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Rising petroleum products pump price: Implication for prices of selected raw food items in Southwestern Nigeria

Najeem Olatunji, Bashir[1+]
Muideen Adejare, Isiaka[2]
Hakeem Olayinka, Onifade[3]

[1]*Department of Economics, College of Arts, Social and Management Sciences, Crescent University, PMB 2104, Sapon Abeokuta, Ogun State, Nigeria.*
[1]*Email: tunjibash@cuab.edu.ng*
[2]*Abeokuta Business School, Crescent University, PMB 2104, Sapon Abeokuta, Ogun State, Nigeria.*
[2]*Email: dr.isiaka@gmail.com*
[3]*Department of Accounting, College of Arts, Social and Management Sciences, Crescent University, PMB 2104, Sapon Abeokuta, Ogun State, Nigeria.*
[3]*Email: hakeemonifade@gmail.com*


(+ Corresponding author)

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ABSTRACT

This study investigated the impact of petroleum product pump prices on garri and yam prices in Southwest Nigeria between 2017 and 2022. The study covers the six Southwest states. Data on prices of garri and yam, automotive gas oil, premium motor spirit, and household kerosene, as well as the prices of imported goods and services and the consumer price index, were collated from the National Bureau of Statistics (NBS) fact sheet and Global Data Lab. The data were analyzed using the ordinary least squares technique. Results show that automotive gas oil prices influence the prices of garri and yam in Ogun, Ondo, and Osun; petrol pump prices have a significant influence on the prices of garri and yam in all the states except Osun. Kerosene prices affect the prices of all commodities across all states except Ekiti and Oyo. The consumer price index and imports of goods and services significantly influence the prices of garri and yam in all states except Ekiti. It was concluded that petrol pump prices are the major influencers of garri and yam prices. As a recommendation, adequate implementation of policies aimed at stabilizing petroleum pump prices to mitigate price volatility of essential commodities should be ensured. Mechanisms targeted at cushioning the impact of fluctuating petroleum product prices on raw food affordability should be considered.

Contribution/Originality: The study provides empirical evidence on the pass-through effects of rising fuel pump prices on raw food item prices in Southwestern Nigeria. This fills the rarely addressed regional gap in energy-food price transmission literature.

1. INTRODUCTION

Food is any substance that provides energy and nutritional support for human beings. This substance, called raw food, consists of fat, carbohydrates, proteins, and other components in the body to sustain growth and energy. Without raw food and other substances like water, human beings cannot survive (Adam, Kwimbere, Mbowe, & O'connell, 2012). The quantity and quality of raw food that households can purchase depend on the prices of the food items they consume (Akpaeti, 2018). Hence, one of the indices that greatly influence the prices of raw food items is petroleum pump prices. There are three major petroleum products that are commonly used by households in Nigeria: petrol, automotive gas oil, and household kerosene (Babalola & Salau, 2020). Since households are the main users of these products, the cost of each one has an impact on them. Due to the correlation between the prices of petroleum pumps and raw foods, households will have to deal with an increase in the cost of raw food due to rising prices of

petroleum pumps (Avalos, 2013). The price increase for raw foods coincided with a comparable increase in the price of petroleum. Petroleum products are utilized as inputs in the industry that produces raw foods. Tractors, pumps, and other agricultural equipment use it as oil. The cost of transportation will also be incurred after manufacturing (Ngare & Derek, 2021).

The South West's poverty levels and raw food insecurity are worsened by the relationship between petroleum prices and raw food costs. Farmers must pay more for inputs like machinery, fertilizer, and insecticides when transportation costs increase due to rising gasoline prices. As a result, customers pay more for vital raw foods, making them less affordable, particularly for low-income households, due to these higher production costs (Nwoko, Aye, & Asogwa, 2016). These dynamic feeds the vicious circle of social inequality, poverty, and starvation. Furthermore, vulnerable groups such as women, children, and the elderly are disproportionately impacted by the increase in raw food prices since they spend a significant percentage of their income on raw food purchases. According to Maijama'a, Musa, Yakubu, and Usman (2019), this circumstance not only jeopardizes their dietary intake but also makes it more difficult for them to obtain other necessary services like healthcare and education.

