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

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Abstract

Domestic policies in Nigeria have been linked to high, volatile, and rising food prices in the country. In light of these linkages, this paper empirically examines the transmission of key monetary policy variables to domestic food prices and the resulting welfare impacts. Estimates of policy-induced price changes from estimated cointegrating relations between commodity prices and policy variables as well as demand elasticities from estimated quadratic almost ideal demand system (QUAIDS) of households' consumption expenditures, were employed to estimate the welfare impact (compensating variation) of the policy-induced price changes. The study found that government management of exchange rates and money supplies as well as withdrawal of subsidies on petroleum products have been the main driver of rising food prices in the country. While the average farm household benefited from these price increases, with the mean (median) compensating variation estimated -7.8% (-0.2%) of the household budget, a sizeable proportion (44.1 – 55.5%) of the households suffered welfare losses from various policy induced price changes. These include, notably households of smallholders (14.3 – 84.2%) and female-headed households (34.1 – 62.8%). Overall, while domestic policy actions relating to money supply and subsidy removal were Kaldor–Hicks efficient, exchange rate devaluation was not.

Résumé

Les politiques intérieures au Nigéria ont été liées à des prix élevés et volatiles des denrées alimentaires dans le pays. En vue de ces liens, ce document examine de manière empirique la transmission des variables clés de la politique monétaire sur les prix intérieurs des produits alimentaires et les effets sur le bien-être qui en résultent. Les effets sur le bien-être (variation compensatoire) sont estimés à partir du changement des prix induits par les politiques intérieures. Ces changements de prix dérivent d'une relation de cointégration estimée entre les prix des produits de base et les variables politiques, et d'élasticités obtenues à partir d'un système quadratique presque idéal de demande (QUAIDS) des dépenses de consommation des ménages. L'étude a révélé que la gestion gouvernementale des taux de change et de la politique monétaire ainsi que le retrait des subventions sur les produits pétroliers ont été les facteurs principaux menant à la hausse des prix des denrées alimentaires dans le pays. Alors que les ménages agricoles ont bénéficié en moyenne de ces hausses de prix, avec une moyenne (médiane) de la variation de revenu compensatoire estimée à -7,8 % (-0,2 %) du budget des ménages, une proportion appréciable (44,1 - 55,5%) des ménages a subi des pertes de bien-être dues au changement des prix provenant des mesures politiques. Parmi ceux-ci figurent notamment les ménages de petits exploitants agricoles (14,3 - 84,2 %) et les ménages dirigés par des femmes (34,1 - 62,8 %). Dans l'ensemble les politiques monétaires et le retrait des subventions alimentaires ont été efficients au sens de Kaldor-Hicks, contrairement au cas de la dévaluation du taux de change.

1. INTRODUCTION

When global food prices rose sharply in 2007-08, the world at large experienced just a taste of the "bitter pill" that Nigerians have been swallowing for the past four decades. While international food prices generally experienced a declining trend from the mid-1970s until the onset of the 2007-08 food crisis, the case in Nigeria was the 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.

The average annual food inflation rate in Nigeria slowed down steadily between December 2005 and November 2007 (from 23.1% to as low as 1.5%), it rose again in response to the global food crisis to 15.3% in November 2008 and was as high as 17.9% by April 2009. Furthermore, the average figure in the decade just prior to the global food crisis (11.0%) was not substantially different from what was experienced during the 2007-08 food crisis period itself (13.0%). The price surge also did not abate significantly in Nigeria after the global crisis, 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 bail the economy out of the huge fiscal deficits and deteriorating economic conditions caused by the crash in the international oil market in 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, while prior to the oil boom of the 1970s, Nigeria had been a major exporter of agricultural commodities like cocoa, cotton, and groundnut, the country had, through years of non-oil sector neglect in pursuit of "cheap" oil money, gradually become a net food importer. This, together with an industrial sector that is heavily dependent on imported inputs, pushed the nation to maintain huge non-oil trade deficits over the years.

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 behind this were the deregulation of external trade and payments arrangements, the adoption of a market-determined exchange rate for the Naira, a 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 conditionality (Easterly, 2005), the nation had to abolish all forms of price control, undertake sharp devaluation of Naira, and embrace 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, the government had to undertake widespread restructuring and rationalization of the public sector through privatization and commercialization, as well as the removal of subsidies on fertilizer, other agricultural inputs, and petroleum products. These strategies 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 these SAP strategies in Nigeria include high lending rates, a wide gap between lending rates and interest rates on bank deposits, steady devaluation of Naira, and a very high and rising cost of production, all leading to rising general price levels. Ironically, stimulating increased producer 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 government reforms since 1986. The fact, however, that the agricultural/rural population remains most severely affected by the rising incidence of poverty and food insecurity in Nigeria (Ogwumike and Aromolaran; 2000; NBS, 2005, 2012; Olomola, 2013) shows a clear need for a critical examination of the impacts of these policies on all strata of society.

This paper examines the links between domestic policy actions and the 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 Territories in Nigeria. It provides estimates of the welfare impacts of the policy-induced price changes on various categories of farm households. The rest of the paper is organized as follows. The introduction is followed by a stylized review of relevant theories and empirical evidence on the link between government monetary policy and prices, as well as drivers of rising food prices across the globe. The third section presents the study

methodology, data, and sources, while the forth section presents and discusses the results. The final section provides the study summary and conclusions.

2. LITERATURE REVIEW

2.1 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, there is growing evidence that domestic policies can have significant impacts on aggregate demand, and therefore household welfare, through their 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, however, vary widely across countries (Dabla-Norris and Floerkemeier, 2006; Mishkin, 2007) and may be influenced by factors such as the size and openness of the economy, the degree of its external orientation, and the features of its institutions (Mangani, 2011).

In the United States, Anzuini, *et al.* (2013) report 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) reports that, while a loosening of monetary policy leads to higher asset prices in China and that these positive asset price developments are linked to higher household consumption, the overall effects of monetary policy on Chinese households' behavior was reported to be limited.

In Malawi, Mangani (2011) reports that while changes in money supply and/or interest rates were not transmitted very significantly to prices, changes in the exchange rate substantially drive most of the changes in domestic prices. He posits that this finding is in agreement with studies in many other African countries – Egypt, Kenya, Ghana, and Nigeria – which have shown that a change in exchange rates is a key variable driving inflation (and therefore rising food prices) in the region. 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 in small (open) developing economies.

2.2 International to Domestic Price Transmission in Africa

Price transmission is a technical term that can be used to describe the relationship between international and domestic prices. It can also be used to describe how changes in one price will bring about changes in another price or in the pricing relationships within internal markets or between farm gate and retail prices, for example. Imperfect price transmission occurs when world price changes are not fully reflected in domestic prices. Price transmission can generally be measured in terms of the transmission elasticity, which is defined as the percentage change in the price in one market given a 1% change in the price in another market. Takayama and Judge (1971) postulate that price transmission is complete with equilibrium prices of a commodity sold on competitive foreign and domestic markets differing only by transfer costs, when converted to a common currency.

