

Fuel Price Variation And The Role Of Financial Inclusion In Household Consumption Among Nigerian Households: Evidence From Cross-Sectional Variation In PMS Prices

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Abstract

This study examined the relationship between digital financial inclusion and the reaction of Nigerian households to changes in fuel prices based on the two theories proposed; Permanent Income Hypothesis (PIH) and Liquidity constraint theory, with the specific variables of interest being consumption of the Premium Motor Spirit (PMS) and total household expenditure (THE). Due to the changes in fuel prices in recent years and the elimination of subsidies, Nigeria is now facing a lot of economic vulnerabilities to Nigerian households, making it very important to understand the role of financial access in household welfare. Data from the Nigerian Household Tax Perception Survey for 2018 (a total of 6,394 national observations) was utilized in the study. Two primary outcomes were analysed: total household consumption expenditure and total household PMS expenditure (as a secondary outcome). This study used three indicators of financial inclusion: bank account ownership, having a mobile phone, and having banking infrastructure (ATM) in an area. Robust econometric models such as Quantile Regression and Generalized Linear Models (GLM) were used in the study. Because of the cross-sectional nature of the data, all findings should be interpreted as associations, and not as causal effects. The results of the analysis showed that there is a significant positive relationship between bank account ownership and total expenditure of the household in all models used. This indicates that the access to formal services is associated with the level of household consumption. However, ownership of mobile phones indicates positive but not significant association with fuel consumption but it also is linked to higher fuel prices. In addition, the differences between regions and between cities and rural areas show that there are important linkages with both total consumption and pricing outcomes. It was concluded that owning a bank account is positively related to consumption of households, but no causal interpretation can be made due to the study design. Recommendations made for policy are: increased availability of affordable banking facilities

in less-developed areas, enhancements to the physical financial facilities and addressing structural inequalities issues in the regional fuel supply.

Keywords: Household, Financial Inclusion, Mobile Banking, ATM, Fuel, Price, Nigeria, Association, Cross-sectional Analysis

1. INTRODUCTION

Fuel consumption particularly petrol (PMS) has a very important role in the welfare and mobility of households in Nigeria. This is because, in Nigeria, public transport and the supply of electricity has been a problem historically. Further, in Nigeria, petrol (PMS) is not only used for transportation but is also used to power houses using generators. Unfortunately, the Nigeria PMS market is unstable and unpredictable, marked by recurrent subsidy reforms, distortions in the supply chain arising from corrupt practices and price volatility. The volatile prices of fuel influence the welfare of households particularly for low-income earners as it could lead to a rise in the cost-of-living standard and impose a reallocation of consumption budgets on households (Adekunjo & Anagun, 2023; Njoku & Mmougbo, 2025).

In June 2023, the newly elected president of Nigeria, Bola Ahmed Tinubu, fully removed petroleum subsidy bringing an end to long-debated policy moves leading to a sharp increase in pump prices nationwide and pushing low-income families to cut their basic needs drastically. However, another discourse was resurrected on the way in which Nigerian families especially the financially challenged cope with such financial economic shock. But one thing is clear: the capacity of those households to sustain their consumption despite the withdrawal of fuel subsidy is not a miracle, but rather a result of their financial services, in particular the financial services they have access to, digital financial services. Njoku and Mmougbo (2025) noted that the shock resulted in significant decreases in the consumption expenditure of these households particularly in the less protected and less served areas where these households lack adequate financial flexibility to cope with the increase in prices. The changes in consumption suggest the importance of financial inclusion as a buffer against economic shocks. Looking back it is important to note that the contribution of financial inclusion to stabilizing consumption and controlling volatility in economic shocks cannot be underestimated (Seck, Naiya & Muhammad, 2017). As reported by Efobi, Atata and Ajefu (2020) banking services are severely constrained in rural areas while people rely on informal (traditional) financial service providers like cooperatives, savings groups, micro credit and mobile money to sustain their lives.

