

Adekunle, C. P.; Akinbode, Sakiru Oladele; Shittu, Adebayo Musediku; Momoh, S.

Article

Food price changes and farm households' welfare in Nigeria: Direct and indirect approach

Journal of Applied Economics

Provided in Cooperation with:

University of CEMA, Buenos Aires

Suggested Citation: Adekunle, C. P.; Akinbode, Sakiru Oladele; Shittu, Adebayo Musediku; Momoh, S. (2020) : Food price changes and farm households' welfare in Nigeria: Direct and indirect approach, Journal of Applied Economics, ISSN 1667-6726, Taylor & Francis, Abingdon, Vol. 23, Iss. 1, pp. 409-425,
<https://doi.org/10.1080/15140326.2020.1743103>

This Version is available at:

<https://hdl.handle.net/10419/314099>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>



Food price changes and farm households' welfare in Nigeria: direct and indirect approach

C.P. Adekunle, S.O. Akinbode, A.M. Shittu & S. Momoh

To cite this article: C.P. Adekunle, S.O. Akinbode, A.M. Shittu & S. Momoh (2020) Food price changes and farm households' welfare in Nigeria: direct and indirect approach, *Journal of Applied Economics*, 23:1, 409-425, DOI: [10.1080/15140326.2020.1743103](https://doi.org/10.1080/15140326.2020.1743103)

To link to this article: <https://doi.org/10.1080/15140326.2020.1743103>



© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 07 Jul 2020.



Submit your article to this journal [↗](#)



Article views: 5697



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 3 View citing articles [↗](#)

RESEARCH ARTICLE



Food price changes and farm households' welfare in Nigeria: direct and indirect approach

C.P. Adekunle^a, S.O. Akinbode^b, A.M. Shittu^c and S. Momoh^a

^aDepartment of Agricultural Economics and Farm Management, Federal University of Agriculture, Abeokuta, Nigeria; ^bDepartment of Economics, Federal University of Agriculture, Abeokuta, Nigeria; ^cDepartment of Agricultural Economics, Landmark University, Omo-Aran, Nigeria

ABSTRACT

This paper analyzed the welfare effects of price changes over categories of farm households in Nigeria taking into consideration the dual role of farm households as both consumer and producer of food between 2010–2016. This study attempts to shed some light on the differences between the direct approach and indirect. Estimated Compensating Variation reveals that 79.0% of farm households were net food buyers and suffered welfare loss (mean = 2.98) with the mean expenditure of N529, 397.5 per annum while 21.0% were net food sellers and enjoyed welfare gain (mean = -1.66) with the mean expenditure of N513, 755.7 per annum. Cereal was identified as food for which the households were most vulnerable to price shocks. When adjustments are allowed, households can adapt their consumption and production patterns resulting in lower deteriorations in welfare with significant differences across quintiles. Therefore, efforts to mitigate extreme price spikes are relevant for improved overall household welfare.

ARTICLE HISTORY

Received 26 October 2019
Accepted 11 March 2020

KEYWORDS

Food prices; demand elasticities; supply elasticities; welfare; Nigeria

1. Introduction

In the last decade, the world prices of many staple food commodities have increased impressively, experiencing large spikes in three circumstances and raising widespread concern about the potential impacts on households' welfare in poor countries. In 2007–2008, the World Bank Food Price Index rose by 60 percent in few months; after a significant decrease in 2008–2010, the World Bank Food Price Index increased sharply reaching its 2008 peak in early 2011. Then, in mid-2012 the World Bank Food Price Index exceeded its 2008 and 2011 peaks (World Bank, 2014).

Empirical studies have shown that the welfare implications of high food prices are not straightforward (Arndt, Benfica, Maximiano, Nucifora, & Thurlow, 2008; Arndt, Hussain, Salvucci, & Lars Peter Østerda, 2016; Ivanic & Martin, 2008; Shittu, Obayelu, & Salman, 2015; Swinnen & Squicciarini, 2012). Food price shocks may lead to welfare gains or loss especially in rural communities (Swinnen & Squicciarini, 2012). The magnitude of the impacts depends on the rapidity and magnitude at which labor and commodity markets within and outside agriculture adjust in response to price shocks (FAO, 2011). In their studies on the welfare effects of policy-induced rising food prices among farm households in Nigeria, Shittu et al.

CONTACT C.P. Adekunle  chiomaadekunle@gmail.com

© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

(2015) noted that on the average, agricultural households benefited from rising prices of foods but between 44% and 56% of the households still suffered welfare losses. Although there are fortunes in food price rise, the declining socioeconomic and welfare conditions of most households in Nigeria cannot be divorced from food price upsurges.

Available statistics suggested that on average, food prices have been rising. For example, according to CBN (2013), the average annual food inflation rate in Nigeria dropped steadily from 23.1% in December 2005 to 1.5% in November 2007 and it rose in response to the global food crisis of 2007–2008, to 15.3% in November 2008 and was as high as 17.9% by April 2009. Moreover, the average annual food inflation rate in the country remained as high as 12.9% between January 2009 and December 2013 (CBN, 2013). However, National Bureau of Statistics (NBS, 2017) posited that food inflation rose from 9.02% in May 2015 to 15.70% in December 2016 and was as high as 20.32% in October 2017 and 20.25% in August 2017.

The burden of food price upsurges is borne more by the poor and vulnerable households who spend up to 80% (Obayelu, 2010) or more of their earnings on foodstuffs. When households are faced with massive negative price or income shocks, reduction in food budget is often the most immediate response (Ayinde, Akerele, Adewuyi, & Oladapo, 2012; Capuno, Kraft, Quimbo, & Tan, 2013). This manifests in compromised dietary intakes in terms of quantity and quality which ultimately engender higher vulnerability to food insecurity, malnutrition, poverty, depreciation in health outcomes and related issues.

In the past few years, smallholder farmers in Nigeria have been subjected to both spikes and volatile environment of food price changes, the implications of which on smallholders' welfare have been much debated in recent years. Farming households comprise many kinds of land-based households with different attachments to the food system. They range from subsistent farmers to commercial farmers who benefit from higher selling prices to farmers who cannot meet their own needs and therefore rely on market purchases. For these farm households, higher food prices can be a significant drain on household income. Therefore, to better understand farm households' adaptive capacity concerning uncertainties regarding food price changes, it is crucial to look more closely at the decision-making processes of smallholder households in their dual role as producers and consumers of food i.e. "prosumers" (Molitor, Braun, & Pritchard, 2017).

