Welfare Effects of Policy-induced Rising Food Prices on Farm Households in Nigeria

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Abstract

Against the background that domestic policies in Nigeria have been linked to an endemic - high, volatile and rising food prices in the country, this paper empirically examined the transmission of key monetary policy variables to domestic food prices in Nigeria. Furthermore, the study employed estimates of policy induced price changes from estimated cointegrating relations between commodity prices and policy variables, and demand elasticities from a system of household demand equations to estimate the associated compensating variation as a measure of the welfare impacts on farm households. The study found that government management of exchange rates and money supplies as well as withdrawal of subsidies from petroleum products have been the main driver of rising food prices in the country. While an average farmer was found to have benefited from the policy induced rising food prices with the mean compensated variation of -3.3% of the household budget, most of the farm households ended up being losers. The gainers were mostly owners of the relatively few large farms (-36.9%) including the commercial livestock farms (-38.9%), rice farm (-35.0%), and fish farms (-27.8%). Smallholders, which constituted about three-quarter of the farm households, lost on the average, about 8.1% of their purchasing power to the rising food prices, with female headed households also loosing 6.6% of their purchasing power.

Keywords: Welfare effects; rising food prices; farm households; government policy; Nigeria

JEL Codes: C23, D12, E52, I30

Introduction

When prices of major food commodities rose sharply in 2007-08 and the World was said to have suffered a food crisis, the World at large just had a taste of the "bitter pill" that Nigerians have been swallowing over the past four decades. For instance, while international food prices were generally on a declining trend from mid 1970s until the onset of the 2007/08 food crisis, the case in Nigeria was an exact opposite: the composite food price index in Nigeria (1985 = 100), rose from 9.0 in 1970 to 308.0 in 1990 and stood at 7323.1 in 2006 (CBN, 2006). This translates to an average annual food inflation rate of 19.8% between 1990 and 2006, with the figure being as high as 30.4% in 1996 and 28.0% in 2001.

While the average annual food inflation rate in Nigeria which had slowed down steadily from 23.1% in December 2005 to as low as 1.5% by November 2007 rose, in response to the global food crisis, to 15.3% in November 2008 and was as high as 17.9% by April 2009, the average figure in the decade just before the global food crisis (11.0%) was not substantially different from what was experienced during the 2007-08 food crisis period (13.0%). The surge, could also not be said to have been abated significantly in Nigeria given that the average annual food inflation rate in the country remained as high as 12.9% between January 2009 and December 2013 (CBN, 2013).

Perhaps worthy of note, is the fact that the onset of the endemic - rising and volatile food prices in Nigeria may be traced to the mid 1980s when the nation adopted the IMF/World Bank's - Structural Adjustment Program (SAP) in a desperate bid to get the economy bailed out of the huge fiscal deficits and deteriorating economic conditions that resulted from the crash in the international oil market of the early 1980s. Prior to this period, Nigeria's economy had become heavily dependent on oil and imported inputs, making it highly vulnerable to external shocks (Anyawu, 1992). Moreover, the nation, which prior to the oil boom of the 1970s had been a major exporter of agricultural commodities like cocoa, cotton and groundnut, among others, had – through years of non-oil sector neglect in pursuit of "cheap" oil money – slipped gradually into becoming a net food importer. This, together with an industrial sector that is heavily dependent on imported inputs, pushed the nation into maintaining huge non-oil trade deficits over the years.

By 1981, Nigeria's non-oil trade deficit was already ₦12.4 billion (US$20.3 billion) (CBN, 2012). Hence, when the oil revenue fell below these figures in early 1980s, the nation ran into heavy trade deficits, and had to draw down her external reserves from US$5.2 billion in January 1981 to as low as barely US$0.2 billion by February 1984 (CBN, 2012). It thus became obvious

that the nation's economy needed some structural transformation to revert a looming "disaster" and this was what pushed the governments of the era towards the IMF/World Bank's SAP, despite its widespread rejection by the people.

According to CBN (2011), SAP in Nigeria "was designed to achieve fiscal balance and balance of payments viability by altering and restructuring the production and consumption patterns of the economy, eliminating price distortions, reducing the heavy dependence on crude oil exports and consumer goods imports, enhancing the non-oil export base and achieving sustainable growth". The main strategies were the deregulation of external trade and payments arrangements, adoption of a market-determined exchange rate for the Naira, substantial reduction in complex price and administrative controls, and more reliance on market forces as a major determinant of economic activity (CBN, 2011). In this pursuit, and in conformity with general IMF/World Bank's conditionality (Easterly, 2005), the nation had to abolish all forms of price control, undertook sharp devaluation of Naira, and ever since, embraced Open Market Operations (OMO) - complemented by reserve requirements and discount window operations - as the main means of implementing government monetary policy (CBN, 2011). In addition to these, governments had to undertake widespread restructuring and rationalization of the public sector through privatization and commercialization as well as removal of subsidies including those on fertilizer, other agricultural inputs and petroleum products, among others. These have remained the persistent features of all policy reforms undertaken in Nigeria since 1986.

As noted by Gladwin (1991), Anyawu (1992) and supported by recent statistics in CBN (2012), key consequences of the persistent adoption of some SAP strategies in Nigeria till date include high lending rates, wide gap between lending rates and interest rates on bank deposits, steady depreciation of Naira, and a very high and rising cost of production, all leading to rising general

price levels. Ironically, stimulating increased producers prices (therefore, promoting steady food price increases) with a view to raising agricultural incomes and attracting foreign as well as local investments into the agricultural sector, has been a key target of various governments' reform agenda since 1986. The fact however, that the agricultural/rural population remain increasingly dominant among the worst affected by the rising incidence of poverty and food insecurity in Nigeria (Ogwumike and Aromolaran; 2000; NBS, 2005, 2012; Olomola, 2013) is a clear call for a critical examinations of the policy impacts on all strata of the Nigerian societies.

Against the above background, this paper examines the links between domestic policy actions and prices of various categories of food commodities as well as aggregated non-food consumption items in the rural communities across the 36 States and Federal Capital Territory in Nigeria. It provides estimates of the Welfare impacts of the policy-induced price changes on various categories of farm households in Nigeria. The rest of the paper is organized thus: this introduction is followed a stylized review of relevant theories and empirical evidences on the link between government monetary policy and prices as well as drivers of rising food prices across the globe in Section 2. The third section presents the study methodology, data and their sources, while the forth section presents the results and their discussion. The final section provides the study summary and conclusions.

Monetary Policy and Food Prices: Some Stylized Facts

While the neoclassical long-run neutrality of money appears to be the dominant view in economic literature, and "little" but "stable" inflation is generally perceived as desirable thus motivating inflation targeting by many Central Banks across the globe, there are growing evidence of significant domestic policy impacts on aggregate demand, and therefore household welfare, through the impacts on relative prices (see: for example, Frankel, 1986, 2007; Kim,

1999; Barsky and Kilian 2004; Hamilton 2009; Anzuini, *et al*., 2013). The impacts and channels of monetary policy transmissions are, however, commonly reported to vary widely across countries (Dabla-Norris and Floerkemeier, 2006; Mishkin, 2007), and may be influenced by factors such as the size of the economy, its openness, the degree of its external orientation, and the features of its institutions (Mangani, 2011).

In the United States, Anzuini, *et al.* (2013) reported that while expansionary monetary policy shocks significantly drive up the broad commodity price index and all of its components, these effects do not appear to be overwhelmingly large. Similarly, Koivu (2010) reported, that while a loosening of monetary policy leads to higher asset prices in China, and these positive asset price developments are linked to higher household consumption, the overall effects of monetary policy on Chinese households' behaviour was reported to be limited.

In Malawi, Mangani (2011) reported that while changes in money supply and/or interest rate were hardly transmitted significantly to prices in the country, changes in the exchange rates is a factor that substantially drives most of the changes in domestic prices in the country. He posited that the study finding is in agreement with studies in many African countries – Egypt, Kenya, Ghana and Nigeria – which have shown that change in exchange rates is a key variable driving inflation (and therefore, rising food prices) in Africa. Similar views were canvassed by Dabla-Norris and Floerkemeier (2006) who noted that, although the interest rate channel is the most important transmission channel in industrial countries with developed financial markets, the exchange rate channel is generally the dominant channel of monetary policy transmission in transition economies as well as small (open) developing economies.