The government has introduced and implemented several measures and strategies to reduce the direct link between petroleum prices and raw food prices in the South West. These measures include government subsidies for agricultural inputs and fuel, strategic reserves of raw food, and programs to boost agricultural diversification and productivity Maku and Adetowubo-King (2018). Furthermore, policies aimed at increasing market efficiency and improving transportation infrastructure have been introduced to reduce distribution costs and ensure stable raw food prices. Additionally, campaigns promoting sustainable agricultural practices, community-based food security programs, and partnerships with foreign organizations have been launched to address the underlying causes of food insecurity and enhance resilience among citizens (Bala & Abdullahi, 2019). Nigeria's excessive reliance on imported gasoline and its vulnerability to external shocks exacerbate structural inefficiencies in the agricultural value chain, including poor road networks, lack of storage facilities, and limited access to loans and market information. These inefficiencies increase transaction costs, post-harvest losses, and fuel price fluctuations in the raw food market (Eregha, Mesagan, & Olawale, 2015). Supply chain disruptions, naira depreciation, and fluctuations in global oil prices also disrupt domestic production and distribution of raw foods, leading to price increases and market distortions. Furthermore, initiatives aimed at addressing the interaction between petroleum pump costs and raw food prices are less effective due to issues with policy implementation, corruption, and poor governance. Inadequate inspection, smuggling, rent-seeking, and market manipulation have worsened raw food poverty and further destabilized raw food prices (Bala & Abdullahi, 2019). Consequently, numerous studies have been conducted across various countries on petroleum pump prices (Babalola & Salau, 2020; Bala & Abdullahi, 2019; Ding, Gummi, Lu, & Mu'azu, 2020; Kirikkaleli & Darbaz, 2021; Ngare & Derek, 2021), but no consensus has been reached among researchers due to different methodologies adopted. Therefore, this study investigates the connection between petroleum pump prices and the prices of garri and yam in the South West of Nigeria.

2. LITERATURE REVIEW

2.1. Petroleum Products Pump Prices and Raw Food Prices

Petroleum pump prices are explained by Bala and Abdullahi (2019) as the prices of different kinds of fuels sold at petrol stations, including diesel, petrol (gasoline), and kerosene. These prices are influenced by several factors such as global supply and demand, taxes, government policies, and domestic market conditions (International Energy Agency, 2021). According to the U.S. Energy Information Administration (2022), factors such as the cost of crude oil and transportation, refining costs, and taxes are the primary determinants of petroleum pump prices. Crude oil, being the main input for gasoline and diesel fuel production, is affected by global demand and supply. After extraction, crude oil must be transported to refineries for processing into fuels. The location of the refinery and its distance from the oil field influence transportation costs. The costs associated with machinery, energy, and personnel involved in

refining are included in the refining costs. Additionally, taxes imposed by governments on gasoline and diesel are significant factors influencing pump prices. These taxes can be ad valorem, which are proportional to the fuel's price, or specific, which are set as a fixed amount per liter of fuel.

Generally, prices of raw foods in markets, supermarkets, and grocery stores can amount to almost one-third of the price of gasoline. These prices are determined by supply and demand, the cost of production and transportation, weather patterns, and government policies (U.S. Energy Information Administration, 2022). Hence, the concept of raw food prices is important because it affects consumers' access to raw food, the profitability of raw food producers and retailers, and the overall health of the economy (Chaudhry, Suleman, Bhatti, & Ullah, 2021). When there is strong or growing demand and a short supply, the price of a certain raw food item will increase. This occurs when manufacturers raise prices due to scarcity to meet demand, and customers are willing to pay a higher price for their desired raw foods. Conversely, the price of that item will decrease as supply increases and demand falls because manufacturers have no choice but to lower prices to prevent spoilage and because consumers are unwilling to pay a premium for easily accessible goods (Food and Agriculture Organization, 2019). Raw food prices are also significantly influenced by manufacturing costs, which include expenses such as fuel, equipment, labor, fertilizer, and seed. Manufacturers may need to increase prices to offset rising production costs, while decreasing prices to remain competitive when production costs fall. Similarly, transportation costs, covering labor, fuel, and vehicle maintenance, also play a crucial role. Retailers may raise prices to offset increasing transportation costs and maintain profitability. Transportation costs can dramatically increase when raw foods are transported over long distances, affecting overall raw food costs. Climatic conditions are another factor that can influence the cost of raw foods, impacting both production and transportation.

The connection between the price of raw food and the price of petroleum pumps is multidimensional and intricate. An essential component of the production and transportation of raw food is petroleum products, which are found in gasoline and diesel (Food and Agriculture Organization, 2019). Accordingly, changes in the petroleum price can have a significant effect on the cost of raw foods (World Bank, 2015). In order to manufacture fertilizers, insecticides, and other chemicals for agriculture, petroleum is an essential input cost device. Consequently, changes in the price of petroleum have a substantial impact on farmers' input costs, which in turn affect the raw food prices. For instance, if the price of gasoline increases, fertilizers and other inputs will also increase. This may lead to higher prices of raw foods. Changes in the petroleum price also affect the cost of producing, processing, and shipping raw food because it is needed in these three phases (World Bank, 2015). The extent to which a nation's economy depends on petroleum is another constraint influencing the nexus between petroleum prices and raw food prices. Countries that rely heavily on petroleum for energy and have limited local petroleum production may be more vulnerable to changes in petroleum prices, as increasing petroleum prices can lead to a surge in transport costs, thereby raising the price of raw food (World Bank, 2015). On the other hand, countries with significant local petroleum production may be less vulnerable to unstable petroleum prices, as they may have more stable petroleum prices, which can assist in stabilizing raw food prices. Additionally, domestic petroleum production can reduce transportation costs, which can also help to stabilize raw food prices (World Bank, 2011).

