000363*** (3.84e-05)
Asset turnover	0.0134* (0.00691)	0.0160* (0.00827)
Profitability ratio	-0.641 (0.439)	
Size ln(total assets)		0.0212 (0.0607)
Constant	-0.0807 (0.0525)	-0.656 (1.449)
Observations	432	432
R-squared	0.981	0.981
Number of Companies	36	36

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

In Table 6, we report the final phase of the algorithm in determining the determinants of firm capital structure in Nigeria, using the fixed effect estimation technique. The coefficient of determination is 98% in both models. We find the profitability ratio and Size ln(total assets) to be statistically insignificant. Based the fixed effect estimation technique, the study concludes that tangibility of assets ratio, effective tax rate, liquidity, and asset turnover ratio are the key determinants of the firm leverage ratio in Nigeria.

## 6. Results and Discussion

The results from the two-step system GMM estimation technique is reported in table 7, 8, 9, and 10 below. From Table 7, the dependent variable is the Book Value of Equity to Leverage ratio (Mkt /Debt-ratio). The results from Model 1-7 show that the lag value of the dependent variable is statistically significant at 1%. Whilst firm profitability ratio and tangibility of firm assets are statistically significant in all the models and consistent with the predictions of the pecking order theory. The firm asset tangibility ratio is positive and statistically significant at 5%. Consistent with the pecking order theory, the study shows that firm leverage is positively associated with tangibility ratio. For instance, from Model 5, a unit increase in asset tangibility ratio causes a 0.00574 increase in leverage. Firm leverage increase as the firm has more visible assets to secure debts through collateralization.

In Table 8 below, the study shows the two-step system GMM model results, analyzing the effects of financial sector rating, institutional quality, macroeconomic management, the rule of law, and profit tax in Nigeria on firm capital structure. The dependent variable is the Book Value of Equity to Leverage ratio (Mkt /Debt-ratio). The lag term of book leverage is statistically significant at 1% in all the models. The models in table 8 show that profitability ratio, tangibility ratio, and liquidity ratio are all statistically significant and meet the expectations of the study, and are consistent with the pecking order theory. The firm profitability ratio and liquidity ratio are negatively associated with firm leverage, while the tangibility of assets is positively associated with firm leverage. Models 6 and 7 find the effect of

institutional quality, financial sector ratings, corporate tax, and macroeconomic management on firm capital structure. In Model 6, we find the institutional quality and macroeconomic management are statistically significant 10%, respectively. While institutional quality is negatively associated with (Book Value of Equity to Leverage ratio (Mkt /Debt-ratio)), macroeconomic management positively affects firm leverage. Worsening conditions of institutional quality cause a decline in firm leverage (Book Value of Equity to Leverage ratio (Mkt /Debt-ratio)). For instance, a unit decline in institutional quality will cause (Book Value of Equity to Leverage ratio (Mkt /Debt-ratio)) to decline by 0.305.

From Table 9, the study reports that the lag of the dependent variable, Book -Value of Assets to Leverage ratio (Debt ratio), is positive and statistically significant at 1% in Models 2 and 7. The study finds that firm profitability ratio, firm size, and asset turnover are not statistically significant. We, however, find that tangibility ratio, liquidity ratio, and effective tax rate are statistically significant and meet the expectations of the pecking order theory. For instance, at a 1% significance level, a unit increase in tangibility ratio will cause firm leverage (Book -Value of Assets to Leverage ratio (Debt ratio)) to increase by 1.393 in Model 7. Also, at 1% significance level, a unit increase in liquidity ratio will cause firm leverage Book -Value of Assets to Leverage ratio (Debt ratio)) to decline by 0.00296 in Model 7. The effective tax rate also shows a negative and significant association between firm leverage (Book -Value of Assets to Leverage ratio (Debt ratio)) at 5%.

In Table 10 below, the study shows the results of the two-step system GMM model, analyzing the effects of financial sector rating, institutional quality, macroeconomic management, and profit tax in Nigeria on firm capital structure. The dependent variable is the Book -Value of Assets to Leverage ratio (Debt ratio). The lag term of book leverage is statistically significant at 1% in models 3 and 4. Among the determinants, liquidity and tangibility of assets are statistically significant, as shown in Models 4, 5, and 6. We also find that institutional quality, financial sector rating, and macroeconomic management are statistically significant 10% and affects firm capital structure in Nigeria.