Methodology

This study employed estimates of policy-induced price changes obtained from estimated cointegrating relations between consumer prices and a vector of exogenous policy variables and demand elasticities computed from a system of household demand equations to assess the welfare impacts of policy-induced rising food prices on farm households in Nigeria. The policy variables of interest include the Monetary Policy Rates (MPR), the official exchange rate of Naira to the US Dollar (EXR) and domestic narrow money (M1) supply, which have been the key instruments by which economic deregulation policies of the Federal Government Nigeria (FGN) are guided since the mid 1980s. Also considered is the pump prices of the premium motor spirit (petrol) in Nigeria (PPET), which have been raised severally by the Petroleum Product Pricing Regulatory Agency, sequel to implementation of subsidy withdrawal policy of the FGN.

Study Data and Sources

Two types of data were used in the study; including, household consumption survey data and monthly time series (2007:1 – 2012) of (a) domestic – rural retail commodity prices across the panel of 36 States and Federal Capital Territory (FCT) in Nigeria, (b) average World prices of same/related commodities, and (c) selected domestic policy variables. The rural commodity prices were obtained on request from the Headquarter Office of the National Bureau of Statistics (NBS) at Abuja. These were products of nationwide market surveys that are routinely conducted by NBS towards construction of Consumer Price Indices (CPI) for the country. It covered 57 food items reported across the 36 States of the Federation and the FCTs. The domestic food price data were supplemented by national aggregate CPI for non-food items extracted from CBN (2012).

World food prices of relevant commodities were extracted from the World Consumer Prices section of the International Financial Statistics (IFS) published by the International Monetary Fund (IMF) on its website. The relevant prices extracted were those of commodities originating from countries that featured prominently as leading sources of Nigeria's import of the specific commodity in 2008. Monthly time series of relevant policy variables – MPR, EXR, M1 and PPET were extracted from CBN (2012).

The household consumption data were extracted from the Wave 1 of the Nigerian General Household Survey (GHS) – Panel 2010/11 conducted by NBS in collaboration with the World Bank Living Standards Measurement Study (LSMS) team, and with funding support of the Bill and Melinda Gates Foundation. The GHS-Panel is a nationally representative survey of 5,000 households drawn in a multi-stage random sampling process across selected enumeration areas in the 36 States and the FCT in Nigeria. These households were surveyed twice within the Wave 1 of an ongoing Integrated Surveys on Agriculture (ISA) program. Relevant socio-economic, production, consumption and price data, among others, were collected from the households during the post planting period (August – October) of 2010 and repeated during the post-harvest period (February – April) of 2011, such that we have a two year panel data on the respondent farm households. The data were downloaded, on request, from the World Bank website. However, only 3,243 households with the complete set of information required, and appearing in both rounds of data collection were included in this study. Hence, the final panel was made up of 6,486 observations, consisting of data collected from 3,243 households, twice in 2010 and 2011.

In preparing the data for subsequent analyses, household consumption expenditure on various food and non-food commodities were aggregated into nine (9) food and one (1) non-food groups, namely: Rice, Wheat & Wheat Products, Other Cereals, Fish & Sea Foods, Meats, Beverages, Pulses,

Tubers & Tuber Products, Other Foods, and Non-Food. The corresponding prices were those (or group averages) of the dominant food item(s) in the food groups as well as the national average non-food CPI for the non-food group given that we had no price data for non-food items.

In modelling Household Demand System, the NBS state level price sets for various food groups for September 2010 and March 2011 were assumed faced by all households in the corresponding state, and were therefore matched with the corresponding household expenditure data collected during the post-planting and post-harvest periods of the panel data collection respectively. However, the community-level median per capita non-food expenditure was used as the price of the non-food group. These approaches to capturing prices in the study became inevitable because of a general lack of uniformity in the measurement and reporting of food quantities in the GHS-Panel dataset due to absence of uniform standard of measurement in Nigeria. While some hints were provided in the GHS-Panel data documentations on possible price conversion factors to use, we consider the standardized prices reported at the state level by NBS more reliable, even though its use is associated with loss of information on variation in prices faced among households within a State.

Assessment of Policy-Food Price Linkages

Crucial to this study is an understanding of how domestic policy actions affect prices of food and non-food commodities in the long-run. Following standard practices in literature, data analyses in this respect were undertaken in three stages. First, seasonal components of all the monthly time series were removed using the X12-ARIMA procedure. Second, statistical properties of the seasonally adjusted series were examined to determine whether or not each of the individual series is stationary at level or first difference, and whether or not some linear combinations of the series are cointegrated. Finally, given results of the first two stages, which showed that: (a) the series are generally I(1) series (Appendix Table A1); (b) the RHS variables – including the

policy variables and relevant world prices – are non-cointegrating (Appendix Table A2); and (c) the rural prices are cointegrated with the hypothesized determinants (Appendix Table A3); the latter sets of cointegrating equations were specified and estimated by Dynamic Ordinary Least Square (DOLS) method, following Kao and Chiang (2000).

Unit Root Tests

The Im, Pesaran and Shin (IPS, 2003) Panel Unit Root Tests procedure was employed in testing for unit roots in each of the balanced panel of food prices (observed across 37 States/FCT over 72 months: 2007:1 – 2012:12), while the standard Augmented Dickey-Fuller (ADF) test procedure were used for the time series of policy variables and World prices. The tests were conducted, using appropriate procedure in Eviews 8, at both the levels and first differences of the series with cases where intercept only as well as those in which intercept and trend are allowed in the test equations examined. In all cases, lag lengths were set to be automatically chosen based on Schwarz Information Criterion.

Cointegration Tests

Two reinforcing approaches were employed in the cointegration tests conducted in the study: the Pedroni (1999, 2004) – Engle and Granger based panel cointegration tests and the Westerlund (2007) panel cointegration tests. The former was done in EViews 8, and the latter using the *xtwest* command of Persyn and Westerlund (2008) in Stata. A key advantage of the Pedroni cointegration tests is that they are applicable where intercepts and/or trend coefficients are heterogeneous across cross-sections. However, like most other residual based tests, Pedroni tests require that the long-run parameters for the variables in their levels are equal to the short-run parameters for the variables in their differences (Persyn and Westerlund 2008), a condition that may not hold in many cases. This condition is not a requirement in Westerlund tests, which also

have the advantage of being more appropriate where cross-member correlation is suspected among the series.

DOLS Model Specification

The DOLS model specified and estimated for each of the food and non-food commodity groups were specified with one lag, one lead and a constant allowed in the deterministic specification, following Kao and Chiang (2000), as follows:

$$y_{it} = X_{it}'\beta + \sum_{j=-q}^{ri} \Delta X_{it+j}'\delta_i - \upsilon_{it} \qquad (1)$$

Where:

y_{it} is the natural log of the seasonally adjusted price of the reference commodity group in the i^{th} state/FCT and period t,

X_{it} is the matrix of exogenous and non-cointegrating RHS variables including MPR, lnM1, lnEXR and lnPPET, lnWP

β and δ_i are parameters to be estimated, in which δ_i are allowed to vary across cross-sections, and β consists of parameters of the cointegrating equation.

Demand System Specification and Elasticities

Estimates of demand elasticities are required to compute the welfare measures employed in this study. These were computed based on parameter estimates from a Quadratic Almost Ideal Demand System (QUAIDS) specified following Banks, Blundell, and Lewbel (1997), with demographic variables incorporated into the model using Ray's (1983) method, following Poi 2012).

