

R&D INVESTMENT AND FIRM COMPETITIVENESS IN THE NIGERIAN CONSUMER GOODS INDUSTRY: EVIDENCE FROM DYNAMIC PANEL REGRESSION MODEL

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Abstract

In this study we explore the impact of R&D investment on firm competitiveness in the Nigerian consumer goods industry as well as the moderating role of firm heterogeneity using the dynamic fixed effect model. We consider firm competitiveness from both industry and stock market perspectives using market share and market value per share as proxies. Our analysis is based on a balanced panel dataset comprising 9 listed consumer goods firms over a period of 9 years from 2014 to 2022. We find that R&D investment has no significant impact on firm competitiveness regardless of how the latter is measured. However, our results show that firm heterogeneity significantly moderates the relationship between R&D investment and firm competitiveness. Based on these findings, we conclude that consumer goods firms are yet to commit sufficient financial resources to R&D activities as a way of enhancing their performance at both industry and stock market levels.

Key words: *R&D investment, firm competitiveness, dynamic fixed effect model*

1 Introduction

In today's hostile business environment, R&D is considered as the main driver of firm competitiveness. R&D investment leads to product, process, and technological innovations that make a company more attractive in the market than its competitors, thereby increasing its customer base and customer retention rate (Sridhar et al., 2014). According to Patin (2024), one of the main functions of R&D activities is to enhance sales revenue and market value through the development of superior and advanced products. Also, according to Caglar and Nisel (2017), companies invest in R&D to increase their intangible assets such as brand awareness, brand recognition, image and reputation, and market-sensing capabilities required to achieve continuous and sustainable marketing and financial performance. Further, according to Usman et al. (2017), firms gain competitive advantage through product innovation and process innovation. Process innovation helps firm to reduce both production and

operational costs, while product innovation helps firm to expand their customer base. R&D investment leads to both types of innovation; hence it is an important driver of corporate financial performance and competitiveness.

Several studies have investigated the impact of R&D investment on firm performance. However, while much of the prior studies are focused on developed countries and Asian emerging markets, there seems to be little agreement regarding both the significance and the direction of the impact of R&D on firm performance. Besides, prior research has ignored the role of firm heterogeneity in the relationship between R&D investment and firm competitiveness, especially in the context of consumer goods industry. According to resource-based theory, organizations require heterogeneous resources that are valuable and rare to gain competitive advantage (Barney, 1991; Sa et al., 2020). The assumption of resource homogeneity in R&D performance and outcomes is surprising given the well-established link between resource heterogeneity and firm performance in theoretical literature.

This study enriches empirical literature by investigating the dynamic impact of R&D investment on firm competitiveness and the moderating role of firm heterogeneity in the Nigerian consumer goods industry using the dynamic fixed effect model. The use of fixed effect model allows us to explicitly account for firm heterogeneity which is a latent organizational factor comprising intangible resources that are not directly observable or measured. Also, the present study is distinct as it considers two dimensions of firm competitiveness: namely industry competitiveness represented by market share, and stock market competitiveness represented by market value per share. This approach is novel as none of the few previous R&D-performance studies in Nigeria considered these two dimensions of firm competitiveness.

The remainder of this study has four main sections. Section 2 contains the theoretical framework and the review of related studies. Section 3 describes the research design, data and sample, research variables, and research models. Section 4 contains data analysis and discussion of findings, while the study is summarized and concluded in section 5.

2 Literature Review

2.1 Theoretical Framework

The impact of R&D investment on firm competitiveness can be investigated under the resource-based theoretical framework. The resource-based theory, which is linked to Penrose (1959), Wernerfelt (1984), and Barney (1991), emphasizes the role of resource heterogeneity in explaining the differences between organizational performance and market positions across firms (Alvarez & Busenitz, 2001). According to this theory, high-performance and highly competitive firms are those that possess and control valuable, rare and inimitable resources and capabilities. Resources include financial, physical, human and organizational assets that help a firm to accomplish its strategic goals, while capabilities include non-transferable resources that are used to improve the productivity and performance of other resources within the control of the firm (Kozlenkova et al., 2014).

