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Farm Households' Demand Response to Escalating Food Prices in Nigeria

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ABSTRACT

This study examined food demand response to rising food prices among farm households in Nigeria using the three waves of the General Household Survey (Panel) conducted between 2010 and 2016. Analysis was within the Quadratic Almost Ideal Demand System framework from which price elasticities and compensated and uncompensated expenditure were computed. The results show that higher prices of almost all of the food categories affected their demand by households. Harvest and location dummies as well as household demographic variables were found to influence household food demand. Poor households consumed less of all the food categories compared to their non-poor counterparts. Escalating prices result in a welfare loss of household expenditure on commodity groups such as rice, wheat, pulses, tuber and other food and non-food items. Overall, 70.1% of the households suffered welfare loss that amounted to an average of 7.52% of the household budget annually.

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Escalating prices; household food demand; Nigeria; QUAIDS

1. Introduction

Food and nutrition insecurity remains a huge source of concern in sub-Saharan Africa (SSA) despite three decades of policy actions and development programming to address the challenge. For Nigeria, trends in many indicators of food availability, access, stability and utilisation seem to suggest that performances in recent years depict gradual relapse back to the weak situations two–three decades ago, if not much worse. For example, FAOSTAT data show that average dietary energy supply adequacy in consumption in Nigeria shrank steadily from 126% in 2007–2009 to 116% in 2016–2018 and protein supply shrank from 63.7 g/capita/day in 2007–2009 to 55.9 g/capita/day 2016–2018, while the prevalence of undernourishment grew by more than double, rising from 6.0% in 2007–2009 to 13.4% in 2016–2018 (Food and Agricultural Organization of the United Nations, 2019). Meanwhile, per capita food production variability, in constant 2004–2006 I$, has been on the increase, rising steadily from 2.3 in the year 2000 to 11.5 in 2016 just as the cereals' import dependency ratio, which rose from 13.7% in 1999 to

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19.2% in 2013 (Food and Agricultural Organization of the United Nations, 2019). These statistics portray a grim food and nutrition security outlook for Nigeria, affecting not just the quantity of available foods but also stability and nutritional quality, despite the fact that per capita gross domestic product (GDP), in constant 2011 international dollars[1] (I $), has been on a steady rise from I$4,597 in 2008 to I$5,351 in 2018 (Food and Agricultural Organization of the United Nations, 2019).

The foregoing evidence is an indication that various policy actions geared towards raising per capita income in Nigeria over the period have had a very limited impact on food and nutrition security, particularly nutritional quality. Shittu, Okuneye, and Olarewaju (2015a) had drawn attention to the negating influence of policy-induced rising food prices in Nigeria. It is instructive to note that Nigeria has been witnessing escalating and volatile food prices over the past three to four decades, which Shittu, Obayelu, and Salmon (2015b) linked to domestic monetary policies, particularly policy-induced Naira depreciation. Between 2007 and 2018, for example, the composite food price index in Nigeria (November 2009 = 100) rose steadily from 67.05 in January 2007 to 296.4 by December 2018, with a 12.3% average year-on-year food inflation rate recorded over the period (Central Bank of Nigeria, 2019). This paper examines the impacts of these escalating food prices on nutritional quality vis-à-vis demand for food commodities that are rich in protein, vitamins, minerals, and essential micronutrients as against other not so nutritious food commodities in Nigeria. The analyses were within the framework of Quadratic Almost Ideal Demand System (QUAIDS) using the most comprehensive household survey data available in Nigeria: the World Bank supported Living Standard Measurement Survey (LSMS) – Panel data, 2010–2016.

The study's main hypothesis is that escalating food prices would exert a disproportionate impact on the demand for various food commodities/groups, triggering substitution of relatively cheap food commodities of low nutritional quality for the nutritionally rich food commodities. It may also tilt the trade balance towards cheap food import to the detriment of local food production, both of which may have far-reaching implications on food and nutrition security in Nigeria. In addition, the study hypothesises that factors such as gender and other socio-demography, season and location would exert varying influence on food choices across different sub-populations and time (season) in the face of escalating prices and dwindling real income. The study thus seeks to investigate these price–food demand dynamics, aiming to inform policy actions to enhance food and nutrition security across various strata of Nigeria's populace as well as the national pursuit of economic diversification, for which increased demand for (and production of) locally produced commodities is crucial.

The rest of this paper is organised as follows: stylised review of recent empirical evidence on prices and food demand dynamics and the implications for food and nutrition security follow this introduction. The third section presents the study methodology, while the fourth presents the results and their discussion. The final section highlights the main conclusions, policy implications and study recommendations.

[1]It is a hypothetical unit of currency that has the same purchasing power parity that the U.S. dollar had in the United States at a given point in time. It is mainly used in economics and financial statistics to determine and compare the purchasing power parity and gross domestic product of various countries and markets.

2. Literature review

Considerable research attention has been devoted to the influence of changes in prices, income, and other socio-economic factors on food demand across the globe. Theoretically, demand for food commodities—considered as necessities—are expected to be negatively price inelastic and positively affected by income, with possible exceptions including certain food commodities of low nutritional qualities consumed mainly by the poor or generally consumed in minute quantities. Extensive empirical evidence supports these theoretical positions (see, for example, Babu, Gajanan, & Hallam, 2017, for a review of food demand studies across the globe over the years). For Nigeria, evidence in Akinleye (2009), Otunaiya and Shittu (2014), Ogundari (2014) to mention a few, supports these theoretical positions, in general, with the main point of departure being the relative magnitude of the income and price effects across various food commodities/groups, and some cases of commodities whose demand seem to defy the norms. For example, Otunaiya and Shittu (2014) found the expenditure (income) elasticity of demand for some vegetables (bitter leaf and eggplant) to be negative, which is similar to the evidence from Ogundari (2014) for vegetable oil and cereals.

Arising from the 2007–08 global food crisis and frequent price spikes and volatility ever since, a number of studies have examined the impacts of food price spikes and/or volatility on nutrition quality, poverty, and food insecurity, among other related issues. Anríquez, Daidone, and Mane (2013) in a cross-country study found that food price spikes do not only reduce calorie-rich food consumption, but it also worsens intra-household food calorie distribution, thereby deteriorating the nutritional status of the population in the developing countries, which included Bangladesh, Cambodia, Guatemala, Kenya, Malawi, Nepal, Tajikistan and Vietnam. García-Germán, Bardají, and Garrido (2018), focusing on households within 26 countries in the European Union, also reported that increases in consumer food prices, following the 2007–12 global increases in agricultural commodity prices, led to rising food deprivation, particularly among households in the lowest income quintiles and low-income households in the densely populated areas with the EU Member States.

Rudolf (2019) investigated the impact of maize price shocks on household food security in Tanzania. The results showed that both rural and urban households were negatively affected by maize price shocks, with rural landless households being the most susceptible group. Specifically, a 50% rise in maize prices cuts calorie intake for rural, urban and rural landless households by 4.4%, 5.4% and 12.6%, respectively. A similar study by Hoang (2018) also found that low-income households in Vietnam faced higher risk of undernourishment due to reduction in their daily calorie consumption in the face of food market price shocks, while Wossen, Berger, Haile, and Troost (2018) reported that price variability negatively affected the food security status of farm households in East and West Africa.