Several authors have studied price transmission within the context of the Law of One Price (*inter alia* Ardeni, 1989; Baffes, 1991) or within the context of market integration (Palaskas and Harriss 1993; Zanias, 1993; Gardner and Brooks, 1994). The concept and the analytical techniques have also been used to evaluate policy reform, such as *ex post* assessments of market integration in the context of the implementation of structural adjustment programmes (Goletti and Babu, 1994; Alexander and Wyeth, 1994). Another vein of research focuses on vertical price transmission along the supply chain from the producer to the consumer (Goodwin and Holt, 1999; von Cramon-Taubadel, 1999).

Conforti (2004) examines price transmission in 16 countries, including three in sub-Saharan Africa, using the error correction model. In Ethiopia, he found statistically significant long-run relationships between world and local prices in four out of seven cases, including retail prices of wheat, sorghum, and maize. In Ghana, there was a long-run relationship between international and local wheat prices, but no such relationship was found for maize and sorghum. In Senegal, he found a long-run relationship in the case of rice, but not maize. In general, the degree of price transmission in the sub-Saharan African countries was less than in the Asian and Latin American countries.

On the question of whether or not domestic food prices in Africa are linked to international prices, Minot (2011) examines the transmission of world food price changes to markets in sub-Saharan Africa based on monthly price series of 62 staple foods across nine countries over 5–10 years. The

analyses were undertaken within the framework of cointegration and Vector Error Correction Modelling (VECM). The study found that while staple food prices in these countries rose by an average of 63% between mid-2007 and mid-2008, and that this increase was about three-quarters of the proportional increase in world prices. However, a long-term relationship with world prices was established in only 13 of the 62 African food prices examined; African rice prices found to be more closely linked to world markets than maize prices. The study also reported that policy responses and local factors exacerbated the effect in some cases and suggested that African governments can reduce vulnerability to external food price shocks by investing in agricultural research, pursuing more predictable policies, facilitating grain trade, and promoting diversification of staple food consumption.

Minot (2014) also examines the question of whether or not food price volatility has really increased in sub-Saharan Africa. The study analysed the patterns and trends in food price volatility in monthly staple food prices in 11 African countries between January 1980 and March 2011 and found that while international grain prices have become more volatile in recent years (2007–2010), there was no evidence that food price volatility has increased in sub-Saharan Africa. The study also found that price volatility is lower for processed and tradable food than for non-tradable food, that price volatility is lower in the major cities than in secondary cities, and that maize price volatility is actually higher in countries with the most active interventions to stabilize maize prices. The author posits that these findings suggest that greater attention should be given to the (high) level of food prices in the region rather than to volatility per se, that regional and international trade can play a useful role in reducing food price volatility, and that traditional food price stabilization efforts may be counterproductive.

2.3 Empirical Evidences on Food Price Effects on Household Welfare

Most studies on the impacts of rising food prices, especially since the 2007-08 food crisis, have focused on the effects on real income, poverty, food insecurity, and household vulnerability. Vu and Glewwe 2008) examine the impacts of rising food prices on poverty and welfare in Vietnam and report that increases in the price of food raise the real incomes of those selling food but make net food purchasers worse off. Overall, they found the net impacts on an average Vietnamese household's welfare to be positive; however, the benefits and costs were not spread evenly across the population. A uniform increase in both consumer and producer prices was estimated to make

56% of households worse off. Similar evidence provided by Maltsoglou, *et al.* (2010) for Cambodia showed that most households gained from an increase in the price of rice, although particular segments of the poor stand to lose. In Brazil, a large food producer, the income effect of higher food prices was reported by Ferreira, *et al.* (2011) to positive and progressive, particularly in rural areas, even though the expenditure effects were also reported to be large, negative, and markedly regressive everywhere. The overall impact was found to be U-shaped, with middle-income groups suffering larger proportional losses than the very poor, who were offered partial protection via social assistance benefits (Ferreira, *et al.* 2011). However, because Brazil is 80% urban, higher food prices still led to a greater incidence and depth of poverty at the national level.

In a study on Ghana and a number of other African countries, Minot and Dewina (2013) reveal that higher maize and rice prices have a relatively modest (negative) short-term impact on national poverty but have significant effects on specific groups of households, including urban households and, surprisingly, a large share of rural households that were net food buyers. Similarly, Ivanic *et al.* (2011), in an assessment of the impact of the price changes between June and December 2010 in 28 low- and middle-income countries, finds that this sudden food price surge increased the number of poor people globally by about 44 million, but with considerably different impacts in different countries. However, in an analysis of the welfare and food security impacts of food price increases between 2005 and 2009 in Kenya, Musyoka and Bauer (2012) note that the welfare effect of international food price changes is dependent on how efficiently and effectively domestic markets transmit the prices. They reported that with uniform price transmission (consumer to farm gate), the negative impact of international food price increases could be reduced by about 83% for rural and 16% for urban households, with the welfare and food insecurity impacts found to be more severe for urban poor households. Similar evidence was also provided by Ivanic *et al.* (2011), who attribute the differences in the impacts of changes in international food prices to wide heterogeneity in the transmission of international prices to local prices and to differences in households' patterns of production and consumption.

Estimates by Ivanic *et al.* (2011) put the average poverty change due to the upsurge in international food prices between June and December 2010 at 1.1 percentage points in low income countries and 0.7 percentage points in middle income countries. Bibi *et al.* (2009) however, reveal that among children (0-14 years old), the increase in food prices between August 2006 (before the global food crisis) and August 2008 (during the crisis) caused an increase in food poverty of more

than 10.3 percentage points; and that the decline in real income was larger among the poorest households due both to their dependence on food consumption and to the fact that they were less likely to sell food. Similar evidence was provided by Cornia and Deotti (2008), who report that increased millet prices, coupled with the failures of domestic and regional market as well as the failure of policies relating to food security, health financing, and international aid, contributed to the sharp rise in the number of severely malnourished children admitted to feeding centres in Niger Republic, creating near famine conditions in 2005. Idrees, *et al.* (2012) also reveal that the degree of vulnerability increased among the poorest Pakistani households when staple food price increased between 2001-02 and 2005-06.

Nouve and Wodon (2008), working within the framework of dynamic CGE model, estimate that an approximately 21% increase in the price of rice in Mali during the 2007-08 food crisis was accompanied by a 0.7 percentage point increase in headcount index of poverty in the first year, while estimates by Joseph and Wodon (2008) put the increase in headcount index of poverty for a 25% increase in the price of the various cereals in the country over the period as high as 1.7 percentage points. Similar estimates for Liberia by Tsimpo and Wodon (2008) put the increase in the incidence of poverty as a result of a 20% increase in the price of rice alone at 3-4 percentage points, which is indeed very large for a single commodity.