2.2. Theoretical Review

2.2.1. Demand Theory

The demand theory proposed by Marshall and Marshall (1879) has implications for the relationship between the prices of consumables such as food items and petroleum products. In demand theory, the concept of derived demand explains how the consumption of one commodity influences the demand for another, often referred to as joint demand or complementary goods (Marshall & Marshall, 1879). When raw food items are purchased, households may also need to buy kerosene for food preparation. This relationship extends further to transportation, where raw food items are transported from production sites to consumption areas via vehicles that require fuel. Since kerosene, food items,

and automobile fuel are interconnected as complementary goods, fluctuations in the prices of petroleum products are reflected in the prices of consumer products, as noted by (Kanu et al., 2019).

2.2.2. The Dutch-Disease Theory

The Dutch disease originates from the Dutch economic crisis in the 1960s after natural gas, which was found in the North Sea, led to the sudden wealth of the Netherlands at the expense of other sectors. The resultant negative economic development caused the decline in agricultural and manufacturing sectors' productivity (Corden & Neary, 1982). The theory is succinctly a description of how a boom or large inflow of capital from a country's natural resources leads to a decline in the economic performance of other sectors. It therefore highlights the adverse effects of wealth from natural resources on the socio-economic progress of a country because the effect of the financial boom is not spread to other productive sectors. The downturn in socio-economic progress occurs because factors of production tend to leave other sectors of the economy for the booming sector. The boom generates huge revenue for the country; this, in turn, results in domestic currency appreciation and reduced competitiveness of the country's export industries due to increased costs. Manufacturing, agriculture, and other tradable sectors become neglected and suffer decline. Nigeria's discovery of hydrocarbons in commercial size in the early 1970s significantly propelled its economic growth, albeit the diversion of the country's attention away from important areas such as agriculture. The resultant outcome was reduced food output in the country, which necessitated food importation. With the growing population and the widening gap in agricultural production, Nigeria becomes threatened with food insecurity.

2.2.3. The Linear/Symmetric Relationship Theory

This study rests on the assumptions of linear/symmetric relationship theory, which was propounded by Hamilton (1983) but modified by Laser (1987), as well as rational choice theory advocated by Becker (1976). According to the former theory, the oil market's events from 1948 to 1972 had an effect on the economies of the countries that imported and exported oil, respectively. According to Hooker (2002), thorough empirical research indicates that the level of oil prices and their fluctuations between 1948 and 1972 had a substantial impact on GDP growth. A latecomer to the symmetric school of thought, Laser (1987) demonstrated that the link between economic growth and oil price volatility was symmetrical. Following existing findings, it was argued that a rise in oil prices requires a fall in GDP, but the impact of a fall in oil prices on GDP is unclear because it varies by nation. On the other hand, the latter offers useful information about the selecting behaviour of specific clients. In the prevailing school of thought in microeconomics today, it is the primary paradigm. Becker (1976) contributed to the popularization of the rational choice theory and applied rational actor models broadly. "When faced with several courses of action, people usually do what they believe is likely to have the best overall outcome," as the theory was encapsulated by Elster (1989).

As explained by Friedman (1953), the rational choice theory defines rationality in a precise sense, indicating that an individual acts as if balancing costs against benefits to arrive at an action that maximizes personal advantage. It is suggested that this theory emerged due to other economics departments' envy of its rules of choice in human behavior. The rational choice theory offers valuable insights into the selection or choosing behavior of specific consumers. Choice theory provides a model for understanding and usually explicitly modeling economic and social behavior. In microeconomic models, the desire for more rather than less of an item is frequently employed as an assumption of human behavior. As postulated by the theorists, the decisions of people as they attempt to optimize their advantages and minimize their disadvantages are reflected in the patterns of behavior found in societies. To put it another way, people weigh the advantages and disadvantages of many options while deciding how best to behave. Choosing an action based on one's preferences, the possible courses of action, and expectations regarding the outcomes of those courses of action is known as rational decision-making.

3. EMPIRICAL REVIEW

The research conducted by Sakanko, Adejor, and Adeniji (2021) analyzed the nexus between petroleum prices in Nigeria and CPI from 1980 to 2020. Hence, the consumer price index and petroleum pump pricing measurements were found to have a long-term equilibrium. The empirical findings also showed an uneven association between Nigeria's CPI and petrol prices. Thus, officials should openly allocate funds for the maintenance and repair of domestic refineries to improve their efficiency and reduce import costs, thereby limiting the periodic fluctuations in petroleum pump prices that drive up domestic inflation.