R&D is an intangible asset that requires the commitment of huge financial resources towards the development of unique, valuable, and non-transferable organizational assets and capabilities. According to Esteve-Pérez and Mañez-Castillejo (2008), the more the resources a firm is willing to commit to R&D, the more likely that the firm would develop capabilities that cannot be easily reproduced or imitated by its competitors. These distinctive and non-imitable assets and capabilities give the firm sustainable competitive advantage. Also, in the context of resource-based theory, Ali and Matsuno (2018) contend that R&D-marketing integration leads to enhanced business performance. Hence, our theoretical framework allows firm competitiveness to respond positively to R&D investment.

Based on the resource-based theory, we specify the theoretical framework for the relationship between R&D investment and firm competitiveness in Figure 1 as follows:

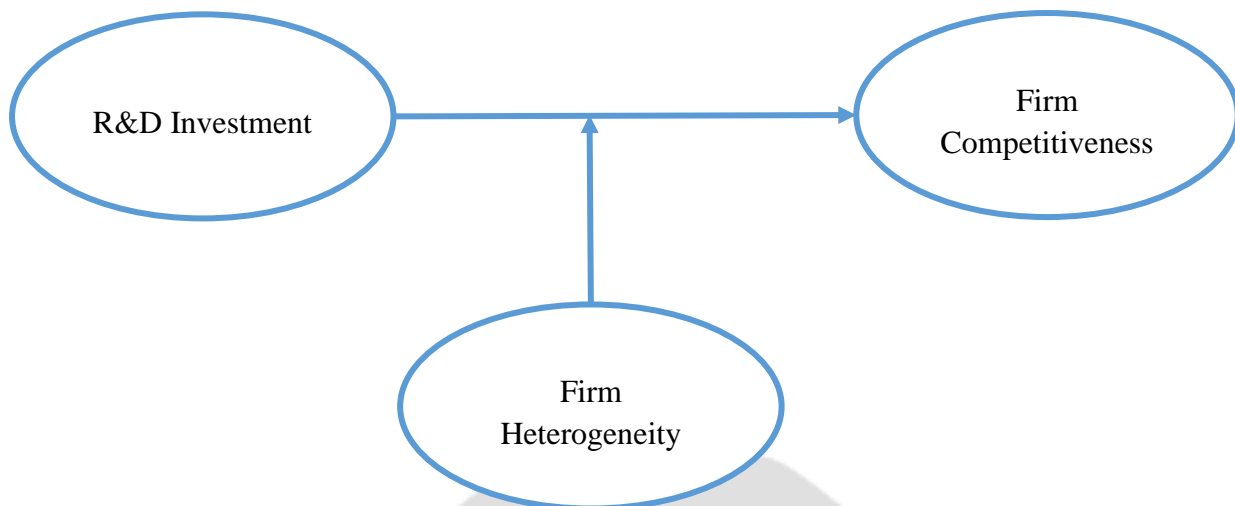


Figure 1: Research Design

2.2 Review of Previous Studies

Several studies have attempted to investigate the relationship between R&D and firm performance. However, while much of the previous studies are focused on developed countries, there are conflicting results regarding both the direction and the magnitude of the impact of R&D on firm performance. While some studies report that R&D investment leads to higher firm performance, others show that impact of R&D can be negative when certain control variables (such as firm size, industry factor, and financial leverage) are incorporated in the R&D-performance model (Boiko, 2022). Also, there are studies whose findings indicate that R&D investment does not matter for firm performance and competitiveness.

Sridhar et al. (2014) employ a vector autoregressive (VAR) model to investigate the long-term effects of R&D expenditure and advertising expenditure on sales revenue and firm value for publicly listed high-tech manufacturing firms in the U.S. They find, among other things, that in the long run, both advertising and R&D expenditures lead to improved firm valuation (Tobin's Q). However, while advertising expenditure increases sales revenue in the long run, the effect of R&D expenditure is not significant. Also, their findings show that both sales revenue and firm value have a feedback effect on R&D and advertising expenditure, thereby confirming the endogeneity between these variables.