This paper builds on already existing evidence from empirical studies both in Nigeria and abroad. For example, Cavoli, Rajan and Siregar (2022) reported that financial inclusion (access to institutional finance, bank accounts/ATM and credit facilities) reduces the volatility of consumption in 85 countries including Nigeria. Other research that supports the notion that financial inclusion plays a role in consumption smoothing is found in Koomson and Danquah (2021), Demirgüç-Kunt et al. (2022) and Nwoko, Aye and Asogwa (2016). Previous studies have revealed the connection between financial inclusion and consumption smoothing, although most of the studies concentrated either on the informal approach like the study of Efobi et al., (2020) or the formal approach like the study of Adekunjo & Anagun (2023). In this context, this paper seeks to explore the relationship between financial inclusion and total consumption of households in Nigeria. All findings are associations as the data is cross-sectional. Specifically, the paper investigates how access to formal financial services such as bank account ownership, using mobile phone and ATM availability corresponds with the amount households spend on total consumption and PMS. The research study also employs a cross sectional observational design that is based on data from the Nigerian Household Tax Perception Survey carried out in 2018 to contrast spending habits of household groups with

varying levels of financial access. In doing this, the paper helps to shed light on the linkages between financial inclusion and household energy security and resilience as a developing economy phenomenon in Nigeria.

2. Literature Review

This section presents the review of existing literatures relevant to this study; covering the theoretical framework, and empirical literature that helps to give more comprehensive view on this study

2.1 Theoretical Framework

The Permanent Income Hypothesis (PIH) and Liquidity Constraint Theory are the theories used in this study. These theories give grounds for analyzing the linkages of financial inclusion and household reactions to fuel price fluctuation in Nigeria. Permanent Income Hypothesis (PIH) was developed by Milton Friedman in 1957. The theory assumes that people make decisions about their consumption based not only on their current income but also on their permanent income -- their long-term income prospects. This theory anticipates that rational households will generally seek to smooth consumption over time, by saving or borrowing when their income or prices change in a temporary way. As with this paper, a price shock on the fuel is treated as a consumption shock. Financial inclusion – including access to bank accounts or other formal financial services – can cushion the effects of volatile fuel prices on the household level. We do not test consumption smoothing dynamics directly, though, because of the cross-sectional nature of our data, we test the implications of PIH (associations between financial access and consumption levels). The theoretical basis for this is congruent with empirical research which found that the household financial asset of having an account in a bank is positively related to the total spending of Nigerian households.

The Liquidity Constraint Theory acknowledges that not all households are able to borrow or take financial assistance during shock periods in developing countries such as Nigeria, particularly. Deaton (1992) suggested that the consumption of financially excluded households is very sensitive to current income or cash-in-hand when they are liquidity constrained, leading them to delay spending on basic goods, in particular fuel, when prices suddenly increase. Through this theory, the importance of financial inclusion in improving household resilience by alleviating financial friction becomes evident.

2.2 Review of Empirical Literature

Many empirical literatures were reviewed in this study for instance, Adekunjo and Anagun (2023) studied the effect of oil price shocks on household consumption expenditure in Nigeria. Time-series data for the period 1981 – 2020 have been utilized, with Brent crude oil prices as a proxy for Oil price shocks, and Household final consumption as a measure of consumption expenditures, both from U.S. Energy Information Administration and the WDI database. Both short run and long run were captured by the authors with the Error Correction Model (ECM) and results suggest that oil price shocks have substantial negative impacts on consumption expenditures in both the short and long run. The study did not directly focus on issues of financial inclusion, but it did mention that poor access to credit facilities and saving reduces the consumption squeeze. Similarly, Adekunjo and Anagun (2023) analysed the effect of oil price volatility on consumption expenditure in Nigeria between 1980 and 2021. The study applied the Error Correction Model (ECM) and determined a long-term relationship between oil price volatility and spending on consumption. Even more, they propose policies to lessen reliance on oil revenue and to encourage savings for the rainy days.

