

# ASYMMETRIC RELATIONSHIP BETWEEN CHANGES IN FOOD PRICES AND HOUSEHOLD CONSUMPTION IN NIGERIA

## Abstract

The influence of price changes on consumption is believed to be enormous. This is because consumption expenditure constitutes a significant part of a consumer's expenditure. For the household, the most important expenditure is on food items. This makes food price changes an important factor in predicting the direction of household consumption in Nigeria. While food price changes can be positive or negative, the effect of each on household consumption in Nigeria has not been empirically examined. This study, therefore examined the asymmetric effect of negative and positive changes in food prices on household consumption in Nigeria. The study utilized time series data for Nigeria over 1981 to 2020. The Non-linear Auto Regressive Distributed Lags Model (NARDL) was used to evaluate the asymmetric effects. The study found that food price changes whether positive or negative have no significant effect on household consumption in Nigeria. However, household income was found to have significant short-run and long-run positive effect on household consumption in Nigeria. The study recommends deliberate efforts by households and the government targeted at increasing the income of household so as to meet up with consumption demands.

**Key Words:** Price Changes, Food Prices, Household Consumption.

## 1. Introduction

Consumption is a very important component of human survival. Maslow's (1943) hierarchy of needs recognize food, clothing and shelter as basic human necessities. The primary reason for a man's work is to meet his consumption.

In society, consumption takes place at three levels – the household, the firms and the government. Though all these levels of consumption are important for economic growth and development, household consumption occupies a central position. At the household level, consumption is divided into food and non-food items. The prices of either of these two have a great influence on aggregate household consumption (Green, Cornelsen, Dangour, Turner, Shankar and Mazzocchi, 2013).

The economic theory of consumer behaviour postulates a strong connection between price and consumption. The link between pricing and consumption is clear: people are more likely to consume a product when they are aware of its cost (Gourville and Soman 2002). Even though income is believed to be the major determinant of consumption, the influence of price is also highly recognized. As prices or income change, the consumer will redefine his/her optimal choices. The implication is that as prices reflect how people evaluate goods and services, the same prices can be used to assess the welfare benefits which include changes in consumption (Varian, 1990).

Changes in food prices can be positive or negative. The directions of change have varying effects on household consumption. Positive changes depict an increase in food prices while negative changes indicate a fall in food prices. David Newbery in his 1989 theory of food price stabilization theory stated that food prices are not only believed to be volatile, but they also comprise a significant fraction of consumer expenditure (Newbery, 1989). According to the theory of demand, higher prices attract lower demand and vice-versa. The theory, however, recognizes exceptional cases where higher prices may still attract higher demand, particularly for necessary goods. Irrespective of what postulation holds for Nigeria, changes in food prices are believed to have an impact on household consumption in Nigeria.

In Nigeria, a consistent increment in food prices has been recorded over the years. This has degenerated into what may be termed food inflation (Olanrewaju, 2021). Food inflation in Nigeria is observed through the rising prices of food items such as rice, beans, bread, yam, vegetables, fruits and eggs which have all gone up by at least 100 per cent between 2011 and 2020 (Mirela, 2020). The rise in food prices, occasioned by positive and negative changes, has been accompanied by similar changes in household consumption in Nigeria within the same period. Between 1981 and 2021, household consumption in Nigeria experienced positive changes 56% of the time while the remaining 44% of the changes in the same variable during the same period were negative (World Bank, 2022). Similarly, during the period 1981 to 2021, positive changes in food prices in Nigeria occurred 80% of the time while for 20% of the time, food prices in Nigeria changed negatively (Trading Economics, 2022). This suggests a level of association between food prices and consumption in Nigeria.

What remains unclear is the nature and degree of the effect of positive and negative changes in food prices on household consumption in Nigeria. How negative change in food prices affects consumption might not be the same as how positive change in the same variable affects consumption in Nigeria. The foregoing has therefore necessitated the need for an enquiry into the asymmetric relationship between food prices and household consumption in Nigeria. The study specifically examines if positive and negative changes in food prices affect household consumption in Nigeria differently.

