Dynamic modelling of the relationship between financial leverage and firm value of selected firms quoted on the Nigerian Stock Exchange

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ABSTRACT

This study examined the long-run effect of financial leverage on firm value with evidence from a sample of 62 firms quoted on the Nigerian Stock Exchange, over the five-year period between 2014-2018. The level of financial leverage as measured by the Debt-Equity ratio while firm value was represented by Tobin's Q Market-Book Value Ratio. The study contributes to the literature by appraising the dynamic dimensions of the causal relationship between firm value and financial leverage, an investigation that has remained elusive in indigenous studies. The study determined the degree of long-term causality by employing an auto-regressive model estimated by the Generalized Method of Moments (GMM) technique. The regression results show that financial leverage has a significant positive effect on the firm value both in the short and long run, while the result of the correlation analysis carried out reveals that there is a significantly positive and strong linear relationship between the time series of firm value and its lagged version implying that firm value does not demonstrate traits of Mean reversion. The Management of these companies was advised to optimize firm value by undertaking quality projects and relying more on debts for funding.

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Introduction

Corporate debt has been on the rise both domestically and globally leading to large volumes of issues as well as trading in corporate debt instruments in major capital markets. This primarily makes the topic of financial leverage an important issue to understand especially with a view to ascertaining its determinants as well as its effects on the financial performance and value of firms. Roberts and Zurawski (2016) noted while referring to the specific case of Chinese firms, that high corporate leverage ratio and associated problems like mounting moral hazards and hidden financial risks led Governments like that of China to identify 'deleveraging' among its structural reform objectives for 2016 (NDRC, 2016).

PwC (2019) in its Nigerian Capital Market Update reported that the volume of activity in the short-term debt market saw considerable annual growth of up to about 94% over the period 2014-2019. Generally, debates regarding the effect of financial leverage and capital structure on the value of Nigerian firms needs to be exclusively studied and extensively by researched. Moreso, as Lawal, Somoye and Babajide (2017) noted, capital markets in developing economies are largely inefficient when compared to those of advanced economies because of the information asymmetry as such, it is not likely that inferences drawn from data obtained from countries with much more sophisticated financial systems would be applicable to a developing economy such as Nigeria.

Certain structural differences which have also been identified include multiple taxation, volatile depositor base, Limited market capitalization, fewness of non-governmental long-term debt market, regulatory inadequacy, and perhaps the most relevant to this study being the peculiarity of the fiscal space and the magnitude of tax shield (Eke, Adetiloye and Taiwo, 2018). In practice, when firms embark on a financing decision, there are basically two alternatives available to the management to choose from namely debt and equity.

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Usually, corporations seek an optimal combination of the two major sources in setting up their capital structure and although many firms are levered, studies have shown that short term loans like money-market instruments, commercial papers, floating and variable rate notes as well as banker's acceptance account more for their leveraged capital structure than long term debts which are not easily obtainable (Onaolapo, Kajola, & Nwiodobie, 2015). While, Debt financing involves short-term payment obligations, long term debt includes instruments such as bonds in the capital market and credit facilities in the loan market. Equity financing basically involves the raising of capital through the issue of a company's stocks in the capital market. Equity financing may also take the form of reinvested earnings whereby past profits which have been a part of shareholders' fund are purposely converted into share capital. In order to further ensure that companies in the real sector gain access to long term debt financing at a reasonable rate the central bank recently made a standing deposit facility policy which restricts commercial banks' daily investment in government securities to a maximum of N2billion (CBN, 2019). The Apex bank had recognized the importance of the intermediary role of the Money Deposit Banks in providing funding for businesses, a role which has been eroded by the riskless profiteering objective of banks who prefer to invest in government securities which they consider to be near risk-free. The effect has been inadequate funding of the real sector and very high cost of funds.

According to Fløgstad (2017), another major contributory factor arises when governments, in a bid to close the output gap and thereby achieve full employment, resort to expansionary fiscal policies largely funded by debts and which often increase the lending rate and crowd out funds from the private sector by way of high lending rates. Investment banks being profit-maximizing economic agents capitalize on such high rates to earn rentals but the real sector is left hurt because their earnings are often eroded by high debt servicing and repayment cost.

Existing literature shows that there is no consensus of opinions among researchers on the effect of financial leverage on firm value. Several researchers like Gill and Obradovich (2013), concluded that it serves the firm's interest to take advantage of the net tax saving arising from higher leverage, since no considerable financial risks arises on account of a more leveraged capital structure. However, a number of other researchers like Akani & Kenn-Ndubuisi (2017) have argued that the dampening effect of higher financial risk especially in the face of information asymmetry diminishes investors' confidence and may increase the weighted average cost of funds. Others like Khan (2012) were of the view that leverage does not affect the value or performance of firms.

Apart from the seeming inconclusiveness of existing studies, this work is also motivated by the failure of any known indigenous study to explore the dynamic nature of the relationship of firm value and the identified primary explanatory variable. This is even more necessary since according to Arellano and Bond (1991) it is believed that dependent variable in a contemporaneous year may be affected by past levels of itself as well as that of the explanatory variable. This thus necessitates the adoption of an Auto-Regressive model which includes the lagged dependent variable in order to determine the existence of mean reversion as well as the long run coefficients of the other right-hand side variables.

Although works like Muritala (2018) addressed the most common form of endogeneity bias which arises from omitted variables through the Pooled Ordinary Least Squares Technique, as well as the Unobserved variables bias such as time and individual effects through the fixed effect approach adopted, they still failed to address the issue of simultaneity which is the third form of endogeneity bias thereby providing rather unreliable results. This study will address issues of reverse causality through the Generalized Method of Moments (GMM)-IV estimation technique

One other observation which necessitates a novel study of the topic is the fact that although several works like Akani & Kenn-Ndubuisi (2017); Abubakar (2016) and Onaolapo, Kajola and Nwiodobie (2015) have considered control variables such as Asset tangibility and Age of firm, this research work will be the first indigenous study to examine the interaction effect of market capitalization within the relationship between financial leverage and firm value.

An in-depth analysis of the literature shows that, most existing research works on Nigerian firms such as Kenn-Ndubuisi and Nweke (2019) and Isola and Akanni (2015) have adopted such improvised measures of firm value such as ROE and ROI as against Tobin's Q Market-to-Book Value which Sharma (2013) considers to be a better measure of firm value.