3. Methodology

This study utilized data from the three waves of the General Household Survey (GHS) – Panel (2010–2016) in Nigeria conducted by the National Bureau of Statistics (NBS) in collaboration with the World Bank Living Standard Measurement Study (LSMS) team

and funded by the Bill and Melinda Gates Foundation. The target respondent included an initial set of 5,000 farm households, drawn across selected rural and urban communities/enumeration areas spread across the 36 states and Federal Capital Territory (FCT) in Nigeria. Each of these was repeatedly visited and interviewed during the post-planting periods (August – October) of 2010, 2012 and 2015, and post-harvest periods (February – April) of 2011, 2013 and 2016. Except for the cases of attrition that is usually typical of long panels, each household was visited six times over the period with data collected on a wide range of issues, including the households' socio-demographic characteristics and food and non-food expenditure, among others (see World Bank, 2020). The study, however, used only data for households that appeared in at least two of the three waves, which yielded an unbalanced panel of 17, 539 observations on 4,407 households.

The GHS-Panel household expenditure and socio-demographic data for each household were matched with the corresponding survey periods' state-level monthly average rural/urban retail food prices. The retail food prices were obtained from the NBS, and were outcomes of national market surveys conducted as a routine towards computing composite consumer price indices (CPI) for the nation (NBS, 2019). The retail prices were on 57 major food items, reported for average rural as well as urban communities in each of the 36 states and FCT for each month (January–December) of 2010–2016. The national aggregate non-food CPI, extracted from CBN – Statistical Bulletin (Central Bank of Nigeria, 2016), was used as a proxy in the price for non-food.

4. Model specification

Household demand response to escalating prices was analysed within the framework of the Quadratic Almost Ideal Demand System (QUAIDS) following (Banks, Blundell, & Lewbel, 1997), with household socio-demographic variables incorporated into the model using Ray's (1983) technique. Following Poi (2012), the QUAIDS model was specified as follows and estimated using the "*quaids*" command in Stata 16:

$$w_{iht} = \alpha_i + \sum_{j=1}^{k} \gamma_{ij} \ln p_{jht} + \beta_i + \eta_i' z \ln\left[\frac{m_{ht}}{\mathrm{b}_0(z)a(p)}\right] + \frac{\lambda_i}{b(p)c(p,z)}\left\{\ln\left[\frac{m_{ht}}{\mathrm{b}_0(z)a(p)}\right]\right\}^2 \quad (1)$$

where

w_{iht} is the budget share of the i^{th} commodity for household h in period t, with k as the number of commodities, indexed by i or j;

p is the vector of commodity prices (N/kg or N/litre);

m is household total consumption expenditure (N/week);

z is the vector of household socio-demographic characteristics as well seasonal and regional variables;

α, β, γ and η are the parameters to be estimated, while

$$\ln a(p) = \alpha_0 + \sum_{i=1}^{k} \alpha_i \ln p_i + \frac{1}{2}\sum_{i=1}^{k}\sum_{j=1}^{k} \gamma_{ij} \ln p_i \ln p_j \quad (2)$$

$$b(p) = \prod_{i=1}^{k} p_i^{\beta_i} \tag{3}$$

$$c(p,z) = \prod_{j=1}^{k} p_j^{\eta_j' z} \tag{4}$$

$$\bar{m}_0(z) = 1 + \rho' z \tag{5}$$

The *quaids* command in Stata estimates parameters of the demand system with the following restrictions implied by adding up, homogeneity and symmetry conditions imposed automatically:

$\sum_{i=1}^{k} \alpha_i = 1$, $\sum_{i=1}^{k} \beta_i = 0$, $\sum_{i=1}^{k} \lambda_i = 0$, $\sum_{j=1}^{k} \gamma_{ij} = 0, \gamma_{ij} = \gamma_{ji}$, and $\sum_{j=1}^{k} \eta_{rj} = 0$ for r = 1, . . ., s.

The *vce* option in the *quaids* command was set as *robust* for use of heteroskedasticity robust standard errors, considering that heteroscedasticity is very common in cross-sectional as well as panel data. Given the parameters estimates, the expenditure, own price and cross price elasticities of demand for various commodities were estimated using *quaids'* post estimation commands (*estat*) in Stata (see Poi, 2012). This computes various elasticity estimates as follows:

Expenditure (income) elasticity:

$$\mu_i = 1 + \frac{1}{w_i}\beta_i + \eta_i' z + \frac{2\lambda_i}{b(p)c(p,z)} \ln\left\{\frac{m}{b_0(z)a(p)}\right\} \tag{6}$$

Uncompensated (Marshallian) price elasticities:

$$\varepsilon_{ij} = -\delta_{ij} + \frac{1}{w_i}\gamma_{ij} - \left[\beta_i + \eta'_i z + \frac{2\lambda_i}{b(p)c(p,z)} \ln\left\{\frac{m}{_0(z)a(p)}\right\}\right] \times$$

$$\left[\alpha_j + \sum_l \gamma_{jl} \ln p_l\right] - \frac{(\beta_j + n'_j z)\lambda_i}{b(p)c(p,z)} \left[\ln\left\{\frac{m}{b_0(z)a(p)}\right\}\right]^2 \tag{7}$$

Compensated (Hicksian) price elasticities:

$$\varepsilon_{ij}{}^{C} = \varepsilon_{ij} + \mu_i w_j \tag{8}$$

5. Assessment of welfare effects of escalating prices

Considering that price changes affect production and consumption decisions of farm households, the welfare effects were assessed by examining the effects on the household net expenditure, which can be defined following the work of Robles and Torero (2010)as

$$B(p,r,U) = m(p,r,U) - \pi(p,r) \tag{9}$$

where B(p, r, U), m(p, r, U) and π(p, r) are the net expenditure, expenditure and profit function, respectively; p is the vector of commodity prices; r is the vector of prices of factors of production and *U* is the household welfare (or utility) level.

The change in the household net expenditure as a result of policy-induced price change were computed, following Robles and Torero (2010) as

$$dB(p, r, U) = \left[(w_h) - (w_y)\right]' \left(\frac{dp}{p}\right) m + \frac{1}{2}\left(\frac{dp}{p}\right)' (W_h)(E)\left(\frac{dp}{p}\right) m \tag{10}$$

where

dB(p, w, *U)* is the change in the household net expenditure, which is the compensating variation (the amount of extra income the household needs to achieve the original level of welfare, *U*) given the policy-induced change in real prices;

dp/p is the vector of policy-induced percent changes in real prices; w_h is the vector of the shares of household expenditure on various commodities;

w_y, is the vector of production shares (value of production of each commodity item divided by total household expenditure);

W_h is a diagonal matrix with the budget shares (w_h) along the principal diagonal;

E is the matrix of compensated price elasticities of demand (own price elasticities along with the principal diagonal and cross-price elasticities as the off diagonal elements); and m is the total expenditure.

The CV measures in (10) were computed for the typical household as well as for each household in the dataset with the values compared across various socio-economic groups.

The first term (before the plus sign) in the right-hand side (RHS) of equation (10) is a measure of the direct (or first round) effect of the recent price changes, which is the CV under the assumption that households do not revise their consumption and production quantities as price changes. The second term is a measure of the substitution effects that accounts for the idea that households could revise their consumption decisions as relative prices change; hence, its addition to the direct effect to estimate the overall welfare effect. Note that while farm households could also revise their production decisions in response to relative price changes, we consider the data span (6 months) too short to allow such a response and hence stick to the standard assumption that farm households do not revise the production decisions in response to relative price changes in the short-run.