Moving on the same train, Cavoli et al. (2022) addressed the question of whether financial inclusion creates smooth consumption in developing countries like Nigeria using panel dataset for the period

1995–2017. The study considered financial inclusion as an indicator (bank account, credit facilities, insurance etc.) and consumption expenditures volatilities as a standard deviation of per capita consumption expenditure. The study used instrumental variable techniques, consumption deviation model and found that financial inclusion has a significant effect on reducing consumption volatility. In Ghana, Koomson and Danquah (2021) examined the linkages between financial inclusion and energy poverty in the country between 2005 and 2017, based on the household survey data. An instrumental variable approach was used to overcome endogeneity, as financial inclusion was measured through ownership of bank account and access to credit and energy poverty was proxied through household's spending on fuel such as kerosene and petrol etc. Results indicated that financially included households were better at smoothing energy consumption even at fuel price volatility. Thus, financial inclusion in Nigeria could have a great role to play in cushioning the effect of fuel price volatility which could help to stabilise the household budget.

An empirical study by Efobi et al. (2020) zoomed how the informal financial sector, namely associations, assists rural households in Nigeria to smoothen their consumption of their food basket in response to adverse fuel price shocks. Three waves of the panel data from the General House Surveys (GHS) from 2010 to 2013 were used. Food consumption was measured using the percent of food expenditure in the household budget and more so, food shocks measured include fuel or food price hikes. Although the study did not explicitly isolate the informal associations, they were defined as community groups such as savings clubs and cooperative societies. The authors then applied the fixed effects model and concluded that the food expenditure of households living in informal association was more than the counterparts during shocks.

Further, in an empirical study, Seck et al. (2017) investigated the effect of financial inclusion on household consumption in Nigeria and found that financial inclusion positively influenced consumption in Nigeria. The analysis indicated that those households with better access to financial services like loans and savings are better able to sustain consumption during adverse economic shocks, such as fuel price increases, based on survey data from 2010 to 2015. This indicates that financial inclusion is a cushioning mechanism in Nigeria's consumption smoothing. Nwoko et al. (2016) analyzed the linkage between the oil price volatility and food price movements in Nigeria from 2000-2013. Their research study leaned on Vector Auto-regression (VAR) model and Granger causality tests, results revealed that there exist significant positive relationship between food prices and squeezing household budgets suggesting that volatility in fuel price affects consumption smoothing through cost of living low-income and Nigerian rural household dwellers.

This is not only limited to the Nigerian context, but also has been corroborated by international evidence which establishes a link between financial inclusion and consumption smoothing. In an important study on the mobile money system in Kenya, M-PESA, Jack and Suri (2011) found that the access to mobile money helped to smooth consumption during negative income shocks and that access was particularly significant for female-headed households and low-income households. Likewise, Aterido, Beck and Iacovone (2013) analyzed 15 countries of Sub-Saharan Africa and concluded that the availability of bank accounts and formal financial services decreased household consumption variability. Cavoli, Rajan and Siregar (2022) obtained compelling evidence for how financial inclusion, through bank-provided access to bank accounts, ATMs and credit, is associated with a significant decrease in consumption volatility across a cross country sample of 85 countries across developing and emerging markets. The results from these international studies indicate that financial inclusion impacts consumption smoothing is a worldwide phenomenon, with size of the effect being dependent on context and type of financial services.

3. SOURCE AND METHODS

This study employed the cross-sectional quantitative research design using data from 2018 Nigerian Household Tax Perception Survey which is a nationally representative dataset which was conducted by the Nigerian Governors' Forum (NGF) in collaboration with development partners. There was no experimental manipulation involved, it is an observational study. The data set is being made public via the Nigerian Governors' Forum (NGF) Data repository. Study is an observational and cross sectional only. No causal statements are made. All the findings are associations, and do not imply any causal relationships.

While data from the 2018 Nigerian Household Tax Perception Survey offer a solid nationally representative data set to examine the impacts of financial inclusion in household consumption, they do not necessarily apply to the impacts of the removal of fuel subsidy in 2023; however, the findings represent general mechanisms of financial inclusion during economic shocks rather than specific mechanisms following the removal of fuel subsidy. More importantly, the structural relationships identified which are strongly supported by the Permanent Income Hypothesis and Liquidity Constraint Theory, are still very relevant as supported by recent studies such as Njoku and Mmoubuo (2025). Further, this analysis could be expanded on with data from after 2023 to provide information on the impacts of subsidy specific to Nigeria.