Many studies have also examined the welfare impacts of food price changes on households based on an analysis of consumption data and estimations of welfare measures such as compensating variation, equivalent income, and/or equivalent variation. Leyaro, *et al.* (2009), for example, report than in real terms, price increases in Tanzania during the 1990s and 2000s worsened the welfare of most consumers; the poor, in particular the rural poor, bore much of the brunt compared to the non-poor (in particular, the urban non-poor). In Ghana, Cudjoe, *et al.* (2008) find that the poorest of the poor, particularly the urban poor, were the hardest hit by high food prices and note that the negative effect of the global food crisis was stronger in the north of Ghana where grains account for a larger share of the consumption basket. They also find that the per capita income levels in the north were much lower. In a study on the Welfare Impact of Food Price Increases on Mexican Households, Wood, *et al.* (2010) find evidence of the need to account for the income effect when performing welfare analysis of food price increases. Similarly, Hasan (2013), in a study of the welfare effects of rice price increases on households in Bangladesh, reported that any welfare gain (loss) would be understated (overstated) if indirect effects arising from a change in household

production and consumption behaviour were ignored. These studies suggest that most previous studies on the subject might have overstated negative welfare effects.

A number of studies have also conducted policy simulations to assess the possible welfare impacts of price changes and the distribution across various household groups. Evidence from Ramadan and Thomas (2010) on Egyptian households reveals that the elimination of subsidy system, in which some food items have predetermined quantity quotas while other products have predetermined (subsidized) prices, tends to worsen the negative welfare impact of rising food prices. However, evidence from Minot and Dewina (2013) for Ghana and a number of other African countries suggests that the current policy of protecting domestic rice producers with an import tax does not contribute to national poverty reduction, in spite of the fact that rice growers tend to be poor. Similarly, in a study of the welfare effects of rice market liberalization in Fars province in Iran, Bakhshoodeh and Piroozirad (2003) estimate that households' welfare, measured by compensated variation, would be reduced by 0.67% in the short run as result of a 10% increase in rice price; however, welfare may increase by 0.24% in the long run if the policy led to long-term price decline. The authors conclude, however, that rice market liberalization would not significantly affect the welfare level of Iranian households on the average because though price increases hurt urban households and vulnerable groups, even though rice producers derive some welfare gains.

In India, simulations with household consumption data by Pons (2011) also show that rural households were more vulnerable to rising food prices than urban households, with the poorest groups in both sectors being more penalized by rising food price than the richest households. The study also revealed that the impact depended on the commodity for which the price had increased; an increase in cereal prices exerted greater impacts on households than a similar increase in fruit prices.

In the search for an appropriate safety net for vulnerable groups, Attanasio, *et al* (2009) examine the effectiveness of conditional cash transfer (CCT) programs in cushioning the welfare impacts of the 2007-08 increases in food prices in Mexico and Colombia. They noted that CCT was effective as a means of alleviating the problem of increasing staple prices; this was in sharp contrast with alternative measures, such as price subsidies. In a study of Ethiopian households, Alem and Söderbom (2010) identify the need for aid programs responding to food price shocks to be more

focused on targeting low-asset households, most especially those with members on the fringe of the labor market.

3. METHODOLOGY

This study employed estimates of policy-induced changes in real prices of consumer goods (both food and non-food) 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-induced price changes were computed from estimated cointegrating relations between real prices of various commodities and a vector of exogenous policy variables, including the Monetary Policy Rates (MPR), the official exchange rate of Naira to the US Dollar (EXR), and domestic narrow money supply (M1), which are the key instruments by which economic deregulation policies of the Federal Government Nigeria (FGN) have been guided since the mid-1980s. Also considered was the pump price of the premium motor spirit (petrol) in Nigeria (PPET), which has been raised significantly by the Petroleum Product Pricing Regulatory Agency following the implementation of the FGN's subsidy withdrawal policy.

3.1 Study Data and Sources

Two types of data were used in the study: household consumption data from Nigeria's most recent General Household Survey (GHS)–Panel and monthly time series data (2007:1 – 2012:12) on:

1. domestic – rural retail commodity prices across the panel of 36 States and Federal Capital Territory (FCT) in Nigeria,
2. average World Price (WP) of same/related commodities as in (a), and
3. targeted domestic policy variables.

The rural retail commodity prices were obtained on request from the Headquarter Office of the National Bureau of Statistics (NBS) at Abuja. These prices are products of nationwide market surveys that are routinely conducted by NBS for the construction of composite Consumer Price Indices (CPI). It covered 57 food items reported across the 36 States of the Federation and the FCT. The domestic food price data were supplemented by national aggregate CPI for non-food items extracted from the 2012 edition of Central Bank of Nigeria (CBN) Statistical Bulletin (CBN 2012). The monthly time series of relevant policy variables – MPR, EXR, M1 and PPET - were also 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 in 2008.

The household consumption data were extracted from Wave 1 of the 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 Wave 1 of an ongoing Integrated Surveys on Agriculture (ISA) program. Relevant socio-economic, production, and consumption data 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 two period panel data FOR 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.

3.2 Variables and Measurement

Expenditure shares and prices for various commodities or commodity groups were required for this study. The GHS-Panel data reported household consumption and/or expenditure on about 180 food and non-food items based on seven days' recall for food and regular non-food items and monthly recall for less frequently consumed non-food items. The cost (or estimated value) of items reportedly consumed were all converted to weekly expenditures and aggregated into nine (9) food and one (1) non-food groups; namely:

- ***Rice*** – including local and imported rice and associated food materials;
- ***Bread*** – including all baked food, wheat, and other wheat products ;
- ***Other Cereals (OCer)*** – including food substances from maize, sorghum, millet, and other cereals other than rice and wheat;
- ***Fish*** – including fish and other aquatic/sea foods;
- ***Meats*** – including all meats from mammalian and avian species, as well as eggs;

- ***Milk*** – including all dairy products, beverages, and sweeteners;
- ***Pulses*** – including cowpea, soybean, groundnut, melon, other pulses, and their products
- ***Tubers*** – including food substances from root and stem tubers;
- ***Other Foods (OFood)*** – including fruits, vegetables, vegetable oil, and spices, among others; and
- ***Non-Food (NFood)*** – including all non-food consumption items like transportation, energy, healthcare, body care, etc.

While the standard practice is to construct household-level price indices for commodity groups as the quantity or expenditure share weighted average prices of the commodities that make up each groups we found doing this very problematic for at least two reasons. First, no price data were reported for various food and non-food commodities in the GHS-Panel data. An attempt to estimate theses prices based on expenditure and quantity data reported on household food purchases turned out to be very problematic because the quantities were reported in diverse non-standardized units. Reliance on certain hints for possible conversion factors for the data collected during the second round of the GHS-Panel was found to not be too helpful, as they yielded household-level prices (as well as the community-level means and medians) that appeared unreasonable in too many cases. It became obvious that using these price estimates would introduce substantial measurement errors into our analysis, which we deemed undesirable. We thus had to fall back on extracting and using the relevant periods' prices from the panel of NBS state-level rural retail commodity prices.