The specific form of the QUAIDS model that was estimated was specified following Poi (2012) as follows:

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

Where:

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

$$b(p) = \prod_{i=1}^{k} p_i^{\beta_i} ; \qquad b(p) = \prod_{i=1}^{k} p_i^{\eta_i' z} ; \qquad \overline{m}_0(z) = 1 + \rho' z ;$$

k is the number of commodity groups indexed by i or j; w_{iht} is the share of total consumption expenditure (m) of household h in period t that was devoted to commodity i; p is the vector of commodity prices; *z* is the vector of demographic variables including the gender, age, and education level of the household head as well as the household size, proportion of household members below 18years and proportion of household members that were females; and the Greek letters (α, β, γ, λ, η and ρ) are model parameters.

The model parameters were estimated using the *quaids* command of Poi (2012) in Stata. The underlying algorithms of the *quaids* command were designed to estimate the model parameters with the following restrictions implied by economic theory imposed:

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

The *quaids* suite of commands in Stata also provide post estimation commands by which demand elasticities may be computed for each individual observation in the dataset and/or evaluated at means of the variables in the argument. As shown in Poi (2012), the command algorithms

compute uncompensated price elasticities of demand for commodity i with respect to changes in price of commodity j as:

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

$$\left. \left[\alpha_j + \sum_l \gamma_{jl} \ln p_l \right] - \frac{(\beta_j + n_j' z)\lambda_i}{b(p)c(p,z)} \left[\ln\left\{ \frac{m}{\overline{m}_0(z)a(p)} \right\} \right]^2 \right) \quad (3)$$

The corresponding compensated elasticities are also computed by Slutsky equation as:

$$\varepsilon_{ij}^{\ C} = \varepsilon_{ij} + \mu_i w_j \quad (4)$$

where μ_i is the expenditure (income) elasticity of demand for commodity i, which is also computed as:

$$\mu_i = 1 + \frac{1}{w_i}\left[\beta_i + \eta_i' z + \frac{2\lambda_i}{b(p)c(p,z)} \ln\left\{ \frac{m}{\overline{m}_0(z)a(p)} \right\} \right] \quad (5)$$

Assessment of Welfare Effects of Policy-induced Price Changes

Assessment of welfare effects of a policy-induced price changes were undertaken in two steps. First, given some hypothetical percentage change(s) in value(s) of a policy variable, the corresponding vector of estimated percentage changes in prices (Δp/p) of various commodities were computed based on coefficients of the policy variable the estimated cointegrating equations in (1). Second, the corresponding policy-induced welfare changes were measured as the compensated variation (CV) for the policy-induced price change. The CV is the extra net income that would need to be transferred to (or withdrawn from) the referenced household to enable her retain her welfare (or utility) level attained before the policy-induced price changes.

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 Robles and Torero (2010) as:

$$B(p,r,U) = m(p,r,U) - \pi(p,r) \quad (6)$$

where B(p, r, U), m(p, r, U) and π(p, r) are respectively the net expenditure, expenditure and profit function; while 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 a policy-induced price changes were computed, following Robles and Torero (2010) as:

$$dB(p,r,U) = \left[(w_h) - (w_y)\right]'\left(\frac{dp}{p}\right)m + \frac{1}{2}\left(\frac{dp}{p}\right)'(W_h)(E)\left(\frac{dp}{p}\right)m \quad (7)$$

where *dB(p,* w, *U)* is the change in the household net expenditure, which is the compensating variation (i.e. the amount of extra income the household needs to achieve the original level of welfare, *U*) given the policy-induced change in prices; *dp/p* is the vector of policy-induced percent changes in 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 uncompensated demand elasticities (own price elasticities along the principal diagonal and cross-price elasticities as the off the diagonal elements); and m is the total expenditure. The CV measures in (7) 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 (7) is a measure of the direct (or first round) effect of the policy-induced price changes, which is the CV under the assumption that households do not revise their consumption and production quantities as price change. The second term is a measure of the substitution effects which 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 response, and hence stuck to the standard assumption that farm households do not revise the production decisions in response to relative price changes in the short-run.

Results and Discussion

The central aim of this study has been to assess the role of government policies in the endemic - high and rising food prices in Nigeria, and the associated welfare impacts on farm households in the country. This paper presents evidences on the link (cointegrating relations) between selected policy variables - monetary policy (interest) rate (MPR), narrow money supply (M1), official exchange rate (EXR) and government – fixed pump price of premium motor spirit (petrol) in Nigeria (PPET) on one hand, and prices of various groups of food and non-food commodities on the other. Estimates of demand elasticities, based on a two year panel of household consumption data and prices, were also generated and used in conjunction estimates of policy induced price changes from the estimated cointegrating equations to measure the compensating variation of the policy induced price changes. The results are summarized in the following sub-sections.

Trends in Policy Variables and Commodity Prices

As a background to the srudy, Figures 1 and 2 respectively present the trends in the monthly series well as 12 months growth rates of selected policy variables and composite food and non-food price indices in Nigeria between January 2007 and December 2012. The trends were also compared with the general patterns in global food prices over the period.

A close examination of the trends in the variables in Figures 1 and 2, points in atleast three directions in terms of policy implications. First, that food prices in Nigeria continued on the rising trend it had mainatined since the mid 1980s (Fig. 1), despite various policy actions that were purportedly targeted at curtailing inflation rates in the country over the study period. It is however, worthy of note that the measures seem to have succeeded in slowing down the rates of of increase in food prices, with the 12-months rate of growth in food price index falling from 15-19.0% in 2008 to 9-12% in 2011/2012, even though the non-food inflation rates kept rising from an average of 5% in 2008 to an average of 13% in 2012 (Fig. 2).

Second, government policy actions – by tinkering with M1, MPR and EXR – seem to be much more closely associated with (suggesting a reaction to) changes in the World Food Prices than that of curtailing rising domestic prices. For example, EXR was raised sharply from N117.70/US$ in November 2008 to N145.80/US$ in December 2008, and thereafter gradually increased to N158.40/US$ by January 2012, while the MPR was reduced steadily from 10.3% in August 2008 to 6.0% in July 2009, in response to the sharp increases in World food prices (Fig. 2). These would suggest an attempt to use monetary policy to: (a) discourage food import by triggering exchange rate depreciation; (b) stimulate increased domestic production by encouraging banks to charge lower interests on loans; and (c) possibly stimulate expansion of domestic exports in the process.