The interaction between energy costs and raw food prices was studied by Kirikkaleli and Darbaz (2021). They further investigate whether this relationship holds true for the raw food subgroups that make up the raw food price index. The study focused a lot of emphasis on this association since the 2008 financial crisis and stated that the cause of the raw food prices was to be more than double. Using relatively novel techniques, such as Toda–Yamamoto causality and Spectral BC causality tests, the study provides new insights into the empirical raw food pricing literature. A two-way connection occurs between the energy cost and raw food price indexes (grains, other raw foods, and oils) at various frequencies, as evidenced by the spectral BC causality test.

Ngare and Derek (2021) assessed how gasoline costs affected the cost of raw foods from 2010 to 2018. The findings revealed that no causal association exists between the prices of maize and beans and fuel prices, but a one-way interaction arises between diesel prices and the prices of potatoes and cabbage. According to the results, a long-term price correlation exists between the cost of fuel and perishable raw commodities, with rising diesel prices leading to substantially higher prices for potatoes and cabbages. Hence, a tax break should be implemented to minimize the increasing price of raw foods whenever the gasoline price reaches a certain threshold.

Wale-Awe and Sulaiman (2020) conducted research on how PMS prices influence Nigeria's inflation over the period of 1980 to 2018. It was therefore established that PMS cost is the major determinant of the inflation rate in the country. However, the causality test shows no direct interaction between PMS prices and inflation in Nigeria. It was then suggested that PMS prices should be stabilized and brought in accordance with the wage rate by the Nigerian government.

Between 1990Q3 and 2019Q4, Sarwar, Hussain, and Maqbool (2020) sampled Pakistan to analyze how crude oil prices affect the prices of raw and non-raw foods. The findings indicate that oil prices significantly affect both raw and non-raw food inflation, but they have a greater influence on non-raw food inflation. Furthermore, it was observed that the influence is asymmetrical. Hence, the study advocates for effective regulation and highlights the substantial influence of market power on commodity pricing in Pakistan.

Bawa, Abdullahi, Tukur, Barda, and Adams (2020) used NARDL to assess how oil price shocks affect Nigerian inflation between 1999Q1 and 2018Q4. The findings revealed that there is an increase in Nigeria's core and raw food inflation in line with rising oil prices. Conversely, a decline in oil prices results in a fall in the marginal cost of production, which in turn helps manage inflation domestically. Additionally, when the study excludes the exchange rate, a negative shock to oil prices leads to an increase in Nigeria's inflation. This implies that the exchange rate absorbs the effect of declining oil prices since a fall in oil prices leads to reduced international reserves, resulting in naira depreciation and inflationary pressures. Furthermore, compared to raw food inflation, core inflation is more responsive to shifts in oil prices. The study suggests that the apex bank's monetary policy actions should focus on controlling core inflation during periods of significant oil price increases.

The interdependence between Nigeria's oil price, exchange rate, and raw food prices was analyzed by Bala and Abdullahi (2019). The data covering 1972 to 2016 were used. The model was analyzed using ARDL approaches. The study revealed a long-term correlation between the factors under consideration. A substantial negative sign is shown by the error correction term. Out of the two independent variables in the model, the exchange rate has a bigger effect on raw food pricing than the oil price because some raw food products are imported. Nigerian policy recommendations are significantly impacted by the outcome. Nigerian raw food prices were heavily influenced by the production of raw

foods. Nigeria's apex bank should consider the currency rate as a factor influencing the price of raw foods in order to fulfill its inflation target.

Anthony (2019) captured the period from 1986 to 2015 to analyze the connection between changes in oil prices and CPI in Nigeria. The findings demonstrated how effectively the state space model captured the progression of the two variables. Based on the study, changes in the global price of crude oil have an indirect impact on domestic prices. As a result, the study suggested that Nigerian monetary and fiscal policies, in addition to annual budgets, should consider oil price fluctuations. Changes in oil prices should also be incorporated into inflation control plans, and accurate inflation predictions should be made within a permissible confidence range to account for the potential volatility of oil prices.

Maijama'a et al. (2019) examined the nexus between interest rates, the price of petroleum pumps, and the cost of raw foods in Nigeria from 1984 to 2018. According to the findings, the price of petroleum pumps and lending interest rates have a positive and significant long-term and short-term impact on the price of raw foods, while goods imports seem to have a negative and significant long-term impact on raw food price changes, but a negligible short-term impact. Changes in the rate of exchange over long and short periods cannot determine the price of raw foods. According to the VECM Granger causality results, the price of petroleum pumps has a long-term causative relationship, while the prices of raw foods, interest rates, imports, and exchange rates all have short-term causal relationships. The variance decomposition results show that the official exchange rate, petroleum pump price, and imports of products and services account for fluctuations in raw food prices and exchange rates. Conversely, the currency rate and the price of raw foods account for changes in imports and interest rates. The apex bank should reduce the interest rate at which it lends money to banks, and the government should reinstate lower constitutionally mandated PMS pump rates to stabilize raw goods pricing. This would incentivize commercial banks to lower their lending interest rates accordingly.

