

TESTING THE PLAUSIBILITY OF OPTIMAL CAPITAL STRUCTURE THROUGH A DYNAMIC MODEL

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Abstract

This study empirically tests the plausibility of optimal capital structure within the context of the three major theories (trade-off, pecking order and agency costs) using the dynamic fixed effect dummy variable regression model. The analysis is conducted using a panel dataset obtained from 11 listed food and beverages companies covering the period from 2011 to 2020. The results show evidence that the three theories are all operational in the Nigerian food and beverages industry. Specifically, we find that debt-equity ratio responds significantly to changes in effective corporate tax rate, earnings to price ratio, asset utilization rate and firm size. Our results also indicate that debt-equity ratio is persistent meaning that it depends on its previous level. Hence, we conclude that optimal capital structure is a function of corporate income tax, degree of asymmetric information in the capital market and the tendency for corporate managers to pursue the interest of shareholders.

Keywords: capital structure, trade-off theory, pecking order theory, agency costs theory

1. Introduction

Since the emergence of the seminal work by Modigliani and Miller (1958) with the attendant extensive expansion of the literature on capital structure, the topic of optimal capital structure has continued to be a major issue in corporate finance. By definition, optimal capital structure is a combination of long-term debt and shareholders' equity that maximizes the value of a firm or minimizes its cost of capital. This is quite contrary to the view of the two popular financial economists that the value of a firm does not respond significantly to changes in its capital composition suggesting that capital markets operate without frictions. The practical implication of their argument is that optimal capital structure is an illusion and does not exist. Quite contrary, several others have relied on the existence of market anomalies or imperfections in the capital market to develop alternative theories that explain the linkage between capital structure and the market value of firms. Among them are the trade-off, pecking order and agency costs theories.

The trade-off theory relates capital structure to corporate tax. The theory which predicts a positive relationship between corporate tax rate and financial leverage, argues that optimal capital structure is attained at the point of intersection between tax advantage of financial leverage (tax shield) and the bankruptcy costs associated with the use of debt. While financial leverage offers some tax benefits to firms since interest payment on debt is tax

deductible, it also exposes them to higher financial risk in the form of bankruptcy costs, especially when earnings on assets are not sufficient to meet contractual debt obligations. Hence, although tax deductibility of interest rate provides an incentive for corporate managers to increase their financial leverage, there is need to minimize the bankruptcy cost effects of debt.

The pecking order theory as enunciated by Meyers (1984), Myers & Majluf (1984) relates capital structure of a firm to asymmetric information that exists between corporate managers (insiders) and investors (outsiders). This theory argues that asymmetric information is the reason why corporate managers prefer internal sources of capital (retained earnings) over external sources but however, when there is need for external capital, debt is preferred over equity. This is because it is believed that the information content of debt has lower asymmetric effects than equity in the relationship between owners and managers of firms. So internal funds are the cheapest source of capital, while debts are cheaper than equity as sources of external funds. So under the pecking order theory, the need for debt issuance arises only when internal funds are not sufficient to finance identified investments. Hence, capital structure decisions on the basis on this theory are strategically focused on reducing the extent of information asymmetry between managers and investors who are either shareholders or creditors.

The agency costs theory as introduced by Jensen & Meckling (1976) relates capital structure to efficiency in asset utilization. According to this theory, there is a positive relationship between leverage and efficiency in the management of agency costs which arise from the misalignments of the interests of corporate managers and their principals (shareholders and creditors). However, this potential conflict of interest can be mitigated with debt financing since higher debt level increases the efficiency of asset utilization (Ang et al. 2000; Lasfer, 1995; Ozkan, 2002). Hence, according to the agency costs theory, optimal capital structure is the debt ratio that minimizes the potential conflicts of interest among the major stakeholders of the firm.