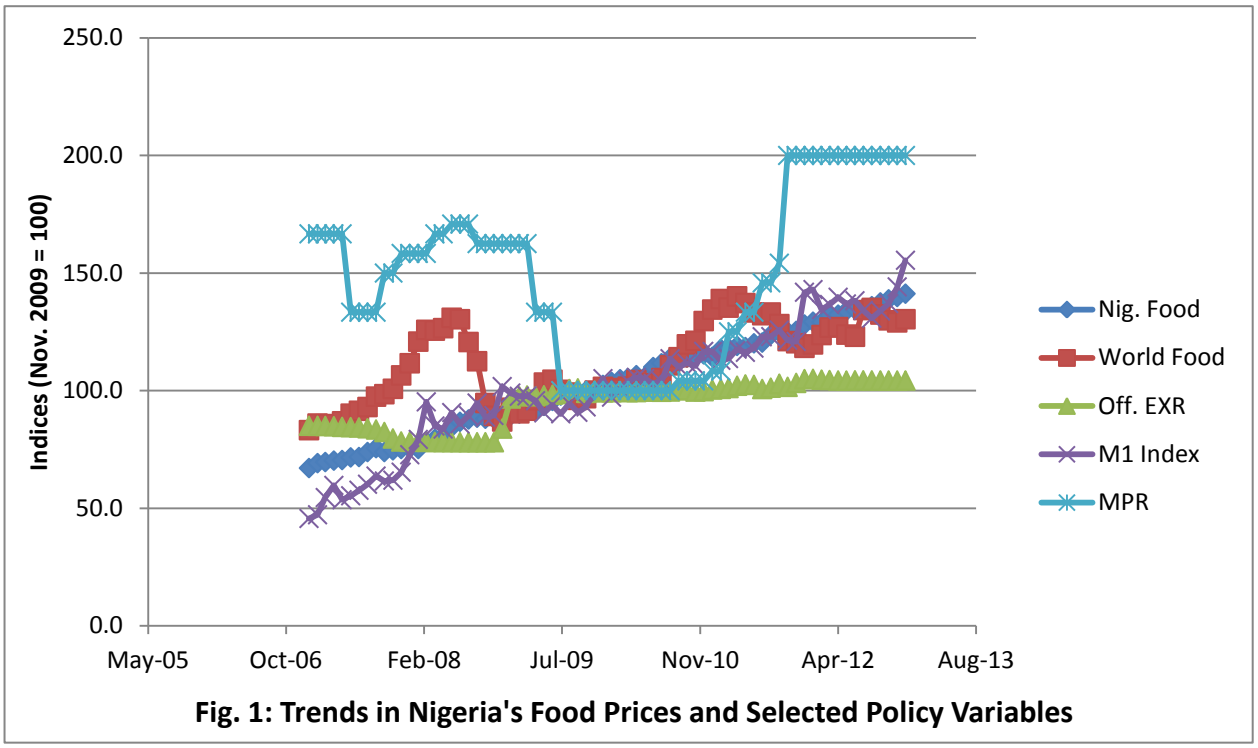


Fig. 1: Trends in Nigeria's Food Prices and Selected Policy Variables

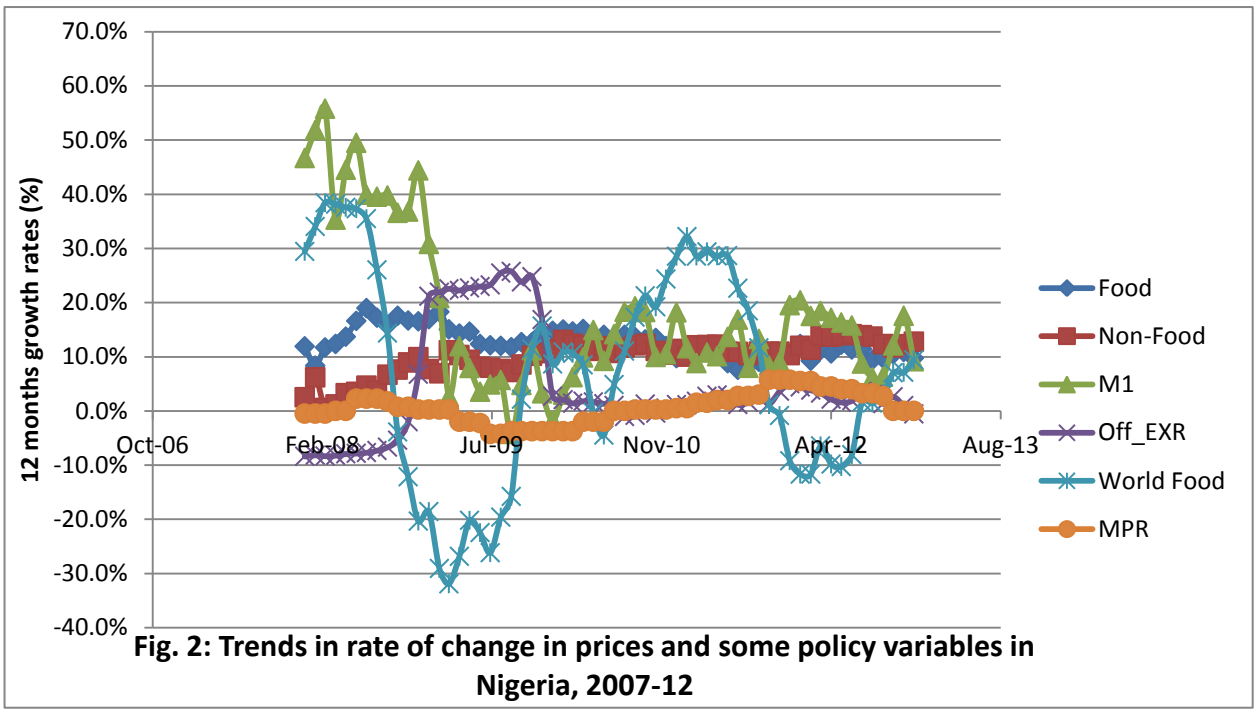


Fig. 2: Trends in rate of change in prices and some policy variables in Nigeria, 2007-12

The aforementioned monetary policy actions suggests that the Federal Government of Nigeria (FGN), acting through the Central Bank of Nigeria (CBN), perceived the rising global food prices as an opportunity to turn the terms of agricultural trade in favor of Nigeria. Not unexpectedly, however, domestic prices rose very sharply in response to government policy actions, and this was greeted with widespread protest by labor unions clamoring for wage increases. As palliatives, the FGN ordered release of some grains from its strategic reserves, placed a barn on maize export, suspended (for a short period) import duties and other taxes on rice, and agreed to increase the minimum wage. The implications of the general wage increase coupled with the gradual withdrawal of subsidies from farm inputs and petroleum products, would imply a rising cost of production in the country, which is made evident by the rising non-food price index (Fig. 2).

The third pattern that is worthy of note in Figures 1 and 2 is the fact that the trend in domestic food prices seems to maintain a close match with those of M1 and EXR, most especially in the post 2007/08 period, while the volatility is far from those of the World food prices. These tend to suggest that the rising food prices in Nigeria has a lot more to do with domestic policy actions than what is causing the general increases and volatility in the World food prices. As noted by Ngogi (2008), the endemic rising food prices in many part of Africa (including Nigeria) may be linked to the neglect of agriculture, leading to a low and sometimes declining agricultural productivity in most part of the region (Fulginiti, *et al*. 2004; Shittu and Phillip, 2009; Shittu, 2014a & b). Ngogi (2008) observed further, that instead of improving the functioning of essential agriculture supporting institutions (e.g. the commodity boards in Nigeria), donors and, in turn, many African countries pursued market solutions that decimated these institutions and tend to weaken agricultural productivity.

Food Price and Policy Linkages

Central to assessment of welfare effects of the policy induced rising food prices in Nigeria is a clear understanding of the response of consumer prices (food and non-food) to changes in key policy variables. Nothing that a wide range of econometric techniques exists for modelling such policy-price linkages, and that the choice should ideally be informed by statisical properties of the series, the study series – including the panel data on domestic food prices, time series of policy variables and world food prices were examined viz-a-viz their stationarity, Granger causality and co-integration tests among linear combinations of the series as discussed in the methodolgy. The results as shown in Appendix, show that the series are generally I(1) series (Table A1); the policy variables and World food prices are exogenous (Table A2) and non-cointegrating (Table A3); and that the policy variables and World food prices are cointegrated with the domestic prices. Hence, the cointegrating relations were modelled using Dynamic Ordinary Least Square (DOLS) Techniques, which Kao and Chiang (2000), showed to have to be superior to other alternatives – OLS, fully modified OLS (FM-OLS), and other estimation methods based on Generalized Methods of Moments (GMM) – in terms of unbiaseness, consistency, and efficiency in finite sample cases, most especially with panel data. The results are summarized in Table 1.

As shown in Table 1, there is a very strong link between explanatory variables in the model (domestic policy variables and World Prices) and the corresponding food prices, with the adjusted R^2 values being higher than 70% in most cases, and most of the coefficients associated with the policy variables being significant at 1% level. The responses of prices of most of the commodities to the policy variables (MPR, M1 & PPET) were positive in most cases, but generally inelastic.