The data analyzed in this study came from the Nigerian Household Tax Perception Survey of the total population of 11,951 households across 36 States and the Federal Capital Territory (FCT) in Nigeria conducted in 2018. The survey used a multi-stage stratified random sampling to be nationally representative. The first stage involved the selection of Enumeration Areas (EAs) from each of the 36 states of Nigeria and FCT based on the population estimates provided by the National Population Commission, proportional to size (PPS) sampling technique. In the second stage, within each of the selected EAs, households were systematically sampled from a stratified framework that considered the regional distribution (geopolitical zones), urban-rural classification, as well as socio-economic characteristics. This design guaranteed that the final sample was sufficiently representative of Nigerian households geographically and demographically. This study, for its part, took into account a final sample of 6,394 household units, after excluding observations where the value of one or more of its key variables was missing or was an implausible value.

The data were carefully cleaned to ensure reliability of the data analysis. Firstly, observations were excluded from the analysis if they lacked key outcome variables, for instance price paid per liter and/or PMS expenditure. Households which reported no spending on PMS were also included in the analysis. Winsorization was used to adjust expenditure values that were extremely high (above 99th percentile) but had limited effect on the results. Also, price-per-liter entries were also scanned for unrealistic prices (all below ₦50 or above ₦500) given the pricing context of 2018 and such entries were removed. After completing these steps, the final dataset used for analysis included 6,394 households.

One possible disadvantage of the data is that it is based on self-reported expenditures and price information, and could thus contain recall bias. The recall period in the survey design was, however, one week for purchasing fuel, to minimise inaccuracies, and in addition the size of the sample minimises individual inaccuracies with the survey.

3.1 Model Specification

To address the research questions stated in Chapter One, the study specified the models using a log-linear functional form as follows:

Model One: Log Transformed Total Household Consumption

$$\ln(\text{TotalConsumption}_i) = \beta_0 + \beta_1 \text{BankAcc}_i + \beta_2 \text{Mobile}_i + \beta_3 \text{ATM}_i + \beta_4 X_i + \varepsilon_i$$

Model Two: Log Transformed PMS Expenditure

$$\ln(\text{PMSSpending}_i) = \alpha_0 + \alpha_1 \text{BankAcc}_i + \alpha_2 \text{Mobile}_i + \alpha_3 \text{ATM}_i + \alpha_4 X_i + \mu_i$$

Where:

$\ln(\text{TotalConsumption}_i)$ is the natural log of the total weekly household expenditure by household i (including all goods and services, not just fuel) while $\ln(\text{PMSSpending}_i)$ is the natural log of total weekly PMS expenditure by household. The BankAcc_i is a dummy variable for bank account ownership (1 if any household member owns a bank account, 0 otherwise) while Mobile_i is a dummy variable for mobile phone ownership (1 if household owns at least one mobile phone, 0 otherwise). The ATM_i is a dummy variable for ATM or bank availability in the area (1 if available, 0 otherwise) while X_i is a vector of control variables including region (geopolitical zone). The gender of household head, urbanization (urban/rural) and household size ε_i and μ_i are the error terms.

3.2 Methods of Analysis and Estimation Techniques

The analysis of this study was conducted using two models, which are: Model 1 (Total Consumption) which was used to study the relationship between financial inclusion and total household consumption and Model 2 (PMS Spending) which was used to study the relationship between financial access and the expenditure of the household on PMS. In both of them, their dependent variables are continuous variables; they are non-negative and more rightly-skewed making them more suitable for continuous outcome modeling such as OLS. However, the Ordinary Least Squares (OLS) regression technique that was initially preferred and employed as a result of its simplicity and interpretability in estimating linear relationships as reported by Wooldridge (2010) suffered some setbacks due to the series inability to satisfy some of the model's assumptions. This finding has been verified following the pre-estimation diagnostic test revealed that the residuals of the series were not normally distributed and there are also some extreme outliers in particular, the fuel price dataset even when logarithmic transformed. Given this background, it was decided that the study will use the other estimation methods which are more robust to OLS, as they assume that the model is a classical linear model, which was not fulfilled by these issues.