6. Measurement and definition of variables

6.1. Commodity groups and prices

The GHS-Panel household expenditure data contain information on about 180 household food and non-food items, including expenditure amount as well as quantities, quantities of food consumed at home, expenses on food consumed away from home and non-food consumption expenditure, among others. These were mostly collected as weekly data based on 7 days recall, except for some less frequently consumed non-food items that were collected over the past 30 days.

In this study, the actual consumption quantities reported over the past seven days of survey visits were valued at the implied prices at which the household purchased the item or the median price of the commodity within the enumeration area, where the household

did not purchase the item. All resulting worth of goods consumed (hereafter referred to as consumption expenditure) were converted to their weekly equivalents, and the commodities were aggregated into nine foods and one non-food category, following Shittu et al. (2015b) as follows:

(i) Rice – including local and imported rice and rice products;
(ii) Wheat – including whole wheat, wheat flour, bread, and other baked food;
(iii) Other cereals (OCereals) – including all foods of maize, millets, sorghum, barley, and oats origins;
(iv) Pulses – including cowpea, groundnut, melon, soybean, other pulses, and their products;
(v) Tubers – including edible substances from roots and tubers;
(vi) Meats – including meats from livestock and wild animals and eggs;
(vii) Fish – including all fishes and other aquatic foods;
(viii) Beverages – including all beverages, sweeteners, other additives, and dairy products;
(ix) Other food (OFood) – including fruits, vegetables, vegetable oil and spices.
(x) Non-food (NFood) – including all non-food consumption commodities such as energy, health care, body care, telecommunication and transportation.

Using the NBS data on state-level rural and urban retail prices for the month/year of visits to the households, prices of each of the nine food groups were constructed for each household at each time of visit as expenditure share weighted average price of the primary commodities that made-up each of the nine food categories. However, because of the diversity and absence of uniform metrics for the non-food commodities, the national aggregate CPI for the time of visit to each household was used as a proxy for the price of the non-food group.

6.2. Sociodemographic, seasonal and locational variables

Given that the study was based on panel data, it was possible to explore the panel structure of the data for more robust estimates. This was undertaken within the limits of Poi's *quaids* command in Stata 16 by introducing some dummy variables for assessments of certain fixed effects. These included the following:

(1) A seasonal dummy variable, *Post-harvest*, which takes on a value of 1 for a post-harvest period, and 0 for a post-plating period.
(2) Five regional dummy variables that respectively take on the value of 1 for households in the Northeast, Northwest, Southeast, Southwest, and South-South geo-political zones of the country, and zero otherwise, with North-central.
(3) A sector dummy variable, *Urban*, which takes on a value of 1 for an urban household, and 0 for a rural household;

Similarly, the influence of a number of household socio-demographic variables was also examined. These include the age of household head (years); sex of household head (female = 1, 0 otherwise); years of schooling by the household head; the number of

persons in the household; and dependency ratio measured as the ratio of non-working member(s) to working member(s) in the household. Also examined is the influence of household poverty status (poor = 1, 0 otherwise), with the Naira equivalence of US$1.25/capita/day consumption expenditure used as the poverty line.

7. Results and discussion

7.1. Household socioeconomic characteristics

As a background to the study, socio-economic profiles of the farm households in the GHS (Panel)data were analysed, and the results are summarised in Table 1. As shown in the table, an average farm household in the sample, and by extension in Nigeria, consists of about 10 members, with a dependency ratio of 2.87. This suggests that a typical farm household in the country has about three dependents per economically active (working) member. The typical farm household head was a man, with only about 11.74% of the households headed by women. The mean age and mean years of formal education (± standard error of mean) among the household heads were 51.43 ± 0.11 and 8.31 ± 0.03 years, respectively. Further evidence from the GHS-Panel data shows that about two-thirds (64.9%) of the household heads had no more than primary school education, with as much as 37.26% not able to read or write in any language. This low level of education is a source of concern in Nigeria's quest for the development of the

Table 1. Summary statistics of model variables.

			95% Conf. Interval	
Variable	Mean	Std. Err.	Lower limit	Upper limit
Age of Head (Years)	51.43	0.1130	51.2108	51.6539
Gender of Head (Woman = 1)	0.11	0.0027	0.1119	0.1228
Schooling by Head (Years)	8.31	0.0290	8.2568	8.3706
Household size (Number)	10.86	0.0233	10.8108	10.9021
Dependency ratio (dependants/worker)	2.87	0.0178	2.8387	2.9084
Household Poverty Status (Poor = 1)	0.67	0.0035	0.6710	0.6848
Location of Household (Dummy)				
• Urban Sector	0.31	0.0039	0.3069	0.3225
• Northeast Nigeria	0.17	0.0032	0.1642	0.1768
• Northwest Nigeria	0.17	0.0032	0.1668	0.1795
• Southeast Nigeria	0.17	0.0032	0.1589	0.1714
• South-south Nigeria	0.16	0.0031	0.1585	0.1710
• Southwest Nigeria	0.18	0.0033	0.1727	0.1855
Weekly Expenditure (N)	10,054.06	25.5383	10,004.00	10,104.12
Budget Share of:				
• Rice	0.06	0.0004	0.0647	0.0661
• Wheat	0.04	0.0003	0.0435	0.0448
• Other Cereals	0.02	0.0001	0.0295	0.0301
• Pulses	0.04	0.0001	0.0404	0.0412
• Tubers	0.09	0.0005	0.0934	0.0955
• Meats	0.11	0.0005	0.1131	0.1151
• Fish	0.070	0.0004	0.0694	0.0712
• Beverages	0.11	0.0004	0.1075	0.1094
• Other foods	0.15	0.0005	0.1517	0.1538
• Non-Food	0.27	0.0009	0.2776	0.2814

Source: Authors' calculation

rural/farm sector, given evidence in the literature that links adoption of improved technologies and increased productivity in Nigeria's smallholder agriculture to higher levels of education (Polson & Spencer, 1991; Shittu et al., 2015a).

Perhaps, a major consequence of low-level of education and tendency for this to be associated with low productivity and income is a high incidence of poverty among Nigeria farm households. As shown in Table 1, the typical farm household spent barely about N10, 054.06 ± 25.54 in an average week on food and regular non-food items, over the period. This put the average per capita daily consumption expenditure of the farm households at about N163.85 ± 0.58 (US$0.91 ± 0.01), with about two-thirds (67.8%) of the farm households falling below the US$1.25/person/day international poverty line.

8. Trends in food and non-food prices

Further enhancing knowledge of the background situations of the farm households, the trends in food and non-food prices, and the evolution of farm household budgetary allocation to various commodity groups were analysed. Figure 1 Figure 2 present the general trends in prices as well as inflation rates, respectively, over the period January 2010 – May 2021. As shown in Figure 1, prices of both food and non-food commodities were on a steady increase from month/year to month/year with the 12-months inflation rates (Figure 2) being generally above 10 percent, except for the period July 2011–January 2016 when we have single-digit.