Finally, existing studies such as Gill and Obradovich (2013) have upheld the postulations of MMI (1958) and MMII (1963) both of which assume near- perfect capital market, the fact that these theories primarily relate to advance economies raises questions about its applicability to developing countries. This work thus seeks to test the applicability of the Modigliani and Miller Theories in the case of firms operating within emerging economies such as the Nigerian economy, by providing empirical evidence to prove its postulations. Based on the aforementioned this study thus seek to achieve the following objectives:

- i. To explain the nature of the dynamic relationship between financial leverage and firm value.
- ii. To ascertain the joint effect of market capitalization and financial leverage on firm value.
- iii. To determine the mean reverting behavior of firm value.

This study thus seeks to provide answers to the following research questions:

- i. What degree of dynamic effect does Financial leverage have on Tobin's Q?
- ii. Do Market Capitalization and financial leverage have a joint effect on firm value?
- iii. Is there a significant negative collinearity between firm value and its lagged value?

Research Hypothesis

- i. Hypothesis One: Financial leverage has no significant dynamic effect on Tobin's Q
- ii. Hypothesis Two: Market Capitalization and Financial leverage have no significant joint effect on Firm value
- iii. Hypothesis Three: There is no significant negative linear relationship between Tobin's Q and its lagged values

This research work will provide more empirical evidence about the nature of the long-run relationship between firm value and financial leverage as well as the impact of certain control variables on firm value. This study will therefore be useful to the Management of Quoted Companies in obtaining information about key factors such as Market Capitalization and Asset Tangibility which should guide their financing decisions. The study will also help investors in the companies quoted on the Nigerian Stock Exchange to determine the magnitude and direction of possible changes in firm value, dividend and capital gains arising from the financial decisions taken by Management.

The rest of the study would be arranged in the following order Section two - Literature review of the relevant concepts relating to Debt, Equity, Leverage. Also in this section, findings from recent related studies will be reviewed. Section three – here, the methodology adopted for the purpose of the study will be discussed. The fourth section presents the panel data regression results and analysis whilst the fifth section contains the summary of findings made, recommendations for the management of the firms concerned as well as suggestions for further studies

Literature Review

Theoretical and Conceptual Background

Modigliani and Miller - Net Tax Advantage Theory

Modigliani and Miller (1967) unlike previous capital structure theories considered the effect of corporate tax shield which accrues to debt and thus suggested that firms that diversify their capital structure to include as much debt as possible would tend to maximize their value (Modigliani & Miller, 1967).

The axiom upon which this postulation rests was the Tax-deductible nature of interest expense which is seen as a borrowing expense that a firm can reclaim on a tax return and thereby effectively reduce taxable income. The Modigliani and Miller proposition with taxes purports that as a result of the omission of interest from the payment of taxes, levered firms tend to have a higher market value than unlevered firms. Due to the tax shield effect, the tax payment is lesser for firms with debt thereby increasing the free cash flow FCF. This in turn influences the firm's market value positively (Alifani & Nugroho, 2013).

Pan (2012) however contends this premise stating that although firms make greater profit after-tax by altering their capital structure in favour of debt over ratio, the value of the firm would not necessarily rise. Similarly, Alifani and Nugroho (2013) observed that the supposition of increased firm value due to tax saving on interest expense seemed to reduce the MM analysis to a mere academic postulation bearing no realism, as it seemed to only accord debt an edge over equity. Miller (1977) explains that with a higher debt to equity ratio, the ratio of interest payment to dividend payout increases so much so that investors have to bear a heavier tax burden on interest payments than on equity returns, this reduces the benefit derivable from the issuance of debt. Although, Ross (2005) opines that the effect of taxation may not necessarily interfere in the relationship between firm leverage and firm value. The net impact of leverage on firm value given personal taxes can still be positive as shown below:

$$VL = VB + \left(1 - \frac{(1 - T_c)(1 - T_s)}{(1 - T_d)} \right) B$$

Where:

VL = Value of levered firm

VB = Value of unlevered firm

$\left(1 - \frac{(1 - T_c)(1 - T_s)}{(1 - T_d)} \right) B$ = Present Value of the tax shield given personal income tax

T_c = Corporate Income tax

T_s = Personal Income tax rate on capital gains of investor

T_d = Personal Income tax rate on interest income of investor

The Net Tax Advantage theory thus suggests that not unless Personal Income tax rate on capital gains of investor equals Personal Income tax rate on interest income of investor, the present value of the tax shield will always be greater than zero which thus makes the value of a levered firm exceed the value of an unlevered firm.

The theory highlights the cost of re-contracting which is implicit in bankruptcy as another factor which within the MMII paradigm limits the extent of a firm's leverage. Although, the costs of re-contracting hardly ever exceeds or even matches the tax advantages in size, the decision of more and more companies taking more loans can be understood. The Modigliani and Miller theories of Capital Structure were theoretical precursors of the Trade-off theory providing the very framework upon which both the static and Dynamic versions of the trade-off theory would later be built.

Comparison of The Modigliani and Miller Net Tax Advantage Theory with other Capital Structure Theories

In the course of studying the Capital Structures in Small and Mid-Capitalized firms, Dommes, Schmitt and Steurer (2019) compared the Trade-Off and Pecking Order Theories. Dommes et. al. (2019) noted that the Trade-off theory of Kraus and Litzenberg (1973) which relies partly on the Agency cost theory of Jensen and Meckling (1979) and Modigliani and Miller theories, along with the Pecking order theory of Myer (1984) and Market timing theory of Baker and Wurgler (2002) have become three alternative capital structure choice theories which have gained wide acceptance among analysts and researchers. The Pecking order theory generally identifies various sources of finance and recommends an order of preference that makes retained earnings of finance to be the most ideal then debt and finally equity financing. The Theory does not stipulate a particular firm-value-optimizing capital structure rather it merely prescribes the use of the next financing option available on the recommended list only when the preceding alternative is not available.

Huang and Ritter (2005) while considering the Market Timing Theory as an alternative theory of financial leverage, do not exactly prescribe a specific target leverage but notes that making a choice between equity financing and debt financing is a function of market conditions in the stock-market. Specifically, the theory recommends the choice of equity financing when the firm's market capitalization is higher relative to Book-value ratio at which time the firm will be able to raise more capital at a cost lower relative to its cost of debt.