To address these violations issues, the study applied a combination of Quantile Regression and the Generalized Linear Models (GLM) with a Gamma distribution and log link. More so, the quantile regression model was chosen for its ability to estimate the conditional median which is more resistant to the influence or effects of outliers and non-normal distributions error (Koenker & Bassett, 1978). On the other hand, the GLM technique is more suitable for modeling positively skewed and the heteroskedastic continuous variables as recommended by Cameron and Trivedi (2009). Moreover, all these models served as complementary to each other because they allowed for robustness checks. Even more interesting, the consistency across these results further confirmed the validity of the findings. This is also in accordance with previous studies such as Babajide *et al.*, 2015 and Demirgüç-Kunt *et al.*, 2022 who applied several robust estimation techniques to achieve single purpose.

3.3 Variable Measurements

Variable Category	Variable	Description	Code	Type
Dependent Variables	Total Household	Weekly total household expenditure on all goods and services (not just fuel)	N/A	Continuous

Variable Category	Variable	Description	Code	Type
Independent Variables	Consumption (₦)			
	Total Weekly PMS Spending (₦)	Weekly household expenditure on PMS; used as the main outcome in secondary models	q63a_1	Continuous
	Log of Total Consumption	Natural log of total consumption; used in GLM and Quantile Regression	log_total_cons	Continuous (logged)
	Log of PMS Spending	Natural log of PMS spending; used in secondary models	log_pms	Continuous (logged)
	Bank Account Ownership	Dummy for whether any household member owns a bank account	bankaccowndum	Binary (0 = No, 1 = Yes)
	Mobile Phone Ownership	Dummy for whether the household owns at least one mobile phone	mobilephonowndum	Binary (0 = No, 1 = Yes)
	ATM Availability	Dummy indicating whether the household has access to a bank or ATM in the area	bank_atmdum	Binary (0 = No, 1 = Yes)
Control Variables	Region (e.g., North East, etc.)	Geopolitical zone where the household is located; South East used as reference category	Region	Categorical (6 levels)
	Urbanization (Rural)	Location type of the household (1 = Urban, 2 = Rural); rural is the comparison group	urbanization	Categorical (2 levels)
	Weights	Household-level survey sampling weight applied in weighted regressions	Weights	Weight variable

4. PRE-ESTIMATION TEST

Pre-estimation diagnostic tests were conducted to verify the assumptions of the Ordinary Least Squares (OLS) model. The histogram of residuals (available upon request) showed non-normal distribution with positive skew, and the residuals vs. fitted values plot indicated mild heteroskedasticity. Formal tests confirmed these observations.

4.1 Results and Discussion

The analysis of data begins with a pre-estimation test to confirm if the model meets the condition of the estimation techniques employed in the study.

Table 4.1 Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Dependent Variables					
Total Household Consumption (₦)	6,394	18,432.50	14,231.80	1,200	85,000
Log Total Consumption	6,394	9.72	0.89	7.09	11.35
Total PMS Spending (₦)	6,394	2,845.32	3,421.67	0	25,000
Log PMS Spending	6,394	7.21	1.43	0	10.13
Price Paid per Liter (₦)	5,892	167.45	42.18	100	350
Financial Inclusion Variables					
Bank Account Ownership (1 = Yes)	6,394	0.43	0.49	0	1
Mobile Phone Ownership (1 = Yes)	6,394	0.78	0.41	0	1
ATM Availability (1 = Yes)	6,394	0.52	0.50	0	1
Control Variables					
Urban (1 = Urban)	6,394	0.38	0.49	0	1

Source: Researcher's computation based on 2018 Nigerian Household Tax Perception Survey

Table 4.1 shows that only 43% of households own a bank account, highlighting the limited formal financial access in Nigeria despite widespread mobile phone ownership (78%). Mean total household consumption is ₦18,432.5 per week.

Table 4.2: Summary of Residual Diagnostic Test Results

Test Type	p-Value	Conclusion
Skewness-Kurtosis Test	0.0000	Residuals are not normally distributed
Shapiro-Wilk W Test	0.0000	Strong evidence of non-normality in residuals

Source: Researcher's Computation (2025).

The pre-estimation test results based on Skewness-Kurtosis and Shapiro - Wilk W Test are presented in Table 4.2 the table revealed that the residuals are not normally distributed even after logging the dependent variables. This made the decision to venture beyond Ordinary Least Squares (OLS) models for the study

seem appropriate. Additionally, the residual vs. fitted plot showed a fairly random spread around zero which indicates that the model is generally well specified. Unfortunately, there were some heteroskedasticity which point to a mild heteroskedasticity. Hence, the results of this study justify the use of Quantile Regression and Generalized Linear Models for obtaining more reliable results.