This study complements previous studies on the determinants of optimal capital structure in Nigeria. In particular, the study employs the dynamic fixed-effect dummy variable regression method to test the explanatory power of each of the theories for changes in capital structure of listed firms in the Nigerian food and beverages industry over the period from 2011 to 2020. Previous Nigerian studies on the determinants of optimal capital structure within the fixed effect framework make implicit assumption that capital structure data are generated by a static process. This assumption is unrealistic given the large body of empirical evidence suggesting that current debt ratios depend on their previous levels. Therefore, we argue that using a dynamic framework to analyze the determinants of capital structure in Nigeria would produce more realistic, more reliable and more robust empirical results.

Furthermore, previous studies on the subject matter reported conflicting results. Hence, there is also the need for more empirical studies, especially from the perspective of firms in the developing and African countries.

The remainder of this study is organized in four sections. The next section focuses on literature review which is divided into theoretical framework and empirical studies. Section 3 introduces and discusses the data, variables, models and methods. Section 4 contains the empirical results and discussion of the findings. The study is summarized and concluded in section 5.

2.0. Literature Review 2.1 Theoretical Framework

Our theoretical framework is consistent with the argument by Myers (2001) that optimal capital structure depends on factors relating to market imperfections such as corporate taxes, asymmetric information and agency costs. These market anomalies provide a basis to seek for optimality in capital structure thereby culminating in the emergence of the trade-off, the pecking order and the agency costs theories.

2.2 Review of Empirical Studies

In our review of the literature, we will focus on recent studies in both developing and developed countries. Though empirical literature on capital structure has progressively developed over time, there has been some concentration more on firms in the developed and emerging Asian countries.

De Jong et al. (2011) employs a sample of 2,259 US firms to test the validity of trade-off and pecking order theories using static and dynamic panel data frameworks. Based on the large dataset comprising 13,338 firm-year observations and covering the period from 1985 to 2005, the pecking theory offers a better explanation of the behavior of US firms in terms of debt issuance than the static trade-off theory. However, in terms of repurchase decisions, they find that the trade-off theory performs better than the pecking order.

The study by Miller (1977) suggests that capital gains and dividends attract taxes and this burden has the tendency to offset the tax shields companies enjoy which is likely to undermine the extensive application of the trade-off theory because such shields justify the use of debt. This is because the effect of taxes is seen from the benefits it provides on the use of debt as the proportion of debt in the company's capital structure increases, its return on equity increases in a linear fashion. Then to establish a relationship between capital structure and firm value we incorporate the cost of financial distress which demonstrates how a firm determines an optimal debt ratio derived by balancing the benefits of the present value of tax shields against the cost of bankruptcy.

Similarly, Myers (1984) examines the financing behavior of selected US firms with a target set to determine cross sectional dispersion of actual debt ratios. From the findings of his study, the tax shields are limited by firm characteristics and non-tax shields such as depreciation and investment credits that emanate from financial leases.

Friedwald et al (2020) present empirical evidence that maturity structure of debts affects corporate earnings using cross sectional data. Short term debt is associated with positive premium but having more exposure to systematic risk. A key contribution of this study is that leverage effects significantly account for the maturity structure of debt which further explains corporate earnings with implications for risk management. These findings therefore clearly violate the M & M conversation of risk principle.

Axelsson and Makarov (2023) introduce the concept of a winner's curse to explain the behavior of investors as they get wary and refrain from financing choices if information fails to provide the desired results. This provides a basis to understand why information asymmetries tend to popularize the pecking order theory. Consequently, the authors recommend choices of financing other than equity for projects and other investment opportunities because of the need to mitigate such an inefficiency. This tends to support the application of the three major capital structure theories. Furthermore, they find that as informal sources of information grow, information losses increase with a corresponding increase in financing cost thereby providing a basis to expand the pecking order theory.

Serrasqueiro and Caetano (2015) analyze the factors that govern the capital structure of firms in Portugal, focusing on small and medium scale enterprises. Their empirical analysis is based on a sample comprising 371 firm-year observations obtained from 53 SMEs from 1998 to 2015. Consistent with the pecking order theory, they find an inverse relationship between profitability and financial leverage, implying that most profitable firms use less debt to finance their investments. However, their results also show that corporate leverage is negatively related to firm size, which according to the authors, is largely consistent with the pecking order theory.

