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Impact of Food Prices on the Welfare of Rural Households in South-Eastern Nigeria

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ABSTRACT

Understanding how food consumers in Nigeria change their food consumption when prices change is not enough without the attendant welfare implications, given that consumers have different cultural backgrounds, socio-economic status, lifestyles, different behaviours and needs. This study assessed the impact of food prices on the welfare of rural households in south-eastern Nigeria. Specifically, the study estimated a complete demand function for commonly consumed food items, estimated the compensated price and income elasticities of demand, and examined the change in welfare of rural household consumers with respect to change in prices of commodities in the study area. A three-stage stratified sampling procedure was used to obtain 682 rural household food consumers. Data collected were analyzed using the Linear Expenditure System (LES) of the point-wise separable Stone-Geary utility function. The results showed that all food commodities are normal, non-Giffen, own-price inelastic and gross complements with weak substitutability, and a corresponding loss in welfare as measured by the compensation variation (CV) and equivalent variation (EV). A counterfactual 10% increase in the price of commodities in the region would lead to welfare loss of between 9.56% and 14.13% of initial food expenditure. Increase in price of food commodities impacts on the subsistence level of household food consumers, particularly on their welfare, in South-eastern Nigeria. Policies should be targeted at reducing such welfare impact and the attendant consequences on households, particularly the low-income earners.

Key words: price, food, elasticity, welfare, consumer

INTRODUCTION

Rural population in Nigeria, as in other parts of the world, is disproportionately affected by poverty, relatively considerably poorer than their urban counterpart (Bussolo, et al., 2009; Robles and Torero, 2010) and are perceived to be particularly vulnerable to external shocks, such as the increases in food prices given their income (Drewnowski and Specter, 2004; Drewnowski and Darmon, 2005; Champagne *et al.*, 2007; Deshmukh-Taskar *et al*., 2007; Darmon and Drewnowski, 2008; Kirkpatrick and Tarasuk, 2008; Gilbert and Morgan, 2010; Huchet-Bourdon, 2011; Kuwornu *et al*., 2011). Since the rapid rise in food prices between 2005 and the first half of 2008, some studies have explored the food habits of specific regions *vis-à-vis* commodities prices on poverty (Desilets *et al*., 2007; Pettinger *et al*., 2006) with little emphasis on the welfare implication. However, De Hoyos and Medvedev (2009*)* showed the vulnerabilities of poor consumers to higher prices of agricultural commodities while such studies on welfare are few and far-between in south-eastern Nigeria. The south-eastern part of Nigeria is noted for its dependence on agriculture and its diverse socio-economic status with high incidence of poverty (76.8%), high difficulty in satisfying household needs of 25.7% in food, 23.8% in school fees, 17.7% utility bills and 25.5% in health care, and high level of orphan-hood (0.8) when compared with 18.7%, 21.1%, 4.7%, 8.7%, 25.0% and 0.6 respectively in south-southern Nigeria (National Bureau of Statistics, NBS, 2011). The average monthly income in the states is between ₦5000 and ₦20000 with poverty incidence of 52.1% in Abia, 45% in Anambra and 50.1% in Imo State, while household expenditure on food are 52.43% in Abia, 51.73% in Anambra and 55.58% in Imo State respectively (National Bureau of Statistics, NBS, 2011). To rely on economic theory is of little help in predicting the quantitative magnitudes of consumer reactions to the current rise in food prices in Nigeria, more so that there is no easy translation into monetary measure for the abstract change in utility.

This study, therefore, examined the impact of food prices on the welfare of rural household consumers of food in south-eastern Nigeria. The study not only updates the earlier demand studies beyond estimates of price and

expenditure elasticities (De Hoyos and Medvedev, 2009; Ivanic and Martin, 2008) and effects of price and income change on poverty (Chávez Martín del Campo, *et al*., 2008; Valero-Gil and Valero, 2008) of different food commodities in other parts of the world, but also the welfare implications for the rural households in Nigeria using transversal data, providing methodological insights best suited in countries where data limitations are the norm. To achieve this, the study estimated the complete demand function for commonly consumed food items, price and income elasticities of demand, and examined the change in welfare of rural household consumers with respect to change in prices of commodities in the region.