Considering that the NBS price set covered only the dominant food items (mostly primary farm produce) to the exclusion of many consumption items found in the GHS-Panel data, the price (or average of the prices) of the dominant food item(s) in each of the nine food commodity groups were used in proxy as the corresponding groups' prices. These were the prices used in both the time series modeling of policy-price linkages and the estimation of the system of household demand equations. For the household demand system, the corresponding prices used were the expenditure data from September 2010 and March 2011 collected during the post-planting and post-harvest periods, respectively, in the corresponding states.

Similarly, because no state-, community-, or household-level price data is available for non-food items, the national level non-food CPI was used as proxy for the price of the non-food group in the time series modeling, while the community-level median non-food per capita household expenditure was used as a proxy for the non-food group in the household demand system modeling.

Our main motivations for the latter act derive from the fact that, in the absence of reliable price data, prices are most commonly estimated by deriving expenditures by corresponding quantities of purchases. We consider the "quantity" of non-food expenditures (largely services such as transport, healthcare, body care, etc.) to be directly proportional to the number of people in the household. Hence, we divided each household's non-food expenditures by the household size and used the community-level median of this per capita non-food expenditure in proxy for the price of the non-food group.

It is instructive to note that using state-level (average) price(s) of the dominant food items in proxy for prices of the various food groups and the community-level median per capita non-food expenditure as the price for the non-food group is a "second best" option we had to fall back on due to data limitations. State-level prices are bound to exhibit less variation than household- or community-level prices, while constructing non-food prices from expenditure data tends to make such prices endogenous in a regression problem. We tried to minimize the likelihood of being faced with an endogeneity problem by using the community-level median rather than the actual per capita non-food expenditure as the price for the non-food group; variation in the food price set is further enhanced by the fact that we worked with a two period panel of consumption data. The reliability of our estimates is further enhanced by the reasonably large data sets used in the study. However, it should still be noted that our results are subject to these data limitations.

3.3 Data Analysis

An understanding of how domestic policy actions affect the prices of food and non-food commodities in the long term is crucial to this study. Following standard practices, our data analyses 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, as well as whether or not some linear combinations of the series are cointegrated. Finally, given the results of the first two stages, which showed that (a) the series are generally I(1) series (Appendix Table A1); (b) the right-hand side (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).

3.2.1 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 was used for the time series of policy variables and world prices. The tests were conducted, using the appropriate procedure in Eviews 8, at both the levels and first differences of the series using cases in which both intercept only and 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.

3.2.2 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 used 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.

3.2.3 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 real price of the reference commodity group in the i^{th} state/FCT and period t. The real prices (RP) were computed as $RP_t = P_t \times 100/CPI_t$, where P_t is the price in period t and CPI is the corresponding composite Consumer Price Index – for all commodities.

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

The parameters were estimated using the DOLS estimation procedure in Eviews 8.

3.2.4 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.

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

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

where:

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

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

k is the number of commodity groups (10) 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 regional and seasonal dummy variables as well as household characteristics including the gender, age, and education level of the household head, household size, proportion of household members below 18 years of age, and the proportion of female household members. The Greek letters (α, β, γ, , η and) are model parameters.

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

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

Given that we worked with panel data coming from two rounds of GHS, it is desirable to explore the panel structure of the data in search of more robust estimates. This, however, could not be fully exploited within the Poi's *quaids* command in Stata. Hence, we worked within the fixed effect framework by incorporating a seasonal dummy variable, five regional dummy variables, and the household demographic variables in (2) to control for seasonal, regional, and household-specific effects in the estimated QUAIDS. The vce (robust) option was also specified in the model estimation, so that the computed standard errors (and t-ratios) are robust to heteroskedasticity.

The *quaids* suite of commands in Stata also provide post-estimation commands by which demand elasticities were computed for each individual observation in the dataset and also 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:

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

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

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

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

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

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

3.3 Assessment of Welfare Effects of Policy-induced Price Changes

Assessment of the welfare effects of a policy-induced price change was undertaken in two steps. First, given the average annual percentage change in value of each of the policy variable, the corresponding vector of estimated percentage changes in real prices ($\Delta p / p$) of various commodities were computed based on coefficients of the policy variable in 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 that household to retain its welfare (or utility) level attained before the policy-induced price changes.

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

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

where B(p, r, U), m(p, r, U) and π(p, r) are respectively the net expenditure, expenditure, and profit function, 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's net expenditure as a result of a policy-induced price change were computed, following Robles and Torero (2010) as:

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

where dB(p, w, U) is the change in the household's 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 real prices; dp/p is the vector of policy-induced percent changes in real prices; w_h is the vector of the shares of household expenditure on various commodities; w_y, is the vector of production shares (value of production of each commodity item divided by total household expenditure); W_h is a diagonal matrix with the budget shares (w_h) along the principal diagonal; E is the matrix of compensated price elasticities of demand (own price elasticities along the principal diagonal and cross-price elasticities as the off 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 prices 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) to be too short to allow such a response and hence stuck to the standard assumption that farm households do not revise their production decisions in response to relative price changes in the short term.

4. 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 their associated welfare impacts on farm households in the country. We present evidence regarding the link (cointegrating relations) between selected policy variables - monetary policy (interest) rates (MPR), narrow money supply (M1), official exchange rates (EXR), and government-fixed pump price of premium motor spirit (petrol) in Nigeria (PPET) - on one hand and the 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 price changes. The results are summarized in the following sub-sections.

4.1 Trends in Commodity Prices and Policy Variables in Nigeria

As a background to the study, the trends in aggregate food and non-food CPI in Nigeria were analyzed and compared with the trend in world food prices between 2001:1 and 2012:12 (Fig. 1). Similarly, the trends in domestic policy variables and real food as well as non-food prices in Nigeria were also compared over the same period (Fig. 2), with all values converted to indices (September 2009 = 100) to facilitate the comparison. A number of findings are worthy of note. First, despite various policy actions that were purportedly targeted at curtailing inflation rates in the country during this period, both food and non-food prices in Nigeria continued along the rising trend they had maintained since the mid-1980s (Fig. 1). The average 12 month food inflation rate during this period was 11.7%, while it was 9.9% for the non-food group.