Akben-Selcuk (2016) examines the determinants of firm competitiveness in Turkey using firm-level panel data spanning from 2005 to 2014. More specifically, the study considers the impact of firm liquidity, financial leverage, firm size, R&D spending, exports, and growth on return on assets, gross margin and market valuation. The results show among other things that R&D expenditure has a negative effect on both gross margin and return on assets while its effect on market valuation (Tobin's Q) is not statistically significant.

Caglar and Nisel (2017) investigate the nexus between (R&D) and marketing expenditures on financial performance in the manufacturing sector for a sample of 41 manufacturing firms that are listed on the Borsa Istanbul market between 2009 and 2015. Using a panel regression framework, they find that the relative effects of R&D and marketing expenditure largely depend on the performance measure used. For sales revenue and gross profit, both R&D and marketing expenses exert a highly significant positive impact, while for operational profit, they exert a negative and highly insignificant impact. Also, for gross profit margin and return on assets, both R&D and marketing expenses exert a non-significant impact.

Usman et al. (2017) use both firm-level data and country-level data to analyze the impact of R&D investment on firm profitability and market valuation. Their analysis focuses on the period from 2004 to 2016 and is based on a sample of listed nonfinancial firms selected from G7 developed countries; namely, France, UK, Germany, Canada, Italy, US, and Japan. Based on Heretical Linear Regression Model (HLM), they find, among other things, that R&D investment exerts a negative impact on firm profitability but leads to higher market valuation.

Abubakar (2018) examines the impact of R&D induced innovation on financial performance of firms in the pharmaceutical industry in Nigeria. Using a random effect model and based on a sample of 9 listed pharmaceutical

firms between 2008 and 2017, it is found that R&D-induced innovation has a positive and significant effect on return on assets.

Coluccia et al. (2019) examine the impact of R&D elasticity on firm competitiveness from investors' perspective, focusing on companies listed on the Euronext 100 index. Based on a sample of 57 companies across four countries (France, Belgium, Luxemburg, Netherlands) and leveraging the OLS multiple regression framework, they show, among other things, that a firm's competitiveness and market valuation, measured in terms of Tobin's Q, is positively linked to R&D elasticity. They conclude that R&D elasticity leads to improved confidence and market appreciation of firm's assets.

Erdogan and Yamaltdinova (2019) use the panel regression framework to explore the impact of R&D expenses on financial performance of production firms in Turkey. For a sample of 62 listed firms between 2008 and 2017, and a model that incorporates financial leverage and total assets as control factors, they find that RDI spending leads to higher financial performance.

Tung and Binh (2022) analyze the impact of R&D investment on firm performance in Vietnam, focusing on listed companies between 2010 and 2018. The study employs different panel regression frameworks (fixed effect and two-stage least square). Based on a sample of 343 companies and a dynamic model that incorporates several control factors (firm size, age, capital intensity, geographical location, CEO gender, and foreign ownership), they find that R&D investment leads to improved revenues, profit, return on equity, and return on assets. Also, their findings show that the positive effect of R&D is more pronounced for firms with high R&D investment compared to those with low R&D investment.

In Iran, Rababah et al. (2022) use a sample of 55 listed companies to investigate the implications of R&D and advertising costs on customer satisfaction and firm value. Using a dynamic panel regression model with several factors (financial leverage, competition, CEO ownership, sales growth, service factor, and company heterogeneity) and focusing on the period from 2008 to 2014, they find amongst others that both R&D and advertising costs lead to improved customer satisfaction and firm value.

Patin et al. (2024) analyze the impact of corporate R&D spending on firm valuation for 10 selected IT firms in US using the OLS regression approach. While firm valuation is measured in terms of Tobin's Q, the effects of both current and lagged R&D spending are investigated. They find that both previous and current R&D spending exert a negative effect on current market valuation, except for few exceptions.