With the current rate of inflation, price escalation has been persistently above 10%, and in recent years (2016 and date), it has been consistent despite the various measures that were put in place. We noticed however, some steady decline in 2016, but in recent years, we observed that this spike is picking up again. Two things happened in Figure 2 – there is relative dispersion that affect more of food item than non-food (2010–2013);

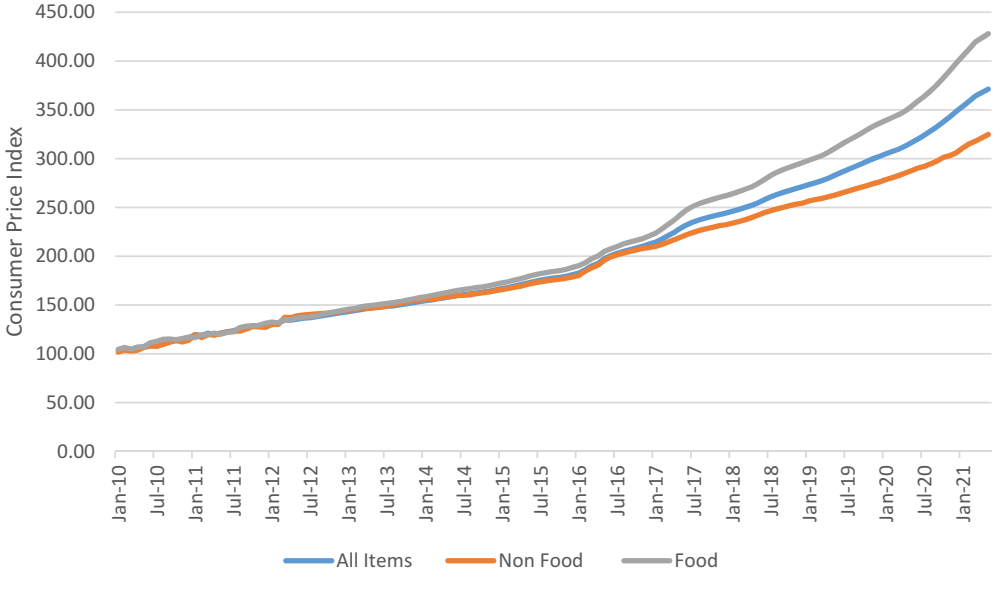

Figure 1. Trends in Consumer Price Indices (CPI) in Nigeria, 2010–2021.

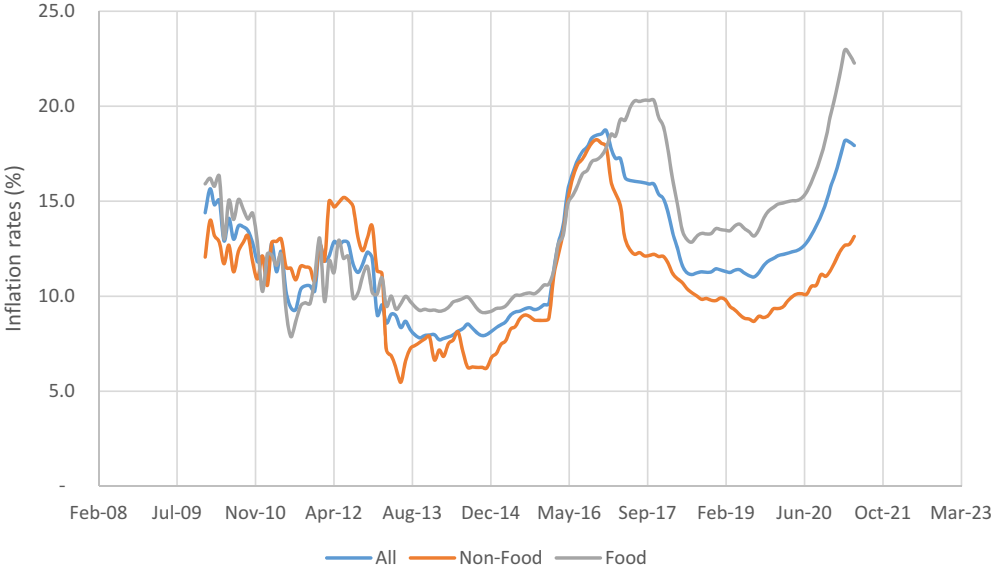

Figure 2. Trends in Inflation rates in Nigeria, 2010–2021.

there is also relative price disparity where food prices (2017–2021) are rising faster than non-food prices with the spike inflation hitting food items than non-food items (June 2020 – May 2021).

9. Estimated household demand system

Tables 2 and Tables 3 summarise the estimated parameters of the QUAIDS aimed at analysing the farm households' demand response to escalating food prices in Nigeria. Diagnostic statistics associated with all equations in the system were generally satisfactory. Coefficients of most of the price and budget size-related coefficients were statistically significant at 5% or stronger levels, which is a clear indication of significant household demand response to changing prices and income among the farm households over the period. In addition, Wald Chi-square tests also lead to rejection of the hypotheses that each of the seasonal, locational and socio-demographic variables was redundant in the QUAIDS model at 5% or stronger levels (Table 3). Coefficients associated with the majority of these variables were also significant at 5% or stronger levels, which show clearly that season, location (geo-political zone), and household-specific factors play important roles in consumption patterns among the farm households as discussed in the following subsections.

9.1. Season and budgetary allocations to food commodities

In general, food commodities are usually cheaper during post-harvest periods than post-planting periods because of higher supply during post-harvest seasons. The study thus hypothesised that budget shares of various food components of the farm households' budgets will be lower during post-harvest periods than post-planting periods. Hence,

Table 2. Estimated coefficients of economic variables in the QUAIDS model.

		$\ln P_j$										$f(m_{ht})$	
Budget Share (w_i)	Constant (α_i)	Rice	Wheat	OCereals	Pulses	Tubers	Meat	Fish	Beverage	OFood	NFood	β_i	λ^i
Rice	0.0528	−0.0048										0.0110	−0.0003
	(7.88)***	(−2.25)**										(1.91)*	(−0.23)
Wheat	0.0008	−0.0085	−0.0047									0.0122	0.0026
	−0.15	(−7.93)***	(−3.87)***									(2.86)***	(2.85)**
OCereals	0.0193	−0.0027	−0.0021	−0.0008								0.0028	0.0011
	(5.94)***	(−2.98)***	(−3.66)***	(−1.02)								(−1.12)	(2.01)*
Pulses	−0.0054	0.0016	−0.0032	0.0008	0.0007							−0.0041	0.0053
	(−1.57)*	(1.80)*	(−5.15)***	(1.52)*	(−0.91)							(−1.40)	(7.84)***
Tubers	0.1147	−0.0014	−0.0029	−0.0006	−0.0050	0.0037						0.0239	0.0031
	(11.15)***	(−0.86)	(−2.26)*	(−0.66)	(−5.41)***	−1.36						(2.61)*	(−1.55)
Meats	0.1450	−0.0206	−0.0128	−0.0025	−0.0052	0.0111	−0.0105					0.0436	0.0063
	(13.42)***	(−9.29)***	(−8.23)***	(−1.88)*	(−3.86)***	(4.78)***	(−2.29)*					(5.11)***	(3.5)**
Fish	0.1252	0.0061	−0.0005	0.0012	0.0011	0.0076	0.0076	0.0031				0.0579	0.0134
	(−12.65)***	(5.94)***	(−0.65)	(2.59)*	(2.19)*	(5.92)***	(5.51)***	(1.89)*				(6.42)***	(6.60)***
Beverages	0.0516	0.0297	0.0528	0.0077	0.0208	−0.0148	0.0119	−0.0119	−0.0749			−0.1356	−0.0179
	(4.42)***	(14.24)***	(35.7)***	(6.5)***	(16.66)***	(−6.44)***	(3.79)***	(−7.41)***	(−20.37)			(−18.34)***	(−10.45)***
OFood	0.0749	0.0004	−0.0198	0.0010	−0.0024	0.0078	0.0293	−0.0056	−0.0354	0.0532		−0.0637	0.0044
	(6.96)***	(−0.21)	(−14.09)***	(−1.01)	(−2.12)*	(3.48)**	(10.04)***	(−3.92)***	(−13.21)	(14.63)***		(−7.42)***	(2.30)*
NFood	0.4211	0.0002	0.0016	−0.0020	−0.0092	−0.0055	−0.0083	−0.0087	0.0142	−0.0286	0.0463	0.0519	−0.0181
	(30.03)***	(0.23)	(1.97)*	(−4.11)***	(−16.10)***	(−3.53)***	(−5.40)***	(−6.39)***	(7.18)***	(−17.03)***	(16.73)***	(4.16)***	(−6.51)***