Several researchers have studied the impact of higher food prices on poverty and household welfare in low-income countries. Deaton (1989) used nonparametric methods to examine the impact of a hypothetical change in rice prices on Thailand's income distribution and found that higher rice prices benefit all rural households, but especially middle-income households. Ravallion and van der Walle (1991) reported that a 10% increase in food prices raised the rate of poverty in Indonesia. Also using nonparametric techniques, Barrett and Dorosh (1996), observed negative impacts of higher rice prices on the welfare of the rural poor in Madagascar because the gains to net rice sellers were concentrated among higher income rice farmers. Ivanic and Martin (2008) examined nine low-income countries and concluded that increased staple food prices would increase poverty in most, but not all, of those countries. These existing literature analyze first-order and immediate effects of price increases on expenditure and supply patterns, or – less frequently – second-order effects on consumption (that is allowing for adjustments in consumption), few studies are taking into account the substitution effects in both consumption and production (Ferreira, Fruttero, Leite, & Lucchetti, 2013; Nakelse, Dalton, Nathan, & Moussa, 2017). Shittu et al. (2015) assessed welfare effects of policy-induced rising food prices among farm households in Nigeria using the consumption data of the Nigeria

General household Survey estimated that on the average, agricultural households benefited from rising prices of foods but between 44% and 56% of the households still suffered welfare losses. However, in the recent study of Shittu, Akerele, and Haile (2018), an overall negative effect of food price spike was found on farm households welfare.

In determining the instantaneous welfare effects of price changes, the first approach can be more appropriate, while the framework including the second-order effects is generally more suitable for longer runs (medium- to longer-term). Also, for relatively small price changes, the first-order approach can well approximate the welfare effects, even in the longer-term. For larger price variations, including second-order effects is recommended. Henceforth, the two approaches may differ in their scope and can have different policy implications (Tiberti & Tiberti, 2016).

This study analysed and discussed the welfare effects due to price increases under two approaches. First, we follow the approach initially proposed by Deaton (1989), which we call the direct/first-order/marginal approach. This approach assumes no responses in consumption and production behaviours by households. Second, we allow households to adapt their consumption and production behaviours as a consequence of food price changes (we call this approach indirect/second-order/response method). Both approaches can be broadly categorised under the agricultural household models (AHMs) proposed by Singh, Squire, & Strauss, (1986), in the sense that households are considered either as net consumers or net producers. But they differ in the way households are allowed to adjust their behaviours following an external price shock: no adjustment is assumed under the direct approach (so more suitable for the short-term) while adjustment in various behaviours (consumption, production, and labour/leisure choice) is allowed in the indirect proposed here (so more indicated in the medium to long run for large price changes).

Besides, the direct model assumes that consumption and production decisions are taken independently and that labour market choices are not affected by such decisions, whereas under the indirect/response approach allowing for consumption and production decisions by farmers are taken jointly as a result of maximisation of households' utility. The approach developed by Deaton (1989) is still the reference and the most adopted tool to assess the welfare impact due to price variations in developing countries.

The objective of this work is to show and discuss the differences emerging between a direct and indirect approach, for a large range of commodities price change. It is important to note adjustment in consumption and production behaviours can take some time. Therefore, one can argue that the direct approach is more appropriate for immediate-term impacts, while the indirect framework can be better for the medium-term effects. However, it is worthy to stress that some of the response changes can be immediate as can be the case for consumption decisions (Ivanic & Martin, 2014a).

The illustrative applications of the two methodologies are carried out on data from Nigeria General Households Survey-Panel data (2010–2016). The welfare effects under the two approaches are estimated over a range of price changes.

In this study, we follow the theoretical framework and estimation strategy proposed in Nakelse et al., 2017; Vu and Glewwe (2011) to estimate the impact of price changes on households' welfare. The study analyzes the household-level impacts of rising food prices. To target the poorest segments of the population and identify the vulnerable groups, households were initially divided by income quintile and urban-rural location. Household typologies were then constructed to identify the vulnerable groups.

Following the introduction, section 2 provides an overview of the methodology applied to the household level impacts assessment. Section 4 presents the results and discussions of the household level welfare impacts and the impacts of household groups. Section 5 concludes.

2. Materials and methods

The unprecedented rises in prices prompt households to make adjustments on their consumption and production patterns. This study analyzed the welfare effects of food price changes on farm households in Nigeria using household-level data. The information needed to estimate the welfare effects requires the knowledge of (a) the budget shares, (b) the magnitude of the price changes during the period of study, and (c) the expenditure and price elasticities, households' production, own-consumption, purchases and sales of these agricultural products.

The study combines monthly disaggregated data on (consumer-level) food prices with household consumption expenditure and agricultural production information to estimate the net welfare effect of the price shock. The study firstly assesses household demand responses by estimating demand elasticities using the Quadratic Almost Ideal Demand estimate households developed by Deaton and Muellbauer (1980) and extended by Banks, Blundell, and Lewbel (1997). Then, the study determined the household supply response (output-input price elasticities) through a normalised profit function approach using restricted Seemingly Unrelated Regression (SURE). Furthermore, the study combines the household impact as producer and consumer to derive the total net effect of price changes, in consideration of the fact that a household could be a producer and consumer.

2.1. Study data and sources

Two types of data were used in the study and these were household consumption data from Nigeria's General Household Survey (GHS)–Panel and monthly time series data (2007:1–2016:12). The retail commodity prices across the panel of 36 states and Federal Capital Territory obtained from the National Bureau of Statistics Headquarter office in Abuja. Besides, retail commodity prices were supplemented with the national aggregate consumer price index (CPI) for non-food items which were extracted from the various issues of the CBN statistical bulletins from 2007–2016 to capture the price of non-food items. The study describes the pattern of the price movement from 2007 to 2016.

The GHS-Panel data reported household consumption and/or expenditure on about 180 food and non-food items. While data on food consumption and purchases (expenditures) were collected over a recall of a period of 7 days, expenditure data on some non-food items either were reported on a weekly and monthly basis (frequent non-food purchases), or over 6 months or 1 year (non-frequent non-food purchases). All data on food consumption/purchases were discounted weekly for uniformity and regular non-food items and monthly recall for less frequently consumed non-food items.

The study has six (6) period panel data for the respondent farm households. This study cleans the original sample of potential outlier observations which could lead to biased outcomes. The study follows a more conventional approach and excludes all observations within each commodity group with values below and above the 1st and the 99th percentiles. However, only 17,539 households with the complete set of information

Table 1. Farm households characteristics in Nigeria.