Although, certain models based on trade-off theories such as the ones developed by Kane, Marcus and McDonald (1985) and Fisher, Heinkel and Zechner (1989) have attempted to define the dynamic relationship between firm value and financial leverage, however the two assumptions that firm value of a levered firm necessarily exceeds the value of an unlevered firm and that the rate of return on the unlevered firm will definitely be less than the fair rate of return, in the opinion of Goldstein, Ju and Leland (2001) reduces the analysis to a one-period framework.

According to Miller (1977) the Net Tax Advantage Theory of Modigliani and Miller (1963) makes no perfect market assumptions and compared to the trade-off theory provide a more realistic framework for dynamic analysis. Fisher (1989) on the other hand, posited that Net tax benefit are negligible in a dynamic sense. The objective of this research work is thus to test the validity of the Modigliani and Miller Net tax advantage theory in a dynamic dimension.

Empirical Review

There is a plethora of empirical studies which have examined the topic of financial leverage. While some studies centered on defining a certain optimum capital structure, a host of other researchers simply addressed the more central subject which is the nature of the causal relationship between financial leverage and firm value. In terms of their conclusions, previous works can be classed into three categories. In the first category are studies which conclude that financial leverage has a positive effect on firm value, while in the second category are works which found a negative relationship between firm value and the primary explanatory variable while the third category found an insignificant response of firm value to financial leverage.

Muritala (2018) also investigated relationship between the capital structure of ten Nigerian firms and operational firm performance, upon the presumption that it is a linear relationship. With the aid of secondary data which covered a five-year period, the results from Panel Least Square (PLS) confirmed that asset turnover, size, firm's age and firm's asset tangibility are positively related to firm's performance.

Similarly, Gill and Obradovich (2013) investigated the impact of corporate governance and firm capital structure on the value of 333 firms quoted on New York Stock Exchange. Using the Ordinary Least Square (OLS) Technique to analyze data covering the 3-year period from 2009-2011, Gill et al. (2013) found that financial leverage, holdings as a measure of corporate governance and a host of other of control variables had a positive effect on the value of the selected firms. However, the results obtained by Muritala (2018) and Gill et al. (2013) are prone to a common form of endogeneity bias arising from differences occurring over the time and entities studied, since the POLS technique does not account for time and entity effects.

In order to obtain more reliable results, Farooq and Masood (2016) while investigating the effect of financial leverage on the firm value (represented by Tobin's Q) of 19 firms over the period 2008-2012, employed both the fixed effects and random effects models and later adopted the results from the more appropriate panel econometric technique after conducting the Hausman Test. Farooq et.al. (2016) found that financial leverage is positively associated with firm value.

The premise of the works which have been reviewed up to this point is the linearity assumption of Firm Capital Structure, which does not consider the existence of an optimal level of capital structure. The optimal capital structure itself presupposes that the

relationship between financial leverage and firm value is concave such that after certain maxima, the firm operates a suboptimal level of capital structure where financial leverage contributes only negatively to firm value.

As such Cuong and Canh (2012) had employed panel threshold regression model while studying 92 Vietnamese firms, using data covering the period 2005 - 2010. this study tested for the panel threshold effect of capital structure on firm value. Cuong et al. (2012) concluded that a capital structure levered to the extent of 59.27% is optimal, and positively impacts on firm value proxied by ROE

More recently, Jaisinghani and Kanjilal (2017) adopted a similar method while examining the effect of capital structure on firm performance 1194 publicly traded manufacturing firms in India using data covering the 10-year period between 2005-2014. The study which utilized the threshold regression technique to ascertain the differential (rather than aggregate) impact of different levels of financial leverage on firm profitability found that where debt financing was in excess of 148 million rupees' firm value was positively affected.

Contrary to the findings of Gill et al. (2013), Farooq et al. (2016), Jaisinghani et al. (2017) a number of studies have adduced empirical evidence supporting the idea that financial leverage does have a negative impact on firm value. Such works include: Pandey and Sahu (2017) Akomeah, Bentil and Alhassan (2018), Ibrahim and Isiaka (2020).

Ibrahim and Isiaka (2020) studied 18 firms quoted on the Nigerian Stock Exchange, using data from 2014-2018, the study appraised firm value from a different perspective by incorporating market capitalization into the valuation process. The Panel data regression model established a negative causal relationship between the dependent variable firm value and long term debt to equity ratio. Although Ibrahim and Isiaka (2020) improved on previous works by addressing issues of heteroscedasticity arising from omitted variable bias as well as multi collinearity, they however did not address the endogeneity bias arising from simultaneity or two-way causality.

Moreover, Ruan, Tian, and Ma (2011) had in their study of 197 Chinese firms concluded that there exists some form of two-way causality between the debt to total assets ratio and firm value although leverage still seemed to impact negatively on firm value.

Similarly, Akomeah, Bentil and Alhassan (2018) studied 20 non-financial firms in Ghana to ascertain the impact of capital structure choice on firm performance using data covering a period of 7 years (2010-2016). The study found that the 2 proxies of leverage (Short term debt to equity ratio and Long term debt to equity ratios) were found to be negatively related to firm performance.

In the same vein, Pandey and Sahu (2017) examined the response of firm performance in the case of certain quoted Indian manufacturing firms to a levered capital structure. Utilizing eight-year data covering the years 2009-2016, Pandey et al. (2017) concluded that capital structure had a negative effect on the selected firms' performance. Pandey et al. (2017) addressed the endogeneity issues arising from omitted variables by adopting the Dummy Variables Technique.

Even though Akani & Kenn-Ndubuisi (2017) conducted a dynamic analysis employing the Vector auto regression (VAR) technique, the primary focus of their study was to examine the response of firm performance to changes in board and ownership structure. forty quoted companies quoted on the Nigerian Stock Exchange (NSE) while over the 9-year period between from 2008 to 2016. The study on and findings showed that there exists a significant negative long-run causal relationship between diluted ownership and Return On Assets (being the firm performance proxy).