The impact of financial inclusion on the total consumption of households in Nigeria is estimated using the above different approaches after confirming the appropriateness of their use. Table 4.3

Table 4.3 Regression Results from GLM and Quantile Regression Models

(Dependent Variable: Log Total Household Consumption)

Variable	GLM (Gamma, Log Link) Coefficient (<i>p</i> -value)	Quantile Regression (Median, $\tau = 0.5$) Coefficient (<i>p</i> -value)
Bank Account Ownership	0.187 (0.001)***	0.156 (0.008)***
Mobile Phone Ownership	0.042 (0.342)	0.038 (0.401)
ATM Availability	0.098 (0.023)**	0.087 (0.067)*
North East	-0.112 (0.087)*	-0.098 (0.124)
South-South	0.045 (0.412)	0.038 (0.489)
North Central	-0.067 (0.234)	-0.054 (0.312)
South West	0.078 (0.145)	0.069 (0.187)
North West	-0.143 (0.012)**	-0.121 (0.034)**
Urbanization (Rural)	-0.089 (0.018)**	-0.076 (0.042)**
Household Size (log)	0.234 (0.000)***	0.218 (0.000)***
Constant	8.342 (0.000)***	8.156 (0.000)***
Model Fit	AIC = 12,847	Pseudo R² = 0.087
Observations	6,394	6,394

Source: Researcher's Computation (2025).

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. P-values are reported in parentheses.

All findings represent associations, not causal effects. Due to cross-sectional design, causal interpretation is not warranted.

In Table 4.3, the dependent variable is the logarithmic transformation of total household consumption. The results indicate a significant positive association between bank account ownership and total household consumption. Households with bank accounts have approximately 18.7% higher total consumption (GLM coefficient = 0.187, $p = 0.001$) compared to those without, holding other factors constant. This aligns with the Liquidity Constraint Theory, which suggests that households with access to formal financial services may have higher consumption levels. This finding is consistent with international evidence from Cavoli, Rajan, and Siregar (2022), who found similar consumption associations across 85 developing countries,

and with Jack and Suri's (2011) study on M-PESA in Kenya, which demonstrated that financial access helps households absorb income shocks.

In a similar vein, the positive and significant association between ATM availability and total consumption (coefficient = 0.098, $p = 0.023$) indicates that physical financial infrastructure plays a crucial role in household consumption patterns. The lack of statistical significance for mobile phone ownership in explaining total consumption is noteworthy. Despite widespread mobile phone adoption in Nigeria, this finding suggests that mobile phones alone do not translate into improved household consumption levels. This reflects limitations in infrastructure and service delivery, particularly in rural and underserved areas.

Results for control variables such as urbanization indicate significant negative association with total consumption (coefficient = -0.089, $p = 0.018$). This shows that after controlling for other factors, urban households have different consumption patterns than rural households. As per Regions, results indicate that households in the North West part of Nigeria have significantly lower consumption compared to their counterparts in the South East region (coefficient = -0.143, $p = 0.012$).

Table 4.4 Regression Results from OLS and GLM Models on Log Price per Litre

(Dependent Variable: Log of PMS Price per Litre)

Variable	OLS Coefficient (<i>p-value</i>)	GLM Coefficient (<i>p-value</i>)
Bank Account Ownership	-0.007 (0.650)	-0.013 (0.491)
Mobile Phone Ownership	0.044 (0.012)**	0.051 (0.010)**
ATM Availability	-0.007 (0.309)	-0.010 (0.406)
North East	0.073 (0.000)***	0.107 (0.001)***
South-South	0.019 (0.086)*	0.026 (0.031)**
North Central	-0.025 (0.020)**	-0.024 (0.020)**
South West	-0.006 (0.463)	-0.006 (0.534)
North West	-0.047 (0.000)***	-0.025 (0.132)
Urbanization (Rural)	0.018 (0.011)**	0.024 (0.028)**
Constant	4.920 (0.000)***	4.920 (0.000)***

Source: Researcher's Computation (2025).