MATERIALS AND METHODS

The study was carried out in Abia, Anambra and Imo states in south-eastern zone of Nigeria. Administratively, the three States are divided into 65 Local Government Areas (LGAs) with 17 in Abia, 21 in Anambra and 27 in Imo State. According to the National Population Commission, (NPC) (2006), the three States has a population of 10 950 771 persons, representing 14.61% of the nation's population. The target population for the study was the set of households that consume the common food items in the study area from April 2015 and May 2016.

A three-stage stratified sampling procedure was used to select households in the three States. The first stage involved a simple random sampling of 3 Local Government Areas (LGAs) from each State. The LGAs were Isuikwuato in Abia State, Ihiala in Anambra State, and Ikeduru in Imo State. The second stage involved a simple random sampling of 2 communities in each LGA from a sampling frame of communities in the respective LGAs. The communities were Imenyi and Ohaise in Isuikwuato LGA of Abia State, Umueze and Ikenga in ihiala LGA of Anambra State, and Akabo and Okwu in Ikeduru LGA of Imo State. In a pilot survey, participants were asked to name the foods frequently served/consumed in their homes. Based on the responses, a list of ten foods commonly served/consumed was generated. If 7 or more in 10 participants reported having been served/consumed a particular food, the food item was selected to be used in the final questionnaire. The sample size for each community was determined using estimate of the income variance for the different communities, a 95% confidence interval and a 0.03 margin of error, using the sample size estimator given as:

$$n_i = \frac{z^2_{\alpha/2} s_i^2}{e^2 + \frac{z^2_{\alpha/2} s_i^2}{N_i}} \quad [1]$$

where $z_{0.025} = 1.96$, s_i^2 is the income variance of the i^{th} community, N_i is the target population of the i^{th} community and $e = 0.03$. A simple random sample of households in each community was then taken from the list of the target population in the region developed during the pilot survey. The sample size were respectively 112 in Imenyi and 96 in Ohaise in Isuikwuato LGA of Abia State, 204 in Umueze and 156 in Ikenga in ihiala LGA of Anambra State, and 184 in Akabo and 168 in Okwu in Ikeduru LGA of Imo State making up a total of 208 in Abia state, 360 in Anambra state and 352 households in Imo state. 970 copies of questionnaire were administered but only 725 copies of questionnaire were retrieved from the respondents making a response rate of 75% while 682 copies of questionnaire were valid for analysis. The final food items considered for analysis were those found to be common in the consumption basket of most households for which the households indicated had experienced rapid price increase for the year 2015-2016.

The price of a food commodity was measured as the sum of the transactions costs incurred by a household and the market prices while the quantity consumed of a food item by a household was the sum of the consumed from farm produce and the purchased from market. The expenditure on farm produce food commodity consumed was measured as the cost of total consumption at current market price. The total expenditure was measured as the aggregate of expenditure on all 6 food items consumed by a household.

The complete demand functions for food items by households were estimated using the Linear Expenditure System (LES), derived from the point-wise separable Stone-Geary utility function which is given in its generic form as:

$$u = \sum_{i=1}^{n} b_i ln(q_i - c_i) \text{ for } \begin{cases} 0 < b_i < 1 \\ \sum_i b_i = 1 \\ q_i - c_i > 0 \end{cases} \quad [2]$$

where the c_i are the minimum subsistence or "committed" quantities below which consumption cannot fall. The demand functions constitute the LES derived from maximization of the Stone-Geary utility function under a budget constraint given as:

$$q_i = c_i + b_i\left(y - \sum_j c_j p_i\right), \; i = 1, \ldots, n \quad [3]$$

where the b_i are the marginal budget shares, $\frac{\partial pq}{\partial y}$, which tell how expenditure on each commodity changes as income changes, q_i are the quantities consumed of each commodity and the p_i are the unit price of the respective commodities, $\sum_j c_j p_i$ is the subsistence expenditure while the term, $y - \sum_j c_j p_i$, is the "uncommitted" or "supernumerary" income which is spent in fixed proportions, b_i, between the commodities. The Full Information–Maximum Likelihood (FIML) technique was used to obtain the parameters of the demand system.