Figures in parentheses are the t-ratio of associated coefficients.
***, ** and * imply that the associated coefficient is significant at $p < 0.01$, $p < 0.05$ and $p < 0.1$ levels, respectively.

Table 3. Estimated coefficients of socio-demographic and locational variables in the QUAIDS.

Budget Share (w_i)	Harvest Dummy	Location (Dummies)						Household Head Characteristics				Household Characteristics		
		Urban	NE	NW	SE	SS	SW	Age	Age^2	Sex	Edu	HHSize	DRatio	Poor
Rice	−0.0045	−0.0023	0.0004	−0.0015	0.0043	0.0043	0.0025	−2.3E-05	7.8E-08	0.0009	−9.6E-06	−0.0001	0.0008	−0.0012
	(−7.71)***	(−6.42)***	(0.73)	(−2.9)**	(6.85)***	(6.68)***	(4.43)***	(−0.94)	(0.39)	(2.27)*	(−0.22)	(−0.65)	(1.04)	(−2.70)*
Wheat	0.0001	−0.0021	−0.0005	−0.0017	0.0025	0.0031	0.0043	−3.3E-06	−3.1E-08	0.0002	7.2E-05	−0.0001	0.0009	0.0002
	(0.3)	(−7.16) ***	(−1.07)	(−3.73)***	(5.50)***	(6.64)***	(9.29)***	(−0.18)	(−0.22)	(0.54)	(2.1)*	(−2.05)*	(1.43)	(−0.62)
OCereals	−0.0012	−0.0002	0.0008	0.0001	0.0003	0.0013	0.0013	4.8E-06	−1.2E-08	0.0007	−2.0E-05	−2.1E-05	0.0005	−0.0001
	(−4.61)***	(−1.09)	(2.88)**	(0.25)	(1.07)	(3.86)***	(4.89)***	(0.52)	(−0.18)	(4.07)**	(−0.9)	(−0.48)	(1.21)	(−0.39)
Pulses	0.0048	−0.0003	0.0019	0.0021	−7.6E-06	0.0016	0.0028	3.5E-05	−1.1E-07	0.0001	1.3E-05	0.0002	0.0005	−0.0009
	(12.23)***	(−1.67)	(5.29)***	(5.92)***	(−0.02)	(4.14)***	(7.73)***	(3.57)**	(−1.86)*	(0.33)	(0.48)	(4.53)***	(1.0)	(−3.21)**
Tubers	−0.0024	−0.0010	0.0041	0.0067	0.0006	0.0010	−0.0040	−0.0001	3.6E-07	−0.0004	−1.5E-05	−0.0001	0.0011	−0.0030
	(−3.30)**	(−1.95)*	(4.78)***	(8.27)***	(0.66)	(1.13)	(−4.67)***	(−2.03)*	(1.86)*	(−0.68)	(−0.23)	(−0.76)	(0.95)	(−4.37)***
Meat	−0.0065	−0.0050	−0.0037	−0.0058	0.0057	−0.0030	0.0022	4.3E-05	−4.2E-07	−3.1E-05	−5.1E-05	−0.0004	−0.0022	−0.0023
	(−8.95)***	(−9.82)***	(−4.86)***	(−7.75)***	(7.10)***	(−3.54)**	(3.03)**	(−0.57)	(−0.61)	(−0.05)	(−0.91)	(−3.09)**	(−1.97)*	(−3.74)**
Fish	0.0003	−0.0009	−0.0007	−0.0009	0.0028	−0.0073	0.0014	−1.8E-05	9.6E-08	0.0002	4.6E-05	0.0002	2.6E-05	−0.0030
	(0.50)	(−2.33)*	(−1.18)	(−1.76)*	(4.79)***	(−9.35)***	(2.45)*	(−0.88)	(0.67)	(0.46)	(1.04)	(2.17)*	(0.03)	(−5.97)***
Beverages	0.0188	0.0005	−0.0085	0.0034	−0.0093	0.0001	−0.0002	0.0002	−8.5E-07	0.0008	7.8E-06	0.0003	0.0014	0.0052
	(22.17)***	(−0.93)	(−8.61)***	(4.18)***	(−9.06)***	(0.06)	(−0.29)	(3.82)***	(−2.49)*	(1.18)	(0.11)	(2.98)**	(1.48)	(7.27)***
OFood	0.0176	0.0012	0.0037	0.0086	−0.0023	−0.0012	0.0025	0.0001	−8.5E-07	−0.0018	1.7E-04	0.0014	0.0026	−0.0083
	(15.87)***	(1.99)*	(3.80)***	(8.97)***	(−2.14)*	(−1.14)	(2.57)*	(2.7)*	(−1.93)*	(−2.51)*	(2.36)*	(9.61)***	(2.1)*	(−9.55)***
NFood	−0.0272	0.0102	0.0026	−0.0109	−0.0046	0.0002	−0.0128	−0.0003	1.7E-06	−0.0006	−2.1E-04	−0.0014	−0.0016	0.0133
	(−14.45) ***	(9.32)	(1.55)	(−6.35)	(−2.86)	(0.09)	(−7.63)	(−3.11)	(2.3)	(−0.51)	(−1.73)	(−5.95)	(−0.78)	(9.27)
ρ_i	1.3443	0.0061	−0.0356	0.5397	−0.4769	−0.2983	0.3675	0.0086	−2.8E-05	−0.0221	0.0082	0.0656	0.1490	−0.1496
	(7.57)***	(0.22)	(−0.73)	(6.37)***	(−10.91)***	(−7.02)***	(5.1)***	(5.71)***	(−7.27)***	(−0.65)	(2.02)*	(6.8)***	(3.66)***	(−3.99)***
χ^2 (10)	243.7***	178.38***	174.23***	253.57***	334.17***	320.12***	225.8***	55.13***	64.5***	26.57***	16.53**	157.73***	24.25***	258.89***

Figures in parentheses are t-ratio of associated coefficients.
***, ** and * imply the associated coefficient is significant at $p < 0.01$, $p < 0.05$ and $p < 0.1$ levels, respectively.

a post-harvest dummy variable (post-harvest = 1 and post-planting = 0) was introduced into the budget share equations, and the hypothesis was tested through tests of significance of coefficients associated with the dummy variable. The results, as shown in Table 3, revealed that coefficients of the post-harvest dummy variable were significant at 1% level in seven out of the 10 budget share equations and at 5% level in one: the exceptions are budget share equations for wheat and fish, which are largely imported. The significant coefficients were negative as expected for most of the commodities except pulses, beverages (including milk), and other foods (including fruits and vegetables). This shows that an average farm household in Nigeria devotes significantly more of the household budget to healthy diets in periods when most food commodities are relatively cheap but sacrifices healthy diets for other commodities in post-planting seasons when most food commodities are relatively expensive.