Characteristics	North Central	North East	North West	South East	South- South	South West	Urban	Rural	Pooled
Age (Mean)	54	57	64	46	51	50	55	48	52
Household Size (Mean)	6	8	7	4	5	4	5	6	6
Dependency Ratio	0.9	1.1	1.4	0.8	0.8	0.9	0.9	1.1	1.0
Gender (% Female Headed Households)	19.5	8.3	4.5	38.2	28.9	26.5	23.3	19.2	21.1
Marital Status (% married households)	71.0	73.5	75.2	66.7	70.2	62.5	68.2	70.8	71.0
Mean Years of Schooling	5.1	5.4	3.9	7.2	9.5	8.1	8.73	5.2	6.4
Housing Ownership (%Owned)	77.5	90.4	89.2	76.5	58.4	38.5	47.8	82.4	68.5

Source: computation from LSMS panel data (2010–2016).

required after data cleaning and appearing in all the three rounds of data collection were included in this study. Hence, the final panel was made up of 17,539 observations.

It is important to note that, for practical and computational reasons, this study cannot model separately demand and supply of about 180 food and non-food commodities for which we have information in the LSMS-IS. To deal with a large number of goods involved and to facilitate the empirical analysis, the study aggregates the major components of food consumption and production into seven groups as shown in Table 1. At the first stage, the commodities were grouped into two distinct components: food and non-food products. The second stage was performed only for the food components since the study focuses mainly on food. The food components were grouped into six (6) broad food classes (cereals, pulses, seeds and nuts, roots and tubers, meats and other animal products, fruit and vegetables and miscellaneous foods). Moreover, there is no theoretical basis on how to construct commodity groupings; the decision is mostly made by the researchers on an ad-hoc basis. Besides, the factors of production were aggregated into labour, biochemical inputs, intermediate inputs, and mechanization.

To evaluate the welfare effect of the price shocks, we first assessed household demand responses by estimating demand elasticities using the Quadratic Almost Ideal Demand developed by Deaton and Muellbauer (1980) and extended by Banks et al. (1997). Then, we determined the household supply-price elasticities using normalized translog profit function. Furthermore, we combined the household impact as producer and consumer to derive the total net effect of a price increase, in consideration of the fact that a household could be a producer and consumer.

2.2. Welfare effects of price changes

To assess the impact of changes in food prices on household welfare, this study uses a methodology introduced by Deaton (1989). The impact of price changes on household welfare is measured by the compensating variation – the amount of money required to keep a household's utility at the utility level it enjoyed before the change in prices. A household profit function can be used to represent the household's production activities, and an indirect utility function can be used to measure its level of welfare. When food prices increase, the (implicit) profits increase for all households that produce food. However, each household must also increase its food expenditure to maintain its previous utility. The change in any household's welfare due to an increase in food prices is calculated as the increase in the household's profits minus the increase in food expenditure needed to maintain its previous utility.

This study uses the model of agricultural households to analyze household market participation (Singh et al., 1986). In each production cycle, households were assumed to maximize their living standard (utility) over agricultural staples, purchase market goods, and leisure.

This study considers two distinct impacts of food price changes on household welfare. The first is the immediate impact, before any changes in consumption or production patterns. The second is which allows for changes in both consumption and production in response to prices. Let us consider a farm household that consumes a particular crop, may or may not produce that particular crop, and trades in other commodities and the labour market.

The welfare effect proposed by Deaton (1989) and used in most applications is expressed as follows:

$$\Delta Welfare = \sum_{i=1}^N (S_{i0} - Q_{i0}) \hat{P}_i \quad (1)$$

Where: $\Delta Welfare$ = welfare effect expressed in percentage terms of the consumption level of household i ;

\hat{P}_i = percent change in commodity prices;

S_{i0} = production/revenue shares (value of production of each commodity item (agricultural sales) divided by total revenue

Q_{i0} = consumption/expenditure shares (value of consumption expenditure of each commodity item divided by total consumption expenditure).

More formally, the expression above is the direct welfare impact of a change in the price of staple food for a household assuming that the price change in both consumer and producer $\Delta p_{pi}/\Delta p_{ci}$ equals one (1). Minot and Dewina (2013) posited the expression above as the Net Benefit Ratio (NBR) which assumes that the percentage change in the farmgate price of a commodity is equal to the percentage change in the retail price of the commodity (Deaton, 1989). Equation (1) summarizes the first-order impacts of a price change.

The study followed the traditional first-order approach to the second-order approach/distributional effects of price changes accounting for both households' consumption and production response to price changes to take into account supply and demand response. This is referring to second-round responses which depend on parameters that include the price elasticity of supply and price elasticity of demand. The change in consumer welfare can be approximated using a consumer surplus, derived from the Marshallian demand curve. Such an approximation in developing countries where the share of agricultural commodities and income elasticities are high could lead to significant error in assessing the welfare effect of a price change (Wohlgenant, 2011).

As a result, the Compensation Variation (CV) was derived from a Hicksian demand curve. As suggested by Hausman, the consumers' CV was derived using the household expenditure function and then the CV was approximated by a second-order Taylor series approximation of the expenditure function. The CV approach measures the change in consumer expenditure necessary to compensate consumers for a given price change, such that utility remains intact (Huang, 1993). A positive CV estimate indicates welfare loss, as the initial utility level can only be achieved at a higher cost, while a negative CV implies welfare gain. A similar approach was used to obtain the welfare effect of production shocks. In this case, the producer surplus may not be able to capture the change in household profit. Similar to the approach proposed by Irvine and

Sims and Martin and Alston (1997), in our study, the producer side welfare change was derived by second-order Taylor series approximation of profit function.

This study approximates the impact of changes in the prices of consumer goods, household outputs, and household inputs using a second-order Taylor-series expansion around the original (before) points in the expenditure and profit functions. The second-order Taylor series approximation of the expenditure function and profit function was specified below following Nakelse et al. (2017) as:

$$\begin{aligned} \Delta welfare = & \sum_{i=1}^M S_{i0} \hat{P}_i - \sum_{i=1}^N Q_{i0} \hat{P}_i + \frac{1}{2} \sum_{i=1}^N \sum_{j=1}^N Q_{i0} \varepsilon_{ij} \hat{P}_i \hat{P}_j \\ & + 1/2 \sum_{i=1}^M \sum_{j=1}^M S_{i0} \theta_{ij} \hat{P}_i \hat{P}_j + \sum_{i=1}^P x_{i0} \hat{w}_i + \frac{1}{2} \sum_{i=1}^P \sum_{j=1}^P y_{ij} \hat{w}_i \hat{w}_j \end{aligned} \quad (2)$$

Where:

Q_{i0} = budget share of consumer good i ;

S_{i0} = value of output i as a share of income (revenue share of good i);

x_{i0} = value of spending on input i as a proportion of income;

ε_{ij} = absolute value of the Hicksian elasticity of demand for good i with respect to the price of good j ;

θ_{ij} = elasticity of supply of output i with respect to the price of output j ; and

y_{ij} = elasticity of demand for input i with respect to the price of input j .