The compensated own-price elasticities, E_{ii}, compensated cross-price elasticities, E_{ij}, and expenditure elasticity, η_i were computed respectively using:

$$E_{ii} = -1 + \frac{c_i}{q_i}(1 - b_i) \quad [4]$$

$$E_{ij} = -\frac{b_i c_j p_j}{p_i q_j} \quad [5]$$

$$\eta_i = \frac{b_i y}{p_i q_i} \quad [6]$$

The food commodities were then categorised according to the signs and magnitudes of the elasticities as normal good with $\eta_i > 0$ ($\eta_i > 1$ luxury; $0 < \eta_i < 1$ necessity) neutral good with $\eta_i = 0$ and inferior good with $\eta_i < 0$ with respect to the income elasticity, non-Giffen good with $E_{ii} < 0$ ($E_{ii} < -1$ elastic; $E_{ii} > -1$ inelastic) and Giffen good with $E_{ii} > 0$ with respect to the own-price elasticity, and gross substitutes with $E_{ij} > 0$ and gross complements $E_{ij} < 0$ with respect to the cross-price elasticity. The variances of the elasticities were estimated using the *delta method* for hypothesis testing and confidence interval estimation.

The welfare effects of price were examined from a counterfactual change in food prices in terms of the compensating variation (CV) and equivalent variation (EV), and estimated respectively by:

$$CV = e(\boldsymbol{P^1}, V^0) - e(\boldsymbol{P^0}, V^0) \quad [7]$$

$$EV = e(\boldsymbol{P^0}, V^0) - e(\boldsymbol{P^0}, V^1) \quad [8]$$

Where $e(\boldsymbol{P^0}, V^0)$ is the expenditure needed to achieve a maximum utility level, V^0 with the price vector**,** $\boldsymbol{P^0}$, $e(\boldsymbol{P^0}, V^1)$ is the expenditure a maximum utility level, V^1, with the initial price vector, $\boldsymbol{P^0}$ and $e(\boldsymbol{P^1}, V^0)$ is the expenditure needed to achieve the same utility level, V^0, with price vector, $\boldsymbol{P^1}$. The maximum utility and expenditure were estimated as:

$$U = V = (y - \sum_{k=1}^{6} c_k p_k) \frac{\prod_{i=1}^{6} {b_i}^{b_i}}{\prod_{k=1}^{6} {p_k}^{b_k}} \quad [9]$$

$$e = \sum_{k=1}^{6} c_k p_k + V \frac{\prod_{1}^{6} {b_i}^{b_i}}{\prod_{1}^{6} {b_i}^{b_i}} \quad [10]$$

This analysis proceeded from the assumption that food consumers are rational, and logically weigh alternative ways to improve their welfare before choosing the one that uses the fewest resources. The study used the two-stage budgeting approach which has found wide application within the empirical literature (Shiptsova, *et al*., 2004; Jabarin, 2005; Menezes, Azzoni, *et al*., 2008).

RESULTS AND DISCUSSION

The summary statistics of the variables are presented in Table 1. The results showed that the unit price of beans was highest (₦243.80 ± 5.45) among the commonly consumed food items, followed by that of rice (₦206.23 ± 3.31) and least with *akpu* (₦70.07 ± 8.83). However, the variability measure was highest with *akpu* (11.89%) and least with plantain (0.83%). The results also showed that the average expenditure on food items in the area was ₦1685.82 ± 68.29 with a variation of 4.05%. This may be attributed to the relatively stable conditions of supply and demand as opined by Food and Agriculture Organisation, FAO, (2008), Christiaensen, (2009), Gilbert, (2010) and Ojogho and Egware, (2015). The low variation of 4.05% of average food expenditure imply that food consumers in the area have about the same food expenditure on commonly consumed food items in the region.