Figure 1: Trends in Nigeria and World Commodity Price Indices, 2007-2012

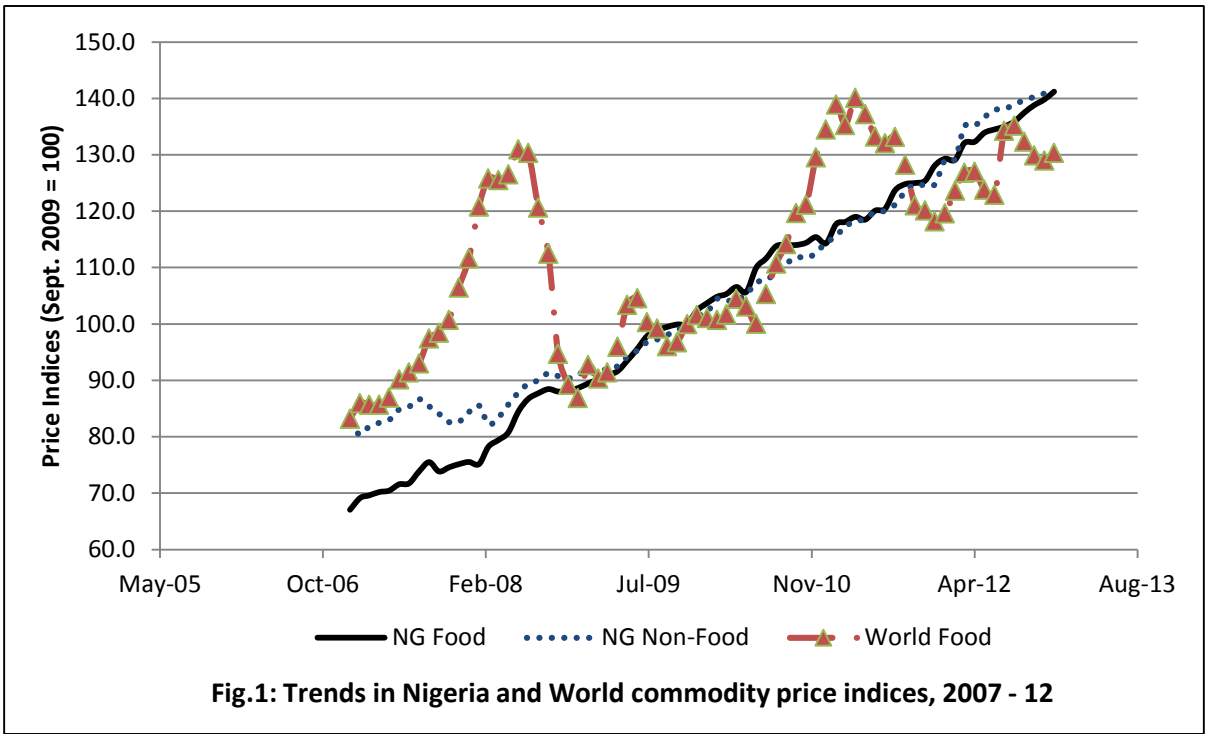


Fig.1: Trends in Nigeria and World commodity price indices, 2007 - 12

Figure 2: Trends in Selected Policy Variables and Real Prices

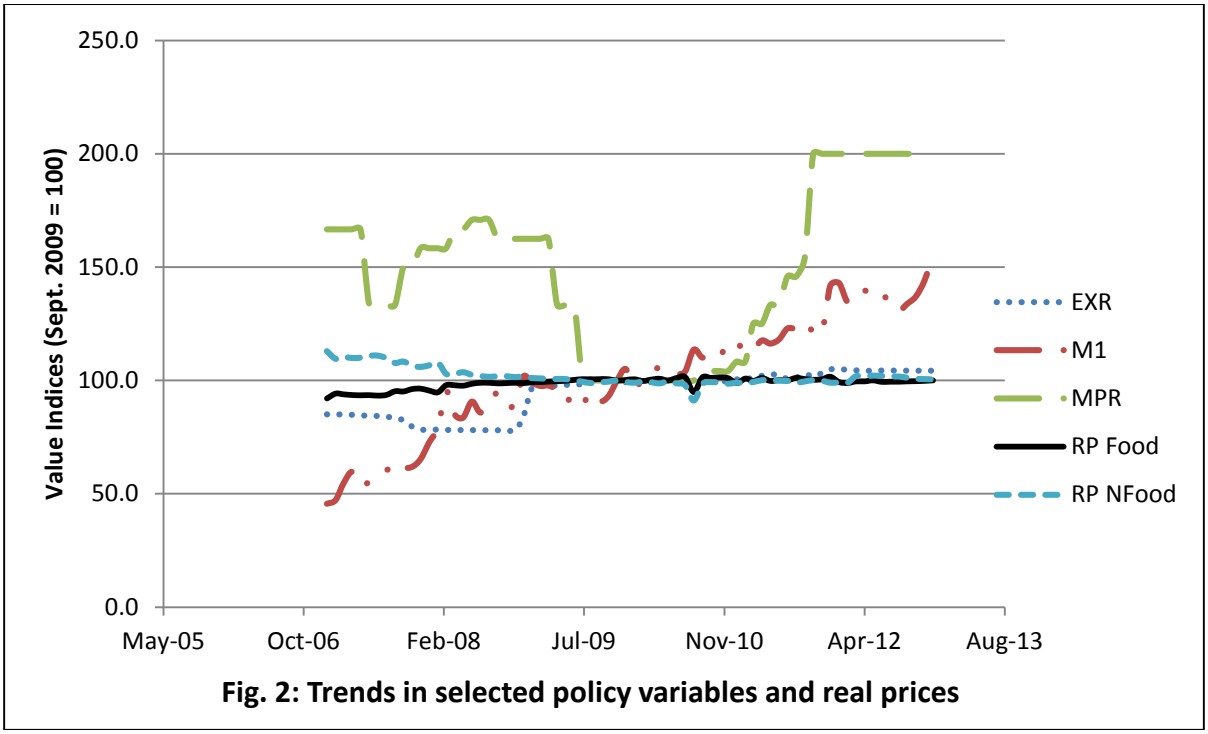
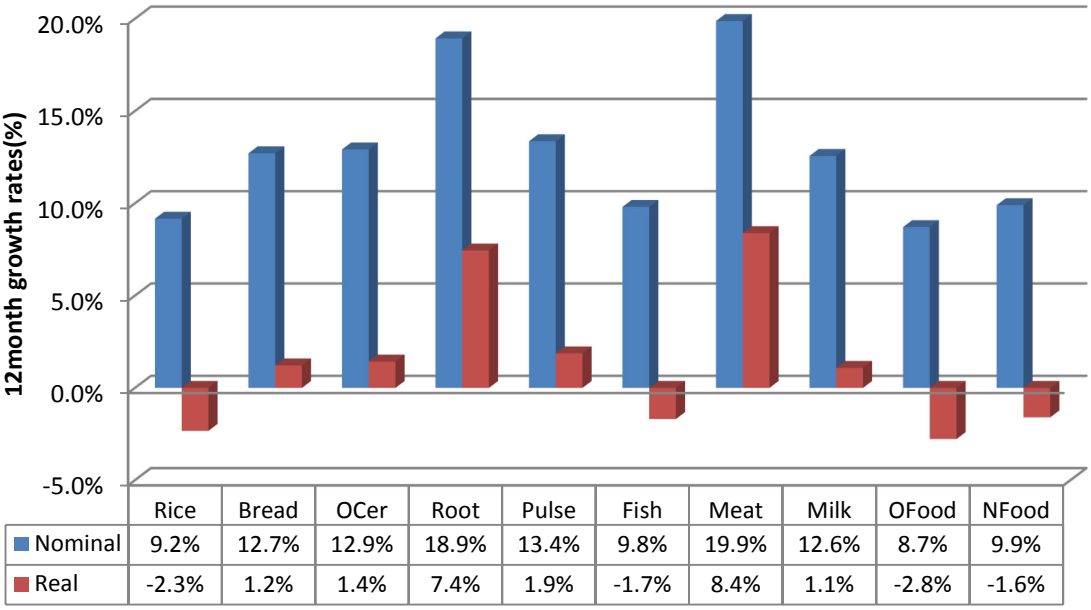