9.2. Location and budgetary allocations to food commodities

The location dummy variable (urban = 1 and rural = 0) as well as regional dummy variables (NE = 1, NW = 1, SE = 1, SS = 1, SW = 1, otherwise, zero) were introduced into the budget share equations, and the hypothesis tested through tests of significance of coefficients associated with the dummy variable. The results, as shown in Table 3, revealed that coefficients of the location dummy variable were significant at 1% level in three out of the 10 budget share equations and at 10% level in three. The significant coefficients were negative across the farm households in northeast and northwest regions, while the coefficients were positive for those households in southern region (SE, SS & SW) for commodities like rice, wheat, meat, and fish. This implies that an average farm household residing in the urban region of the Northeast and Northwest geo-political zones devotes significantly less of the household budget to those food commodities perhaps because a larger chunk of these food items are produced in the North, and hence, they are relatively cheaper at an affordable rate. Conversely, those households living in the urban region of Southern Nigeria devote significantly more of the household budget to rice, wheat, meat and fish. The exception of a lesser budget share of fish and meat in both the SE and SS regions could be explained by the relatively cheap and affordable access to fish and meat in those areas. The coefficient of other food groups (including fruits and vegetables) was significantly positive across the location and regional dummy variables with the exception of SE and SS regions. This shows that an average farm household in Nigeria devotes significantly more of the household budget to healthy diets.

9.3. Household characteristics and budgetary allocations to food commodities

The results, as shown in Table 3, revealed that coefficients of the age and age square variables were significant at 1%, 5%, and 10% levels in four out of the 10 budget share equations. The significant coefficients were positive for age and negative for age square for commodities like pulses and beverages (including milk) and negative for tubers and other foods (including fruits and vegetables). We found that the budget shares of pulses and beverages tend to decrease with age, while that of other foods and tubers are expected to increase with age.

Education is another relevant factor that influences farm household behaviour. Table 3 revealed that coefficients of the education variable were significant at 1% and 10% levels in two out of the 10 budget share equations. The significant coefficients were positive as expected for wheat and other foods (including fruits and vegetables). This shows that a year's increase in education will significantly increase an average farm household budget to healthy diets in Nigeria. Similarly, the coefficients of the household size variable were significant at 5% and 10% levels in four out of the 10 budget share equations. The significant coefficients were positive for fish and negative for commodities such as wheat, meat, and beverages. This shows that the budget share of fish commodities rises with increasing household size as expected, while, on the contrary, the shares of commodity groups such as wheat, meat, and beverages tend to reduce with the increasing family size.

The coefficients of the household poverty status variable were negative and statistically significant at 1%, 5%, and 10% levels for commodity groups such as tubers, rice, meat, fish, beverages and other foods. This indicates that an average farm household in Nigeria that falls below the poverty line will spend a lesser household budget on the earlier mentioned food commodities.

10. Demand elasticities of commodity groups

10.1. Expenditure elasticities

Expenditure elasticity is an important policy parameter in the demand equations. As presented in Table 4, all the estimated expenditure elasticities estimated follow *a priori* expectations, i.e., the commodity groups all had positive expenditure elasticities ranging between 0.50–1.36. This indicates that all the commodities are normal goods, consumption of which will increase with an increase in household income/budget (Adekunle, Akinbode, Shittu, & Momoh, 2020; Yaseen, Mehmood, & Ali, 2014). It is pertinent to note that expenditure (income) elasticities for all food groups are expected to be less than one, while that of the non-food group should be above one, indicating that only the non-food group can be classified as a luxury while food items belong to the necessity category (Abdulai, 2002). Our results, however, found that four out of the eight food categories fall under necessity goods, while the other four (rice, wheat, tubers, meat), as well as non-food categories, fall under luxury goods. The deviation of meats from the earlier assertion by Abdulai (2002) could be explained by Bennet's law,

Table 4. Marshallian own-price and expenditure elasticities.

Commodity category	Expenditure elasticity	Own-price elasticity
Rice	1.13 (0.02)	−1.09 (0.03)
Wheat	1.02 (0.03)	−1.11 (0.03)
OCereals	0.92 (0.02)	−1.02 (0.03)
Pulses	0.5 (0.02)	−0.97 (0.02)
Tubers	1.06 (0.02)	−0.97 (0.03)
Meat	1.06 (0.02)	−1.11 (0.04)
Fish	0.97 (0.03)	−1.00 (0.02)
Beverages	0.64 (0.01)	−1.79 (0.03)
OFood	0.61 (0.01)	−0.63 (0.02)
NFood	1.36 (0.01)	−0.97 (0.01)

Figures in parentheses are the standard errors.
Source: Own calculation.

which states that as peoples' incomes increase, they tend to eat less carbohydrate/starchy foods and more protein foods. This result is in agreement with that of Ansah, Marfo, and Donkoh (2020) who found that the average expenditure elasticity of meat is 1.55. The deviation of rice and wheat could be because a larger chunk of these food commodities is imported. This corroborates the findings of Obayelu, Okoruwa, and Ajani (2009) who found that cereal and animal protein had elasticities above one implying that the food groups were luxury.

10.2. Marshallian/Uncompensated own price elasticities

Consumer's responses to price and income changes are measured in the form of expenditure and price elasticity. Hence, consumer response to price change is summarized in terms of own price elasticity and cross-price elasticity. Both Marshallian and Hicksian price elasticities are computed. The Marshallian/uncompensated elasticity of demand represents changes in the quantity demanded as a result of changes in prices, capturing both substitution and income effects. Compensated elasticity of demand refers to the portion of the change in quantity demand, which captures only the substitution effect.

As expected, the own-price elasticities in Table 4 all have negative signs. The uncompensated price elasticities show that own-price elasticities fall between −0.63 and −1.79. The own-price elasticity of rice, wheat, other cereals, meats and beverages are found to be above one, while the elasticity for the pulses, tubers, other food, and non-foods groups have inelastic demand. This indicates that a uniform percentage decrease in prices of all commodities would elicit a greater demand for rice, wheat, other cereals, meats and beverages food groups, and *vice versa*. However, the demand for pulses, tubers and other foods in Nigeria is not very sensitive to the respective food-price changes. This was probably a reflection of the fact that those foods are the staple food in Nigeria. Other food groups show the lowest (absolutely) own-price elasticity, indicating that it is the least sensitive to changes in its own price.