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. P-values are reported in parentheses.

In Table 4.4 the GLM model results revealed that ownership of mobile phones has a statistically significant positive association with the price paid for PMS considering the coefficient of 0.051 and a p -value of 0.010. This indicates that households with a mobile phone are likely to pay a higher price per liter because fuel scarcity and hoarding of PMS which leads to price hike is more common in the cities (urban areas) where ownership of mobile phone is largely common.

Furthermore, the OLS robust model also confirmed the result of GLM model, with a coefficient of 0.044 and a p -value of 0.012, it shows that ownership of mobile phone ownership has significant positive association with price paid per liter. This indicates that a one unit increase in mobile phone ownership is

associated with a 4.4% increase in price paid per liter. However, in both the models, bank account ownership and availability of ATM machine has negative and insignificant coefficients of -0.012, -0.009 respectively and p values of (0.491 & 0.406) respectively, which indicates that there is no significant association between bank account ownership and availability of ATM machine with PMS Price in either of the two models. This indicates that these segments of financial inclusion can also facilitate households' saving and transactional purposes as well as quick credit/loan, but not necessarily to be associated with higher willingness-to-pay for fuel price in Nigeria; perhaps due to the structural inefficiency in the downstream fuel market.

Also, for both models, regional variable (control) indicates a variation in price, as it is found that the price paid by households in the North Eastern part of Nigeria is significantly higher than the price paid by households in the South Eastern part of Nigeria. This is confirmed with GLM and OLS coefficients of (0.107 & 0.073) backed by p-values of (0.001 & 0.000). More so, this supports the hypothesis that the weaknesses in regional supply chain, transportation cost and insecurity such as Boko Haram and Banditry influence the pricing of fuel in the northern region. Even more, there is some evidence of spatial heterogeneity in pricing dynamics in both North Central and North West regions. Moreover, the variable "urbanization" shows significant positive association in both models considering p-values of (0.028 & 0.011). This suggests that households in the cities (more urbanized) areas pay more per liter possibly due to more demand and informal retail premiums.

Although the OLS model provides valuable insights and intuitive estimates especially considering the use of log DV, however in terms of model fit, the GLM is more suitable considering the positive and skewed nature of PMS price data. Moreover, the deviance and AIC showed good convergence and log link has been used to help interpret the coefficients in percentages. More importantly, as is typical with cross sectional household data this low but not insignificant R-squared (3.6%) suggests that whilst financial inclusion and location have some effect on price, other factors not measured in the model are important – including supply side constraints and market manipulation.

5. DISCUSSION OF FINDINGS

This study's results provided valuable information on the association between financial inclusion and household consumption in Nigeria. The study examined two main outcomes variables namely: Total household consumption (primary) and total household spending on PMS (secondary). The results were generally consistent across all models of Quantile Regression and Generalized Linear Model (GLM) revealing that ownership of bank accounts has significant positive association with total household consumption in Nigeria. This is consistent with the findings of Cavoli, Rajan and Siregar (2022) who argued that financial inclusion helps households in developing countries smooth consumption during periods of shock or volatility. In the case of Nigeria, this means that households with access to formal banking services such as savings or credit facilities show higher consumption levels. However, due to the cross-sectional design, we cannot determine whether this association reflects causality.

On the other hand, ownership of mobile phones was not statistically significant across all the models in explaining total household consumption in Nigeria. This means that although mobile phones are widely adopted and used in communication and payments for services however, they do not generally show association with household consumption levels. Furthermore, this finding reflects limitations in infrastructure and service delivery in Nigeria most especially in rural and underserving areas. It also aligns with concerns raised by Demirgüç-Kunt *et al.* (2022) concerning uneven progress of financial inclusion. More so, the availability of ATM and banks revealed positive and significant association with total consumption in both the quantile and GLM models. These results show that households living in areas

with access to financial infrastructure have higher consumption levels. This may be due to greater ease in accessing funds or transactions. This is in line with a study by Seck, Naiya and Muhammad (2017) who reported that proximity of financial services influences household resilience and financial behavior.