While conducting a static analysis of the impact of financial leverage on the ROE of 66 non-financial Nigerian firms. Abubakar (2016) developed a 10-year Panel using data covering the years 2005- 2014. Abubakar (2016) who employed both the Panel Least Squares Technique and the dummy variables Techniques found empirical evidence to conclude that financial leverage is negatively associated with the return on equity (ROE) and firms' financial performance by deduction.

In a similar study, Ilyukhin (2015) concluded that leverage is negatively associated with firm value of selected Russian companies. Ilyukhin (2015) used a 10-year data covering 2004–2013 to estimate three panel data regression models, which had ROA, ROE and Gross Profit Margin as the response variables respectively while Debt - Total Assets Ratio was used as the primary regressor

Similarly, Khan (2012) adopting Total Debt - Asset ratio and Short Term Debt - Total Assets ratio as proxies of leverage and Tobin's Q as a measure of firm value, examined the causal relationship between the capital structure of 36 KSE listed companies and their value. Results from a seven-year Panel covering the years 2003-2009 reveal that a significantly negative relationship exists between the measures of financial leverage and firm value.

The rest of this review will consider such studies which purport that their financial leverage has no significant effect on firm value. Such works include: San and Heng (2011) and Chadha and Sharma (2015).

San and Heng (2011) examined the nature of the causal relationship between financial leverage and the firm performance of a number of Malaysian companies. San et al. (2011) found that financial leverage had no major impact on the performance of construction industry.

Similarly, Chadha and Sharma (2015) appraised the effect of capital structure on the firm value of 422 manufacturing companies quoted on the Bombay Stock Exchange. Chadha et al. (2015) utilized data the 10-year period covering 2004-2013 concluded that the choice of a levered capital structure is not associated with any response in terms of changes in return on asset and Tobin's Q. This

study will employ a panel data model. similar to the one developed by Chadha et al. (2015) which included relevant variables such as Tonion's Q, Debt-Equity Ratio and asset size of the company, as well as other significant drivers of a firm's value. However, in order to fill the research gap, this study will be developing and estimating an auto regressive model first to determine the dynamic causal relationship and to understand the dynamic behavior of firm value.

Research and Methodology

This study utilizes the panel data research design which is a combination of cross-sectional & time-series data. A Panel Data is a dataset in which several individuals or companies are observed across time. Panel Data is particularly useful when the data set comprises a Large Number of Individuals and a small-time frame. The Generalized model for any given panel data is a matrix of the form

$$Y_{it} = a_i + Bx_{it} + U_i$$

where Y_{it} represents the dependent variable for company (i) at time (t), x_{it} is a ($T * K$) matrix of the primary dependent variable and a_i is the independent effect in the model and it controls for the effect of unobservable regressors which are uniquely related to individual or company i , while U_i is the error term. Importantly both a_i and U_i are unit matrices of the ($T*1$) form. With this framework the existence and significance of a causal relationship between the ratio of long term debt to equity and short term to equity ratio (two proxies of financial leverage) and Tobin's Q (a proxy of firm value) is investigated. Secondary data is collected on a total of 62 firms. Other control variables such as Assets, Market Capitalization, Lending rate and Return on Asset of the 62 quoted firms over the 5-year period between 2014-2018 are utilized.

Population of the Study

This Population of this study are the 164 companies quoted on The Nigerian Stock Exchange. The NSE is divided into 11 different segments Agriculture, Construction, Consumer goods, Financial Services, Health Care, ICT, Industrial goods, Natural Resources, Oil and Gas, Services and Conglomerates.

Sample Size and Sampling Technique

Given that the population of the companies under study is 164, by applying Taro Yamane (1967), the minimum sample size at 90% confidence interval will be 62 companies. This study adopts the Stratified Sampling technique which requires that the population is first divided into different section and then the relative size of each sub-population or group is used as a basis of determining the sample drawn from each sub-group. Stratified Sampling technique improves the precision and representativeness of inference by reducing bias involved in the sampling process. The 164 companies are divided into the 11 segments. A total of 62 companies will then be selected from all 11 segments based on the groups proportion of the total population. In order to achieve this, the formula

$$\text{Sample from each segment} = \frac{\text{Number of companies in the segment}}{\text{Total number of listed companies}}$$

Subsequently the formula N/n is used to determine the interval for choosing samples from each sub-group the components of which will be arranged in an alphabetical order. This technique will ensure that all industries as well as all sub-groups based on market capitalization have a fair chance of being selected in the sample.

Table 1: Analysis of Sampled Companies Based on Industry

S/N	Industry	Total Number of Quoted Companies	Number of Companies Selected
1.	Agriculture	5	3
2.	Construction	7	2
3.	Consumer goods	21	13
4.	Financial Services	53	14
5.	Health	10	5
6.	ICT	7	2
7.	Industrial goods	14	7
8.	Natural Resources	4	1
9.	Oil and Gas	12	5
10.	Services	25	7
11.	Conglomerates	6	3
	Total	164	62

Source: Author's own computation.

Table 1 shows the breakdown of the population based on the industry or sector wherein respective companies operate as well as the number of firms selected from each sector. In total, 62 sectors are selected randomly from the 11 sectors of the Nigerian Stock Exchange.

Afterwards, in order to capture the effect of differences in company size based on market capitalization as at 2018, a requirement for addressing hypothesis three, this study will divide the 62 sampled companies according to Aigner and Schrabmair (2020) first into 6 categories where firms with market capitalization of up to \$50 million are regarded as Nano Cap firms, \$50million to \$250million are regarded as Micro Capitalization Firms, \$250million to \$2billion Mid-Capitalization \$2billion to \$10billion, Large Capitalization \$10billion to \$200billion Mega Capitalization above \$200billion. Then later on the sampled firms will be divided into 2 groups so that Nano Cap and Micro Cap organizations are referred to as smaller companies while Mid, Large and Mega Corporations are regarded as Larger companies.

Table 2: Analysis of Sampled Companies Based on Market Capitalization

	Larger	Smaller	Total
Sample (n)	8	54	62

Source: Author's own computation.