3. Results and discussion

3.1. Farm household demographic profile

As presented in Table 1, the information about farm household demographic characteristics by region and rural (68.45%) and urban (31.55%) is discussed. The average household size was 6 persons. Rural and urban averages were 6 and 5 persons, respectively. The data also revealed that households in the South tend to be smaller than those in the North; household size in the South ranges from 4 to 5 persons, while in the North the range is 6 to 7 persons. The dependency ratio in rural (1.14) areas is higher than in urban areas (0.94). Regionally, the highest dependency ratios occur in the North West (1.42) and North East (1.11). As would be expected, the mean age of farm households ranges between 54–64 years. Besides, 21% of the farm households were female-headed, with the highest regional occurrence found in the South East (38%). Furthermore, 71% of farm households were married.

3.2. Expenditure elasticities/compensated own and cross price elasticity

Table 2 reports the compensated price elasticities, as well as income (expenditure) elasticities in Nigeria using QUAIDS specification evaluated at mean value. The estimated demand elasticities were, in general, in line with a-priori expectations: the expenditure elasticities were all positive, while the own-price elasticity of demand was all negative. The food and non-food commodities were revealed as generally price inelastic. It was observed that none of the expenditure categories' expenditure elasticities can be associated with inferior goods, as all expenditure elasticities were positive (Abdulai, 2001) ranging from 0.55–1.40. However, all the food groups except for animal

Table 2. Estimated expenditure and compensated price elasticity of demand.

Commodity	Expenditure Elasticity	Price of Commodity						
		Cereals	Pulses	Roots & Tubers	Fruits & Vegetables	Animal Products	Other Foods	Non-Food
Cereals	0.734	-0.966	0.079	-0.084	-0.147	0.201	0.119	0.542
Pulses	0.717	0.272	-0.983	0.141	0.153	0.178	0.015	0.224
Roots & Tubers	0.979	-0.124	0.062	-0.786	0.206	0.365	0.067	0.209
Fruits & Vegetables	0.554	-0.251	0.077	0.238	-0.728	0.273	0.138	0.253
Animal Products	1.210	0.089	0.023	0.109	0.071	-0.640	0.036	0.311
Other Food	0.611	0.330	0.012	0.125	0.222	0.221	-0.994	0.084
Non-Food	1.395	0.269	0.034	0.071	0.073	0.354	0.015	-0.815

Source: Author's computation, 2019.

products, are normal goods and necessities having values less than unity. That is, as income increases, the proportion of income expended on these food groups decreases. The demand for fruits and vegetables has the lowest expenditure elasticity follow by other foods, which means fruits and vegetables have the lowest responsiveness to change in income followed by other foods. It is important to note that as expected, commodities that constitute the diet of poorer households have lower income elasticities as posited by Ackah and Appleton (2003). However, animal products and non-food are luxury goods, having elasticity greater than 1. It should be considered that the non-food expenditure category includes a large number of items that are generally deemed to be luxury goods.

The estimated own-price elasticities of all the crops as shown in the diagonal matrix have the expected negative sign, thereby satisfying the negativity property of own price effects. According to the compensated price elasticity, the estimated own-price elasticities of all the crops have the expected negative sign. Compensated own-price elasticities of all seven (7) commodities were inelastic implying that if we consider compensated own-price elasticities, an increase in prices will not strongly lead to a decrease in the demand for food items. Besides, cereals, pulses, and other foods have the highest degree of responsiveness to food price changes i.e. most affected by changes in their prices. The own-price elasticity of animal products was the smallest in absolute terms, indicating that animal products were the least sensitive to changes in its price.

The magnitude and patterns of cross-price elasticity evident from the off-diagonal of Table 4, indicating substitution and complementary expenditure categories, seem plausible. The cross elasticities seem to be smaller than their elasticities. This indicates that individual commodity groups do not have any strong substitutes or complements. Using more detailed commodity bundles, one might find a higher degree of substitutability (Dybczak, T'oth, & Vo'nka, 2010). A positive cross-price elasticity, as in the case of cereals and pulses, pulses and fruits and vegetables, indicates substitutes. Once the prices of cereals rise, cereal consumption is reduced accordingly, and pulses intake rises simultaneously. Negative cross-price elasticities, as with cereals and tubers, cereals and fruits and vegetables, indicate complementarities (Varian, 1992).

3.3. Results of output supply and input demand response to changing prices

As presented in Table 3, all own-price elasticities of supply have positive signs which are consistent with the implications of profit maximization. The diagonal elements provide

Table 3. Output supply and input demand elasticities.

	Elasticities with respect to										
	Cereals	Pulses	Roots & Tubers	Fruits & Vegetables	Animal Products	Other foods	Nonfarm Income	Labour	Biochemical Inputs	Intermediate inputs	Mechanisation
Cereals	1.2461	-1.6801	-0.1426	0.6803	0.5141	0.7388	0.5331	-0.4428	0.3559	-0.4529	-0.0957
Pulses	-0.1473	1.1647	-0.0679	0.9274	0.6155	1.4905	0.2677	-0.1182	-0.2780	-0.0777	0.3137
Roots & Tubers	-0.1010	-0.1865	0.6859	-0.6417	-0.4869	-0.5103	-0.3090	-0.3335	0.1209	-0.3181	-0.0305
Fruits & Vegetables	0.0391	0.2073	-0.0522	0.6818	-0.0188	0.3371	0.1035	-0.0173	-0.1559	-0.0118	0.0553
Animal Products	0.1184	0.5503	-0.1584	-0.0755	0.5401	0.0702	0.7903	-0.0869	-0.0850	-0.1567	-0.1767
Other foods	0.0312	0.2448	-0.0305	0.2477	0.0128	1.1298	-0.2736	-0.0150	0.0297	-0.0168	0.0225
Non-farm Income	0.0093	0.0182	-0.0076	0.0316	0.0603	-0.1136	0.7971	-0.0067	-0.0061	-0.0073	-0.0029
Labour	-0.4676	0.4846	0.4974	0.3180	0.3986	0.3741	0.4081	-1.1500	0.3486	-0.3754	-0.4219
Biochemicals	0.0552	0.1674	-0.0265	0.4201	-0.0571	0.1089	0.0542	0.0512	-1.4453	0.0790	-0.1169
Intermediate inputs	0.4729	-0.3148	0.4691	0.2139	0.7102	0.4161	0.4341	-0.3712	0.5315	-1.4871	-0.5839
Mechanisation	0.0055	0.0709	0.0025	0.0560	-0.0441	0.0311	-0.0091	-0.0232	-0.0439	-0.0326	-0.8503

Source: Author's computation, 2019.