Baek and Lee (2024) attempt to address the issue of whether R&D investment can significantly corporate sustainable performance using panel data obtained from Korean companies. They also examine the moderating effect of R&D investment in the relationship between ESG (environmental, social, and governance) management and corporate financial performance. Their empirical results indicate that R&D investment has no significant effect on corporate financial performance, although it positively moderates the relationship between ESG and corporate financial performance.

3 Methodology

3.1 Research Design

The study investigates the unidirectional causal flow from R&D investment to firm competitiveness under a dynamic panel framework. The panel framework also allows us to examine the moderating role of firm heterogeneity (unobserved firm-specific effects) in the relationship between R&D investment and firm competitiveness.

3.2 Data and Sample

This study uses a balanced panel data obtained from 9 listed consumer goods firms: namely Dangote Sugar, Nigerian Breweries, NASCON, Guinness, Unilever, Flour Mill, Nestle, PZ, and Cadbury. All selected firms are listed on the Nigerian exchange over the period from 2014 to 2022. Data is obtained from the annual reports/financial statements of the selected firms, accessed and downloaded from their official websites and the Nigerian stock exchange. Data analysis is aided by EViews and Excel software packages.

3.3 Variables and Measurement

- **R&D Investment:** R&D investment comprises marketing and promotional expenses and research and product development expenses. We scale this variable by total assets.
- **Firm Size:** This is measured in terms of natural logarithm of total assets.

- **Firm Competitiveness:** This is proxied by market share. Market share is defined as the ratio of a firm’s sales revenue to the industry sales performance.
- **Firm Value:** This is proxied by market value per share or share price

Figures 1 – 3 show the graphical plot of market share, market value per share, and R&D investment (R&D Intensity) for the selected consumer goods firms. From Figure 1, Flourmill has the highest mean market share, followed by Nigerian Breweries, and then by Nestle, while NASCON, Cadbury, Unilever, and PZ have the lowest market share. From Figure 2, Nestle has the highest mean market value per share, followed by Nigerian Breweries, and then by Guinness, while NASCON, DSR, and Cadbury are the least valued companies in the stock market. From Figure 3, Cadbury, Nestle, Guinness, and Nigerian Breweries have the highest R&D investment relative to total assets, while Flourmill, Dangote Sugar, and NASCON have the lowest R&D investment relative total assets.