GMM/IV Technique

The Generalized Method of Moments GMM is a dynamic panel data analysis which makes use of instrumental variables IV developed based on certain orthogonal conditions. Ullah, Zaefarian and Akhtar (2018) explain how the GMM technique addresses endogeneity bias arising from simultaneity and reverse causality which may be inherent within dynamic panel data models. controls for endogeneity by introducing a lagged dependent variable in a dynamic panel model when there is correlation between the explanatory variable and the residual. Similarly, the GMM accounts for omitted variable bias, and unobserved panel heterogeneity. The use of GMM-IV implies the introduction of instrumental variables this requires a sufficient number of individuals in order to allow for a sufficient degree of freedom, which normally reduces as the number of parameters increases. However, where GMM-IV estimates are close to the Fixed Effect estimates, it implies that the long term dynamics captured using the instrumental variables are not statistically significant.

Regression Model Specification

Dynamic Panel Data Model

To address **Hypothesis, I(H0₁): Financial leverage has no significant dynamic effect on Tobin's Q**, we build a dynamic model of the form:

$$Q_{it} = \alpha + \lambda Q_{it-1} + \beta_2 TDE_{it} + \beta_3 [MCKPTL_TDE]_{it} + \phi LogASS_{it} + \gamma_2 ROA_{it} + \varepsilon$$

The dynamic equation above includes the lagged Tobin's Q which makes it possible to identify the long run impact of TDE_{it} on Q_{it} . In order to robustly address endogeneity issues arising from potential endogeneity between Q_{it} and the dependent variables, equation is estimated with the GMM-IV estimation technique of Arellano and Bond (1991). The possible of autocorrelation arising from under or over estimation of the standard error will be addressed by the Newey-West (1978) robust standard error measure.

Long-run effects for the kth parameter of each variable (provided such is statistically significant will be computed as $\beta_k / [1 - \lambda]$; where β_k is the short run coefficient of the variable k, while λ is the coefficient of the Lagged dependent variable.

Diagnostics

Basically the Z statistics and Wald test will be used to adjudge the individual and joint significance of the variables and of the model respectively. Additionally, Blundell and Bond (1998) states that for a GMM estimator to be considered unbiased and efficient, the coefficient of the lagged dependent variable in an autoregressive model must not be persistent nor close to being a random walk in which case λ does not tend towards 1. Arellano-Bond (1991) valid analysis require that the number of instruments is smaller than the Number of groups.

Interaction Effect Model

To address:

Hypothesis II(H0₂): Market Capitalization and Financial leverage have no significant joint effect on Firm value

The interaction model comprising three endogenous variables the third of which is the interaction term will be utilized to determine the interaction or joint effect between company size (in terms of market capitalization) and Total debt to Equity Ratio.

By differentiating equation above partially with respect to TDE, we obtain:

$$\frac{\delta Q_{it}}{\delta TDE} = \beta_2 + \beta_3 [MCKPTL]$$

Therefore the effect of Total Debt to Equity TDE on Tobin's Q in the case of firms with relatively larger market capitalization (denoted by a MCKPTL dummy value of 1) will be $\beta_2 + \beta_3$ while in the case of relatively smaller companies, MCKPTL assumes the value zero and as such the $\frac{\partial Q_{it}}{\partial TDE_{it}}$ is constrained to β_2 . By induction, β_3 represents the difference between when MCKPTL assumes the dummy code 0 (denoting smaller companies) and when MCKPTL assumes 1 (denoting larger companies). This is quite in line with the result obtained when the first differential obtained from equation above is differentiated with respect to the categorical variable: MCKPTL

$$\frac{\partial Q_{it}}{\partial MCKPTL_{it}} = \frac{\delta[\frac{\partial Q_{it}}{\partial TDE_{it}}]}{\delta MCKPTL_{it}} = \beta_3$$

The estimated value of β_3 , if significant at a level of 5%, represents the extent to which Market Capitalization interferes with the relationship between firm value and financial leverage. In other words, it is regarded as the difference between the effect of financial leverage on firm value in the case of large firms and smaller firms

Table 3: Description of Variables and Parameters

Variables	Interpretation	Purpose
$Q_{i,t}$	Natural log of Tobin's Q	Measure of Firm value
$L. Q_{i,t}$	Lagged value (Tobin's Q)	Determine the dynamic behavior of Firm value
$TDE_{i,t}$	Total Debt to Equity Ratio	Measure of Financial Leverage
$MCKPTL_{i,t}$	Large Market Capitalization	Dummy code representing larger firms with 1 and smaller firms with 0
$MCKPTL_TDE_{i,t}$	Product of [MCKPTL] and [TDE]	Interaction term
$LogASS_{i,t}$	Natural log of Total Asset	Book value of the company's Asset
$ROA_{i,t}$	Natural log of Returns on Asset	Measure of current profitability of the firm
	Error term	Measure of variation in the dependent variable due to unobserved variables
α	Constant	
$\beta, \phi, \chi, \lambda$	Parameters of the Model	

A-priori expectations: $\beta > 0, \lambda > 0, \phi > 0, \chi > 0$.

Correlation

To address **Hypothesis III (H0₃):** *There is no significant negative linear relationship between Tobin's Q and its lagged values.*

The correlation coefficients of all the relevant variables would be computed and the levels of significance would also be ascertained, using the pairwise correlation matrix. Where firm value and its lagged value are negatively correlated, firm value is said to demonstrate mean reversion. The a-priori expectation of two significantly correlated constructs is a correlation coefficient of (R) > 0.5, with a P-value that is less than 5%

Test of significance: The estimates obtained under the regression and correlation analyses would be tested for statistical significance using the P-Values. Statistical significance will be determined at 1%, 5% and 10% levels.

Data Analysis

Summary Statistics

Table 4 shows the summary statistics characterize the 62 firm sample understudy. Being a 5year panel data the observations are 303 observations, 7 observations less than the 310 expected observations due to the unbalanced nature of the panel. Nevertheless, the observations adequately represent the population. The mean Tobin's Q of all 62 companies is 1.503209 while the average Tobin's Q for the 8 larger-sized companies is 4.949926 which is much higher the average Tobin's Q obtained for the smaller sized companies (0.9789936). Similarly, the Standard Deviation of the larger sized company sized company (5.00802) is much higher than that of the smaller sized company, implying thereby that the firm value of the larger-sized companies is more volatile than that of the smaller-sized companies (2.400862). In terms of financial leverage, Debt to Equity Ratios tends to be indicative of greater reliance on Debt as against Equity, as such average TDE of the 62 firms is 2.31492.