Table 1: Estimated DOLS cointegrating equations and long-run elasticities

Dependent Variable	Exogenous Explanatory Variables (X)					Adj. R^2
	lnWP	lnEXR	MPR	lnM1	lnPPET	
Aggregate Food CPI	0.164	0.56**	0.002	0.324**	0.181*	0.98
	(1.89)	*(3.29)*	*(0.52)*	*(4.44)*	*(2.54)*	
Domestic Price of:						
Bread	0.041	0.392**	0.023**	0.220**	0.316**	0.74
	(1.65)	*(4.33)*	*(10.83)*	*(6.99)*	*(10.03)*	
Fish	-0.064	0.046	0.009	0.443**	0.621**	0.55
	(-0.71)	*(0.26)*	*(1.41)*	*(6.71)*	*(10.35)*	
Meats	0.465**	0.600**	0.002	0.199**	0.161**	0.76
	(10.32)	*(6.45)*	*(0.79)*	*(5.35)*	*(5.21)*	
Milk	0.304**	0.552**	0.018**	-0.112**	0.356**	0.73
	(7.41)	*(8.27)*	*(9.03)*	*(-4.27)*	*(10.98)*	
Other Cereals	-0.137**	-0.593**	0.006*	0.253**	0.675**	0.85
	(-5.25)	*(-7.06)*	*(2.43)*	*(7.97)*	*(21.84)*	
Pulses	-0.480**	-1.300**	0.017**	0.586**	1.049**	0.85
	(-10.78)	*(-11.79)*	*(6.58)*	*(17.06)*	*(22.69)*	
Rice	0.254**	0.304**	-0.002	0.166**	0.168**	0.79
	(12.78)	*(5.07)*	*(-1.69)*	*(9.04)*	*(6.72)*	
Tubers	0.354**	1.041**	0.003	0.221**	0.095**	0.78
	(7.86)	*(12.34)*	*(1.48)*	*(7.49)*	*(2.69)*	
Other Foods	0.047	0.182*	0.494**	-0.020**	0.037	0.74
	(0.93)	*(1.89)*	*(12.07)*	*(-9.68)*	*(0.94)*	
Non-Food CPI	-0.015*	-0.127**	-0.247**	0.003**	0.006	0.99
	(-1.81)	*(-6.76)*	*(-33.50)*	*(9.89)*	*(1.15)*	

Note: ** *and* * *imply the associated coefficient is significant at1% and 5% levels respectively*

Focusing on response of aggregate domestic food price index to the policy variables, a 1% increase in the amount of Naira exchanged for a US$ was found to be associated with 0.56% increase in aggregate food CPI, while similar increase in narrow money supply (M1) and price of petrol (PPET) were revealed as being associated with 0.32% and 0.18% increase in aggregate food CPI, respectively. Impact of MPR was found to be insignificant even at 10%.

Similar patterns were observed across commodity groups. However, exchange rate depreciation was found to be associated with significant reduction in prices of other cereals (maize, millet & sorghum), pulses and non-food items, while increase in money supply was also found to lead to significant decline in price of milk (beverages) and other foods group. We also found that increase in MPR significantly raise prices of bread, milk, other cereals, pulses and other food groups. These are mostly food commodities that are produced and/or processed domestically before consumption, hence the positive MPR impacts. Increase in price of petrol, a commodity that is closely linked with transportation of the mostly bulky farm produce, was also found to be linked to significant increases in prices of most food commodities. As shown on Table 1, increases in World prices are also passed significantly to prices of the corresponding domestic commodities in Nigeria, except for fish and the other foods group. We however, found that while increase in world prices of the various commodities were associated with significant increase in domestic prices of most of the commodities, they lead to decrease in domestic price of pulses, other cereals group, and non-food commodities group that do not feature significantly in Nigeria's external trade.

Estimates of Policy-induced Price Chages

Given the estimated cointegrating relations in Table 1, estimates of the contributions of various factors to the observed commodity prices inflation rates in Nigeria are summarized in Table 2

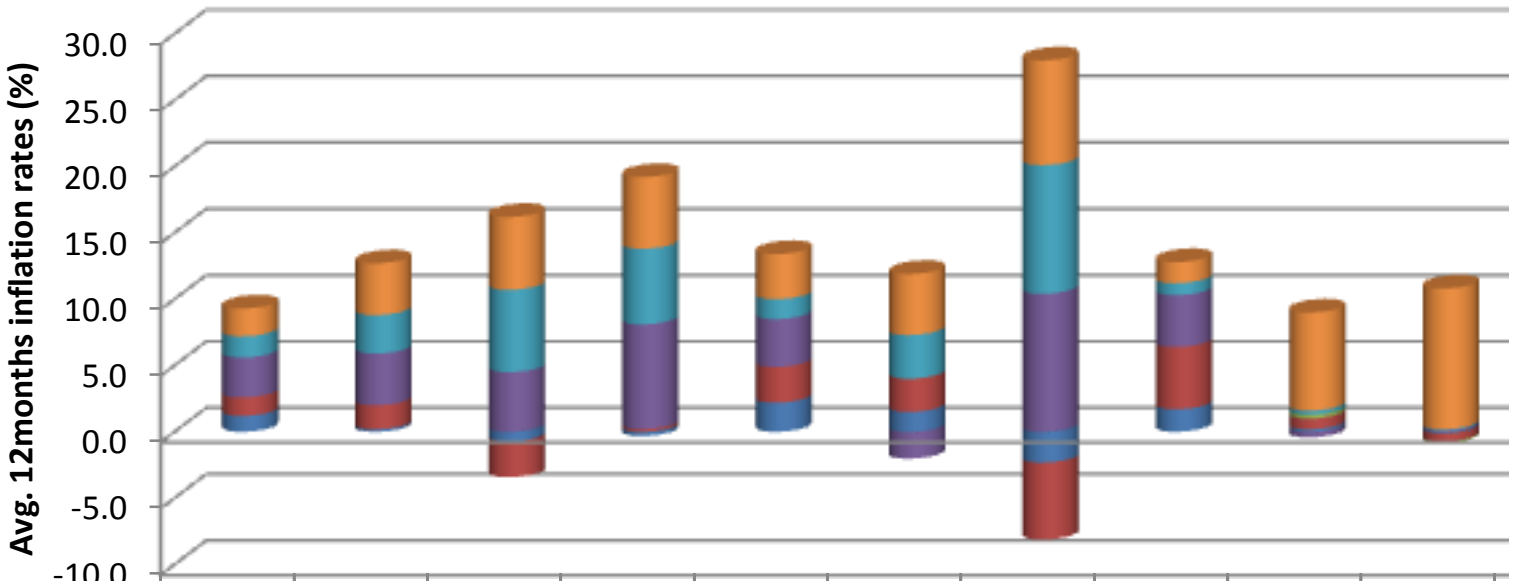
and Figure 3. It is instructive to note that the average 12months food inflation rates in the country between January 2007 and December 2012 was estimated to be 11.7%, with the average figure ranging from 8.7% for other foods group (fat & oil, vegetables, fruits, spices, etc) to 19.9% for pulses (cowpea, soya bean, groundnut, melon, etc). However, the rates of growths in World Price, EXR, MPR, M1 and PPET are respectively 4.8%, 4.5%, 0.6%, 17.8% and 9.3%.

A number of points are worthy of note in the observed patterns of inflation rates in Nigeria as shown Table 2 and Figure 3. First, the average annual inflation rates of prices of commodities that are largely produced and consumed within the domestic economy (pulses, other cereals like maize, sorghum & millet, meats and tubers including products of cassava and yams), are on the average higher than those of commodities that feature significantly in Nigeria's food imports (rice, fish, milk, and other foods including fat & oil, sweeteners, etc). Second, only about 0.5% out of the 11.7% of the average commodity price inflation rates in Nigeria could be attributed to the rising food prices in the World at large. Most of the observed commodity price inflation rates in Nigeria were driven by factors/actions inherent in the domestic economy.

Focusing on government policy actions, results on Table 2 and Figure 3 revealed that increase in domestic money supply, followed by increase in pump price of petrol (a proxy for withdrawal of subsidies) and policy-induced exchange rate depreciation are the leading drivers of commodity prices inflation rates in Nigeria. Changes in these policy variables between 2007 and 2012 have, respectively, been contributing 2.4%, 2.2% and 0.8% of the 11.7% average annual commodity price inflation rates in Nigeria over the study period. The impacts of policy induced interest rate (MPR) changes were however found to be very minimal.