Table 2 shows the results of the LES demand system parameter estimation of the commonly consumed food commodities in the area. The results showed that all parameters were significant at p-value less than 0.0005 at the most and a probability of rejection error of 0.01. The per *capita* minimum subsistence levels of *akpu,* beans, cocoyam, *garri,* plantain and rice require by the consumers were 2.95Kg, 1.03Kg, 1.11Kg, 1.13Kg, 1.41Kg and 1.35Kg per week respectively. That the per *capita* minimum subsistence levels for the food commodities, determined empirically, were positive implies that the food commodities expenditure, at subsistence level, takes a positive share from the income of households, suggesting that they are the main staple food consumed by the households, especially by the poorest quintiles. The marginal budget shares of the food commodities were all non-negative with respectively values of 0.15, 0.04, 0.17, 0.06, 0.34 and 0.25 for *akpu,* beans, cocoyam, *garri,* plantain and rice at committed expenditure of ₦206.71, ₦242.08, ₦127.68, ₦127.64, ₦185.72, and ₦278.62 respectively with the respective estimated amount spent on the respective food commodities in the region, on average, as ₦284.32, ₦262.77, ₦210.42, ₦158.68, ₦361.63 and ₦407.95. That the marginal budget shares of the food commodities were all non-negative implies that the budget share on food commodities is increasing with increase in expenditure on food consumed and increase in consumer income. The total cost of subsistence amounts to ₦1168.45 with ₦517.37 as "supernumerary expenditure" spent in fixed amount of ₦77.61, ₦20.69, ₦82.78, ₦31.04, ₦175.91 and ₦129.34 among the food commodities.

The *supernumerary* income of the food consumers spent was in fixed proportions of 15%, 4%, 16%, 6%, 34% and 25% among the food commodities while expenditure on them change by ₦0.15, ₦0.04, ₦0.17, ₦0.06, ₦0.34 and ₦0.25 respectively with ₦1.00 change in income of consumers. However, the change in plantain budget share with ₦1.00 change in income was highest (0.34), followed by rice (0.25) and least with beans (0.04). The change in budget share with ₦1.00 change in expenditure was highest (0.34) for plantain, followed by rice (0.25) and least with beans (0.04). This is in agreement with the

findings of Chávez Martín del Campo, *et al*., (2008). McKenzie (2006) demonstrated that mean expenditure shares on food reacted more than expected under Engel's law to price changes. The result is also in line with Hossain and McGregor (2011) that reported that household responses to the food price shock included spending a larger share on food, changing food shopping habits by buying smaller quantities more often and from cheaper sources.

The price and expenditure elasticities of commonly consumed food commodities are presented in Table 3. The results showed that the expenditure elasticities for the food commodities are all statistically significant and positive. The statistically significant positive expenditure elasticities for the food commodities imply that all 6 food commodities are normal goods. This is easily explained by the fact that they are the main staple food consumed by the households, especially by the poorest quintiles in south-eastern Nigeria. The expenditure elasticities of cocoyam (1.11), plantain (1.61) and rice (1.05) were greater than 1 while the expenditure elasticities of *akpu* (0.84)*,* beans (0.21), and *garri,* (0.62) were less than 1. These results imply that cocoyam, plantain and rice are luxury food commodities in south-eastern Nigeria, are possibly consumed only on special occasions, are highly preferred food commodities in the consumer's budget, and their consumption is fairly sensitive to changes in income while *akpu,* beans and *garri* are necessities. The implication is that as the income of these food consumers increases, they would likely trade quantity for quality in the case of *akpu,* beans and *garri* and thus substitute more away from

Table 1: Descriptive statistics of variables

Variable	Mean	Median	Max.	Min.
Quantity of *garri* (Kg)	1.354 ± 0.06	1.350	2.700	0.400
Quantity of cocoyam (Kg)	2.242 ± 0.14	2.000	4.000	0.300
Quantity of a*kpu* (Kg)	4.320 ± 0.21	3.250	12.400	0.600
Quantity of rice (Kg)	1.976 ± 0.08	2.000	4.000	0.500
Quantity of beans (Kg)	1.131 ± 0.09	1.000	8.000	0.400
Quantity of plantain (Kg)	2.671 ± 0.15	2.100	5.900	0.800
Price of *garri* (₦)	112.96 ± 5.84	100.00	487.50	50.00
Unit price of cocoyam (₦)	114.82 ± 3.89	100.00	200.00	50.00
Unit price *akpu* (₦)	70.07 ± 8.33	58.53	806.45	28.57
Unit price of rice (₦)	206.23 ± 3.31	200.00	325.00	133.33
Unit price of plantain (₦)	131.53 ± 1.09	125.00	187.50	125.00
Unit price of beans (₦)	243.80 ± 5.45	250.00	500.00	14.00
Income Y(₦)	1685.82 ± 68.29	1645.00	4250.00	510.00