Table 4. Direct/first order impacts of food price changes.

Groups	Net Benefit Ratio (%)	Net Sellers (%Gainers)	Net Buyers (%Losers)
		% of households in Category	
Cereals	-1.84	28.67	71.33
Pulses	-0.82	8.59	91.41
Roots and Tubers	-0.73	21.76	78.24
Fruits and Vegetables	-0.16	2.89	97.11
Animal Products	-1.55	3.28	96.72
Other Foods	-0.41	2.00	98.00
Non-Food	-2.26	0.00	100.00
All Group (Mean)	-6.93	21.00	79.00
Sector			
Urban	-8.87	17.78	82.22
Rural	-6.13	36.56	63.44
Household type			
Female-Headed	-8.13	17.25	82.75
Male-Headed	-4.64	16.56	83.44
Geo-political Zone			
North central	-7.11	20.85	79.15
North east	-6.01	22.01	77.99
North west	-6.33	19.89	80.11
South east	-6.08	20.71	79.29
South south	-7.83	21.04	78.96
South west	-8.61	21.64	78.36
Main Enterprise			
Non-Farm	-7.31	25.74	74.26
Smallholder Crop	-8.63	25.35	74.65
Smallholder Livestock	-7.60	23.22	76.78
Smallholder Crop & Livestock	-8.13	20.23	79.77
Commercial crop	-8.09	20.45	79.55
Commercial livestock	-6.71	18.20	81.80
Commercial Crop & Livestock	-5.11	15.34	84.66
Land ownership			
Landless	-7.62	24.32	75.68
Landed	-5.83	28.60	71.40
Income Quintile			
Quintile 1	-7.37	23.52	77.48
Quintile 2			
Quintile 3	-7.42	23.74	72.26
Quintile 4	-6.61	20.39	79.61
Quintile 5	-5.71	19.66	80.34

Note: quintile 1 refers to the poorest quintile, quintile 5 refers to the wealthiest quintile.

Source: Author's computation, 2019.

the own-price elasticities which are positive for the seven outputs and negative for each of the inputs when evaluated at the mean values of prices and quantities. The own-elasticities of output supply were generally less than unity (inelastic) and only the supply function of cereals, pulses, and other foods is elastic. However, cereals, pulses, and other foods are all more responsive to the change in their price implying that these food groups respond quickly to price changes. Cereals prices especially rice and wheat, as well as its production, were very influenced by the government policies, which intended to reduce the importation of this product. Ruvalcaba et al. (2016) found that cereals, roots, fruits, and vegetables have smaller (inelastic) own-price elasticities of supply than other food categories, as these are the goods that households rely most heavily on upon. A perfectly elastic supply and market clearing demand is an appropriate assumption when dealing with traded goods, such as imported foods, in the case of small open economies like

Nigeria (Anand et al. 2016). Our estimates suggest the presence of a stronger food supply response than food demand response to price changes.

As for the estimated input demand equation, all own-price elasticities of input demand have negative signs as expected and the input demand functions are generally price elastic except mechanisation. The own-price input demand elasticities for labour, agrochemicals, and intermediate inputs are -1.15 , -1.44 and -1.49 respectively, again indicating a substantial degree of price responsiveness to input price changes by Nigerian farm households. Of particular interest is the evidence that the demand for labour, agrochemicals and intermediate inputs were elastic. The estimates suggest that the returns to labour and the level of farm employment may decrease dramatically as a result of an increase in wage. An increase in wage rate would result in an absolute reduction in all outputs as well as induce changes in the composition of outputs.

3.4. Welfare impact of higher prices

As presented in Table 4, the results of the direct welfare effect of higher food prices. All the food groups have negative Net Benefit Ratios (NBRs) which implies a welfare loss. A larger share (79%) of farm households can be identified as net food buyers, few (21%) of them are net food sellers who are not significantly affected by food price increases. However, studies in sub-Saharan Africa have indicated that in many cases, more than half of rural households are net buyers of individual food crops (Barrett & Dorosh, 1996; Weber et al. 1988; World Bank, 2008) and are mainly small-scale farmers who are often net buyers of staple food crops, relying on income from remittances, the sale of labour, or microenterprises to cover the cost of food purchases (Minot & Dewina, 2013). The average NBR is -6.9% . This implies that a 1% increase prices of food and non-food commodities would reduce the real income or welfare of farm households by 6.9%.

On average, about 72% of total household budgets are spent on foods, which translates into a likely greater impact on household welfare following an increase in the price of food commodity especially cereals and pulses. Cereals production is generally not large enough to protect households from higher prices. As depicted from Table 4, a 1% increase in the price of cereals corresponds to a deterioration in the household welfare by 1.84% (around 71.33% for farm households). Or, equivalently, for a 1% increase in the price of cereals, an increase of 1.84% in the household income is required to allow individuals to enjoy real welfare. However, animal products have a welfare loss of 1.6% for a 1% change in price while fruits and vegetables have a welfare loss of 0.16% for a 1% change in price. Among the food groups, cereal was identified as food for which the country is most vulnerable to price shocks. Hence, cereals are identified as the most important food security crops in terms of their effects on price shocks. This study posited that from a food security perspective it is clear that in the context of Nigeria, food security mostly relates to household's access to cereals.

Moreover, specific household characteristics were added to the analysis in order to identify potentially vulnerable groups within the population. By doing so and specifying some key household characteristics households can be grouped into detailed household typologies.

Based on the direct welfare effects of price changes, vulnerable household groups were the urban, female-headed, small-holder, landless and poorest farm households. The impact of higher food prices is more adverse in urban (8.9%) than in rural areas (6.1%). The implication of this is that farm household in urban centers are most immediately affected

by economic shocks (price spikes) than rural consumers. This might be because the urban farm households rely on non-agricultural employment for its livelihood and so is likely to be more affected by rising food prices than the rural population segments. The results also show that female-headed households have a more negative NBR (8.1%) than male-headed (4.6%) households, suggesting that female-headed households are somewhat more vulnerable to increases in prices. According to the survey data, female-headed households are less likely to be net sellers and more likely to be net buyers compared with male-headed households. However, food production is a smaller share of income for female-headed households than for male-headed households. The results show that land ownership does influence the welfare impacts, households that do not own land, both in rural and urban areas, tend to lose from the price increase. The negative sign of the net benefit ratios faced by households in different income quintiles thus give a sense of poorer households lose more than richer households when food prices rise.