Nhung et al. (2017) examine the factors that affect the capital structure of firms in the real estate industry in Vietnam using the system GMM framework. Their sample includes 34 firms that are listed on HSX (Ho Chi Minh stock exchange) from 2010 to 2015. They find mixed evidence on the determinants of capital structure, especially, as it relates to short-term and longterm debts. However, the study reveals that firms in the real estate industry of the country rely more on debts than equity when financing their investments providing empirical support to all the major three capital structure theories.

Sofat and Singh (2017) examine the determinants of capital structure of a firm focusing on the Indian manufacturing firms using multiple regression method. While their sample comprises 91 firms across different industries, their dataset covers the period of ten years from 2002/3 to 2011/2 fiscal periods. They find that debt ratio responds mainly to changes in business risk, asset composition and profitability (return on assets), while the effects of firm size and debt service capacity are not statistically significant. These results suggest that the Indian manufacturing firms tend to align their capital structure decisions more to the principles of the pecking order theory than those of the trade-off theory.

Cevheroglu-Acar (2018) seeks to identify the firm-specific factors that affect the capital structure of nonfinancial firms in Turkey using data collected from Thomson Reuters DataStream from 2009 to 2016. Their empirical analysis which is based on the static fixed effect method, gives results that are more consistent with the pecking order theory than the trade-off theory. More specifically, their empirical evidence shows that a firm's capital structure is affected mostly by size, profitability, non-debt tax shield, liquidity and tangibility.

Khémiri and Noubbigh (2018) employ the system GMM estimation and the fixed effect methods to examine the determinants of capital structure in sub-Saharan African countries focusing on listed nonfinancial companies. Their analysis is based on a panel dataset comprising 102 firms selected from five sub-Saharan countries: namely, Nigeria, Kenya, Ghana, South Africa and Zimbabwe for the period from 2006 to 2016. Their empirical analysis gives results that are consistent with both the trade-off theory and pecking order theory with variables such as corporate tax and profitability dominating the influence in the results. They also find, among other things that capital structure ratios are persistent as they depend on their previous levels.

Abba et al. (2018) examines the firm-specific (contextual) factors affecting the capital structure of firms in Nigeria using the static classical multiple regression framework. Their sample includes 280 firm-year observations obtained from 56 companies over a period of five years from 2012 to 2016. They find among other things, that corporate financial leverage is negatively related to profitability while it is a positive function of firm size.

Anande-Kur and Agbo (2018) examine the factors that explain the cross-sectional variation in debt ratios in Nigeria using the fixed effect framework. Based on a sample of 31 listed manufacturing firms spanning from 2007 to 2014, they find that profitability has a negative effect on corporate leverage.

Orjinta and Ifurueze (2018) employ the static panel data regression framework to examine the determinants of corporate leverage in the Nigerian industrial sector. The sample used in the study comprises 15 companies covering the period from 2003 to 2017. Their results show that corporate income tax, dividend tax, debt tax shield and profitability all have a positive relationship with corporate leverage.

Oyedeko and Zubairu (2019) examine the factors that determine corporate financial leverage in Nigeria within the pecking order and trade-off theoretical frameworks. Their empirical analysis, which is based on a sample of six listed SMEs from 2010 to 2017, shows among other things that profitability and reliance on debt to finance investments are positively related, while the effect of firm size on corporate leverage is negative.

Paseda (2020) considers the impact of tax on corporate debt issuance in Nigeria using the panel least square technique. The study is based on a sample of 50 nonfinancial firms that are listed on the Nigerian stock exchange from 1999 to 2014. The reported results of the study show weak evidence that tax considerations are among the important determinants of capital structure among the selected firms. However, corporate leverage is also found to move in opposite direction with both corporate tax and firm size.