Furthermore, TDE appears to be higher in the relatively smaller companies (2.400862) than in larger companies (1.749906). Figures on the asset tangibility show that companies which have larger market capitalization are also larger in terms of asset tangibility (8.06e+11) than companies with smaller market capitalization (4.35e+10). The average ROA of the 62 firms is 0.3165641 or 31.65641%; although the mean ROA of the larger firms is relatively lower at 23.26995% (.2326995) than that of the smaller firms at 32.93191% (.3293191).

Table 4: Descriptive Statistics

	All Companies					Larger- Sized Companies				Smaller & Medium -Sized Companies			
Variable	Obs	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Q	303	1.5032	2.70403	-5.649	20.44	4.949926	5.00802	.3286879	20.445	.9789936	1.614059	-5.64945	9.345305
TDE	303	2.31492	3.20387	-44.04	60.926	1.749906	1.343782	.280136	5.2690	2.400862	7.262376	-44.0486	60.92691
MCKPTL	303	5.67e+1	1.71e+1	-29.47	1.3e+12	3.48e+11	3.42e+11	4.85e+10	1.3e+12	1.24e+10	3.66e+10	0	4.33e+11
ASS	303	1.44e+11	6.30e+11	6.38e+07	5.96e+12	8.06e+11	1.57e+12	1.79e+10	5.9e+12	4.35e+10	1.14e+11	6.38e+07	1.07e+12
ROA	303	.3165	1.96094	-4.015	19.37	.2326995	.1956996	-.22040	.856384	.3293191	2.103674	-4.01502	19.3712

Source: Author's own computation.

Note: Obs represents Number of Observations, while SD represents Standard Deviation, Min represents Minimum, Max denotes Maximum Observation while TDE denotes Total debt to equity ratio, MCKPTL represents Market Capitalization, ASS –Asset tangibility, ROA Return on Asset

Table 5: Dynamic Regression Model Results (Using GMM Approach)

Variables	SHORT- RUN GMM		LONG- RUN GMM	
	Coefficient	P-Value	Coefficient	P-Value
Q_{t-1}	0.6060979 (0.0728651)	0.000***	_____	_____
TDE_{i,t}	0.1025549 (0.0177161)	0.000***	0.2603564 (0.0653791)	0.000***
MCKPTL_TDE	-2.01e-11 (6.74e-12)	0.003***	-5.10e-11 (1.71e-11)	0.003***
LogASS	-.0507074 (0.1685623)	0.764	_____	_____
ROA	-0.0959047 (0.0414624)	0.381	_____	_____
Year Dummies	Yes			
No of Observation	181			
Wald chi statistics	296.95			
Prob. (chi)	0.000			
Instrument/Groups	15/61			

Source: Author's own computation. *Note:* The parentheses contain the standard errors. *p < .10. **p < .05. ***p < .01.

Dynamic Model (GMM) Results

Hypothesis IV(H0₄): Financial leverage has no significant dynamic effect on Tobin's Q.

The Generalized Method of Moments utilizes an autoregressive model to first determine the statistically significant short run parameter estimates through the inclusion of the lagged dependent variable Q_{t-1} . The variables with statistically significant short-run coefficients are thereafter considered in the subsequent long run analysis. In this way, the GMM provides a reliable estimate of the long-run effects of the independent variables on the response variable.

Table 5 above shows that the coefficient of Q_{t-1} as 0.6060979 using the half-life adjustment formula of $\ln(2)/k$ where k or $1-\lambda$ is the coefficient of partial adjustment, firm reverts to its long run equilibrium in 3.5 years. This shows that firm value in preceding years has a rather positive effect on contemporaneous value of the firm. With a P-Value of 0.0728651 this coefficient is statistically significant at the 5% level of significance. Importantly, the fact that the coefficient of the lagged dependent variable is evidently less than one and is statistically significant shows that the model valid instruments. Blundell and Bond (1998) states that for a GMM estimator to be considered unbiased and efficient, the coefficient of the lagged dependent variable in an autoregressive model must not be persistent or close to being a random walk in which case λ does not tend towards 1.

Similarly, the autoregressive model estimates the short-run coefficient of the TDE as 0.1025549 along with a P-Value 0.00 affirming the statistically significant positive short-run effect of TDE on Firm Value. The coefficient of MCKPTL_TDE being -2.01e-11 shows that firms with relatively smaller market capitalization gain more firm value, although very marginally, from adopting higher levels of gearing in a static sense. In effect, the overall impact of TDE in firms with larger capitalization is 0.1025549 added to -2.01e-11 the result of which is a value marginally smaller compared to 0.1025549 which is the effect of TDE in smaller firms. Apart from Q_{t-1} , TDE and MCKPTL_TDE no other variable returned a statistically significant short run coefficient. Hence, the Long run relationship between each of TDE, MCKPTL_TDE and Q_{t-1} was examined. The results show that both variables tend to have equally significant effects in the long run, although to a greater degree. While the average effect of a unit-change in TDE on firm value increased from 0.1025549 in the short-run to 0.2603564 (0.000), in the long run ceteris paribus, the average effect of a unit change in MCKPTL_TDE on firm value increased from -2.01e-11 in the short run to -5.10e-11 (0.000) in the long run ceteris paribus.

The Wald test of joint/model significance is estimated at 296.95 with a P-Value of 0.000 which shows that the model is significantly better than an intercept-only model. Importantly the number of observations were reduced because the non-orthogonal option was adopted. According to Arellano and Bond (1991) an analysis using valid number of instruments utilizes instruments smaller than the number of groups, as such in this case the number of instruments is 15 which is considerably less than the number of groups which were 61. Hence the researcher rejects the null hypothesis that financial leverage has no statistically significant dynamic effect on firm value.

Interaction Effect Model Results

Hypothesis II(H0₂): Market Capitalization and Financial leverage have no significant joint effect on Firm value.

Table 6: Interaction Effect Model Result

Large Capitalized	Coefficients	SE	t -Stat	P-value
MCKPTL β_3	-2.01e-11	(6.74e-12)	-2.9821	0.003***

Table 6 above shows the value of β_3 which represents the amount by which the size of Market Capitalization affects the relationship between firm value and financial leverage. Given that the coefficient of β_3 is estimated as -2.01e-11 and the same is statistically significant at 1% level of significance, it can be deduced that the effect of financial leverage on the value of larger firms is 2.01e-11 less than its effect on the value of smaller firms.