3.5. Change in consumer and producer welfare

The study further differentiates among net buyers and net sellers of food commodities by conducting a separate analysis with net food buyer farm households and net food seller farm households.

As shown in Table 5, the CV measure is positive (2.02), which indicates a welfare loss that an increase in the overall price by 2.38% requires a 2.02% increase in income to keep welfare unchanged. As expected, the mean producer welfare due to price increase is negative (−1.58), which indicate welfare gain. An average net food buyer household derived a welfare loss of 2.98% of the mean annual expenditure (N539,397.5 approximately 1,477.8 USD at the average official exchange rate of N365/US\$1), while an average net seller household derives a welfare gain of 2.82% of the mean farm output value (N399,301.6 approximately 1,094 USD at the average official exchange rate of N365/US\$1) as a result of higher food prices in a typical year between 2010 and 2016.

Hence, there is a negative effect on consumers (net buyers) and positive effects on producers (net sellers). This implies that as food prices increase, the monetary cost of achieving a fixed consumption basket increases, thereby reducing consumer's welfare (De Hoyos & Medvedev, 2009). This is generally peculiar to the consumers. However, for

Table 5. Mean consumer welfare and producer welfare.

Description	Second Order Impact on Consumer/Net Food Buyers				
	Households (%)	Median CV (% of M)	Mean CV (% of M)	Expenditure, M (N/year)	Farm Output, Y (N/year)
Gainers	20.59	−1.53%	−1.66%	513,755.7	362,318.5
Losers	79.41	3.09%	2.98%	539,397.5	347,041.3
All Households	100	2.74%	2.02%	526,192.7	368,267.4
Description	Second Order Impact on Producer/Net Food Sellers				
	Households (%)	Median PW (% of Y)	Mean PW (% of Y)	Expenditure, M (N/year)	Farm Output, Y (N/year)
Gainers	57.52	−2.39%	−2.82%	509,960.56	399,301.56
Losers	42.48	1.51%	2.10%	530,741.45	339,155.76
All Households	100	−1.62%	−1.58%	526,192.73	368,267.42

Source: Author's computation, 2019.

the segment of the population whose income depends either directly or indirectly on markets for agricultural products (wage workers in the agricultural sector, self-employed farmers and rural landowners), a rise in food prices increase their monetary income.

However, studies by Van Campenhout, Pauw, and Minot (2013), Shimeles and Delelegn (2013), Karugia (2011), Ivanic and Martin (2008), Loening and Oseni (2007), found negative effects on net food consumers, positive effects on net food producers and overall negative effects of rising food prices on farm households' welfare. Shittu et al. (2015) in their studies on the welfare effects of policy-induced rising food prices among farm households in Nigeria found that on the average, a sizeable proportion (53%) of agricultural households enjoyed welfare gain from rising prices of foods with the mean CV estimated -7.8% of the household budget.

3.6. Indirect welfare impacts

Evidence from Table 6, the second-order approximation gives a more positive welfare impact than the first-order approximation (Van Campenhout et al., 2013). For each household, the net welfare of an increase in food prices was based on a combination of a loss in purchasing power and again in monetary income. However, the impact of increasing food prices was found to be purely negative on farm households' welfare in Nigeria.

Table 6. Net welfare effects among losers of real price changes.

Description	Mean Annual Expenditure	Mean Annual Output	Losers (%)	Net Welfare (%)
National Average	526,192.73	368,267.46	78.92	-1.92
Household type				
Male Headed	526,304.72	366,789.52	46.45	-1.56
Female Headed	525,691.51	368,558.81	53.55	-1.85
Sector				
Urban	510,146.03	370,908.18	43.13	-1.48
Rural	533,587.15	367,200.82	56.87	-1.98
Geo-political Zone				
North central	527,248.22	368,041.91	69.26	-1.88
North east	527,664.84	376,700.05	70.10	-2.11
North west	530,136.33	355,689.23	64.23	-1.91
South east	523,278.35	377,816.24	61.89	-1.97
South south	534,906.52	370,713.06	55.59	-1.78
South west	514,076.36	360,367.14	50.43	-1.92
Main Enterprise				
Non-Farm	644,693.24	378,307.57	62.46	-1.41
Small holder Crop	484,993.13	347,041.34	60.82	-1.84
Small holder Livestock	539,807.21	379,301.06	53.26	-1.52
Small holder Crop & Livestock	498,191.82	339,155.11	55.45	-1.69
Commercial crop	621,325.13	372,176.21	47.13	-1.28
Commercial livestock	628,957.84	364,005.54	34.23	-1.76
Commercial Crop & Livestock	611,342.03	322,405.16	30.03	-1.18
Land ownership				
Landless	494,383.92	343,283.92	65.37	-1.93
Landed	540,093.55	365,122.41	34.63	-1.46
Income Quintile				
Quintile 1	544,534.22	355,112.46	54.68	-1.98
Quintile 2	568,934.43	368,432.75	52.15	-1.94
Quintile 3	662,998.55	367,647.23	67.77	-2.06
Quintile 4	472,128.16	367,263.56	47.27	-1.63
Quintile 5	485,767.48	367,113.31	41.56	-1.62

The results suggest that all the household groups suffered welfare loss arising from the food price increases from 2010 to 2016. On average, the second-order effects represent up to roughly 28% of the total first-order effects. Overall, 79% of households suffered a welfare loss that amounted to an average of -1.92% of the household's budget in an average year between 2010 and 2016 as a result of changes in the real price of food and non-food commodities. In general terms, the incidence of welfare losses due to real price changes was higher among female-headed farm households (1.85), domiciled in rural areas (1.98), smallholder (1.84), located in the northern part of Nigeria (1.88–2.11), landless (2.06).