Table 2: Estimates of actual and policy-induced inflation rates in Nigeria, 2007 - 2012

Description		Rice	Bread	Other Cereals	Fish	Meats	Milk	Pulses	Tubers	Other Foods	Non-Food	Avg
		Actual Annual Price Changes (%/year)										
Geopolitical Zone												
North-Central		9.0	12.2	15.5	17.3	12.7	11.1	20.6	13.8	9.1		
North-East		9.4	13.4	16.6	16.9	17.0	8.9	22.9	10.8	8.6		
North-West		9.8	16.1	16.4	21.6	16.0	9.2	23.0	12.4	9.1		
South-East		8.9	10.4	7.7	21.3	12.9	9.3	16.0	14.1	7.6		
South-South		9.1	10.8	7.3	19.5	9.2	10.3	16.4	11.8	8.7		
South-West		8.5	12.9	13.2	16.9	12.5	9.9	19.6	12.7	8.8		
National Average		**9.2**	**12.7**	**12.9**	**18.9**	**13.4**	**9.8**	**19.9**	**12.6**	**8.7**	**9.9**	**11.7**
Inducing factor (X)	ΔX (%)	Policy-induced Price Changes (%/year)										
World Price	4.8	1.2	0.2	-0.7	-0.3	2.2	1.5	-2.3	1.7	0.2	-0.1	0.5
Exchange Rate	4.5	1.4	1.8	-2.7	0.2	2.7	2.5	-5.8	4.7	0.8	-0.6	0.8
Interest Rate (MPR)	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	-0.1	0.0
Money Supply (M1)	17.8	3.0	3.9	4.5	7.9	3.6	-2.0	10.4	3.9	-0.4	0.1	2.4
Petrol Price	9.3	1.6	2.9	6.2	5.7	1.5	3.3	9.7	0.9	0.3	0.1	2.2
Other factors		**2.1**	**3.9**	**5.5**	**5.4**	**3.4**	**4.6**	**7.9**	**1.6**	**7.4**	**10.6**	**5.9**



	Rice	Bread	Other Cereals	Fishes	Meats	Milk	Pulses	Tubers	Other Foods	Non-Food
Others	2.1	3.9	5.5	5.4	3.4	4.6	7.9	1.6	7.4	10.6
PPET	1.6	2.9	6.2	5.7	1.5	3.3	9.7	0.9	0.3	0.1
M1	3.0	3.9	4.5	7.9	3.6	-2.0	10.4	3.9	-0.4	0.1
MPR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	-0.1
EXR	1.4	1.8	-2.7	0.2	2.7	2.5	-5.8	4.7	0.8	-0.6
WR	1.3	0.3	-0.7	0.3	2.3	1.5	-3.3	1.7	0.3	0.1

It is also worthy of note that some domestic factors other than those explicitly captured in the model, were identified as jointly contributing about half (5.9%) of the 11.7% average annual commodity price inflation rates in Nigeria. These may be production linked, given evidences from other studies (e.g. Fulginiti, *et al*. 2004; Ngogi, 2008; Phillip *et al.* 2008; Shittu, 2014) that have blamed the neglect of agriculture that keeps agricultural productivity levels low and sometimes declining, as possible causes of the rising food prices in Nigeria. Phillip *et al.* (2008) also draw attention to the fact that food production in Nigeria are being constrained by inadequate access to modern inputs like fertilizer and tractors services, low access to agricultural credit, land tenure insecurity, land degradation, poverty, low and unstable investment in agricultural research, and poor market access among others.

Estimates of Welfare Impacts

The main aim of this study has been to assess the welfare impacts of policy induced rising food prices on farm households in Nigeria, and compare the estimates across socio-economic groups. The welfare impacts were measured as the compensating variation (CV) of the policy induced price changes following Robles and Torero (2010) as earlier explained in the methodology. Estimates of demand elasticities required to compute the CV measures for each household in the sample were based on coefficients of a QUAIDS model (Banks *et al.*, 1997) specified, with demographic variables incorporated using Ray's (1983) method, and estimated using Poi (2012) *quaids* command in Stata. The results are summarized in Appendix Table A4 & A5, while the demand elasticities evaluated at means of the argument are summarized in Table A6. The CV associated with the key policy variables that were identified as the key drivers of rising food prices in Nigeria as well as with the overall price changes recorded in an average year between 2007 and 2012 are summarized in Tables 3.

Table 3: Estimates of Compensated Variation of policy-induced inflation rates in Nigeria

Description	Percent of Farm Households	Mean Expenditure (N/year) (M)	Mean Compensated Variation (% of M) associated with:			
			Higher Food Prices	Exch. Rate Depreciation	Rising Money Supply (M1)	Increase in Petrol Prices
All Households	100	357,202.17	-3.33	0.25	-1.97	-1.67
		(3,288.32)	*(0.35)*	*(0.07)*	*(0.11)*	*(0.12)*
Gender of Head						
Female Headed	12.7	287,360.38	6.56	0.33	1.21	1.28
		(7,578.73)	*(0.40)*	*(0.08)*	*(0.14)*	*(0.12)*
Male Headed	87.3	367,334.73	-4.76	0.24	-2.43	-2.09
		(3,580.11)	*(0.39)*	*(0.07)*	*(0.13)*	*(0.13)*
Farm size						
Smallholders	74.6	370,759.94	8.09	0.39	1.57	1.63
		(3,926.59)	*(0.07)*	*(0.02)*	*(0.02)*	*(0.02)*
Larger Farms	12.7	317,325.36	-36.90	-0.14	-12.39	-11.35
		(5,763.29)	(0.94)	(0.25)	(0.32)	(0.36)
Enterprise Type						
Crops Only	56.6	395,113.26	6.57	0.77	0.98	0.76
		(4,665.45)	(0.23)	(0.05)	(0.08)	(0.09)
Smallholder Livestock	22.6	296,004.84	4.66	-0.13	0.69	1.20
		(5,820.70)	(0.17)	(0.05)	(0.06)	(0.05)
Commercial Livestock	20.8	320,729.56	-38.93	-0.72	-12.88	-11.39
		(6,442.07)	(1.07)	(0.27)	(0.36)	(0.39)
Special Groups						
Fish Farmers	0.6	408,290.38	-27.79	1.23	-10.94	-9.94
		(43,566.72)	(7.49)	(1.14)	(2.70)	(2.76)
Rice Farmers	3.4	319,203.35	-35.02	2.06	-12.59	-12.54
		(16,127.80)	(2.74)	(0.57)	(0.96)	(1.06)

Note: *Figures in parentheses are standard errors of associated means.*

As shown in Table 3, the welfare impacts of the rising food prices and the policies that induce the change vary widely across socio-economic groups in the country. On the average however, the results revealed that an average farm household in the country derived a welfare gain of about 3.3% of the mean expenditure (N357, 202.17/year) as a result of the rising food prices in an average year between 2007 and 2012.

The welfare gain by the average farm household was primarily derived from the price effects of increase in domestic money supply (1.97% of household budget) and increase in pump price of petrol (1.67% of household budget), while price effects of a policy induced exchange rate depreciation attracted a net welfare loss of about 0.25% of household budget in each year between 2007 and 2012. In effect, the results tend to suggest that an average farm household in Nigeria derived moderate welfare gain from the inflation targeting policy actions of the CBN and withdrawal of subsidies in pursuit of market liberalization and efficiency between 2006 and 2012. However, measures targeted at discouraging import and promoting export by inducing exchange rate depreciation was found to be harmful to farm households that were purportedly being protected. The reason for this is however not farfetched. First, Nigerian government's trade and exchange rate policy actions are primarily driven by concerns to raise / maintain external reserves at some levels. "Protection" of domestic farms is considered relevant only because more agricultural export and less food import would enhance trade balance. Second, is the fact that maize (a crop in other cereals group), which is one of the few crops in which Nigerian farmers have marketable surplus was placed on export prohibition list during the period.

Hidden behind the shield of this aggregate welfare gain however, is the fact that smallholders, which constituted about three-quarter (74.5%) of the farm households, recorded on the average, a net welfare loss of about 8.1% of the household budget, while an average female headed

household also suffered a net welfare loss of about 6.6% of her budget annually as a results of the rising food prices. As shown in Table 3, the real gainers of the rising food prices are owners of the relatively large farms with mean CV of -36.9% of the household budget. These include owners of the commercial livestock farmer (-38.9%) as well as the very few rice farms (-35.0%) and fish farms (-27.8%).