Toby and Sarakiri (2021) validate Sarakiri (2020) that the tax relief from corporate borrowing is a strong determinant of value maximization which agrees with the revised M and M framework thereby opposing the proposition that debt equity ratio is constant at all levels of capital structure. With data from quoted firms across all sectors of Nigeria's economy and covering the period from 1990 to 2016, both studies reveal that significant variations of market value per share are due to changes in corporate income tax. In addition, the Pairwise Granger causality test shows that there is a feedback effect from market value of firm to debt equity ratio. So for firms

operating in the Nigerian capital market, the principles of the trade-off theory better explain the way they manage their capital structure.

3 Methodology

3.1. Data and Variables

To test the plausibility of optimal capital structure, we use 110 balanced panel data yearly observations obtained from 11 food and beverages companies that are listed in the Nigerian stock exchange from 2011 to 2020. The firms are Nigerian Breweries, Nestle, Guinness, Champions Breweries, Unilever, PZ, Flour Mills, Dangote Sugar, NASCON, Cadbury and MCNICHOLS. We collected the data from two sources: namely, www.cashcrat.com and the annual reports of the individual firms. All analyses are done in EViews.

Table 1: Operationalization of variables

Variable	Proxy	Operationalization	Theory/Expectation	Source
Dependent Variable				
Capital structure	Debt to equity ratio (DER)	Long-term liability to equity ratio		
Explanatory variables				
Corporate tax	Effective tax rate (TAXR)	Tax expense (amount) divided by profit before tax	Trade-off theory (+)	Bolton et al. (2013), Glover and Hambusch, (2014)
Asymmetric information	Earnings price ratio (EPR)	Earnings to share price divided by share price	Pecking order theory (-)	Glover and Hambusch, (2014)
	Retained profit (RET)	Profit After Tax Dividend Payment		
Agency costs	Asset utilization ratio (AUTR)	Total revenue divided by total assets	Agency costs theory (+)	Ang et al. (2000)

Control variable

Firm size Total Assets Natural logarithm
 of total assets

Table 1 describes the variables with expected outcomes. The trade-off theory predicts that financial leverage is positively related to effective corporate tax rate. Hence, we expect that $\gamma_2 > 0$ so that higher effective tax rate would lead to higher debt to equity ratio due to tax deductibility of interest.

For pecking order theory, we expect $\gamma_3, \gamma_4 < 0$ because financial leverage is negatively related to corporate earnings. Higher earnings reduce financial leverage since firms would prefer internal capital (retained earnings) over external capital (equity and debt) when financing additional investments. But if these coefficients are significantly greater than zero, then the evidence would be consistent with the trade-off theory (Abba, et al., 2018). For agency theory, we expect that $\gamma_5 > 0$ so that higher opportunity costs in terms of manager's sacrifices mean higher efficiency which would bring about increased financial leverage. It simply means that for the firm to attain higher levels of efficiency in asset utilization, managers must put in more efforts leading to higher agency costs. This is then likely to result in higher financial leverage.

3.2. Empirical Strategy

Our dataset comprises both cross-sectional (11 firms) and time dimensions (10 years), hence we employ the dynamic panel data framework to analyze the determinants of optimal capital structure in the food and beverages industry in Nigeria. The empirical model which captures the three popular capital structure theories, is hereby specified as follows:

$$LDER_{it} = \gamma_0 + \gamma_1 LDER_{it-1} + \gamma_2 LTAXR_{it} + \gamma_3 LEPR_{it} + \gamma_5 LRET_{it} + \gamma_5 LAUTR_{it} + \gamma_5 LTA_{it} + k_i + \varepsilon_{it}$$

As a dynamic model, it allows debt to equity ratio to depend on its previous level, effective tax rate (trade-off theory), earnings to price ratio (pecking order theory), retained earnings (pecking order theory), asset utilization ratio (agency costs theory) and natural logarithm of total assets (a proxy for firm size). Also, our model is a fixed-effect dummy variable regression model as it incorporates firm-specific factors, k_i , that are not directly observable (e.g., organizational culture, leadership quality and style), but may have a highly significant explanatory power for the observed cross-sectional variation in debt-to-equity ratio. However, the suitability of this modeling approach in the context of our data would be formally established using the popular Hausman specification tests.