Correlation Results

Hypothesis V (H0s): *There is no significant negative linear relationship between financial leverage and Tobin's Q*

Table 7: Correlation Matrix

	1	2	3	4	5	6
Q	1					
Q _{t-1}	0.7566*** (0.0000)	1				
TDE _t	0.2215*** (0.0001)	0.0467 (0.4190)	1			
MCKPTL _t	0.4838*** (0.0000)	0.393*** (0.0000)	-0.0296 (0.6078)	1		
ASS _t	-0.0262 (0.6498)	-0.0102 (0.8600)	-0.0084 (0.8847)	0.282*** (0.0000)	1	
ROA _t	-0.0203 (0.7250)	0.0031 (0.9566)	0.0528 (0.3601)	-0.0128 (0.8243)	-0.0148 (0.7977)	1

Source: Author's own computation. *Note:* The parentheses contain the p-values. *p < .10. **p < .05. ***p < .01.

Table 7 above shows the result of the pairwise correlational matrix which depicts the degree of the correlational relationship between all the variables under study while the corresponding P-Values are stated underneath the correlation coefficient as parenthetical materials. There exists a positive but weak relationship between the dependent variable (firm value measured by Tobin's Q) and one of the primary explanatory variable (TDE) to the extent of $r = 0.2215$, since the p value is 0.0001, a value far less than 0.05 the relationship is considered to be statistically significant. Similarly, there exists a positive but weak relationship between Tobin's Q measure of Market Value-Book Ratio and Size of Market Capitalization MCKPTL to the magnitude of $r = 0.4838$, since the corresponding p value 0.0000 is less than 0.05, the variables are considered to be moderately collinear at the 1% level of significance.

The correlational relationship between the TDE a proxy of financial leverage and ASS appears to be negative and weak with the r figure estimated as -0.0262 this estimated as it is the case with estimate of ROA is not significant at 1,5 and 10% levels of significance. Market Capitalization (MCKPTL) and Asset Tangibility (ASS) both of which measure firm size but from different perspectives were found to have a positive correlation given that the computed correlation coefficient is +0.282 this relationship is however weak but statistically significant at the 1% level of significance.

Of greatest importance in this regard, is the relationship between Q and Q_{t-1}, the result shows a correlational coefficient of 0.75 which implies that there is 75% semblance between time series of Firm Value and that of its lagged version. Being that the correlational relationship is positive and strong it can be deduced that firm value does not demonstrate traits of mean reversion implying that increases in firm value will rather be followed by a further rise in firm value than a fall.

Hence, we fail to reject the null hypothesis that there is no significant negative linear relationship between firm value and its lagged value.

Discussion of Research Findings

This study has adopted longitudinal data from 62 firms over 5 cross sections defined by the time period between 2014-2018, developing thereby a stylized panel data with a total of 310 observations. The first objective of this study was to establish the nature and extent of the causal relationship between the ratio of Debt to Equity as a proxy of financial leverage and Tobin's Q as a measure of firm value in a dynamic sense while addressing for omitted variable and endogeneity bias, it sought also to appraise the long-run dynamics of the firm value. In this regard, this research has found a positive causal long-run relationship between Debt to Equity ratio and Firm Value and this is in line with the works of Farooq et.al. (2016) and Muritala (2018). This would imply that most of the firms quoted on the stock exchange tend to perform better with higher long term debts such as sovereign and corporate debt securities. The null hypothesis that Debt - Equity ratio has no significant dynamic effect on Tobin's Q is therefore rejected.

In respect of the second objective of this study, the effect of total debt to Equity ratio on firm value has proven to be more pronounced in the cases of companies with larger Market Capitalization when compared to relatively smaller companies. This implies that the firm value of companies with larger market capitalization tend to respond more positively to changes in financial leverage than the smaller companies.

Finally, the time series of Firm Value has been found to be positively correlated with the time series of its lagged version implying that firm value does not demonstrate traits of mean- reversion. This study thus provide enough evidence to reject the null hypothesis that Debt to Equity ratio has no significant dynamic effect on Tobin's Q.

Implications

The Modigliani and Miller theory of capital structure holds that levered firms accrue tax advantage resulting first in better firm performance and in turn higher firm value. Other contending theories such as the Trade-off theory of Kraus and Litzenberger (1973) however opine that more debts bring about higher default risk and lower firm value. Hence, the major pre-occupation of this study like previous studies such as Jaisinghani et al. (2017) was to determine the nature and extent of the relationship between financial leverage and firm value of the companies quoted on all sub-sectors of the Nigerian stock exchange.

This sub-section therefore provides a summary of the outcomes of this research work. Firstly, the short-run estimates of the auto regressive model reveal that a unit increase in Total Debt -Equity ratio is associated with a 0.1025549% percent rise in the firm value at 5% percent significance level. Similarly, in the short-run, a percentage increase in Asset Tangibility is associated to a 0.0507074 percent reduction in the firm value at 1 percent significance level (this however is not significant).

Moving on to the results obtained from the Dynamic Regression Model, the long-run impact of financial leverage on firm value was appraised using an auto-regressive GMM model and the outcomes reveal that an increase in Debt to Equity brings about an increase in the Tobin's Q ratio in the long-run ceteris paribus. This result is in line with the findings Gill et al. (2013), Farooq et al. (2016), Jaisinghani et al. (2017) but contrarian, to the findings of Pandey and Sahu (2017) Akomeah, Bentil and Alhassan (2018), Ibrahim and Isiaka (2020) as well as Chadha and Sharma (2015).

Likewise, the results obtained from the interaction or joint effect model suggest that where financial leverage is proxied by firm's Total Debt to Equity Ratio, then firm value is measured by the Tobin's Q ratio of Market to Book Value the significant causal relationship between financial leverage and firm value is amplified by 1.458671921 in the case of larger firms. In achieving this, Large market capitalization is surrogated by a dummy code of one as against zero in the case of the relatively smaller firms. It can be deduced therefrom that the size of the firm measured by market capitalization increases the effect of financial leverage on firm value by 1.458671921% annually. Based on this finding we reject the null hypothesis that Market capitalization has no significant effect on the relationship between financial leverage and firm value.