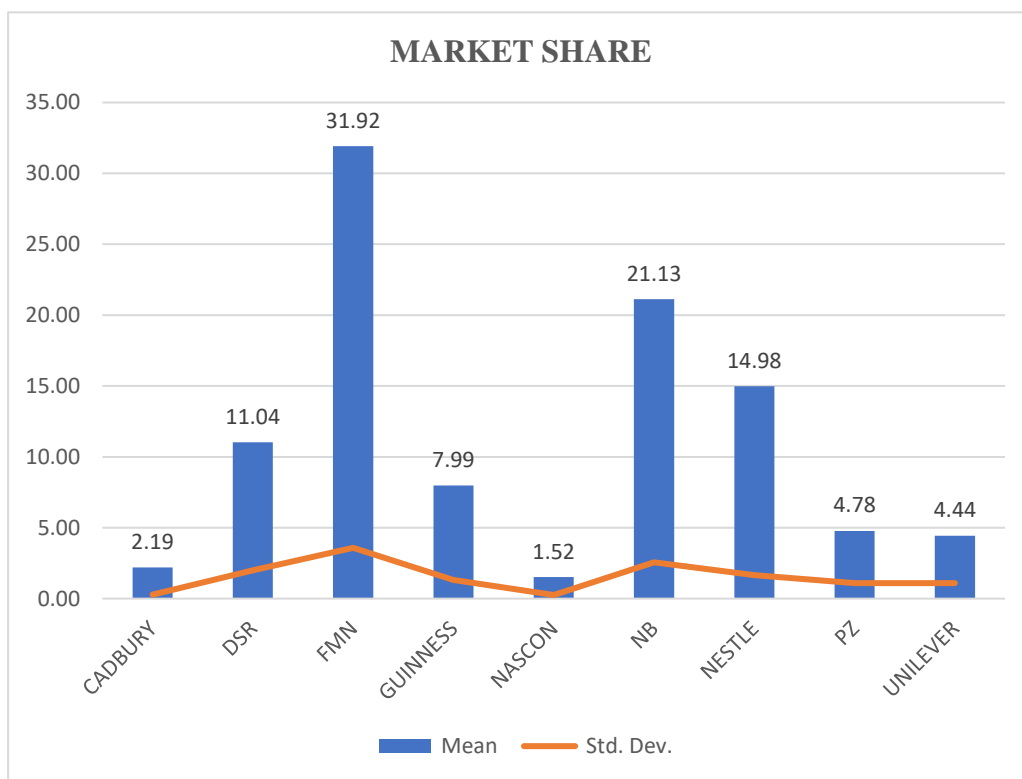


Figure 1: Market Share for Selected Consumer Goods Firms

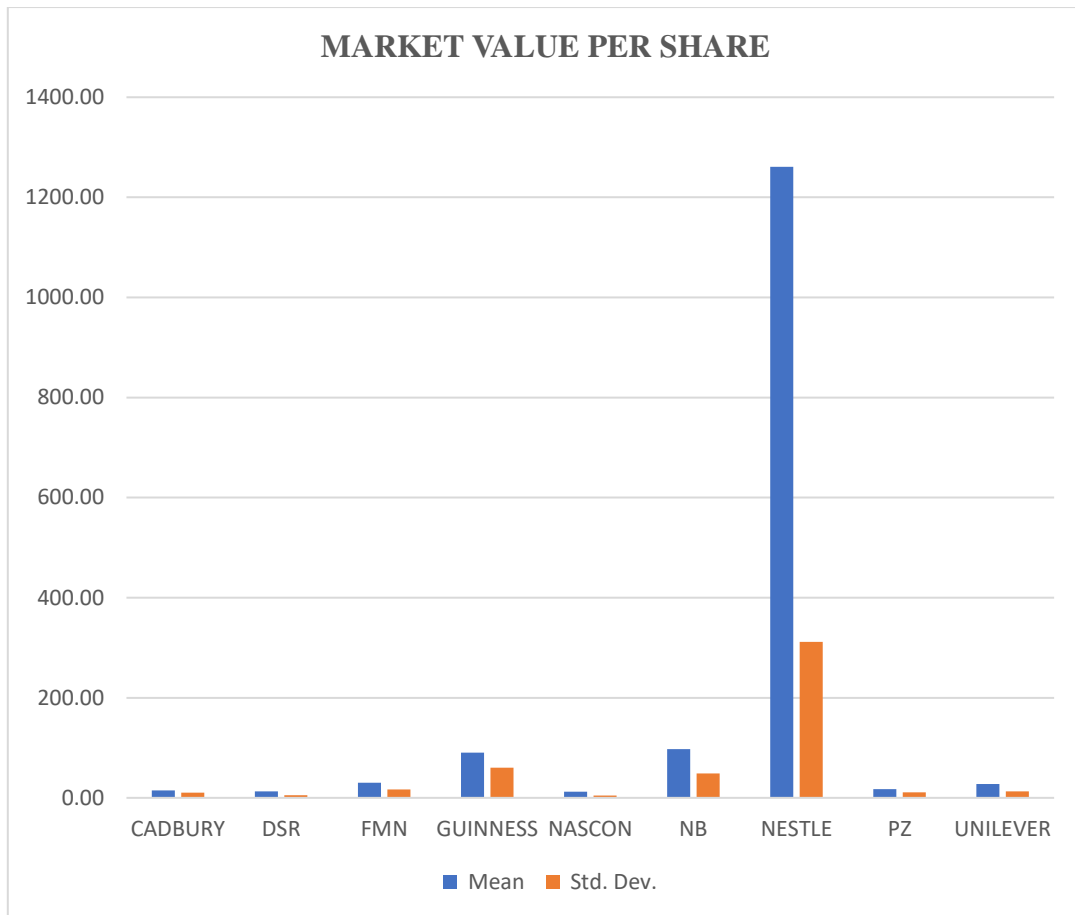


Figure 2: Market Value Per Share for Selected Consumer Goods Firms

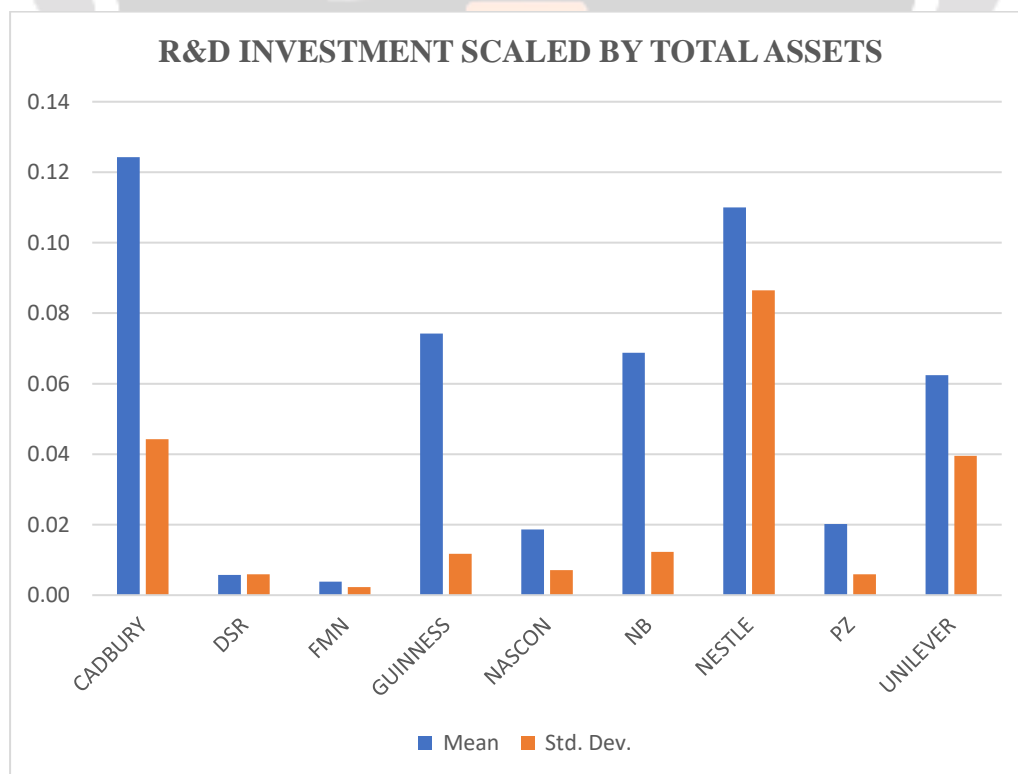


Figure 3: R&D Investment for Selected Consumer Goods Firms

3.4 Model and Method

We employ a dynamic fixed effect model to analyze the impact of R&D investment on firm competitiveness. This framework allows us to control the endogeneity of R&D investment and firm competitiveness as well as to explore the moderating role of company heterogeneity which is consistent with the resource-based theory.

Our dynamic fixed effect model (in logarithmic form) for the relationship between R&D and firm competitiveness is specified as follows:

$$LMS_{it} = \beta_0 + \phi_i + \beta_1 LMS_{it-1} + \beta_2 LRDI_{it} + \beta_3 LTA_{it} + \epsilon_{it} \quad (1)$$

$$LMVS_{it} = \lambda_0 + \phi_i + \lambda_1 LMVS_{it-1} + \lambda_2 LRDI_{it} + \lambda_3 LMS_{it-1} + \lambda_4 LTA_{it} + \epsilon_{it} \quad (2)$$

Where MS = market share, MVS = market value per share, RDI = R&D investment, TA = total assets, and L = logarithm. Also, ϕ_i is the time-invariant heterogeneity parameter, representing the unobserved company-specific effects such as management style and organizational culture. For model (1), market share is specified as a function of lagged market share, R&D investment and total assets, while for model (2), market value per share is specified as a function of lagged market value per share, R&D investment, lagged market share and total assets. The inclusion of lagged market share in model (2) is based on the assumption that investors rely largely on the previous industry performance of a company to determine its current stock market price.