Table 7. Two-step systems GMM estimation.

VARIABLES	The Dependent variable is Book Value of Equity to Leverage ratio (Mkt /Debt-ratio)						
	Model	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
L.(Mkt/Debt ratio)	0.737*** (0.144)	0.712*** (0.146)	0.717*** (0.146)	0.698*** (0.154)	0.687*** (0.161)	0.685*** (0.169)	0.692*** (0.180)
Profitability ratio		-0.197* (0.104)	-0.174** (0.0836)	-0.229** (0.110)	-0.220* (0.108)	-0.161** (0.0774)	-0.172* (0.0910)
Size ln(total asset)			-0.00133 (0.00402)	-0.000319 (0.00480)	0.000195 (0.00524)	8.87e-05 (0.00514)	0.00107 (0.00677)
Tangibility ratio				0.00557** (0.00225)	0.00574** (0.00235)	0.00560** (0.00215)	0.00546** (0.00217)
Liquidity ratio					0.000158 (0.000196)	0.000158 (0.000205)	0.000142 (0.000209)
Asset turnover						0.00453 (0.00308)	0.00429 (0.00263)



VARIABLES	The Dependent variable is Book Value of Equity to Leverage ratio (Mkt /Debt-ratio)						
	Model	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Effective tax rate							4.15e-06 (9.34e-06)
Constant	0.149* (0.0761)	0.184** (0.0775)	0.211** (0.0876)	0.201* (0.104)	0.191* (0.108)	0.177* (0.101)	0.156 (0.128)
Observations	319	319	319	319	319	319	319
Number of Companies	36	36	36	36	36	36	36
Hansen test	30.84	28.78	25.27	30.65	29.30	23.98	29.30
Hansen_p-value	0.987	0.987	0.987	0.987	0.987	0.987	0.987
Sargan_test	68.16	59.88	59.65	58.21	57.17	56.05	55.87
Sargan_Probability	0.099	0.108	0.109	0.2001	0.241	0.243	0.112
AR(1)_test	-2.30	-2.25	-2.27	-2.29	-2.27	-2.15	-2.13
AR(1)_p-value	0.022	0.024	0.023	0.022	0.023	0.031	0.033
AR(2)_test	-1.02	-1.04	-1.03	-1.00	-1.02	-1.05	-1.04
AR(2)_p-value	0.309	0.299	0.302	0.319	0.309	0.294	0.299
No. of Instruments	24	24	24	24	24	24	24

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 8. Two-step systems GMM estimation.

VARIABLES	The Dependent variable is Book Value of Equity to Leverage ratio (Mkt /Debt-ratio)					
	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)
L.(Mkt leverage ratio)	0.783*** (0.171)	0.780*** (0.170)	0.805*** (0.152)	0.794*** (0.153)	0.702*** (0.197)	0.840*** (0.176)
Profitability ratio		-0.375** (0.179)	-0.323** (0.127)	-0.277** (0.133)	-0.311* (0.157)	-0.264** (0.108)
Size ln(total assets)			-0.00449 (0.00648)	-0.00110 (0.00676)	-0.000138 (0.00582)	0.00446 (0.00714)
Tangibility ratio				0.00562** (0.00234)	0.00649** (0.00239)	0.00476** (0.00211)
Liquidity ratio					0.000996*** (0.000271)	0.00155*** (0.000445)
Asset turnover						-0.000348 (0.00504)
Financial sector		-0.00964 (0.0267)	0.0563 (0.0353)	0.00929 (0.0474)	0.00836 (0.0449)	-0.0323 (0.0380)
Macro Mgt.				0.0341* (0.0211)	0.0309* (0.0175)	0.0388** (0.0199)
Profit Tax						0.0464 (0.187)
Institutional quality			-0.472* (0.257)	-0.413* (0.221)	-0.305* (0.152)	
Constant	0.121 (0.0888)	0.185 (0.142)	1.271 (0.934)	1.067 (0.886)	0.831 (0.771)	-1.007 (3.539)
Observations	188	188	188	188	188	188
Number of Companies	36	36	36	36	36	36
Hansen test	35.91	33.36	32.06	26.09	26.01	21.30
Hansen_p-value	0.987	0.987	0.987	0.987	0.987	0.987
Sargan_test	66.12	73.52	57.14	57.52	46.17	79.63
Sargan_P-value	0.673	0.671	0.662	0.663	0.672	0.543
AR(1)_test	-2.23	-2.21	-2.34	-2.39	-2.21	-1.97
AR(1)_p-value	0.026	0.027	0.019	0.017	0.027	0.048
AR(2)_test	-1.00	-1.01	-1.01	-1.04	-1.16	0.26
AR(2)_p-value	0.318	0.312	0.313	0.297	0.247	0.798
No. of Instruments	24	24	24	24	24	24