10.3. Hicksian (compensated) cross-price elasticities

Table 5 shows the results of the Hicksian cross-price elasticities of 10 commodity groups. The estimates reveal the substitutability and complementarity effects. Negative cross-price elasticities show complementarity, while positive cross-price elasticities indicate substitutability. It is worth noting that the increase in price of one commodity will result in the increase in the demand for that commodity's substitutes and a decrease in the demand for its complements. Wheat, other cereals and meat were found to be complements to rice, while other cereals, pulses, meat and other food were found to be complements to wheat. Rice was substituted to pulses, tubers and other foods; wheat was substituted to tubers; and pulses were substituted for rice and other cereals as well as meat substituting for fish. These imply that once the price of a commodity rises, the demand for that commodity is reduced drastically as in the case of complementary goods, while the demand for its substitute rises simultaneously.

Table 5. Hicksian cross-price elasticities.

Commodity category	Expenditure elasticity	Rice	Wheat	OCereals	Pulses	Tubers	Meat	Fish	Beverages	Ofood	Nfood
Rice	1.13		−0.09	−0.01	0.07	0.07	−0.21	0.16	0.58	0.17	0.27
	(0.02)		(0.02)	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.03)	(0.03)	(0.02)
Wheat	1.02	−0.13		−0.02	−0.03	0.02	−0.12	0.04	1.34	−0.28	0.31
	(0.03)	(0.02)		(0.01)	(0.01)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)
OCereals	0.92	−0.03	−0.03		0.07	0.07	0.03	0.10	0.38	0.19	0.22
	(0.02)	(0.03)	(0.02)		(0.02)	(0.03)	(0.04)	(0.01)	(0.04)	(0.03)	(0.02)
Pulses	0.5	0.11	−0.03	0.05		−0.03	−0.01	0.09	0.61	0.07	0.10
	(0.02)	(0.02)	(0.02)	(0.01)		(0.02)	(0.03)	(0.01)	(0.03)	(0.03)	(0.01)
Tubers	1.06	0.05	0.01	0.02	−0.01		0.22	0.13	−0.02	0.25	0.21
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)		(0.02)	(0.01)	0.02	(0.02)	(0.02)
Meat	1.06	−0.12	−0.07	0.01	−0.01	0.19		0.12	0.25	0.43	0.19
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)		(0.01)	0.03	(0.03)	(0.01)
Fish	0.97	0.15	0.03	0.04	0.05	0.17	0.19		0.04	0.11	0.14
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)		(0.01)	(0.02)	(0.02)
Beverages	0.64	0.35	0.54	0.10	0.23	−0.02	0.26	0.02		−0.24	0.47
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.010		(0.02)	(0.01)
Ofood	0.61	0.07	−0.08	0.04	0.02	0.15	0.32	0.05	−0.17		0.14
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)		(0.01)
Nfood	1.36	0.06	0.05	0.02	0.02	0.07	0.08	0.04	0.18	0.07	
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	

Figures in parentheses are the standard error. Row headings denote a particular commodity's own price, while column headings denote the quantity demanded of the said commodity.
Source: Own calculation.

Table 6. Price shock and budget share response.

	Post-Harvest Price (P)			Budget share (w)			
Commodities	2011	2016	ΔP/P (2011–16)	2011	2016	Δw/year	$\hat{w}$(2021)
Rice	192.8	258.86	29.50%	6.70%	5.80%	−0.18%	4.90%
Wheat	147.81	253.79	54.10%	4.80%	3.90%	−0.18%	3.00%
O-Cereals	88.69	103.12	15.10%	2.90%	2.90%	0.00%	2.90%
Pulses	172.61	237.88	32.10%	4.10%	3.80%	−0.06%	3.50%
Tubers	118.91	140.52	16.70%	9.70%	8.30%	−0.28%	6.90%
Meats	514.59	589.47	13.60%	11.70%	10.30%	−0.28%	8.90%
Fish	829.83	881.57	6.00%	7.40%	6.20%	−0.24%	5.00%
Beverages	633.35	691.24	8.70%	7.10%	13.70%	1.32%	20.30%
O-Foods	149.58	171.13	13.50%	17.50%	13.10%	−0.88%	8.70%
Non-Food	120.24	196.62	49.20%	28.10%	32.00%	0.78%	35.90%

Source: Authors' calculations.

11. Effects of escalating prices on budget shares

The effect of percentage change in price on budgetary allocation (Table 6) of various food and non-food commodity groups over the post-harvest periods of five years (2011–2016) presents a number of striking features with huge implications on nutritional quality in the farm households. First, the percentage change in price across the various food and non-food commodity groups resulted in the loss of purchasing power with the exception of commodity groups such as other cereals, beverages and non-food. This shows clearly that the main effect of these spikes will be to reduce the dietary quality of the people. The households tend to spend more on the aforementioned food items, thus sacrificing nutritional quality for beverages, non-food and other cereals.

Despite the high percentage price change (49.2%), the change in budget share per year to the tune of 0.78% is still allocated to non-food commodities, including health care, body care, energy, transportation, and telecommunication, among others. This suggests that non-food items are price elastic and the general increase in commodity prices over the period seem to cause farm households to sacrifice some food consumption for non-food items perhaps in an attempt to live with increased cost of non-food necessities. One possible explanation may be increased pressure to spend more on healthcare services (hospitals, drugs, etc.) as nutritional quality of food consumption is impaired by escalating food prices.

With respect to other cereals and beverages, the purchasing power for other cereals (maize, millets, sorghum, barley, and oats) remains unchanged while that of beverages (including carbonated drinks, alcohols and other beverages) increased by 1.32%. This is understandable as beverages are relatively cheaper, while the likely explanation for that of other cereals might be because of the locally made and staple nature of this food item, which constitutes a dominant portion of a standard diet for a given household.

If the linear trend (change in budget share per year) is assumed, the estimated budget share across the various food and non-food commodity groups are shown in Table 6 with non-food, beverages, meats, tubers taking the highest budgetary allocation.

12. Income, substitution and welfare effects of escalating prices on losers

Table 7 shows the income, substitution, and welfare effects of escalating prices on losers. Focusing on the welfare effect expressed as a percentage of annual expenditure, an average farm household in Nigeria recorded a welfare gain of 22.2% of household expenditure. Escalating prices result in a welfare loss of about 0.49% of the household expenditure for rice, the loss is a bit lower for wheat (0.35%) and much higher for pulses (1.24%). Similarly, the farmers are losing about 1.36% of household expenditure for other foods, 0.92% for tubers and 5% for non-food respectively. The commodities that suffers the highest welfare loss to the households are non-food (5.0%) and pulses (1.24%) with fish having the lowest purchasing power. For wheat and non-food, all the farm households lose, while the majority lose for commodities such as rice (97%), pulses (99.5%), tuber (97.7%) and O-food (95%). An average household is losing about 9.07% of its household budget to escalating prices across all commodity groups. Similarly, the loss to the real income will be 1.66% for pulses, 1.82% for tuber, 2.30% for O-food and 5.96% for non-food respectively. Rising prices seem to benefit average farm households more though; the benefits were enjoyed by just a few. The majority suffer welfare losses (70.1%) particularly the net consumers and households that were not involved in crops and/or livestock production.

13. Effects of escalating prices on various categories of losers

Table 8 shows the distribution of households that suffer welfare losses across various socio-economic groups. Overall, 70.1% of the households suffered welfare loss that amounted to an average of 7.52% of the household budget in the year because of changes in real prices of food and non-food commodities over the period. The incidence of welfare losses due to real price changes does not vary much across the age category and

Table 7. Price escalation for various food commodities.