4.0. Results and Discussion 4.1. Descriptive Statistics

Table 2: Descriptive statistics

VARIABLES	$\bar{x}$	σ	CV	<i>S</i>	<i>K</i>	P-value (JB)
DER	39.75	35.78	90.01	1.0	3.81	0.0000
TAXR	64.06	28.41	44.35	-1.34	10.97	0.0000

EPR	1.07	3.98	371.96	4.37	22.90	0.0000
RET	26321595	30783889	116.95	1.24	3.64	0.0000
AUTR	1.02	0.36	35.29	0.72	5.14	0.0000
TA	1.19E+08	1.24E08	104.20	1.25	3.58	0.0000

(₦'million)

Table 2 shows their distributional properties. Overall, all variables recorded high variability over the study period and have a distribution that significantly deviates from the theoretical normal distribution. Hence, to minimize the negative effect of outliers and other unwanted features of the data, our empirical analysis would be based on the log-transformed data.

4.2. Empirical Results

Table 3: Regression results

Variable	Dynamic FEM	Static
Constant	-5.2571	0.1698
LDER (-1)	0.4766	0.0001
LTAXR	0.8311	0.0001
LEPR	-0.3519	0.0072
LRET	-0.3247	0.1156
LAUTR	0.8514	0.0164
LTA	0.4407	0.0767
Hausman Stat.	21.017	0.0018
F-statistic	23.507	0.0000
Durbin-Watson	2.0128	
R-squared	0.8423	
Adj. R-squared	0.8065	

Table 3 presents the dynamic fixed effect regression results for the determinants of optimal capital structure in the Nigerian food and beverages industry. From the lower panel, the Hausman statistic is significant at the 1% level, which has strongly confirmed the presence of cross-sectional heterogeneity in our dynamic panel data model. Hence, for companies in the food and beverages industry in Nigeria, optimal capital structure is a function of three factors: (1) observable firm specific factors such as lagged debt-to equity ratio, corporate taxation,

asymmetric information and agency costs, (2) unobservable firm-specific factors such as organizational culture, leadership quality and style, and (3) the correlation between these factors. Besides, goodness of fit and model diagnostic tests show that the fitted model for optimal capital structure is highly statistically significant, has very little or no serial correlation problem and explains about 81% of the observed changes in debt-to-equity ratio.

Capital Structure is Autoregressive

Our results show that capital structure is autoregressive as it depends on its previous level. The coefficient on LDER is estimated at 0.4766, indicating that debt-equity ratio is a positive function of its lagged value. This may be interpreted as suggesting that optimal capital structure is persistent and hence, can be predicted by its past levels. A 1% increase in debt-equity ratio in the current period is expected to lead to about 0.48% increase in the next period's debt-equity ratio, holding all other factors constant. This is consistent with the findings of Khemiri and Noubbigh (2018).

Capital Structure and Trade-off Theory

The trade-off theory implies that a firm's reliance on debt financing is a positive function of effective tax rate (Bolton et al., 2013). As predicted, the value of the coefficient on LTAXR in the upper panel is 0.8311 (p-value = 0.0001), showing that financial leverage moves in similar direction with effective corporate tax rate. All other things being equal, a 1% increase in effective corporate tax rate would, on average, lead to approximately 0.83% increase in the proportion of long-term debt in firms' capital structure. Hence, firms increase their reliance on debt to finance their investments when effective tax rate increases and vice versa. This finding, which has validated the trade-off theory in the Nigerian food and beverages industry, implies that the tax advantage of debt gives firms incentives to increase their financial leverage. This finding also agrees with Orjirnta and Ifurueze (2018) but disagrees with Paseda (2020).