## **2. Literature Review**

### **2.1 Conceptual and Empirical Issues**

Economic scholars refer to food price asymmetry as the long-term fluctuations in the trend of food prices (Food Monitor, 2020). Changes in food prices can follow positive or negative directions depending on the food production process, including food marketing and food distribution. The asymmetric relationship between food prices is determined by many compounding factors. These factors, according to Amadeo (2020), Serge, Andria, Auberto and Hollier (2012) and Spratt (2013) include geopolitical events, global demand, exchange rates, government policy, diseases and crop yield, energy costs, availability of natural resources for agriculture, food speculation, changes in the use of soil and weather events have a direct impact on the increase or decrease of food prices.

Household final consumption expenditure consists of expenditure incurred by the resident household on goods or services that are used for the satisfaction of needs or wants (Eurostat, 2022). Household final consumption expenditure does not include expenditure partially or fully

covered by social transfers in kind. The final consumption expenditure of households includes only the share of expenditure on health, education and housing, remaining to be paid by them, after possible reimbursements. The part which is reimbursed to them is included in the final consumption expenditure of the sector of the general government.

Empirical evidence suggests that food prices will continue to rise on average due to a variety of reasons. According to Dokua (2022), the growing world population will put more pressure on supply and demand; climate change will increase extreme weather events, including droughts, storms and heavy rain; and overall increases in temperature will have an impact on food production which may affect food security. Shittu, Akerele and Mekbib (2018) find that high prices of cereals are negatively associated with the food security status of households in Nigeria.

The relationship between food prices and household consumption can scarcely be found in the empirical literature. Khadijat, Joanna, Bageant and Sylvia (2019), used historical food prices and household panel survey data to examine the relationship between unexpected food price shocks and household food security status. They found that unexpected food price volatility is negatively associated with household food security outcomes and that net buyers of food items are more affected. In the same vein Shittu, Akerele and Mekbib (2018) examined the welfare effects of food price spikes on household consumption in Nigeria. Findings from their study suggested that food distribution may be more effective in improving the welfare of households than direct cash transfers.

Another study was carried out by Nyong and Ubong (n.d) who examined the economic determinants of household consumption expenditures in the West African sub-region with special emphasis on Nigeria and Ghana. Based on the analysis, it was observed that gross national income and inflation rate exerted a positive and significant effect on household consumption expenditure, while interest rate and savings exerted a negative and significant effect on household consumption expenditure.

Agricultural productivity is measured as the ratio of agricultural outputs to inputs (Mervin, 2013). While individual products are usually measured by weight, which is known as crop yield, varying products make measuring overall agricultural output difficult. According to Mervin (2013), agricultural productivity can be defined as the market value of the final output. This productivity can be compared to many different types of inputs such as labour, capital or land. Such comparisons are called partial measures of productivity (Alejandro, 2003). Agricultural productivity may also be measured by what is termed total factor productivity (TFP). This method of calculating agricultural productivity compares an index of agricultural inputs to an index of outputs. This measure of agricultural productivity was established to remedy the shortcomings of the partial measures of productivity; notably that it is often hard to identify the factors that cause them to change. Changes in TFP are usually attributed to technological improvements (Zepeda, 2007).

Akpan and Udoh (2009) in a study on estimating food relative price variability and inflation rate movement in different agricultural policy regimes in Nigeria, found out that inflation had a positive and significant effect on the relative price variability of food and that the SAP and civilian post SAP agricultural policy regimes in Nigeria brought about a positive significant shift in the coefficient of inflation which implies an increase in the relative price variability of grains. Mesike et al. (2010) also found out that inflation has a significant positive impact on relative

price variability in the short-run and long-run and that those policies that would protect the agricultural sector from the impact of inflation in the short-run should be encouraged. There is a relationship between the world food price, world agricultural productivity, world food production, food consumption, food inventory, world oil prices, and the exchange rate of the dollar (Fang Min, 2019).