Goel, Garg, and Sharma (2018) assessed how the prices of raw foods are linked with oil prices. Over the previous ten years, agricultural commodity prices have been increasing. Crude oil prices have also risen significantly over the same time frame. The subject of whether an increase in oil prices results in higher pricing for raw foods, a phenomenon known as pass-through, has been brought up by the concurrent rise in oil prices and agricultural inputs.

Nwoko et al. (2016) investigated how Nigerian raw food prices fluctuated between 2000 and 2013 in relation to the price of oil. The study used a VAR rather than a VECM to examine the short-term association because the results indicated that a long-term correlation exists between oil prices and changes in raw food prices. The VAR model's output showed a strong and positive short-term correlation between the price of oil and the volatility of the prices of all the selected raw foods, with the exception of rice and wheat. The impulse response functions further supported these findings. As revealed by the Granger causality test, a one-way nexus exists between the oil price and the prices of maize, beans, and sorghum, but not between the prices of wheat and rice. Based on these findings, the study derives various policy implications.

Dillon and Barrett (2016) investigated the connection between local raw food prices in East Africa and the price of oil globally. The study demonstrates that global oil prices indeed impact the price of raw foods, primarily through transportation costs rather than channels related to biofuel or production costs, using data on maize and gasoline prices from East Africa.

According to the study, global oil prices influence local maize prices more quickly than world maize prices. This implies that the immediate effects of linked product price shocks on local raw food costs are driven by transportation costs rather than grain prices. Additionally, the data indicates that for markets located farther inland, changes in global oil prices have a greater effect on local maize prices than changes in world maize prices.

Eregha et al. (2015) studied how Nigerian inflation was affected by changes in the price of petroleum products between 1994 and 2012. According to the study, PMS prices remained constant until the military took over the nation's governance, and the military leaders of the time arbitrarily raised petroleum product prices. The study also

discovered a strong positive correlation between Nigerian inflation and PMS and AGO prices. Accordingly, the study concludes that increases in petrol prices, particularly 'PMS' and 'AGO,' have a major influence on Nigerian inflation. Given this outcome, the study advises the government to put the concept of eliminating PMS subsidies on hold and to concentrate on deregulating the downstream industry in order to attract private sector investment.

4. METHODOLOGY

The data employed for this study is secondary in nature. The data were collated from the National Bureau of Statistics (NBS) fact sheet and Global Data Lab. All six (6) states (Ekiti, Lagos, Ondo, Ogun, Osun, and Oyo states) in the South West of Nigeria are used as the sample.

The study captured monthly data ranging from January 2017 to June 2022. Variables include the Consumer Price Index (using combined urban and rural CPI), automotive gas oil (using AGO price per litre), PMS price (using PMS per litre), dual-purpose kerosene (using DPK per litre), importation of commodities and services (using imports of goods and services per state), and the prices of gari and yam (using the price of gari in Kongo and the price of yam per tuber). Ordinary Least Squares (OLS) was used to examine the data due to its highly appealing statistical characteristics, which have made it one of the most potent and widely used regression analysis techniques. Its foundation is the idea that the sum of squares of the prediction errors should be minimized. BLUE, or Best Linear Unbiased Estimator, is an acronym for the desirable ideal qualities of the least squares estimators.

4.1. Model Specification

The model is specified based on the previous research (Babalola & Salau, 2020; Bala & Abdullahi, 2019; Bawa et al., 2020; Ding et al., 2020; Kirikkaleli & Darbaz, 2021). Based on the research of Maijama'a et al. (2019) and Ding et al. (2020), this straightforward model examines the nexus between petroleum pump prices and the costs of raw foods. The dependent variable is represented by the price of garri and yam, and the regressors are the price of dual-purpose kerosene per liter, premium motor spirit per liter, and automotive gas oil per liter. To distinguish this work from earlier research, the consumer price index and imports of goods and services are included as control variables.
The functional relation is given as.

$$Pgy = f(ago, pms, dpk, cpi, m) \quad (1)$$

In econometric terms

$$p_{gy} = \beta_0 + \beta_1 ago_t + \beta_2 pms_t + \beta_3 dpk_t + \beta_4 cpi_t + \beta_5 m_t + \mu_t \quad (2)$$

A partial log is therefore taken due to the nature of a variable like the consumer price index, which is usually reported in rate or percentage.