Capital Structure and Pecking Order Theory

The pecking order theory predicts a negative relationship between a firm's profitability and the use of debt to finance new investments. Consistent with this theoretical prediction, the coefficients of -0.3519 (LEPR) and -0.3247 (LRET) in the upper panel of Table 3 show that the corporate financial leverage is negatively related to both earnings to price ratio and retained earnings. This implies that holding other factors constant, debt to equity ratio would, on average, reduce by about 0.35% and 0.32% following a 1% increase in earnings to price ratio and retained earnings respectively. However, while the effect of earnings to price ratio on debt-to-equity ratio is statistically significant at the 1% level, the effect of retained earnings is not; even at 10% level. These findings therefore support the theoretical argument that due to asymmetric information in the capital market, firms with more growth opportunities and are profitable have the tendency to rely on internal equity to finance their new investments. These results also support the findings of Serrasqueiro and Caetano (2015), Abba et al. (2018),

Anande-Kur and Agbo (2018) but disagree with Orjinta and Ifurueze (2018) as well as Oyedeko and Zubairu (2019).

Capital Structure and Agency Theory

The agency costs theory predicts that debt ratios are positively related to efficiency in asset utilization. Debt financing forces corporate managers to be more prudent and more efficient in asset utilization, thereby reducing the agency costs associated with agency relationship between them and outsiders, leading to higher firm value. Consistent with the agency costs theory, the coefficient on LAUTR in the upper Panel of Table 3 has an estimated value of 0.8514, which is positive and sizable, indicating that higher asset utilization ratio leads to higher debt to equity ratio. A 1% increase in asset utilization ratio would, on average, lead to as much as approximately 0.85% in debt equity ratio, holding other factors constant. The pvalue of 0.0164 shows that the effect of asset utilization on financial leverage is also statistically significant at the 5% level. This finding implies that leverage ratios are significantly higher for firms with higher asset utilization rate with managers incurring higher opportunity costs as agents and lower for firms with lower opportunity costs. Hence, corporate financing policies are designed to reflect the extent of agency problem between corporate insiders and outsiders in the Nigerian food and beverages industry. This finding is largely consistent with Zhang (2008).

Capital Structure and Firm Size

The results in the upper Panel of Table 3 show that firm size and debt-equity ratio are positively related and this relationship is statistically significant at the 10% level. This shows that in the Nigerian food and beverages industry, larger firms rely more on long-term debts to finance new investments than smaller firms. The coefficient of 0.4407 implies that *ceteris paribus*, a 1% increase in firm size in terms of total assets would, on average, lead to approximately 0.44% increase in the proportion of debt in the capital structure. This finding has implication for both trade-off theory and agency theory. In the context of trade-off theory, this finding implies that larger firms have the tendency to maximize the tax benefits associated with financial leverage leading to higher profitability than smaller firms. In the context of agency theory, it implies that larger firms issue more debts in line with their capacity to utilize the assets and to signal the extent of their commitment to reduce conflicts associated with the separation of ownership from control. This finding contradicts Oyedeko and Zubairu (2019), Paseda (2020), Serrasqueiro and Caetano (2015), Sofat and Singh (2017). On the contrary, it agrees with Abba et al. (2018).

5. Summary and Conclusions

This study examines the determinants of optimal capital structure of a firm within the Nigerian context using the dynamic fixed-effect dummy variable regression framework. Specifically, the study examines the plausibility of the three main capital structure theories: namely, the trade-off, the pecking order and the agency costs theories, using data collected from 11 listed food and beverages companies covering the period from 2011 to 2020. The main conclusions are as follows:

There is evidence that debt to equity ratio responds significantly to its previous level as well as changes in effective corporate tax rate, earnings to price ratio, asset utilization ratio and firm size. Hence, we conclude that in the Nigerian food and beverages industry, contrary to Modigliani and Miller's (1958) argument, optimal capital structure exists and is determined in line with the predictions of the three major capital structure theories: namely, the trade-off theory, the pecking order theory and the agency costs theory. Also, these theories and other firm-specific factors (both observed and unobserved) jointly explain over 81% of the crosssectional variation in the debt-to-equity ratio of listed food and beverages firms in Nigeria. Hence, our findings have validated the Myers' (2001) argument that optimal capital structure depends on factors relating to market imperfections such as corporate taxes, asymmetric information and agency costs.

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