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 9. Two-step systems GMM estimation.

VARIABLES	The Dependent Variable is Book -Value of Assets to Leverage ratio (Debt ratio)						
	Model	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
L.(Book Leverage)	0.0131 (0.00774)	0.0210*** (0.00515)	0.0141 (0.0123)	0.00598 (0.00978)	0.00611 (0.00526)	0.0100 (0.0107)	0.00914*** (0.0042)
Profitability ratio		4.494 (3.567)	5.184 (3.423)	-0.186 (0.506)	-0.225 (0.456)	-0.329 (0.344)	-0.278 (0.348)
Size ln(total assets)			-0.252 (0.261)	0.0147 (0.0266)	0.0111 (0.0272)	0.00983 (0.0283)	0.00788 (0.0303)
Tangibility ratio				1.396*** (0.0460)	1.390*** (0.0320)	1.390*** (0.0377)	1.393*** (0.0367)
Liquidity ratio					-0.00295*** (0.000125)	-0.00298*** (0.000145)	-0.00296*** (0.000152)
Asset turnover						-0.0136 (0.0140)	-0.0118 (0.0153)
Effective tax rate							-7.60e-05** (3.28e-05)
Constant	0.744*** (0.213)	0.305* (0.169)	6.310 (6.176)	-0.450 (0.648)	-0.339 (0.647)	-0.256 (0.676)	-0.226 (0.721)
Observations	319	319	319	319	319	319	319
Number of Companies	36	36	36	36	36	36	36
Hansen test	35.18	33.90	32.83	32.61	30.57	28.17	28.92
Hansen_p-value	0.987	0.987	0.987	0.987	0.987	0.987	0.987
Sargan_test	72.38	68.25	83.57	69.18	84.35	75.18	75.88
Sargan_Probability	0.463	0.478	0.401	0.436	0.428	0.331	0.322
AR(1)_test	-1.00	-1.00	-1.00	-1.16	-1.17	-1.16	-1.15
AR(1)_p-value	0.316	0.315	0.317	0.245	0.242	0.248	0.250
AR(2)_test	-1.29	-1.06	-1.09	-0.90	-0.67	-0.85	-0.98
AR(2)_p-value	0.198	0.291	0.276	0.368	0.504	0.397	0.326
No. of Instruments	24	24	24	24	24	24	24

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 10. Two-step systems GMM estimation.

VARIABLES	The Dependent Variable is Book -Value of Assets to Leverage ratio (Debt ratio)					
	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)
L.(Book Leverage)	0.00813 (0.00673)	-3.60e-05 (0.0132)	0.0182* (0.0108)	0.00587*** (0.00280)	0.00432 (0.00324)	0.0123 (0.0104)
Profitability ratio		7.752 (6.804)	7.437* (4.265)	-0.642 (0.788)	-0.577 (0.700)	-0.637 (0.747)
Size ln(total assets)			-0.321 (0.222)	0.0127 (0.0354)	0.0164 (0.0335)	0.00943 (0.0319)
Tangibility ratio				1.379*** (0.0487)	1.387*** (0.0396)	1.372*** (0.0531)
Liquidity ratio					-0.00296*** (0.000207)	-0.00390*** (0.000499)
Asset turnover						-0.0168 (0.0147)
Financial sector rating		-0.748 (0.799)	-0.821** (0.445)	0.208 (0.151)	0.170 (0.141)	0.185 (0.156)
Macroeconomic Mgt				-0.0696* (0.038)	-0.0491 (0.0718)	-0.167* (0.092)
Profit Tax						0.0817 (0.535)
Institutional quality			-0.336*** (0.181)	-0.139** (0.071)	-0.122 (0.195)	
Constant	0.893** (0.352)	2.421 (2.188)	11.07 (6.595)	-0.372 (1.386)	-0.451 (1.202)	-1.914 (10.60)
Observations	188	188	188	188	188	188
Number of Companies	36	36	36	36	36	36
Hansen test	34.10	28.65	25.91	28.97	24.67	23.94
Hansen_p-value	0.987	0.987	0.987	0.987	0.987	0.987
Sargan_test	77.21	90.76	93.15	81.02	89.05	73.60
Sargan_Probability	0.253	0.363	0.117	0.463	0.234	0.456