Source: Author's calculation, 2016

Table 2: Parameter estimates of the LES demand system

Parameters	Food items					
	Akpu	**Beans**	***Cocoyam***	***Garri***	**Plantain**	**Rice**
b_i	0.150***	0.035***	0.170***	0.056***	0.336***	0.253***
	(0.027)	(0.009)	(0.026)	(0.014)	(0.044)	(0.035)
	[5.509]	[3.762]	[6.426]	[4.112]	[7.585]	[7.322]
c_i	2.950***	1.031***	1.112***	1.130***	1.412**	1.351***
	(0.554)	(0.095)	(0.287)	(0.128)	(0.666)	(0.284)
	[5.325]	[10.858]	[3.881]	[8.809]	[2.119]	[4.756]

Source: Author's calculation, 2016; *** Significant at P-value < 0.0005, **significant at P-value < 0.02, values in parentheses are standard errors, values in square brackets are t-values.

Table 3: Price and Income Elasticities of Food Commodities Demand

	Akpu	Beans	Cocoyam	*Garri*	Plantain	Rice	η_i
Akpu	-0.420***	-0.476***	-0.122	-0.202***	-0.149***	-0.302***	0.835***
	(0.014)	(0.031)	(0.166)	(0.0002)	(0.0001)	(0.060)	(0.016)
	[-30.026]	[-15.134]	[-0.736]	[-968.757]	[-101.056]	[-5.050]	[52.810]
Beans		-0.120***	-0.008	-0.014***	-0.010	-0.020	0.214***
		(0.009)	(0.007)	(0.006)	(0.02)	(0.017)	(0.006)
		[-13.757]	[-1.085]	[-2.452]	[-0.506]	[-1.167]	[37.475]
Cocoyam			-0.588***	-0.140***	-0.103***	-0.209***	1.113***
			(0.011)	(0.011)	(0.042)	(0.036)	(0.018)
			[-51.485]	[-12.803]	[-2.447]	[-5.739]	[62.689]
Garri				-0.212***	-0.034	-0.070*	0.617***
				(0.010)	(0.043)	(0.037)	(0.016)
				[-21.434]	[-0.796]	[-1.891]	[38.200]
Plantain					-0.649***	-0.360***	1.612***
					(0.019)	(0.032)	(0.022)
					[-34.267]	[-11.322]	[72.887]
Rice						-0.489***	1.047***
						(0.012)	(0.015)
						[-39.640]	[69.300]

Source: Author's calculation, 2016; *** significant at P-value < 0.0005, **significant at P-value < 0.0005, **significant at 10% level, values in parentheses are standard errors, values in square brackets are t-values

Table 4: Estimates of the demand system and welfare impact

Food item	$\boldsymbol{B_0}$ **(Kg)**	$\boldsymbol{B_1}$ **(Kg)**	$\left(\frac{\boldsymbol{B_1 - B_0}}{\boldsymbol{B_0}}\right)\mathbf{100}$	**Welfare Impact of Price change**						
				V^0	V^1	$e(P^0, U^0)$	$e(P^0, U^1)$	$e(P^1, U^0)$	CV	EV
Akpu	4.320	3.899	-9.76	0.79	0.75	1685.82	1665.31	1706.46	20.65	20.50
Beans	1.131	1.094	-3.27	0.79	0.75	1685.82	1662.52	1710.97	21.15	23.30
Cocoyam	2.242	1.779	-20.66	0.79	0.76	1685.82	1672.50	1698.56	12.74	13.31
Garri	1.354	1.353	-0.06	0.79	0.77	1685.82	1674.48	1698.55	12.73	11.33
Plantain	2.671	2.548	-4.67	0.79	0.74	1685.82	1668.40	1704.46	18.64	17.42
Rice	1.976	1.887	-4.50	0.79	0.73	1685.82	1656.68	1713.66	27.84	29.14
Total				0.79	0.60	1685.82	1605.96	1804.30	118.49	79.86