According to the fixed effect model, this parameter correlates strongly with R&D investment and hence can play a moderating role in the model. Further, for each model, the lagged dependent variable (or the persistence term) is incorporated to control for the endogeneity between R&D investment and firm competitiveness. This endogeneity arises from the possible feedback effect from firm competitiveness to R&D investment.

To determine the plausibility of our model, we employ the Hausman specification test to test the significance of ϕ_i in moderating the effect of R&D investment on firm competitiveness. This test is implemented under the null hypothesis that ϕ_i does not correlate or interact with R&D investment and other explanatory variables in our model. Hence, our model is plausible if the test hypothesis is rejected.

4 Analysis and Results

4.1 Bivariate Correlation Analysis

Table 1 shows the Pearson's pairwise correlation matrix among the variables.

Table 1: Pairwise correlation matrix

VARIABLE	MS	MVS	RDI	TA
MS	1			
MVS	0.18	1		
RDI	0.26	0.35	1	
TA	0.87	0.08	0.39	1

Source: Output from EViews

From Table 2, R&D investment is positively correlated with both market share and market value share which is consistent with the resource-based theory. However, the correlation between RDI and MVS ($r = 0.35$) is higher than the correlation between RDI and MS ($r = 0.26$), suggesting that R&D investment drives a firm's performance in the stock market more than it drives its industry performance.

4.2 Empirical Analysis

4.2.1 Model Estimation and Analysis

Table 2 shows the results of the estimated dynamic fixed effect model for the relationship between R&D investment and firm competitiveness. The Table contains both the estimated parameters and the model diagnostic/specification tests for both market share and market per share models. From Panel B, the Adjusted R-square is quite high while the Durbin-Watson value is around 2 for both models, indicating that the results are not spurious. Further, for both models, the F-statistic is estimated with zero probability, indicating that the results are highly significant. Besides, the Hausman specification test is significant for both models, thereby rejecting the null hypothesis that firm heterogeneity does not correlate with R&D investment and other explanatory factors in the firm competitiveness model. All these imply that the dynamic fixed effect model is a plausible description or representation of the dynamic relationship between R&D investment and firm competitiveness. Hence, our empirical results are valid and a true reflection of reality in the Nigerian consumer goods industry.

Table 2: Fixed Effect Results

Variable	LMS	LMVS
Panel A: Model Parameters		
Constant	0.5833 (0.1849)	-0.8296 (0.5520)
y_{t-1}	0.6879 (0.0000)	0.5532 (0.0000)
LRDITA	-0.0229 (0.6075)	0.1563 (0.2621)
LTA	-0.0437 (0.4531)	0.2140 (0.2365)
Panel B: Diagnostic/Specification Tests		
R-squared	0.9865	0.9387
Adjusted R-squared	0.9840	0.9273
F-statistic	392.98	82.190
Prob(F-statistic)	0.0000	0.0000
Durbin-Watson stat	2.1286	1.8823
Hausman Test	10.648 (0.0138)	24.667 (0.0000)

Table 3: Estimated Firm Heterogeneity

Variable	LMS	LMVS
NB	0.1682	-0.0265
NESTLE	0.1358	0.5762
UNILEVER	-0.0879	-0.0918

DSR	0.0705	-0.0463
GUINNESS	0.0125	0.0300
NASCON	-0.2066	-0.0066
CADBURY	-0.1890	-0.1976
FMN	0.2118	-0.0304
PZ	-0.0983	-0.1348

From Panel B of Table 2, the coefficient on the lagged dependent variable is positive, appreciably sized, and highly statistically significant for both market share and market value per share models, showing that there is persistence in both dimensions of firm competitiveness as they depend on their previous levels. This can be interpreted as suggesting that firm competitiveness also determines the extent of R&D investment in the consumer goods industry. Hence, consistent with Sridhar et al. (2014), our findings have confirmed the endogeneity or feedback relationship between R&D investment and firm competitiveness in the Nigerian consumer goods industry.