Fig. 2: Trends in selected policy variables and real prices

Second, as shown in Fig. 1, domestic price volatility in Nigeria during the period was much lower than the general pattern in world food prices. It appears, given the patterns of changes M1, MPR, and EXR, that government policy action during the period was primarily geared toward protecting the domestic economy against external shocks and curtailing price volatility. 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 as the world food prices rose sharply. These would suggest an attempt to use monetary policy to (a) discourage food imports by triggering exchange rate devaluation; (b) stimulate increased domestic production by encouraging banks to charge lower interest on loans; and (c) possibly stimulate expansion of domestic exports in the process. Meanwhile, money supply (M1) rose steadily over the period (Fig. 2); this trend was very similar to the trend of rising commodity prices (Fig. 1), suggesting that Nigeria's rising food prices were closely linked to rapidly growing monetary aggregates resulting from monetization of enhanced oil receipts (CBN, 2011).

As shown in Fig. 2, the combined effects of government monetary policy in Nigeria during the period were a slow but steady increase in real food prices. However, the average 12 month rates of change in real food prices varied widely across food commodity groups (Fig. 3). Further evidence on the possible link between changes in real prices and domestic policy variables are provided in Fig. 4, which shows that 12 month annual changes in real food and non-food prices maintain a close match with those of M1 and EXR. This lends credence to the likelihood that Nigeria's rising food prices have a lot more to do with domestic policy actions than with what is causing the general increases and volatility in world food prices.

Figure 3: Average Annual Changes in Nominal and Real Commodity Prices



	Rice	Bread	OCer	Root	Pulse	Fish	Meat	Milk	OFood	NFood
Nominal	9.2%	12.7%	12.9%	18.9%	13.4%	9.8%	19.9%	12.6%	8.7%	9.9%
Real	-2.3%	1.2%	1.4%	7.4%	1.9%	-1.7%	8.4%	1.1%	-2.8%	-1.6%

Fig. 3: Average annual changes in nominal and real commodity prices

Figure 4: Trends in Growth Rates of Real Prices and Policy Variables

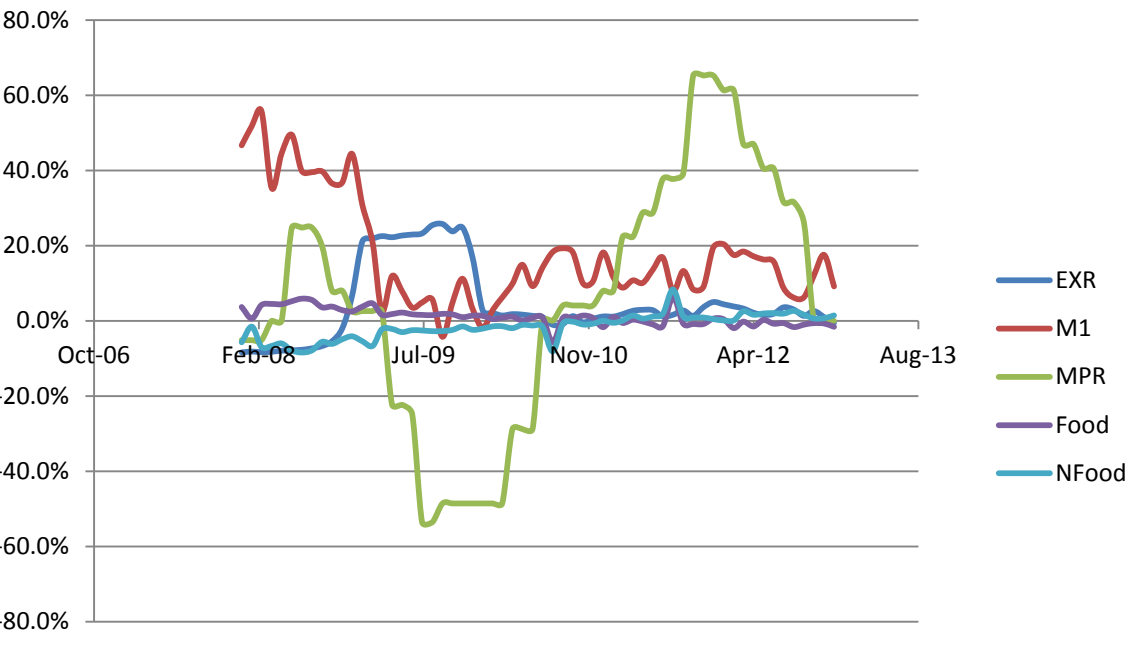


Fig. 4: Trends in growth rates of real prices and policy variables

These results are also in consonance with earlier observation by Ngogi (2008) that the endemic rising food prices in many parts of Africa (including Nigeria) may be linked to the neglect of agriculture, leading to low and sometimes declining agricultural productivity in most parts of the region (Fulginiti, *et al*. 2004; Shittu and Phillip, 2009; Shittu, 2014a & b). Ngogi (2008) observes further that, instead of improving the functioning of essential agriculture support institutions (e.g. the commodity boards in Nigeria), donors and, in turn, many African countries pursued market solutions that decimated these institutions and tended to weaken agricultural productivity.

4.2 Domestic Policy and Price Linkages

Central to the assessment of welfare effects of Nigeria's policy induced rising food prices is a clear understanding of the response of consumer prices (food and non-food) to changes in key policy variables. These policy-price linkages were analyzed within the framework of Dynamic Ordinary Least Square (DOLS) Techniques, which Kao and Chiang (2000) showed 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 lack of bias, consistency, and efficiency in finite sample cases, especially with panel data. The choice was particularly informed by the examination of statistical properties of the series via unit root, Granger causality, and co-integration tests. The results, as shown in the Appendix, reveled 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), while the policy variables and world food prices are cointegrated with domestic prices. Results of the estimated DOLS model of policy-price linkages are summarized in Table 1.