calories towards non-nutrient characteristics of foods such as taste and variety while rice cocoyam and plantain are possibly not affordable to the poorest of the poor. This would significantly decrease the price elasticity of calorie than the price elasticity of *akpu,* beans and *garri*. As expected, the model yields negative own price elasticities for all commodities but greater than -1 with plantain having the highest absolute value. Consequently, their demand is relatively inelastic, implying that a rise in prices will lead to a comparatively weak decline in consumption. These are consistent with the results of income elasticities. Similarly, the cross-price elasticities of the food commodities are negative, implying that they are gross complements, dependent and that the income effects are stronger than the substitution effects. This is in agreement with Mittal (2010). The price elasticities were relatively low among the households. This may suggest that it may be difficult to substitute since the results on cross price effects between all pairs of commodities illustrate weak substitutability.

The committed expenditure for the 6 food commodities is significantly higher than zero while the expenditure on the commodities exceeds the committed level. This reflects that not only are the food commodities basic needs for every household but that there is a welfare gain from purchasing each food commodity.

Table 4 shows the welfare sensitivity analysis of a counterfactual 10% increase in the prices of the food commodities. The results showed a per *capita* base consumption per week of 4.32Kg for *akpu,* followed by plantain (2.67Kg) and least with beans (1.13Kg). However, these quantities decreased after a counterfactual 10% increase in own-price to 3.90Kg, 2.55Kg and 1.09Kg for *akpu,* plantain and beans respectively, representing 9.76%, 4.67% and 3.27% decrease respectively. The compensation variations for *akpu,* plantain and beans were respectively ₦20.65, ₦18.64, and ₦21.15 while the equivalent variations were respectively ₦20.50, ₦17.42 and ₦23.30 of initial expenditure of ₦1685.82. The consumer of rice (₦29.14) and beans (₦23.30) had a greater welfare loss in the region than consumers of other food commodities with a welfare loss of between 9.56% and 14.13% of initial expenditure on these commodities. These results of welfare impact showed that increase in price of a consumer commodities basket means more expenditure. These results are in agreement with Jacoby (2013), Van Campenhout, *et al*., (2013), Minot and Goletti (2000) and McKay and Tarp (2014). This is against the well-known stylized fact that most of these poor households depend on agriculture for their livelihoods. It indicates that many of the poorest households in the area are actually net buyers of staple foods. Households may adjust by switching from cheaper and often less preferred quality staples to protect energy intake as suggested by Ruel*, et al*., (2010). This, however, may be difficult since the results on cross price effects between all pairs of commodities illustrates weak substitutability, leaving them with little room to substitute in an effort to mitigate the nutritional impacts of price changes (Jensen and Miller, 2008). Thus, except compensated, these households would be spending a larger portion of their budget on food with a rise in price, particularly as the food items are for subsistence. The overall compensation and equivalent variations were respectively ₦79.36 and ₦118.48 or 4.74% and 7.03% of initial expenditure of ₦1685.82. Food commodities consumers would need to be given ₦118.48 of additional income to allow for a 10% increase in a vector of consumed food prices so as to make them as well-off as they were before the price increase. This means that the consumers would be just as well-off as they would be, facing the 10% prices increase and having an income of ₦1804.30 instead of ₦1685.82. Alternatively, the consumers would rather give-up ₦79.36 to prevent a 10% increase in a vector of food prices so as to leave them as well-off as they would be after the 10% price increase. This means that the consumers would be just as well-off as they would be with an income of ₦1605.96 rather than face the 10% increase in a vector of food prices.

CONCLUSION AND RECOMMENDATION

This study reveals certain systematic tendencies in consumer behavior in South-eastern Nigeria from the year 2015 to 2016. Evidence from the region micro-level budget data suggests that the so-called subsistence parameters are positive for all commodities implying that all commodities are price inelastic. Given the pattern of demand, the consumption on the food commodity will be declining over time; hence higher quality of these goods produced and supplied at home would entail smaller imports of these goods. The relative low price elasticities of the food commodities also indicate that price interventions for these products can have a less significant impact on their consumption, at least in the short run. So it is very important for policymakers to consider the effects of price and subsidy policies on these goods. Increase in price of food commodities can have bad toll on the subsistence level of food consumers, particularly on their welfare, in South-eastern Nigeria. Policies should be targeted at reducing such welfare impact and the attendant consequences on households, particularly the low-income earners.

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