Murtala (2010) posited that the coefficient of inflation was negative and significant in influencing economic performance in Nigeria and noted that both supply-side policies and demand management policies such as a reduction in the real broad money supply should be adopted to reduce inflation in the short-run and the long-run. Ukoha (2007) found out that the effect of inflation on relative price variability is non-neutral for both food crops and cash crops, and that there is a significant positive impact of inflation on price variability in both the short run and the long run.

A good number of studies on agricultural productivity and food prices can be found in many other studies such as Njegovan and Simin (2020) who examined inflation and prices of agricultural products and concluded that the prices of agricultural food products will not decrease. Manzamasso (2020) found that if consumption drives production along the seed-food value chain, matching the preferences of the demand and supply improves the promotion of the newly developed variety.

Oyinbo, Oyakhilomen and Rekwot, (2014) investigated the links between inflationary trends, agricultural productivity and economic growth in Nigeria using time series data spanning 1970 and 2011. The results of the analyses indicated a unidirectional causality from inflationary trend to agricultural productivity, unidirectional causality from agricultural productivity to economic growth and no causality between inflationary trend and economic growth.

Also, Fang and Zibo (2019), analyzed the factors influencing the world food price by using data from 1964 to 2013. The world agricultural productivity, world food production and the exchange rate of the dollar were found to have a significantly negative effect on the world food price. World food consumption had a significantly positive impact on the world food price. The impact of the world food stock and the world crude oil price on world food prices was not statistically significant. The elasticity of world food production on the world food price was less than the elasticity of world food consumption.

The studies reviewed herein indicate that the relationship between food prices and household consumption in Nigeria seemingly lacks empirical literature. The asymmetric effect of food prices on household consumption in Nigeria has not, therefore, been empirically investigated. This shows that there is still a literature gap on the effects of negative and positive food price changes on household consumption in Nigeria.

## **2.2 Theoretical Consideration**

This study builds on the elements of the consumer theory which assumes that utility resides in the goods and services themselves. Mathematically, a consumer's utility function is said to be a function of goods and services. It is this utility function that the consumer, subject to her income, price and resources, maximizes. This theory assumes that prices of commodities and individual income do not change for the duration, for instance, one month, of the study of a consumer's

choice. As prices or income change, the consumer will redefine his optimal choice. This would imply that, as prices reflect people's evaluation of goods and services, prices, can be used to assess the welfare benefits of policy proposals which would induce changes in consumption. The consumer theory implies that consumption is a function of price and income. By extension, household consumption is dependent on the level of food prices and the income level of the household.

Another theory relevant to this study is the theory of food price stabilization propounded by David Newbery in 1989. Newbery's theory emphasizes the stabilization of prices and the availability of the main food grain, for obvious reasons. The theory recognizes that international cereal prices are unstable, and the international markets are subject to a shifting variety of national interventions by major exporting and potential importing countries. Many countries, therefore, aim at food self-sufficiency, with the consequence that the country may be an exporter in good years, but an importer in bad years. As a result, the domestic price fluctuations will tend to be an amplified version of international price fluctuations. The food price stabilization theory justifies this study's claim that food prices fluctuate, and the fluctuation could be negative or positive for a given period.

Therefore, the theoretical underpinnings of the two theories discussed in this study suggest that food prices in Nigeria fluctuate between positive and negative changes. The positive and negative changes in turn exert influence on household consumption, which is also a function of household income.

### 3. Methodology

This research is typically analytical in nature. The study made use of secondary data obtained from the World Bank database and the database of Trading Economics from 1981 to 2020. The data cover household consumption (HHC), food prices (FP), interest rate (IR), government expenditure (GEX), gross fixed capital formation (GFCF), taxation (TX) and household income (HHY). Apart from Food prices (FP) which are obtained from Trading Economics, data for all other variables were obtained from the World Bank. The study uses a non-linear autoregressive distributed lags model (NARDL) to examine the asymmetric effect of positive and negative food price changes on household consumption in Nigeria. Test of stationarity was done using Augmented Dickey-Fuller (ADF) test, while post-estimation tests such as the Wald test, normality test, serial correlation test and test of heteroskedasticity were used to check the reliability of the estimates of the models.