Table 1: Estimated DOLS Cointegrating Equations and Long-run Elasticities

Dependent Variable (y)	Exogenous Explanatory Variables (X)					Adj. R^2
	lnWP	**lnEXR**	**MPR**	**lnM1**	**lnPPET**	
	Real Price of:					
Bread	0.043	-0.200*	0.014***	-0.135***	0.178***	0.55
	(1.56)	*(-1.76)*	*(5.62)*	*(-3.40)*	*(13.81)*	
Fish	-0.119***	0.207**	-0.003	0.248***	-0.385***	0.44
	(-2.89)	*(2.16)*	*(-1.09)*	*(8.17)*	*(-9.65)*	
Meats	-0.827***	-0.967***	0.005*	0.609***	0.562***	0.73
	(-17.31)	*(-8.21)*	*(1.91)*	*(18.07)*	*(11.97)*	
Milk	0.234***	0.488***	0.005*	-0.138***	0.001	0.50
	(4.11)	*(4.91)*	*(1.92)*	*(-3.00)*	*(0.02)*	
Other Cereals	-0.275***	-1.267***	0.1E-3	0.465***	0.096**	0.83
	(-8.69)	*(-11.15)*	*(0.04)*	*(11.54)*	*(2.00)*	
Pulses	0.094	0.506***	-0.002	-0.118	0.088	0.51
	(1.38)	*(3.43)*	*(-0.61)*	*(-1.58)*	*(1.61)*	
Rice	0.485***	0.101	-0.010***	-0.424***	0.080***	0.66
	(18.62)	*(1.21)*	*(-7.40)*	*(-12.65)*	*(2.95)*	
Tubers	-0.296**	-0.335	0.012**	0.498***	0.133	0.40
	(-2.40)	*(-1.41)*	*(2.49)*	*(4.92)*	*(1.38)*	
Other Foods	-0.078*	-0.450***	-0.021***	0.239***	-0.174***	0.54
	(-1.80)	*(-5.39)*	*(-12.20)*	*(6.75)*	*(-5.15)*	
Non-Food CPI	0.066***	0.097***	0.009***	-0.179***	0.010***	0.90
	(14.55)	*(11.00)*	*(51.07)*	*(-47.93)*	*(2.90)*	

Note: ***, ** and * imply the associated coefficient is significant at 1%, 5% and 10% levels respectively

As shown in Table 1, there is a very strong link between explanatory variables in the model (domestic policy variables and world Prices) and domestic commodity prices, with the adjusted R^2 values ranging from 0.40 – 0.90 and most (64%) of the estimated coefficients being significant at the 1% level. The response of domestic real commodity prices to changes in the corresponding average world price, as well as domestic policy variables (EXR, MPR, M1 & PPET), were mixed, mostly significant but generally inelastic. An increase in average world food prices was found to be linked to a significant reduction in the real price of most of the corresponding food commodities in Nigeria, except for milk and rice – featuring prominently in Nigeria's food imports – whose real prices tends to rise significantly and for bread and pulses, whose real prices were not significantly affected. This shows that higher world food prices caused the corresponding food commodities in Nigeria to become relatively cheaper, except for those that are imported in large quantities.

Focusing on the impact of domestic policy actions, exchange rate devaluation (that is, an increase in the amount of Naira officially exchanged for a US Dollar) was found to be linked to a significant decline in the real price of bread, meats, other cereals (maize, sorghum, millet, etc.), and other foods (fruits, vegetables, vegetable oil, spices, etc.), while causing the real price of fish, milk, and pulses to rise significantly. Except for the case of bread (a wheat product) and pulses (cowpea, melon, ground nut, soybean, etc.), these results are quite plausible. Theoretically, exchange rate devaluation is expected to make locally produced goods become relatively cheaper while causing imported goods to become relatively more expensive within the domestic economy. A close examination of Nigeria's Food Balance Sheet revealed that in 2011, most of the wheat (96%), fish (77%), and milk (63%), as well as 41% of the rice and 29% of the vegetable oil, supplied in Nigeria were imported, while the import share of most other food commodities were negligible (FAO, 2014). The decline in the real price of bread caused by exchange rate devaluation may, however, be because substantial domestic value additions are required before wheat is consumed as bread (and other wheat products). Moreover, the structure of Nigeria's bread market is oligopolistic, which makes raising the price of bread without a broad-based collusion among bakers very difficult. The case with pulses may also be linked to the fact that they are most often consumed jointly with other food commodities.

Domestic real price responses to an increase in the money supply were, in most cases, qualitatively the opposite of what occurs with exchange rate devaluation. Increased money supply causes real increases in the price of fish, meats, other cereals, tubers, and other foods which, with the exception

of fish, are mostly produced locally, while causing the real price of mostly imported food items (bread, milk, and rice) to decline. Increased interest rates (MPR) were also found to be linked with significant ($p<0.05$) increases in the real price of bread and tubers and a decrease in the real price rice and other foods (including vegetable oil). Increases in the pump price of petroleum products (PPET), a proxy for the government policy of withdrawing subsidies from domestic producers and consumers, was also found to be linked to significant increases in the real price of most food and non- food commodities, except fish and other foods (including vegetable oil).

At least two points are worthy of note from results presented thus far. One is the fact that most increases in domestic prices (food and non-food) in Nigeria are significantly linked to the government's fiscal operations. These include the policy of subsidy withdrawal leading to sharp increases in the domestic cost of petrol production and increases in real prices of locally produced goods. In addition, monetization of enhanced oil receipts leading to rapid increases in monetary aggregates is linked to significant increases in the domestic price of both food and non-food commodities and tends to turn the terms of trade against locally produced goods.

The second point relates to the qualitative impacts of the relative price changes in terms of the choice between local and imported food commodities and the nutritional impacts of supported food choices. From all of the policy variables analysed, evidence suggests that the policy directions adopted over the study period tend to cause the real prices of locally produced food commodities to rise and make imported food commodities relatively cheaper. While noting that an increase in real producer prices is in consonance with the broad development objective of raising farmers' income to reduce poverty, it is diametrically opposed to the ongoing efforts to reduce the nation's dependence on food imports and stimulate increased non-oil exports. Also worthy of note is the fact that an increase in money supply leading to general price increases tends to make animal protein-rich foods (fish and meats) relatively more expensive. This may have grave implications for the country's nutritional status.

4.3 Estimates of Policy-induced Price Changes

Given the estimated cointegrating relations (Table 1) between the policy variables and the real price of various food and non-food commodities, estimates of policy-induced real price changes in an average year between 2007 and 2012 are summarized in Table 2. It is instructive to note that the average 12 month food inflation rates during this period was 11.7%, with the average figure

ranging from 8.7% for other foods group (fat & oil, vegetables, fruits, spices, etc.) to 19.9% for meats. Similarly, the average annual growth in money supply (M1) was 17.8%, while the amount of Naira officially exchanged for a US Dollar rose by an average of 4.5% per annum; annual rates of increase in the world Price, MPR, and PPET were respectively 4.8%, 0.6%, and 9.3%.