The coefficient on LRDITA is not statistically significant for both LMS and LMVS models, showing that R&D investment does not drive the competitive performance of consumer goods firms at both the industry and stock market levels. This finding underscores the low investment in R&D and promotional activities in the consumer goods industry. Also, this result is surprising, given the strategic importance of R&D in driving both product innovation and market competition. Hence, there is need for consumer goods firms to increase their investment in R&D and promotional activities to improve and sustain their competitiveness at both the industry and stock market levels.

The coefficient on LTA is not statistically significant for both LMS and LMVS models, showing that firm size does not significantly affect the relationship between R&D investment and firm competitiveness. However, the positive sign attached to the LTA coefficient in the LMVS model reveals the tendency for consumer goods investors to assign higher premium to larger firms than smaller firms in their valuation model. One explanation is that larger firms have the capacity to commit considerable financial resources to R&D and hence have higher growth potential than smaller firms.

From Table 3, we can observe the differences in unobserved firm-specific effects which reflect the differences in management style and organizational culture across firms. For Nestle and Guinness, the heterogeneity parameter is positive for both market share and market value per share models, while for Unilever, NASCON, Cadbury, and PZ, the heterogeneity parameter is negative for both models. For Nigerian Breweries, Dangote Sugar, and Flourmill, the heterogeneity parameter is positive for market share model, while it is negative for market value per share model. However, as evident from the Hausman test, these latent firm-specific factors are all significant; hence they affect both market share and market value per share not only directly, but also through their interaction with R&D investment. Hence, consistent with the resource-based theory, our results have confirmed the moderating role of firm heterogeneity in the relationship between R&D investment and firm competitiveness.

4.2.2 Discussion of Findings

Our main objective is to determine the extent of the impact R&D investment on firm competitiveness. The resource-based theory implies that R&D investment leads to the development of innovations and capabilities that enhance firm competitiveness. Hence, we expected, *a priori*, that R&D investment would exert a highly significant positive effect on both market share and market value per share.

Contrary to the resource-based view of the firm, we find no significant relationship between R&D investment and both dimensions of firm competitiveness. We attribute this to low commitment of managers to R&D and promotional activities, which may be due to poor knowledge of the strategic role of these activities in driving long-term performance and growth. Another plausible explanation is the long gestation period between R&D investment and its outcomes. This finding also contradicts several previous studies including Coluccia et al. (2019), Rababah et al. (2022), and Tung and Binh (2022). On the contrary, our finding tends to align with Baek and Lee (2024).

On the role of firm heterogeneity in the firm competitiveness model, we find that the latent parameters are all significant in both market share and market value per share models, thereby validating the theoretical view that possession of heterogeneous intangible resources enhances the ability of a firm to compete favourably in the market (Barney, 1991). This shows that firm heterogeneity significantly moderates the relationship between R&D investment and firm competitiveness in the Nigerian consumer goods industry. Hence, our empirical results provide strong evidence that both customers and investors evaluate firms in terms of their distinctiveness in resource ownership and possession.

5 Summary and Conclusions

In this study, we explore the impact of R&D investment on firm competitiveness from the perspectives of both customers (market share) and investors (market value per share) using a dynamic fixed effect model. Also, we consider the moderating role of firm heterogeneity in the relationship between R&D investment and firm competitiveness. Our model incorporates firm assets as a control factor while our sample includes 9 listed consumer goods firms in the Nigerian stock exchange between 2014 and 2022. The main conclusion is as follows:

There is evidence that both market share and market value per share are strongly persistent and hence can be determined based on their previous levels. However, while the impact of R&D investment on both dimensions of firm competitiveness is not statistically significant, the moderating role of firm heterogeneity is significant. Hence, our conclusion is that consumer goods firms are yet to commit sufficient financial resources to R&D activities as a way of enhancing their performance at both industry and stock market levels.

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