#### Model Specification

The model used for this study is drawn from the two theories reviewed in the previous section. The theory of consumer behaviour postulates that consumption is a function of prices and income. This suggests that household consumption is a function of food prices and household income. Mathematically,

$$HHC = f(FP, HHY) \quad (1)$$

Where *HHC* is household consumption, *FP* is food prices and *HHY* is household income.

The food price stabilization theory states that food prices are characterized by positive and negative changes. If food price is replaced by its positive and negative fluctuations, equation (1) is re-stated as follows

$$HHC = f(FP^+, FP^-, HHY) \quad (2)$$

Other determinants of household income are incorporated into the model as control variables. these are interest rate (IR), government expenditure (GEX), gross fixed capital formation (GFCF) and taxation (TX). The model becomes

$$HHC = f(FP^+, FP^-, IR, GEX, GFCF, TX, HHY) \quad (3)$$

To ascertain the existence of the impact of positive and negative food price changes on household consumption in Nigeria, the model was estimated using non-linear modelling (Non-linear Autoregressive Distributed Lags Model, NARDL). The choice of NARDL was necessitated by the fact that positive and negative changes in food prices are expected to exert separate effects on household consumption in Nigeria. Based also on the asymmetry-in-effect theory, the asymmetric model can be specified in NARDL ( $p, q_1, q_2, q_3, q_4, q_5, q_6$ ) as follows- where  $p$  is the maximum lag for  $HHC_t$  and  $q_{1-6}$  are the maximum lags for the explanatory variables respectively.

$$\begin{aligned} \Delta HHC_t = & \alpha + \beta HHC_{t-1} + \gamma FP_{t-1}^+ + \delta FP_{t-1}^- + \theta IR_{t-1} + \vartheta GEX_{t-1} + \lambda GFCF_{t-1} + \mu \ln TX_{t-1} \\ & + \xi \ln HHY_{t-1} + \sum_{i=1}^p \pi_i \Delta HHC_{t-i} + \sum_{i=0}^{q_1} \omega_i FP_{t-i}^+ + \sum_{i=0}^{q_2} \rho_i FP_{t-i}^- + \sum_{i=0}^{q_3} \omega_i \Delta IR_{t-i} \\ & + \sum_{i=0}^{q_4} \varrho_i \Delta GEX_{t-i} + \sum_{i=0}^{q_5} \sigma_i \Delta GFCF_{t-i} + \sum_{i=0}^{q_6} \varsigma_i \Delta \ln TX_{t-i} + \sum_{i=0}^{q_7} \tau_i \Delta \ln HHY_{t-i} \\ & + \varepsilon_t \dots \dots \dots (4) \end{aligned}$$

Where  $i = 1, 2, \dots, N$ .

#### 4. Results and Discussions

The results of the model estimated in this study are discussed in this section. The series considered in this study include household consumption (HH), food prices (FP), interest rate (IR), government expenditure (GEX), gross fixed capital formation (GFCF), Tax (TX) and household income (HHY). A pre-estimation analysis is performed to ascertain the level of stationarity of the series under study. The parsimonious model for the study is also selected using the lag selection criteria. Next, the study presents and discusses the NARDL estimates generated using the model specified in the study.

##### 4.1 Test for Unit Root

To ascertain whether the series have unit root problem, the Augmented Dickey-Fuller (ADF) test was applied to that effect. Results of the unit root test are thus presented in Table 1.

**Table 1: Results of Unit Root Test using ADF**

Series	Level Prob.	1 <sup>st</sup> Diff. Prob.	Order of Integration
HHC	0.0000*	0.0000*	I(0)
FP	0.6307	0.0000*	I(1)
IR	0.4510	0.0006*	I(1)
GEX	0.0000*	0.0000*	I(0)
GFCF	0.0000*	0.0000*	I(0)
TX	1.0000	0.0015*	I(1)
HHY	0.3469	0.0555	I(2)

**Source:** Computations using Eviews 10.

(\*) indicates significance at 5%.