Though the results of the first-order welfare impacts revealed that urban farm households were affected negatively by increasing prices since lack of land reduces the chances of being a surplus producer, the full effect revealed otherwise. Rural farm households were the worst hit by the food price spikes in the indirect effect. It is important to note that as reported in the Nigeria LSMS-IS, agricultural activities dominate the rural areas while participation in non-farm enterprises and wage jobs are more common in urban areas. Urban farm households are the most affected by rising food prices in the short run, but in the long run, they would have possible adjustment by seeking productive job opportunities in urban areas in order to response to the food price shocks as there are more productive job opportunities in urban areas when compare to the rural areas. In addition, transaction costs in rural areas are high due to poor transportation infrastructure networks and removal of subsidy on premium motor spirit prices further increase the cost. Both costs tend to increase the price of food and non-food commodities, causing the final price to be relatively high in rural areas as compared to urban areas, because most food and non-food commodities must be transported from cities and town centers. Hence, spikes in price of food and non-food commodities can negatively affect rural consumer's considerably more than urban households. This indicates how important it is to respond to a food crisis by raising the productivity of land and labor in smallholder farming and facilitating access to even land for landless and rural households to produce more of their own food needs.

FAO (2008) found that most adversely affected are the urban and rural poor, the landless and female-headed households. Kumar and Quisumbing (2010), found that female-headed households are the most vulnerable group in rural Ethiopia. Maltsoglou, Dawe, and Tasciotti (2010) posited that in the case of land, all landless farm households are negatively impacted by rice price increases. In the case of the gender of the household head, urban female-headed households are hurt by an increase in the price of rice. Also, for small-scale producers who produce less food than they consume the welfare improvement from higher producer prices does not offset the negative effect of higher consumer prices resulting in overall welfare loss. These are also evident in Vu and Glewwe (2011). Minot and Dewina (2015) found that the urban middle class is likely to be more affected by rising food prices than either the poorest or the richest population segment.

4. Conclusion

While most of the existing literature assessing the welfare impact of food price changes focuses on the direct effects, very few studies incorporate the adjustments in both the consumption and production behaviours by farm households, especially for the sub-Saharan African country like Nigeria.

By using data from GHS-Panel data, this study aimed at shedding some light on the differences that may occur when a direct approach is used compared with an indirect

model. This study estimated a non-separable agricultural household model, where joint adjustments in consumption, production and farmers' labour market behaviours are taken into account. Since most farm households in Nigeria are both consumers and producers of food commodities, such an approach seems particularly appropriate.

When consumption and production adjustments are allowed, households can adapt their consumption and production patterns by resulting in significantly lower deteriorations of their welfare, though significant differences emerge along with the household types. The average required compensation as estimated through the direct approach for all the price increase at 6.9%, while when the indirect framework is used the compensation is just 1.92%.

All in all, in the medium- to longer-term and under relatively large food price increases, the impact of a food price change on household welfare is said to be seriously overestimated if a direct approach is used. Understanding the implications of the two methods well can also be particularly relevant for policy interventions, which, as we well know, can differ depending on the time scales considered by the policy-makers.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Notes on contributors

C.P. Adekunle is a Lecturer II in the Department of Agricultural Economics and Farm Management of the Federal University of Agriculture, Abeokuta, Nigeria. She is an agricultural development economist with a research interest in food, gender, and welfare economics issues for over 7 years.

S.O. Akinbode is a Senior Lecturer in the Department of Economics, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria.

A.M. Shittu is a Professor of Agricultural and Resource Economics, Landmark University, Omu-Aran, Kwara State, Nigeria (Sabbatical); and Federal University of Agriculture, Abeokuta, Nigeria (Permanent).

S. Momoh is a professor of Agricultural Marketing in the Department of Agricultural Economics and Farm Management of the Federal University of Agriculture, Abeokuta, Nigeria.

ORCID

A.M. Shittu  <http://orcid.org/0000-0002-0857-0337>

References

- Abdulai, A. (2001). *Household demand for food in Switzerland. A quadratic almost ideal demand system*. Sonneggstrasse 33, 8092 Zurich, Switzerland: Department of Agricultural Economics, Swiss Federal Institute of Technology.
- Ackah, C., & Appleton, S. (2003). Food Price Changes and Consumer Welfare in Ghana in the 1990s. CREDIT Research Paper. 07/03. Centre for Research in Economic Development and International Trade. University of Nottingham.
- Anand, R., Kumar, N., & Tulin, T. (2016). Understanding india's food inflation: the role of demand and supply factors. IMF Working Paper. Asia and Pacific Department. 14

- Arndt, C., Benfica, R., Maximiano, N., Nucifora, A. M. D., & Thurlow, J. (2008). Higher fuel and food prices: Impacts and responses for Mozambique. *Agricultural Economics*, 39(Supplement), 497–511.
- Arndt, C., Hussain, M. A., Salvucci, V., & Lars Peter Østerda, L. P. (2016). Effects of food price shocks on child malnutrition: The Mozambican experience 2008/2009. *Economics and Human Biology*, 22, 1–13.
- Ayinde, I. A., Akerele, D., Adewuyi, S. A., & Oladapo, M. O. (2012). Can food calorie be an index for poverty in a rural economy? An extrapolation from farm households in Ogun State, Nigeria. *International Journal of Consumer Studies*, 36(6), 688–695.
- Banks, J., Blundell, R., & Lewbel, A. (1997). Quadratic engel curves and consumer demand. *Review of Economics and Statistics*, 79(4), 527–539.
- Barrett, C., & Dorosh, P. (1996). Farmers' welfare and changing food prices: Nonparametric evidence from rice in Madagascar. *American Journal of Agricultural Economics*, 78(3), 656–669.
- Capuno, J. J., Kraft, A. D., Quimbo, S. A., & Tan, C. A. R., Jr (2013). *Shocks to Philippine households: Incidence, idiosyncrasy, and impact by Discussion PaperNo. 2013–12*. Retrieved from https://www.bmg.eur.nl/fileadmin/ASSETS/bmg/english/HEFPA/Publications/WorkingPapers/Hefpa_WP16_compleet.pdf
- Central Bank of Nigeria (2013). Quarterly statistical bulletin, 2 (1) march 2013– Tables. CBN, Abuja, Nigeria. Available at: <http://cenbank.org/documents/Statbulletin.asp>
- De Hoyos, R. E., & Medvedev, D. (2009). 'Poverty effects of higher food prices: a global perspective', World Bank Policy Research Working Paper No. 4887. Washington D.C: The World Bank.
- Deaton, A. (1989). Rice prices and income distribution in Thailand: A non-parametric analysis. *The Economic Journal*, 99, 1–37.
- Deaton, A. S., & Muellbauer, J. (1980). An almost ideal demand system. *American Economic Review*, 70(3), 312–326.
- Dybczak, K., T'oth, P., & Vo'nka, D. (2010). Effects of price shocks on consumer demand. Estimating the QUAIDS demand system on czech household budget survey data. *WORKING PAPER SERIES 8 of the Czech National Bank (CNB)* 1–57.
- FAO. (2011). *The state of food insecurity in the world: How does international price volatility affect domestic economies and food security?* Rome: Food and Agriculture Organisation of the United Nations. Retrieved from <http://www.fao.org/docrep/014/i2330e/i2330e.pdf>
- Ferreira, F. H. G., Fruttero, A., Leite, P. G., & Lucchetti, L. R. (2013). Rising food prices and household welfare: Evidence from Brazil in 2008. *Journal of Agricultural Economics*, 64, 151–176.
- Food and Agricultural Organisation. (2008). *The state of food insecurity in the world 2008*. Rome, Briefing: Food and Agriculture Organization (FAO) of the United Nations.
- Huang, C.L., Raunika, R., & Misra, S. (1993). The application and economic interpretation of selectivity models. *American Journal of Agricultural Economics*, 73(2), 496–501.
- Ivanic, M., & Martin, W. (2008). Implications of higher global food prices for poverty in low-income countries. *Agricultural Economics*, 39(s1), 405–416.
- Ivanic, M., & Martin, W. (2014a). Short- and long-run impacts of food price changes on poverty. *Policy Research Working Paper 7011*. Washington, DC: World Bank.
- Karugia, J. (2011). 'High and Volatile Food Prices: Drivers and Impacts on Food Security in Eastern and Central Africa. A Paper Prepared for the 1st ASARECA General Assembly. December 14 – 16. Uganda, Entebbe: Association for Strengthening Agricultural Research in Eastern and Central Africa.
- Kumar, N., & Quisumbing, A. (2010). *Policy reform towards gender equality in ethiopia: little by little the egg begins to walk*. Washington, DC: Mimeo, International Food Policy Research Institute.
- Loening, J., & Oseni, G. (2007). 'Approximating Urban and Rural Welfare Effects of Food price inflation in Ethiopia', Mimeo. Washington DC: World Bank.
- Maltsoglou, I., Dawe, D., & Tasciotti, L. (2010). Household-level impacts of increasing food prices in cambodia. environment and natural resources management working paper no. 37, FAO, Rome 2010.
- Martin, W., & Alston, J. M. (1997). Producer surplus without apology? evaluating investments in rd*. *Economic Record*, 73(221), 146–158.