		Average Household				Losers				
Commodity	Price Change	Direct effect	Subst. effect	Welfare effect	WE%	Loser%	Direct effect	Subst. effect	Welfare effect	WE%
Rice	0.15	3,477.92	−382.69	3,095.22	0.49%	97.0%	5,225.32	−384.23	4,841.09	0.92%
Wheat	0.10	2,350.63	−121.58	2,229.05	0.35%	100.0%	2,350.63	−121.58	2,229.05	0.42%
Cereals	0.32	−106,617.60	−784.47	−107,402.07	−17.1%	76.4%	4,963.28	−782.60	4,180.68	0.79%
Pulses	0.27	9,010.10	−1196.60	7,813.50	1.24%	99.5%	9,937.10	−1,195.63	8,741.47	1.66%
Tuber	0.20	7,697.66	−1943.32	5,754.35	0.92%	97.7%	11,550.07	−1,944.74	9,605.33	1.82%
Meat	0.07	−2,996.41	−99.34	−3,095.74	−0.49%	86.5%	3,400.79	−101.22	3,299.57	0.63%
Fish	0.04	−466.38	−15.58	−481.96	−0.08%	87.8%	825.86	−15.72	810.13	0.15%
Beverage	0.08	−58,615.93	−185.10	−58,801.02	−9.36%	64.2%	4,697.78	−190.85	4,506.93	0.85%
O-Food	0.17	9,081.54	−539.64	8,541.89	1.36%	95.0%	12,657.46	−541.15	12,116.31	2.30%
Non- Food	0.22	33,373.01	−1983.44	31,389.58	5.00%	100%	33,373.0102	−1983.4352	31,389.575	5.96%
All Commodities		−137,078.46	−2325.42	−139,403.89	−22.2%	70.1%	50,195.07	−2,334.55	47,860.52	9.07%

Authors' calculations.

Table 8. Price shocks and the response on compensating variation among losers.

Description	Average Budget Size, M	Mean CV (% of M)	Mean CV (N/year)	Std. Error	% Losers
Losers	636,729.58	7.52%	47,860.52	239.38	70.10%
Age Category					
Youth	622,082.10	7.62%	47,426.78	487.66	71.20%
Middle age	641,081.58	7.48%	47,965.75	356.21	69.50%
Elderly	642,561.73	7.48%	48,051.16	425.17	70.20%
Household Type					
Male-headed	632,773.46	7.58%	47,989.38	267.37	70.00%
Female-headed	655,442.67	7.21%	47,235.40	528.48	70.40%
Location					
North Central	540,512.84	8.84%	47,793.14	572.18	64.70%
Northeast	731,987.00	6.28%	45,978.41	805.18	48.30%
Northwest	705,369.77	6.86%	48,410.16	676.23	45.00%
Southeast	724,225.30	5.79%	41,947.32	484.29	82.90%
South South	704,727.85	7.56%	53,282.15	636.28	92.70%
Southwest	500,617.83	9.79%	49,011.87	400.43	87.80%
Production Category					
Not farmers	624,892.73	8.81%	55,030.10	267.78	100.00%
Net consumers	661,013.38	5.80%	38,334.77	369.12	88.40%
Net producers	650,331.50	1.51%	9,796.86	542.44	6.00%

Source: Authors' calculations.

by household type (female-headed – 70.4% and male-headed – 70.0%). Considering the household type, household uniformly feels the effect of price hike on agricultural food and non-food commodities. Under the production category, the incidence of welfare loss due to real price changes among the net consumers and net buyers was 88.40% and 6.0%, respectively, while those households that are not farmers are losing 100%.

Further evidence (Table 8) on the distribution of households that suffered welfare losses disaggregated by location shows that households in the Southern part of the country are losing between 82.90%–92.70% while their counterparts in the northern parts are losing between 45%–64.70%. The incidence of welfare losses is generally higher among the households in the southern part of the country as against their northern counterparts.

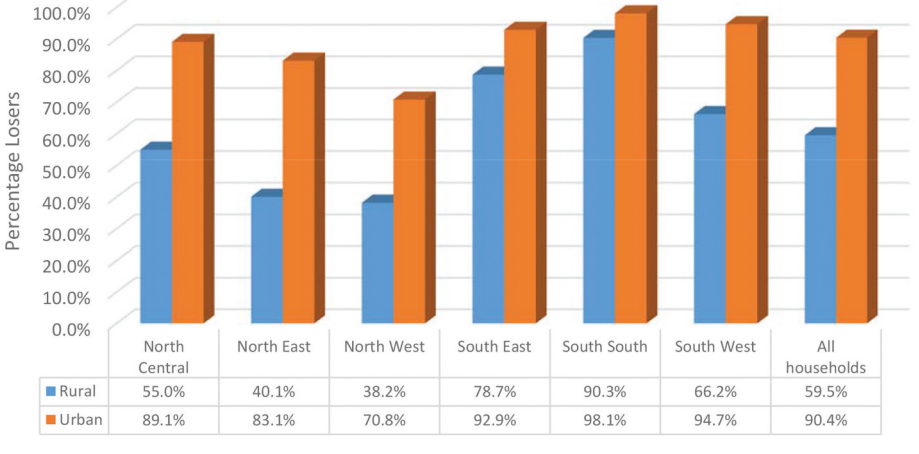

Figure 3. Distribution of losers across the geopolitical zones.

As shown in Figure 3, for all households and across the geopolitical zones, the percentage of farm households that are losing because of price changes in commodity groups is higher in the urban sector than in the rural sector. Generally, farm households in urban areas are net buyers when compared to their counterparts in rural areas. The majority of the households in the rural sector produce their own food while in the urban sector, the households produce marginally.

14. Conclusion and policy implications

The study aimed at analysing the effect of rising food prices on household food demand patterns. The three waves of the GHS survey of 2010/2011, 2012/2013, and 2015/2016 data set that consisted of 17,539 observations were aggregated and utilized for the demand equation. We used QUAIDS model to analyse the effect of rising food prices and household demographic variables on household food demand, while the welfare effects were assessed by examining the effects on the household net expenditure. Evidence from the study shows that other cereals, pulses, fish, beverages and other food are necessities, while rice, wheat, tubers, and meat are luxuries. This suggests that the latter are more responsive to income shocks, which is a typical reflection of a food insecurity situation in Nigeria. Empirical evidence with respect to welfare effects shows that an average farm household in Nigeria recorded a welfare gain of 22.2% of a household expenditure. Escalating prices result in a welfare loss of household expenditure on commodity groups such as rice, wheat, pulses, tuber, other food, and non-food. Overall, 70.1% of the households suffered welfare loss that amounted to an average of 7.52% of the household budget annually.

The policy implications from this study are as follows:

(1) Government and relevant agencies should intensify the promotion of crop and livelihood diversification among the net consuming households and households that were not involved in crops and/or livestock production. This serves as a cushion effect to rising food prices on their welfare status as well as to increase the demand for (and production of) locally produced commodities. This policy action will improve the food and nutritional security of the farm households in the end.
(2) An average household loses about 9.07% of his household budget to escalating prices, and hence, government policy that will compensate farmers in terms of percentage of real income that was lost whenever there is a welfare loss (as a result of price escalation) should be formulated and implemented.

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Declaration of Interest Statement

The authors declare that there is no potential conflict of interest.

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