Table 1 indicates that household consumption, government expenditure and gross fixed capital formation are stationary at level while food prices, interest rate and taxation are stationary at the first difference. Household income, however, became stationary after the second difference. The presence of the mixed order of integration among the series warrants the estimation of the non-linear model in its dynamic form. Hence, the non-linear autoregressive distributed lags model is appropriate for the relationship under investigation.

#### 4.2 Asymmetric Bounds Cointegration Test

To examine the existence or not of a long-run relationship among the variables used in this study (especially between positive and negative food prices and household consumption), the asymmetric bounds testing procedure for cointegration was adopted. The results are presented in Table 2.

**Table 2: Results of the Asymmetric Bounds Cointegration Test**

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.511367	2.152	3.296	2.152
k	7	2.523	3.829	2.523
		3.402	5.031	3.402

**Source:** Researcher's Computations using Eviews 10.0

The asymmetric bounds cointegration test examines the null hypothesis that there is no levels relationship between positive and negative food prices and household consumption in Nigeria. Table 2 indicates that the null hypothesis of no cointegration cannot be accepted at 5% level of significance. This is because the F-statistic is greater than the upper critical value bound at the 5% level. This implies that there is a long-run cointegrating relationship among the variables considered in this study. Thus, there is a direct long-run relationship between positive and negative food prices and household consumption in Nigeria. This suggests the short-run asymmetric effect of food prices on household consumption in Nigeria is not the same as the asymmetric effect in the long run.

### 4.3 Short-run and Long-run Asymmetric Effects

Due to the existence of a cointegrating relationship among the variables considered in this study, the asymmetric effect of oil price volatility on unemployment in Nigeria, in the long run, was analyzed separately from the short-run effect. The asymmetric short-run results are presented in Table 3.

**Table 3: Asymmetric Short-Run Effect of food prices on household consumption in Nigeria**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GFCF)	-0.278125	0.093633	-2.970363	0.0062
D(LHHY)	55.48035	8.455108	6.561754	0.0000
CointEq(-1)*	-1.078213	0.123707	-8.715844	0.0000
R-squared	0.816010			
Adjusted R-squared	0.805497			
Durbin-Watson stat	1.778876			

**Source:** *Researcher's Computations using Eviews 10.0*

Table 3 reveals that there is no visible short-run effect of food prices on household consumption in Nigeria. This is predicated on the automatic omission of food prices from the asymmetric short-run results. This suggests that the effect of food prices on household consumption is more of a long-run phenomenon. However, the sign of the error correction term (-1.078213) and its significance (0.0000) indicate that the short-run and the long-run asymmetric effects differ from each other, though both are likely to converge after a given period. The error correction term, which is also the speed of adjustment between the short-run and long-run equilibria, indicates that the discrepancy between the short run and the long run will be automatically corrected after 11 months and 3 days.

Nonetheless, the short-run effects of gross fixed capital formation and household income are statistically significant. This provides the basis for discussing the effects of gross fixed capital formation and household income on household consumption in Nigeria in the short run. Gross fixed capital formation has a negative effect on household consumption in Nigeria in the short run. Any 1% rise in gross fixed capital formation will lead to a fall in household consumption by 0.28%. This is in line with the theoretical underpinning of consumer behaviour. Since gross fixed capital formation (otherwise known as an investment) is a function of savings such that the two are directly related, an increase in investment directly implies an increase in savings. Based on the indirect relationship between savings and consumption, an increase in savings causes a fall in consumption. If a household decides to raise its savings (with the savings later converted into an investment), household consumption is likely to fall.

The effect of household income on household consumption in Nigeria is positive in the short run. For any percentage rise in household income, household consumption is likely to increase by 55.48%. The theory of consumption stipulates a positive relationship between income and consumption. This has justified the short-run relationship between household income and household consumption in Nigeria as found by this study.

The short-run results are quite robust with high R-squared and R-squared adjusted. The Durbin-Watson statistic is also within the tolerable threshold, depicting the absence of autocorrelation. This implies that the short-run estimates are reliable for policy formulation and execution.