From the angle of price behavior, results from the study indicate that mobile phone ownership is significantly associated with higher price paid per liter of PMS in Nigeria. One possible explanation is that ownership of phones is more common in urban areas where fuel is normally sold at higher prices due to higher demand and also more frequent reliance on informal market sources. This is in line with findings of Koomson and Danquah (2021) who report that financial access can stimulate energy-related decisions especially in city or urban contexts. However, ownership of bank account and availability of ATM did not show any significant association with price paid, meaning that although financial inclusion corresponds with higher spending, it does not equally correspond with protection from higher fuel prices. Additionally, control variables such as region and urbanization were also important in influencing the outcomes. For instance, households in the North Eastern and South-South part of Nigeria were found to be spending more on PMS and also paid higher prices per liter compared to their counterparts. This is likely due to regional supply chain issues, problems of insecurity or cost of distribution. This confirmed the regional variations as noted by Njoku and Mmougbo (2025), it also supports earlier works done by Nwoko, Aye and Asogwa (2016) on the nexus between oil prices and household consumption smoothing. Conversely, urban households have negative associations with PMS spending indicating shorter commuting distances and availability of various alternative sources of energy in the cities.

5.1 Limitations and Future Research

This study has a few important limitations. Firstly, because the data is cross-sectional, the results show associations rather than cause-and-effect relationships, and causal interpretation is not warranted. We cannot rule out reverse causality, omitted variable bias, or selection effects. Second, the data was collected before Nigeria's 2023 fuel subsidy removal, so current dynamics may differ despite the relevance of the underlying patterns. Third, the study relies on self-reported data, which may include recall errors, and it measures financial inclusion only in terms of access, not how often or how well services are used. Fourth, without panel data we cannot measure consumption smoothing over time.

Future research could improve on this by using panel data to better identify causal effects, collecting post-2023 data to capture recent changes, and exploring in more detail how households actually use financial services to cope with price shocks. Including supply-side factors and a deeper look at digital financial services would also give a more complete picture.

5.2 Conclusion and Recommendations

This paper examined the relationship between financial inclusion and household consumption in Nigeria with two outcomes being considered, total household consumption (primary) and total PMS spending (secondary). National survey data was used and a sophisticated statistical analysis was conducted using quantile regression, GLM and robust OLS methods. The study results reveal a positive association between having a bank account and total spending because it is a consistent predictor. Because of the cross-sectional design, however, it is not appropriate to draw causal inferences. In contrast, mobile phone ownership showed no consistent relationship to spending, though large differences in spending were consistent in explaining the differences probably more due to market dynamics than financial access.

The study further found that there are significant differences between region and urban-rural associations with access and pricing of fuels, which points to structural inequalities in the downstream sector of Nigeria. More importantly, it has affirmed that financial instruments can't necessarily be used to overcome

these barriers. Therefore, the study concluded that although financial inclusion remains a valuable development goal across the globe; however its association with household consumption depends on the type of financial service provided, regional infrastructure and economic conditions.

In line with the findings from the study several policy recommendations are suggested in order to enhance household energy resilience in Nigeria. It is important that the government, together with other financial institutions, make increased access to low-cost banking a priority for low-income households. This is important as the study uncover strong significant and positive association between bank account ownership and total household consumption in Nigeria. Hence, the availability of financial products that are affordable and inclusive could help households to deal with the increasing cost of energy. More importantly, the Government should make every effort to enhance the physical financial infrastructure in rural areas including the ATM network, bank branches in villages and other places, and show that this is a strong correlation of household expenditure on essential commodities such as fuel in villages, where access to such facilities was historically limited.

In addition, the Nigerian policy makers must diversify their investments in the supply chain logistics and encourage transparency in pricing in all the states of the federation of Nigeria, particularly in the northern part of the country, as a result of the observed variation in PMS prices and their consumption level. Even though mobile phone ownership did not show significant association with total consumption based on the results in this study, its inclusion along with digital finance platforms and other initiatives that generate income can increase its effectiveness in the long run. Additionally, the negative association between urbanization and PMS spending strongly suggests the need for an increased investment in affordable public transportation in urban areas. Having such infrastructure would lessen the dependence of individual households on petrol, which would enable the energy affordability and sustainable environment in cities of Nigeria.

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