Summary and Conclusions

This study had sought to empirically examine the role of government policy actions on an endemic – high, rising and sometimes volatile food prices in Nigeria and the welfare impacts on farm households. The empirical techniques included estimation of the cointegrating relations between rural prices of 10 commodity groups (food and non-food) and selected policy variables using a monthly panel data on 36 States and Federal Capital Territory (FCT) in Nigeria between January 2007 and December 2012. The associated estimates of policy induced price changes were combined with demand elasticities from an estimated Quadratic Almost Demand System (QUAIDS) model to compute the compensating variation of the policy induced price changes. The QUAIDS model was estimated using a two year balanced panel data with information on consumption behavior of 3,250 households, which were those with complete information among the 5000 households covered in the recently released General Household Survey (Panel) 2010/2011 for Nigeria.

The study found among, other evidences, that increase in narrow money supply (M1), increase in official exchange rate of Naira per US Dollar and withdrawal of subsidy from premium motor spirit (petrol) are the main policy actions driving the rising food prices in Nigeria. Other key factors, seems to be linked with production and marketing constraints being faced by farmers within the domestic economy that tends to limit productivity growth within the farm sector in

Nigeria. The study also found further that while changes in World food prices are also significantly transmitted to food prices in Nigeria, the impact is relatively small when compared with those arising from government policy actions, among other domestic factors.

In general, evidence from study showed that an average farm household in the country benefited from the rising food prices with the mean compensated variation estimated at -3.3% of the household budget. However, the study found that the welfare gains were enjoyed mostly by owners of the relatively few large farms whose mean compensated variation was as high -36.9% of the household budget. These gainers include the owners of commercial livestock farms (-38.9%), rice farms (-35.0%), and fish farms (-27.8%). Smallholders, which constituted about three-quarter of the farm households, and female-headed households, were however found to have ended up being net losers from the rising food prices. The mean compensated variation among the smallholders was found to be about 8.1% of the household budget, and 6.6% among the female headed households. Such magnitude of welfare loss is perhaps a contributory factor in the very limited success achieved in the pursuit of poverty reduction among farm households in Nigeria, over the years.

The study thus, concluded that while inflation targeting and the "guided" trade and exchange rate deregulation by the CBN/FGN have the potentials to enhance agricultural income in Nigeria, it may end up widening the gap between the rich and the poor in the country, unless supplementary measures are put in place to help the predominant smallholder farmers in the country to take advantage of the economic opportunities. Key actions that may be taken in this regard may include intensification of efforts to mobilize farmers into forming appropriate cooperative/economic interest groups, and strengthening of such groups with capacity building, legislation, and possibly performance/target based input subsidies. For example, farmers' groups

that could provide verifiable evidences of working together to develop local development plans (LDC), pull together sizeable area of land for mechanized farming, mobilize some counterpart funding for productive asset acquisition or LDC project implementation, etc. may be granted take-off grant, revolving loan, and or subsidy for effectiveness of their operations. Such interventions had already been experimented with under the Fadama Development Project sponsored by the World Bank. The Nigerian governments now need to pull together experiences gathered from all such interventions to come up result oriented actions to mobilized/transform the huge number of smallholders in the country into becoming viable and self sustaining agribusiness units.

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Table A1: Results of Im, Pesaran and Shin (IPS) Panel Unit Root Tests

Series (Test Statistics)	Test at level		Test at 1st Difference	
	Without Trend	With Trend	Without Trend	With Trend
WStat for Nat. log of Seasonally Adjusted Domestic Prices				
Bread (Wheat products)	1.32	-21.24*	-67.43*	-68.68*
Fishes	-8.70*	-33.21*	-66.16*	-67.21*
Meats	1.36	-29.66*	-62.47*	-61.29*
Milk (Beverages)	-2.13	-15.12*	-69.23*	-70.70*
Other Cereals (Maize, Sorghum & Millet)	-5.91*	-15.33*	-70.01*	-71.43*
Pulses (Cowpea, Groundnut &Soybean)	3.12	-5.88*	-75.28*	-77.84*
Rice (local & imported)	-3.02*	-14.49*	-69.77*	-69.63*
Tubers (Cassava products, yams & others)	3.09	-25.16*	-65.46*	-66.38*
Other Food	-8.54*	-23.41*	-68.56*	-61.57*
Non-food CPI (Cross section ADF t-stat)	0.98	-2.77*	-8.74*	-8.77*
Cross section ADF t-stat for Nat. log of Seasonally Adjusted World Prices				
Wheat	-2.24	-1.74	-6.54*	-6.50*
Fishes	-1.54	-1.67	-7.16*	-7.10*
Meats	-0.55	-2.53	-7.30*	-7.25*
Beverages (Index)	-2.30	-1.71	-5.78*	-6.02*
Other Cereals (Maize, Sorghum & Millet)	-0.98	-1.68	-7.17*	-7.14*
Pulses	-1.67	-1.96	-4.74*	-4.70*
Rice (Long grain)	-3.08*	-3.00	-4.00*	-4.02*
Food (Index)	-2.00	-2.51	-5.17*	-5.15*
Cross section ADF t-stat for Domestic Policy Variables				
Official Exchange Rate (ln)	-1.12	-2.32	-5.20*	-5.16*
Monetary Policy Rate	-2.19	-3.45	-8.89*	-8.98*
Petrol Price (ln)	-0.74	-2.88	-9.23*	-9.19*
Broad Money Supply (ln)	-0.69	-1.03	-7.78*	-7.99*

Note: * *imply the Null hypothesis that the series is non-stationary is rejected at 5% level*

Table A2: Results of Granger causality test among exogenous variables

Null Hypothesis:	Obs	F-Statistic	Prob.
LNM1 does not Granger Cause LNEXR	70	3.12576	0.0506
LNEXR does not Granger Cause LNM1		0.25963	0.7721
MPR does not Granger Cause LNEXR	70	0.05188	0.9495
LNEXR does not Granger Cause MPR		0.12832	0.8798
LNPPET does not Granger Cause LNEXR	70	0.51001	0.6029
LNEXR does not Granger Cause LNPPET		5.04601	0.0092
LNWFPI does not Granger Cause LNEXR	70	1.71706	0.1876
LNEXR does not Granger Cause LNWFPI		2.54420	0.0863
MPR does not Granger Cause LNM1	70	0.46907	0.6277
LNM1 does not Granger Cause MPR		2.19111	0.1200
LNPPET does not Granger Cause LNM1	70	1.01329	0.3687
LNM1 does not Granger Cause LNPPET		2.81691	0.0671
LNWFPI does not Granger Cause LNM1	70	0.58395	0.5606
LNM1 does not Granger Cause LNWFPI		0.65848	0.5211
LNPPET does not Granger Cause MPR	70	0.37410	0.6894
MPR does not Granger Cause LNPPET		4.22077	0.0189
LNWFPI does not Granger Cause MPR	70	4.26763	0.0181
MPR does not Granger Cause LNWFPI		0.64789	0.5265
LNWFPI does not Granger Cause LNPPET	70	0.14727	0.8633
LNPPET does not Granger Cause LNWFPI		0.71624	0.4924

Note: *tests were with two(2) lags in the series, using monthly time series from 2007:1 – 2012:12*

Table A3: Results of Panel Cointegration Tests

Test Variables	Pedroni Residual Based Test Statistics			Westerlund Statistics	
	Panel ADF	Panel ADF (Weighted)	Group ADF	Panel τ	Group τ
Exogenous Variables (X)	5.27^{+}	8.31^{+}	5.27^{+}	-14.898	-2.449
Price of Item & X					
• Bread	-28.55*	-28.51*	-28.52*	-28.82*	-4.63*
• Fish	-33.38*	-31.17*	-35.94*	-30.18*	-5.03*
• Meats	-29.37*	-29.32*	-30.47*	-28.95*	-4.87*
• Milk	-24.00*	-24.89*	-25.65*	-25.60*	-4.22*
• Other Cereals	-25.78*	-26.60*	-26.89*	-29.21*	-5.16*
• Pulses	-19.56*	-19.26	-18.35*	-18.27	-2.85
• Rice	-24.39*	-23.28*	-25.09*	-26.46*	-4.63*
• Tubers	-26.80*	-27.46*	-28.19*	-27.97*	-4.27*
• Other Foods	-30.36*	-30.17*	-34.45*		
• Non-food CPI	-8.92*	-8.92*	-8.48*		

Note: *X = (LNWP$_i$, LNEXR, MPR, LNM1, LNPPET)*
*The Null hypothesis of no cointegration is rejected at 5% level
+ While the Null hypothesis of no cointegration could not be rejected based on virtually all the Pedroni test statistics {the weighted & un-weighted Panel v (stat=0.76, p-value=0.22), Panel rho (stat=2.47, p-value=0.99), Panel PP (stat=1.80, p-value=0.96), Group rho (stat=4.87, p-value=1.00) and Group PP (stat=3.75, p-value=1.00) based tests}, the v-statistic based test suggest the null is rejected at 1%. including.