$$lnp_{gy} = \beta_0 + \beta_1 lnago_t + \beta_2 lnpms_t + \beta_3 lndpk_t + \beta_4 cpi_t + \beta_5 lnm_t + \mu_t \quad (3)$$

Where, Pgy= Price of garri and yam; ago = Automotive gas oil (litre); pms = Premium motor spirit (litre); dpk = Dual-purpose kerosene (litre); cpi = Consumer price index; m= Imports of goods and services; β_0= Constant term; β_1–β_5 = Coefficient of explanatory variables; μ= Error terms

5. EMPIRICAL RESULTS AND DISCUSSION

5.1. Trend Analysis of Pump Price and Raw food Prices in the South Western States

Fluctuations in petroleum pump prices affect transportation costs and inflation rates, while the increase in raw food prices impacts household budgets and raw food security. Table 1 presents the trend of petroleum prices and raw food prices across states in the South West of Nigeria.

Table 1. Trend of petroleum pump and raw food prices in the Southwest states.

State	*Pb*	*pr*	*ago*	*Pms*	*hdpk*
Ekiti state	395.21	505.72	307.98	159.29	441.71
Lagos state	406.44	479.44	314.69	159.76	446.44
Ogun state	391.68	475.31	310.18	158.68	450.97
Ondo state	410.89	517.43	317.78	160.40	437.08
Osun state	382.89	452.32	318.57	160.06	434.71
Oyo state	440.73	490.30	318.56	160.01	412.59

Where, pb represents the price of beans per kongo, pr represents the price of rice per kongo, ago represents automotive gas oil (diesel) price per litre, pms represents premium motor spirit (petrol) price per litre, hdpk represents household kerosene price per litre.

Table 1 presents the trend and volatility of petroleum pump and raw food prices across states in the South West Nigeria. On average, Oyo State has the highest price volatility of ₦440.73 in terms of beans per congo, while Osun has the lowest price volatility of ₦382.89. Additionally, Ondo State exhibits the highest price volatility of ₦517.43 in rice per congo, whereas Osun State has the lowest volatility of ₦452.32 on average. The price of premium motor spirit is highest in Ondo State at ₦160.40, while in Ogun State, it is lowest at ₦158.68. Household kerosene prices are highest in Ogun State at ₦450.97 and lowest in Oyo State at ₦412.59. In general, Osun State has the lowest prices for beans, rice, and tomatoes, while Ekiti State has the highest prices for rice. Ondo State has the highest prices for premium motor spirit. Ogun State has the highest price for household kerosene, while Oyo State has the lowest. The study, therefore tests for a unit root to determine whether ordinary least squares estimates are appropriate, using group cross-sectional independence and dependent panels. The outcome of the unit root test is presented in Table 2.

Table 2 shows the group unit root test results.

Cross-sectional independent panels		
Test	**Statistic**	**Prob**
Levin, Lin & Chu t*	-2.20	0.014***
Im, Pesaran & Shin W-stat	-10.40	0.000***
ADf-Fisher Chi-square	184.96	0.000***
PP- Fisher Chi-square	198.64	0.000***
Cross-sectional dependent panels		
Common trend	4776.62	0.01***
Idiosyncratic elements: Pooled test	+/- Inf	0.00***

Note: Sig. levels in brackets: *** p<0.01, * p<0.1

Table 2 presents the results of a group unit root test for both cross-sectional independent panels and cross-sectional dependent panels. The test assesses whether the variables under analysis possess a unit root, which would indicate non-stationarity. For the cross-sectional independent panels, three different test statistics are reported: Levin, Lin & Chu t*, Im, Pesaran & Shin W-stat, ADF-Fisher Chi-square, and PP-Fisher Chi-square. The values of these statistics are -2.20, -10.40, 184.96, and 198.64, respectively. Corresponding probabilities (prob) are also provided. The results demonstrate that all test statistics are significant at the 1% level, implying that the variables in the cross-sectional independent panels are stationary and do not contain a unit root.

For cross-sectional dependent panels, two test statistics are reported: Common trend and Idiosyncratic elements (Pooled test). The Common trend statistic has a value of 4776.62, and the corresponding probability is 0.01, indicating the level of significance at the 1% critical value. The Idiosyncratic elements (Pooled test) statistic is reported as +/- Inf, indicating an infinite value, and the associated probability is 0.00, suggesting strong evidence against the presence of a unit root. In summary, based on the results of the unit root test in Table 2, the variables in both cross-sectional independent panels and cross-sectional dependent panels are stationary and do not exhibit unit root behavior. According to the results, the stationarity of the variables was found at level, i.e., I(0), meaning that long-run

associations exist among the variables and the OLS method will be appropriate for the work. Table 3 presents the effect of petroleum pump prices on the price of garri and yam in the Southwest.