- Minot, N., & Dewina, R. (2013). Impact of food price changes on household welfare in Ghana. *IFPRI Discussion Paper 01245*. Washington, DC: International Food Policy Research Institute.
- Minot, N., & Dewina, R. (2015). Are we overestimating the negative impact of higher food prices? Evidence from Ghana. *Agricultural Economics*, 46, 1–15.
- Molitor, K., Braun, B., & Pritchard, B. (2017). The effects of food price changes on smallholder production and consumption decision-making: Evidence from Bangladesh. *Geographical Research*, 55(2), 206–216.
- Nakelse, T., Dalton, T., Nathan, P. H., & Moussa, K. (2017). The impact of changes in commodity prices on household welfare in Rural Burkina Faso. Contributed paper to Southern Agricultural Economics Association 2017 Annual Meeting, February 4–7, 2017, Mobile, Alabama. 1–29
- Nakelse, T., Dalton, T., Nathan, P. H., & Moussa, K. (2017, February 4–7). The impact of changes in commodity prices on household welfare in rural Burkina Faso. *Contributed paper to Southern Agricultural Economics Association 2017 Annual Meeting* (pp. 1–29), Mobile, Alabama.
- National Bureau of Statistics. (2017). *Selected Food price watch*. Retrieved from <https://www.proshar eng.com/admin/upload/reports/FOODPRICES MAY2017.pdf>
- Obayelu, A. E. (2010). Global food price increases and nutritional status of nigerians: the determinants. *Coping Strategies, Policy Responses and Implications*, *ARPN Journal of Agricultural and Biological Science*, 5(2), 67–80.
- Ravallion, M., & van der Walle, D. (1991). The impact on poverty of food pricing reforms: A welfare analysis for Indonesia. *Vietnam Journal of Policy Modeling*, 13(2), 281–299.
- Ruvalcaba, M.A., Prifti, E., & Daidone, S. (2016). *How do price increases affect vulnerable households in zambia?*. Food and Agriculture Organization of the United Nations (FAO).
- Sadoulet, E., & de Janvry, A. (1995). *Quantitative development policy analysis*. Baltimore, MD: Johns Hopkins University Press.
- Shimeles, A., & Delelegn, A. (2013). Rising food prices and household welfare in Ethiopia: Evidence from microdata. *Working Paper Series 182*. African Development Bank Group.
- Shittu, A. M., Akerele, D., & Haile, M. (2018). Effects of food price spikes on household welfare in Nigeria. *ZEF-Discussion Papers on Development Policy No. 248*. Retrieved from SSRN: <https://ssrn.com/abstract=3156939>
- Shittu, A. M., Obayelu, O. A., & Salman, K. K. (2015, April). Welfare effects of policy-induced rising food prices on farm households in Nigeria. *AGRODEP Working Paper 0010*.
- Singh, I., Squire, L., & Strauss, J. (1986). *Agricultural household models: Extensions and applications*. Baltimore: Johns Hopkins University Press.
- Swinnen, J., & Squicciarini, P. (2012). Mixed messages on prices and food security. *Science*, 335 (6067), 405–406.
- Tiberti, L., & Tiberti, M. (2016). Food price changes and household welfare: What do we learn from two different approaches. *The Journal of Development Studies*, 54(1), 72–92.
- Van Campenhout, B., Pauw, K., & Minot, N. (2013). The impact of food price shocks in Uganda: First-order versus long-run effects. Available at: <http://www.ifpri.org/publication/impact-food-price-shocks-uganda>.
- Varian, H. R. (1992). *Microeconomic analysis*. New York, NY: W.W. Norton & Company, Inc.
- Vu, L., & Glewwe, P. (2011). Impacts of rising food prices on poverty and welfare in Vietnam. *Journal of Agricultural and Resource Economics*, 36(1), 14–27.
- Weber, M. T., Staatz, J. M., Holtzman, J. S., Crawford, E. W., & Bernstein, R. H. (1988). Informing food security decisions in africa: empirical analysis and policy dialogue. *American Journal of Agricultural Economics*, 70(5), 1044–1052.
- Wohlgenant, M. K. (2011). Consumer demand and welfare in equilibrium displacement models. In *The Oxford handbook of the economics of food consumption and policy* (pp. 1–44).
- World Bank. (2014). Food price watch poverty global practice the world bank group. *Www.worldbank.org/poverty*, (18), 1–10.