VARIABLES	The Dependent Variable is Book -Value of Assets to Leverage ratio (Debt ratio)					
	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)
<i>AR(1)_test</i>	-1.00	-1.00	-1.01	-1.20	-1.17	-1.18
<i>AR(1)_p-value</i>	0.316	0.319	0.312	0.231	0.242	0.238
<i>AR(2)_test</i>	-1.29	-0.36	0.07	0.19	0.28	-0.27
<i>AR(2)_p-value</i>	0.198	0.715	0.946	0.849	0.777	0.786
<i>No. of Instruments</i>	24	24	24	24	24	24

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 7. Conclusion and Recommendations

A comprehensive study of firm-specific characteristics and market-related factors that determine firms' capital structure enhances an understanding of how firms make their financing decisions. It also helps regulators to design a financial system consistent with the achievement of an efficient resource allocation. This study investigates the determinants of firm capital structure of 36 non-financial firms listed on the Nigeria Stock Exchange from 2008 to 2019. Specifically, the study examined the determinants of firm leverage of these firms listed on the Nigeria Stock Exchange. The study also examined how institutional quality, macroeconomic management, the rule of law, and financial sector performance affect the capital structure of non-financial firms in Nigeria.

The two-steps systems GMM estimation technique was applied to the panel data. The study finds that firms adjust their leverage levels to achieve targeted capital structure. Although most of the determinants identified in the literature affect firm-level leverage, the degree and significance of each determinant are firm-specific. Among the determinants of capital structure (firm leverage) in Nigeria, the study finds that profitability ratio, effective tax rate, and liquidity of assets are negatively associated with leverage ratios. The findings of the study are consistent with the results of [18], who found evidence anchored on the expectancy and the pecking order theory among energy sector firms in Kenya. The tangibility of assets and firm size is positively related to firm leverage ratios. The negative relationship established between firm profitability and liquidity of assets suggests that firms with enormous liquid assets have significant cash at hand or bank to commit to investment activities. Hence will higher profitability and liquidity ratios can finance their investment activities internally. The relationship between profitability ratio, liquidity of assets, and firm leverage finds support in the Pecking order theory, suggesting that profitable and liquid firms will have to use retained earnings over debt issuance in their capital investing mix. Similarly, the positive association between tangibility of assets, firm size, and firm leverage indicates that firms with more physical assets will finance their investment activities with debt issuance. Our results also confirm the findings of [22], who found that firm age, profitability, size, asset structure, risk, and managerial ownership are the crucial factor that determines the capital structure mix of firms in Ghana.

The study also identified that macro-variables such as

institutional quality, macroeconomic management, the rule of law, and financial sector performance significantly influence firm financing mix. Local and international investors favor countries with strong and quality institutions, the rule of law, human rights protection, and property rights enforcement with sound macroeconomic management.

This study has identified critical factors that affect the financing mix of non-financial firms listed on the Nigeria Stock Exchange. Therefore, the study's findings suggest that firm-specific factors on a firms' leverage are influenced by firm profitability, asset tangibility ratio, liquidity ratio, asset turnover ratio, and effective tax rate. The study also found evidence that institutional quality, macroeconomic management, the rule of law, financial sector performance matters in firm financing mix, and investor decision-making demands a conscious effort towards strengthening governance and law and property rights. The study results are generally consistent with the literature and the theories of firm capital structure in an international setting. However, further research is recommended to examine the effect of CEO characteristics and corporate governance factors on capital structure.

## Data Availability Statement

The data for this study was extracted from the published annual financial reports of the companies. The data is available at: Asiedu, Michael (2021), "Africa capital structure - firms", Mendeley Data, V1, doi: 10.17632/8dv486w9w7.1.

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