Table 3. Effect of Petroleum Pump Prices on the Price of Garri and Yam in the Southwest.

Variables	Dependent variable: Pgy						
	Ekiti state	Lagos state	Ogun state	Ondo state	Osun state	Oyo state	Southwest
Ago	0.225 [0.364]	-0.271 [0.233]	-0.315 [0.038]**	-0.403 [0.041]**	-0.467 [0.035]**	-0.081 [0.542]	0.141 [0.115]
Pms	1.664 [0.001]***	0.912 [0.056]*	-0.472 [0.084]*	-0.546 [0.054]*	-0.549 [0.213]	-0.739 [0.011]**	0.867 [0.000]***
hdpk	0.094 [0.770]	0.404 [0.096]*	0.329 [0.099]*	0.447 [0.069]*	0.479 [0.083]*	-0.041 [0.823]	0.205 [0.087]*
Cpi	2.193 [0.243]	6.414 [0.000]***	6.781 [0.000]***	11.412 [0.000]***	12.018 [0.000]***	9.749 [0.000]***	0.217 [0.019]**
M	6.252 [0.318]	144.960 [0.000]***	-17.502 [0.000]***	326.669 [0.000]***	48.165 [0.000]***	-100.362 [0.000]**	0.215 [0.033]**
Constant	-40.683 [0.222]	-630.311 [0.000]***	38.624 [0.000]***	-1306.788 [0.000]***	-242.551 [0.000]***	345.891 [0.000]***	-2.897 [0.001]***
R^2	0.579	0.587	0.725	0.710	0.381	0.790	0.372
Adjusted R^2	0.545	0.553	0.703	0.686	0.330	0.773	
F-stat	16.80 [0.000]***	17.35 [0.000]***	14.37 [0.000]***	29.81 [0.000]***	7.51 [0.000]***	45.83 [0.000]***	234.11 [0.000]***

Note: Sig. levels in brackets: *** p<0.01, ** p<0.05, * p<0.1

Where, pgy represents the price of garri & yam per kongo and tuba, ago represents automotive gas oil (diesel) price per litre, pms represents premium motor spirit (petrol) price per litre, hdpk represents household kerosene price per litre, cpi represents consumer price index, & m represents imports of goods and services per state.

In Ogun, Ondo, and Osun states, diesel prices per litre have a negative and significant impact on the prices of garri and yam per Kongo and Tuba. This suggests that changes in diesel prices per litre directly affect the prices of garri and yam in these states. Specifically, in Ogun state, a 1% increase in diesel prices per litre leads to a 0.315% decrease in the prices of garri and yam per Kongo and Tuba. In Ondo state, a 1% rise in diesel prices per litre results in a 0.403% fall in the prices of garri and yam per Kongo and Tuba. Similarly, in Osun state, a 1% increase in diesel prices causes a 0.467% decline in the prices of garri and yam per Kongo and Tuba. The negative coefficients indicate that rises in diesel prices are associated with declines in the prices of garri and yam in Osun, Ogun, and Ondo states. This interaction is attributed to diesel being used in machinery and transportation for garri and yam production. An increase in diesel prices can lead to higher production and transportation costs, which may result in lower prices of garri and yam to maintain market competitiveness. Conversely, the prices of garri and yam per Kongo and Tuba are positively and significantly influenced by fuel prices per litre in Ekiti and Lagos states. This indicates that the impact of the prices of garri and yam per Kongo and Tuba is affected by variations in gasoline prices per litre. Specifically, in Ekiti state, the price of garri and yam per Kongo and Tuba increases by 1.664% for every 1% rise in gasoline prices per litre. In Lagos state, prices for Kongo and Tuba increase by 0.912% for every 1% increase in gasoline prices per litre.

However, in Ogun, Ondo, and Oyo states, the prices of garri and yam per Kongo and Tuba are negatively influenced by petrol prices per litre. This explains the opposite direction that changes in the price of gasoline also have a direct impact on the cost of garri and yam in these states. Specifically, in Ogun State, the price of garri and yam per Kongo and Tuba declines by 0.472% with every 1% rise in the price of gasoline per liter. An increase in petrol prices per litre by 1% leads to a 0.546% fall in prices in Ondo State and a 0.739% drop in prices per Kongo and Tuba in Oyo State. These findings show that the impact of the price of gas on the cost of garri and yam differs from state to state. The positive impact in Lagos and Ekiti implies that increasing petrol prices might raise the production and distribution costs, which would increase the price of yam and garri. An increase in petrol prices, on the other hand, may lead to a fall in demand or output, which would reduce the price of garri and yam, based on the negative