Finally, the correlation coefficients show not only that firm value does not exhibit traits of mean reversion similar to stock returns, since previous levels of firm value are positively associated with contemporaneous firm value, but also that firm value has a significant but weak collinear relationship with the financial leverage.

Conclusions

In the course of this study, the specific recent developments which occasioned an inquiry into this area of study were discussed in the background of the study, afterwards existing works were reviewed with a view to identifying the research gaps present in the body of knowledge, the same were then duly identified as the research problems. The empirical gaps identified include the need for a study of domestic companies that classifies the selected firms based on size as well as the need to understand the dynamic effect of selected capital structure for each category while also addressing the endogeneity bias which affects the reliability of the results obtained from most of the previous studies. The specific research objectives, questions, and hypotheses of the study were thereafter stated.

Following the usual sequence, a review of such underlying concepts as Debt, Equity, Leverage, Market Value and Asset Tangibility the understanding of which is pertinent for a proper appraisal of the topic was undertaken. Thereafter, recent empirical works were studied teasing out, in the process, important details such as the methodology adopted, empirical model and findings of previous works.

In the third section, survey research design was identified as the chosen research design. Longitudinal data which combines qualities of time series and cross-sectional data was adopted in constructing a stylized panel data. The Population of the study was defined while the appropriate sample size was determined using the Tar Yamane Formula (1967). Thereafter, stratified sampling technique adopted for the purpose of selecting the sample. The Dynamic Panel Data Models was stated, while the variables and a priori of coefficient estimates were defined

With regard to the actual data analysis, descriptive statistics analysis was conducted mean, maximum, minimum and Standard deviation values of the proxies of financial leverage, firm value and other variables were computed. Analysis of other control variables largely followed the same pattern. Also, in this paper, a series of regression analysis were carried out to ascertain the nature and degree of the short term and long-term causality between financial leverage and firm value.

Based on the findings of this study, the Management of the companies quoted on the Nigerian Stock Exchange are advised to take more debts and consider less of equity and other financing alternative.

Furthermore, the companies are encouraged to undertake projects which will increase their future earning and market capitalization particularly market price since higher market value or capitalization has been found to be consistent with higher firm value. Also firms can consider issuing new shares but ensuring that as much debt as is required to maintain or increase the ratio of debt to equity is obtained.

From the R^2 of the regression analyses, the model which comprises lending rate, market capitalization and ROA appears to be inadequate in forecasting the future levels of firm value while the results of the correlational analysis show that financial leverage being weakly correlated with firm value, can also not be entirely relied upon for predicting the direction of firm value. Hence the shareholders and other stakeholders cannot entirely rely on the levels of financial leverage to predict future changes or levels of firm value.

Further studies may consider studying the effect of financial leverage on firm value in the six different categories of market capitalization by actually denominating each category with a zero and one dummy variable for each pair of categories where preceding pair is submerged under the first of the succeeding pair thus creating a total of five pairs and ten dummy variable. This would help in further understanding the intermediating role of market capitalization in the relationship between financial leverage and firm value.

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APPENDIX : List Of Sampled Companies

	Companies	Industry
1.	Academy press	Services
2.	Aiico	Financial services
3.	Arbico	construction /real estate
4.	Austin laz	Industrial goods
5.	C&i leasing	Services
6.	Conoil	Oil&gas
7.	Capitaloil	Oil&gas
8.	Chams	Ict
9.	Contre	Financial services
10.	Cutix	Conglomerate
11.	Dangote flourmill	Consumer goods
12.	Deap capital mgt.	Financial services
13.	Ekocorp	Health
14.	Ellah lakes	Agriculture
15.	Ftn	Agriculture
16.	Fidson	Health
17.	Gsk	Health
18.	Greif nig. Plc	Industrial goods
19.	Honeywell	Consumer goods
20.	Inter linked	Industrial goods
21.	Johnholt	Conglomerate
22.	Lasaco	Financial services
23.	Midview	Services
24.	Mrs	Oil&gas
25.	Mbft	Financial services
26.	Meyer	Industrial goods
27.	Neimeth	Health
28.	Nfml	Consumption
29.	Nem insurance	Financial services
30.	Nig-german	Health
31.	Omatek	Ict
32.	Portland	Industrial goods
33.	Rt briscoe	Services
34.	Regency	Financial services
35.	Scoa	Conglomerate
36.	Smart	estate
37.	Standard alliance	Financial services
38.	Tanterlizers	Services
39.	Thomas wyatt	Natural resources
40.	Uacn prop dev.	Construction/real estate
41.	Unass	Financial services
42.	Unpress	Services
43.	Union homes	Financial services
44.	Vitafoam	Consumer goods
45.	Betaglass	Industrial goods
46.	Custodianinvestment	Financial services
47.	Forte oil	Oil&gas
48.	Axa mansard	Financial services
49.	Nascon	Consumer goods
50.	Pz	Consumer goods
51.	Sterlingbank	Financial services
52.	Total	Oil&gas
53.	Transcorp	Conglomerate
54.	Dangote sugar	Consumer goods
55.	Flour mills nig	Consumer goods
56.	Int'l brewries	Consumer goods
57.	Lafarge	Industrial goods
58.	Nestle	Consumer goods
59.	Okomu oil	Agriculture
60.	Unilv	Consumer goods
61.	Znth	Financial services

List of formulas utilized in computing the data on each variable

	Variable	Interpretation	Formulae
1.	Tobin's Q	Market to Book Value Ratio	$= \frac{\text{Market Value of the Firm's Shares}}{\text{Book Value of Firm's Assets}}$
4.	TDE	Total Debt to Equity	$= \frac{\text{Total Debt}}{\text{Total Equity}}$
5.	ROA	Return on Asset	$\frac{\text{Profit After Tax}}{\text{Total Assets}}$
6.	MCKPTL_TDE	Product of TDE and MCKPTL	$= \text{TDE} * \text{MCKPTL}$
7.	MARKETCAP	Market Capitalization	$= \text{Closing Prices of Shares} \times \text{Number of Outstanding Shares}$
8.	MCKPTL	Dummy Code assigned to different firms based on MARKETCAP	MCKPTL of Larger firms =1 MCKPTL of smaller firms =0