**Table 4: Asymmetric Long-Run Effect of Food Prices on Household Consumption in Nigeria**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FP_POS	-0.001921	0.001221	-1.573785	0.1272
FP_NEG	-0.001174	0.001870	-0.627899	0.5353
IR	1.133944	0.588099	1.928151	0.0644
GEX	-0.025229	0.023333	-1.081267	0.2891
GFCF	-0.011248	0.242199	-0.046443	0.9633
LTX	-1.556901	2.882368	-0.540146	0.5935
LHHY	18.16142	8.540844	2.126420	0.0428
C	-521.0776	201.2216	-2.589571	0.0153

**Source:** *Researcher's computations using Eviews 10.0*

Positive and negative food prices have no significant effect on household consumption in Nigeria in the long run. This is predicated by the probability values of the coefficients of positive food prices and negative food prices, which are not statistically significant at 5%. Similarly, interest rate, government expenditure, gross fixed capital formation and taxation are not significant determinants of household consumption in Nigeria in the long run. This suggests that food prices are not strong predictors of household consumption in Nigeria in the long run. It is only the coefficient of household income that has a significant long-run effect on household consumption in Nigeria.

A 1% positive change in household income is likely to lead to an increase in household consumption by 18.16%. Income is known to be the strongest determinant of consumption, and there is a likely tendency for consumption to increase at the instance of an increase in income. When household income rises, the household is economically empowered to meet its consumption needs in the long run. Even if the increased income is split between consumption and investment, the return on investment provides a further income increase in the future. This will directly increase the consumption of the household.

**Table 5: Diagnostic Tests**

Test Statistic	F-Statistic	Probability
Wald Test	1.884375	0.1714
Jarque-Bera	0.044423	0.978033
Breusch-Godfrey serial correlation LM test	0.551807	0.4642
Breusch-PaganGodfrey Heteroscedasticity	1.311626	0.2738

**Source:** *Researcher's computations using Eviews 10.0*

The Wald test examines the null hypothesis that there is no asymmetric effect of food prices on household consumption in Nigeria, that is, positive and negative food prices have the same effect on household consumption in Nigeria. The Wald test null hypothesis, therefore, sets the coefficients of positive and negative food prices equal to zero. The decision concerning the acceptance or otherwise of the null hypothesis is determined by the probability value of the F-statistic. Table 5 indicates that the null hypothesis that the coefficients of positive and negative food prices are both equal to zero cannot be rejected. This means that there is no asymmetric effect of food prices on household consumption in Nigeria. Thus, the effect of positive food prices and negative food prices on unemployment in Nigeria is the same. This justifies the individual insignificance of the effects of positive and negative changes in food prices on household consumption in Nigeria as discussed earlier.

The Breusch-Godfrey test of serial correlation and the Breusch-Godfrey-Pagan test of heteroskedasticity show that the residuals of the model are free from autocorrelation (or serial correlation), and are homoscedastic (i.e., the residuals have the same constant variance).

## **5. Conclusion and Recommendations**

The findings discussed in this study indicate that first, food prices have no significant effect on household consumption in Nigeria, with the effect not visible in the short run and not significant in the long run. This is the same for both positive and negative changes in food prices. The strong determinants of household consumption in Nigeria are gross fixed capital formation and household income. The effect of gross fixed capital formation (also referred to as investment) is only significant in the short run. On the other hand, household income has proven to be the major determinant of household consumption in Nigeria in the short run and long run. Household consumption will increase in the short run and long run at the instance of a rise in household consumption. the transmission of agricultural productivity to inflation in Nigeria is a long-run phenomenon.

Based on the findings referred to in this study, the following recommendations are made. First, changes in the prices of food do not necessarily determine the consumption of the households in Nigeria. The attention of the government should therefore focus on empowering households to adopt coping strategies that will enable them to maintain their consumption level whether food prices rise or fall. Second, the influence of income on consumption has been proven once again. Consumption itself is measured in monetary terms, and if income increases irrespective of a rise or fall in food prices, household consumption will rise. Households should, therefore, engage in economic activities that will deliberately increase their income so as to keep up to the increasing consumption demand. Government on her part should assist households to raise their income levels by creating job opportunities, enacting investment friendly policies, providing loans and to households, among others.

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