consequences observed in Ogun, Ondo, and Oyo states. The costs of Kongo and Tuba, household kerosene per litre, have a significant impact on the price of garri and yam in Lagos, Ogun, Ondo, and Osun states. This implies that the price of garri and yam per Kongo and Tuba is directly influenced by changes in kerosene prices per litre. In Lagos State, a 1% rise in the price of kerosene per liter leads to an increased price of garri and yam per Kongo and Tuba by 0.404%. The prices per Kongo and Tuba rise by 0.329% in Ogun State, 0.447% in Ondo State, and 0.479% in Osun State with a 1% increase. The positive coefficients show that in Lagos, Ogun, Ondo, and Osun states, increasing kerosene prices are associated with rising costs of garri and yam. This interaction may arise from the use of kerosene for cooking, which is an important step in raw food production such as garri and yam. When the price of kerosene increases, the cost of cooking for households also increases, which is then passed on to consumers in the form of higher prices for yam and garri.

In Lagos, Ogun, Ondo, Osun, and Oyo states, the cost of garri and yam is positively and significantly affected by the Consumer Price Index (CPI). For instance, in Lagos state, an increase in CPI by 1% leads to a 6.414% rise in the price of garri and yam per Kongo and Tuba; in Ogun state, it increases by 6.781%; in Ondo state, it rises by 11.412%; in Osun state, it increases by 12.018%; and in Oyo state, a 9.749% increase occurs per Kongo and Tuba. The positive coefficients indicate that garri and yam prices in these states are driven up by increasing CPI, reflecting an increase in overall price levels in the economy. This relationship may stem from various factors such as increased production costs, transportation expenses, or demand pressures. Additionally, imports of goods and services have a statistically significant effect on the price of garri and yam per Kongo and Tuba in these states, but the direction of the effect varies across states. In Lagos, Ondo, and Osun states, imports of goods and services have a statistically significant positive effect on the price of garri and yam. A 1% increase in imports leads to a 144.96% increase in Lagos state, a 326.669% increase in Ondo state, and a 48.165% increase in Osun state. However, in Ogun and Oyo states, imports of goods and services have a statistically significant negative effect on the price of garri and yam. A 1% increase in imports leads to a 17.502% decrease in Ogun state and a 100.362% decrease in Oyo state. The divergent effects suggest that the impact of imports on the price of garri and yam depends on various factors such as domestic production capacity, trade policies, and market dynamics. In some states, a rise in imports may lead to an increase in prices because of increasing demand or competition, while in others, it can lead to a fall in prices due to increased supply or market saturation.

Among the three factors employed to determine petroleum prices in the Southwest analysis, the prices of kerosene and petrol significantly impact the prices of garri and yam per Kongo and Tuba, with positive and significant coefficients of 0.867% and 0.205%, respectively. Garri and yam prices in the Southwest are positively related to household kerosene and gasoline prices. This interaction occurs due to the use of gasoline in machinery and transportation of yam and garri. Increasing gas prices can raise the costs of manufacturing and transportation, which could lead to higher prices for yam and garri. Additionally, increases in kerosene prices can also raise cooking expenses, which may then be passed on to final consumers in the form of higher prices for garri and yam. Furthermore, the consumer price index and imports of goods and services were also significant in determining the prices of garri and yam per Kongo and Tuba, with positive coefficients of 0.217% and 0.215%, respectively. The positive coefficients indicate that higher consumer price levels, reflecting increased overall price levels in the economy, contribute to higher prices of garri and yam per Kongo and Tuba in the Southwest region, while increased demand for imported commodities or services also results in higher prices for locally manufactured goods like garri and yam.

6. CONCLUSION AND RECOMMENDATION

This study investigates the impact of petroleum product pump prices on certain food items in South Western Nigeria. Automotive gas oil is mainly used by heavy-duty vehicles often employed to transport large and bulky food items from farms to the metropolis. Its price influences the prices of food items such as garri and yam in the region. This also holds true for petrol pump prices, which significantly influence the prices of garri and yam across the states,

as petrol is the most commonly used fuel by most vehicles. The duo of CPI and the importation of goods and services directly influence people's food basket, which reflects their real income, hence the impact on the prices of garri and yam across most states.

Government intervention is required through the implementation of petroleum products pump price initiatives aimed at stabilizing petroleum pump prices in order to lessen the volatility seen in raw food prices, especially for necessities like garri and yam. This could entail strategies like price limits, strategic reserves, or subsidies to mitigate the effect of volatile petroleum prices on the affordability of raw foods. It will also be necessary to evaluate inflationary patterns, as well as consider measures to alleviate the affordability of basic food items, particularly for disadvantaged groups. The intricate interaction of raw food prices with petroleum prices should be addressed by creating a comprehensive policy framework that integrates energy, agricultural, and economic development plans. Both short- and long-term plans to advance sustainable growth and raw food security in the Southwest of Nigeria should be taken into account in this comprehensive approach.

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