Appendix A4: Estimated QUAIDS Model (Coefficients of Prices)

Commodity shares (w_i)	α_i	Price coefficients (γ_{ij})									
		lnP1	lnP2	lnP3	lnP4	lnP5	lnP6	lnP7	lnP8	lnP9	lnP10
Rice (w1)	0.069	-0.017									
	(2.14)*	(1.42)									
Wheat Products (w2)	0.035	-0.018	-0.004								
	(1.58)	(4.71)**	(1.72)								
Other Cereals (w3)	-0.056	-0.007	0.008	-0.067							
	(1.51)	(1.59)	(3.02)**	(12.55)**							
Fishes (w4)	-0.131	0.010	-0.001	0.044	0.016						
	(3.14)**	(2.92)**	(0.39)	(12.09)**	(3.41)**						
Meats (w5)	-0.073	-0.008	0.008	-0.005	0.012	0.007					
	(2.05)*	(1.15)	(2.75)**	(1.05)	(2.61)**	(0.85)					
Beverages (w6)	0.131	0.006	-0.019	0.065	-0.004	-0.005	-0.038				
	(3.22)**	(0.79)	(6.97)**	(15.16)**	(1.17)	(0.79)	(4.90)**				
Pulses (w7)	-0.088	-0.002	0.004	0.004	0.000	0.024	0.018	-0.010			
	(3.51)**	(0.41)	(1.87)	(1.34)	(0.17)	(5.20)**	(4.38)**	(1.82)			
Tubers (w8)	0.011	0.048	0.022	0.019	-0.006	0.028	-0.038	-0.013	-0.042		
	(0.29)	(7.11)**	(6.61)**	(3.88)**	(1.55)	(4.63)**	(6.44)**	(3.71)**	(4.63)**		
Other Foods (w9)	0.168	-0.001	-0.006	-0.030	-0.038	-0.007	0.014	-0.003	0.017	0.057	
	(3.24)**	(0.09)	(2.25)*	(6.38)**	(8.19)**	(1.01)	(2.47)*	(0.67)	(2.87)**	(6.84)**	
Non Food (w10)	0.933	-0.012	0.005	-0.030	-0.033	-0.055	0.001	-0.023	-0.035	-0.002	0.184
	(17.20)**	(2.00)*	(1.29)	(4.12)**	(4.93)**	(9.13)**	(0.14)	(5.12)**	(4.64)**	(0.27)	(10.50)**

* $p<0.05$; ** $p<0.01$

Appendix A5: Estimated QUAIDS Model (Coefficients of Other Variables)

Commodity shares' Equation (w_i)	Total Expenditure		Demographic Variables (η_i)					
	β_i	λ_i	Household Head's			Household Composition		
			Gender	Age	Yrs in Schl	Size	pUnder18	pFemales
Rice (w1)	-0.009	-0.001	0.001	0.000	0.000	0.000	-0.000	0.001
	(1.00)	(0.87)	(1.51)	(1.57)	(2.47)*	(0.54)	(0.72)	(1.32)
Wheat Products (w2)	0.006	0.001	-0.001	0.000	-0.000	-0.000	-0.000	0.000
	(1.06)	(1.37)	(2.59)**	(2.65)**	(2.43)*	(0.28)	(1.02)	(0.26)
Other Cereals (w3)	-0.038	-0.003	0.000	0.000	0.000	-0.000	-0.001	-0.000
	(3.70)**	(3.71)**	(0.14)	(0.25)	(3.34)**	(3.68)**	(1.59)	(0.58)
Fishes (w4)	-0.045	-0.002	-0.003	-0.000	-0.000	0.000	0.000	-0.000
	(4.22)**	(3.25)**	(5.57)**	(3.40)**	(3.81)**	(2.95)**	(0.11)	(0.60)
Meats (w5)	-0.067	-0.006	0.001	0.000	0.000	-0.000	0.000	-0.001
	(7.89)**	(11.35)**	(2.08)*	(0.27)	(3.92)**	(3.30)**	(0.07)	(1.82)
Beverages (w6)	0.004	0.000	0.001	0.000	0.000	0.000	0.001	0.002
	(0.38)	(0.36)	(2.59)**	(0.96)	(1.19)	(1.17)	(0.78)	(2.47)*
Pulses (w7)	-0.026	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(3.85)**	(2.98)**	(1.25)	(2.71)**	(1.05)	(0.96)	(0.53)	(0.11)
Tubers (w8)	-0.041	-0.003	-0.001	0.000	0.000	0.000	0.000	0.001
	(3.99)**	(4.26)**	(0.76)	(1.18)	(4.69)**	(4.34)**	(0.55)	(1.10)
Other Foods (w9)	0.038	0.005	0.000	0.000	-0.000	0.000	-0.002	-0.000
	(2.71)**	(5.09)**	(0.27)	(0.06)	(0.20)	(2.97)**	(2.48)*	(0.04)
Non Food (w10)	0.178	0.011	0.001	0.000	-0.000	-0.000	0.003	-0.002
	(13.38)**	(12.01)**	(1.23)	(1.30)	(8.15)**	(2.52)*	(2.56)*	(1.44)
Rho			0.030	-0.002	-0.056	0.228	-0.166	0.153
			(0.26)	(12.50)**	(12.10)**	(11.26)**	(5.20)**	(10.59)**

* $p<0.05$; ** $p<0.01$

Table A6: Estimated Expenditure and Price Elasticity of Demand based on QUAIDS Results

Elasticity wrt:	Commodity Demanded									
	Rice	Wheat Products	Other Cereals	Fishes	Meats	Beverages	Pulses	Tubers & Products	Other Foods	Non-Food
Expenditure	0.848	1.371	0.370	0.055	-0.349	1.095	0.250	0.624	1.442	2.032
Price of Commodity										
• Rice	-1.164	-0.220	-0.034	0.170	-0.055	0.168	-0.002	0.800	0.154	0.183
• Wheat Products	-0.626	-1.123	0.441	0.133	0.479	-0.670	0.265	1.044	-0.085	0.142
• Other Cereals	-0.025	0.120	-1.750	0.399	-0.096	0.829	0.016	0.298	-0.166	0.372
• Fishes	0.205	0.033	0.620	-0.917	0.100	0.050	-0.060	-0.033	-0.415	0.414
• Meats	-0.059	0.159	-0.177	-0.099	-1.082	0.066	0.183	0.364	0.098	0.543
• Beverages	0.143	-0.201	0.882	0.037	0.036	-1.367	0.272	-0.297	0.321	0.173
• Pulses	0.008	0.129	0.073	-0.100	0.442	0.481	-1.253	-0.196	0.106	0.307
• Tubers & Products	0.388	0.178	0.163	-0.064	0.193	-0.160	-0.087	-1.170	0.278	0.279
• Other Foods	0.081	-0.021	-0.033	-0.068	0.121	0.156	0.086	0.303	-0.493	-0.129
• Non Food	0.047	0.028	0.110	0.165	0.025	0.054	0.078	0.101	0.131	-0.735