Table 2: Estimates of Policy-Induced Changes in Real Prices

Description	Avg. Annual Change (%)	Commodity									
		Bread	**Fish**	**Meat**	**Milk**	**OCer**	**OFood**	**Pulse**	**Rice**	**Tubers**	**NFood**
Nominal Price Change (%)		12.71	9.81	19.87	12.57	12.92	8.71	13.36	9.17	18.93	9.90
Real Price Changes (%)		1.22	-1.68	8.38	1.08	1.43	-2.77	1.87	-2.32	7.44	-1.59
		Induced annual real price changes (%)									
World Price	4.80	0.21	-0.57	-3.97	1.12	-1.32	-0.37	0.45	***2.33***	-1.42	0.32
Exchange Rate	4.50	-0.90	0.93	-4.35	***2.20***	***-5.70***	-2.03	**2.28**	0.45	***-1.51***	0.44
Interest Rate (MPR)	0.60	0.01	0.00	0.00	0.00	0.00	-0.01	0.00	-0.01	0.01	0.01
Money Supply (M1)	17.80	***-2.40***	**4.41**	**10.84**	**-2.46**	**8.28**	**4.25**	***-2.10***	**-7.55**	**8.86**	**-3.19**
Petrol Price	9.30	1.66	***-3.58***	***5.23***	0.01	0.89	-1.62	0.82	0.74	1.24	0.09
Other factors (residual)		**2.65**	-2.88	0.64	0.21	-0.72	***-2.99***	0.43	1.70	0.26	***0.74***

As shown earlier in Fig. 3 and repeated in Table 2, the real price of most food commodities rose (i.e. increased at faster rates than the general price levels) during the period, except for fish, rice, and other mostly imported foods (fruits, vegetables, fat & oil, etc.). Focusing on the impacts of domestic policy variables and world prices on real price changes within the domestic economy, the results in Table 2 reveal that an increase in money supply (M1) is the leading factor inducing the observed pattern of real price changes in Nigeria. In absolute magnitude, it was the largest contributor to changes in the real price of eight out of the 10 commodity groups and the second largest contributor to changes in the real price of the other two commodity groups (bread and milk).

Exchange rate devaluation was found to be the leading factor inducing the rising real price of pulses as well as milk (which emerged second) and was second in importance for other cereals. The increase in pump price of petroleum products (proxy for subsidy withdrawal) was second in importance to money supply in raising the real price of meats and causing fish to become relatively cheaper over time, while the world price was the second largest contributor to the trend rising real rice prices.

The contribution of interest rates was found to be generally low for all the commodities, but was noticeable (about 0.1%) for bread, tubers, other foods, non-foods, and rice. It is worthy of note that these are mostly locally produced commodities, possibly underscoring the importance of interest rates for the real sector in the domestic economy. The results in Table 2 also revealed that other domestic factor(s) not captured in the model were leading drivers of the rising real price of bread and were second in importance for other foods and non-food groups. These other factors may be production-linked, given evidence from other studies (e.g. Fulginiti, *et al*. 2004; Ngogi, 2008; Phillip *et al.* 2008; Shittu, 2014) that has blamed the neglect of agriculture and the resultant low and sometimes declining productivity as possible causes of Nigeria's rising food prices. Phillip *et al.* (2008) also draw attention to the fact that food production in Nigeria is being constrained by inadequate access to modern inputs like fertilizer and tractors, low access to agricultural credit, land tenure insecurity, land degradation, poverty, low and unstable investment in agricultural research, and poor market access.

4.4 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 to compare the estimates across socio-economic groups.

The welfare impacts were measured as the compensating variation (CV) of the policy-induced changes in the real price of food and non-food commodities within the economy, following Robles and Torero (2010). The 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 Tables A4 & A5, while the demand elasticities evaluated at means of the argument are summarized in Table A6.

The estimated QUAIDS model is quite robust, with most of the parameters being significant at 1% or 5% levels (Tables A4 and A5). Wald Chi-square test of redundancy of the seasonal and regional fixed effect, as well as household demographic variables, were also rejected at 1% levels in most cases (Table A5). 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 were all negative. The food and non-food commodities were revealed as generally price inelastic, except for other cereals and milk.

The estimated CV and the distribution of the gainers and losers from the observed changes in real prices, as well as estimated policy-induced price changes, are summarized in Table 3. The results also show the mean annual household expenditure and value of agricultural outputs of the typical gainer and loser, with a view to throwing light on the source and quantum of the estimated CV. In all cases, the CVs were expressed as a percentage of annual household expenditure, while the gainer (loser) distributions were expressed as a percentage of all households in the study.

As shown in Table 3, an average household in the sample derived a welfare gain of about 7.8% of the mean annual expenditure (₦373, 141.41, approximately US$2, 618.72 at the average official exchange rate of ₦142.49/US$1) as a result of higher food prices in a typical year between 2007 and 2012. As noted earlier in Section 4.2 and summarized in Table 2, domestic policies and global trends during the period resulted in increased real prices of most of the food commodities in the country, except for fish, rice, and other foods groups that are mostly imported. They did lead, however, to a decline in real prices in the non-food group.

As shown in Table 3, households that derived welfare gain from these real price changes were in a slight majority (53%). The mean welfare gain among these gainers (15.9% of ₦319, 595.09) was

found to be greater than the mean welfare loss among the losers (1.3% of ₦433, 534.01). The typical welfare gainer was found to be a farm household that produced a marketable food surplus, a mean farm output valued at ₦648, 440.15 (about US$4, 550.78) in 2010-11 as compared with the mean annual household expenditure of ₦319, 595.09 (about US$2, 242.93).

Table 3: Compensating variation of actual and policy induced changes in real prices

Description	Households (%)	Median CV (% of M)	Mean CV (% of M)	Expenditure, M (₦/year)	Farm Output (₦/year)
		Avg. Annual Change in Real Prices			
Gainers	53.0%	-3.0%	-15.9%	319,595.09	648,440.15
Losers	47.0%	1.1%	1.3%	433,534.01	43,927.47
All households	100.0%	-0.2%	-7.8%	373,141.41	364,345.57
		Avg. Annual Change in World Food Prices			
Gainers	44.5%	-0.4%	-0.5%	431,062.24	31,208.84
Losers	55.5%	1.3%	7.1%	326,615.42	631,943.90
All households	100.0%	0.1%	3.7%	373,141.41	364,345.57
		Avg. Annual Change in Exchange Rate (N/US$)			
Gainers	52.4%	-0.7%	-0.9%	432,800.96	24,175.03
Losers	47.6%	2.9%	13.0%	307,465.42	738,821.04
All households	100.0%	-0.1%	5.7%	373,141.41	364,345.57
		Avg. Annual Change in Money Supply (M1)			
Gainers	52.0%	-5.7%	-25.9%	332,078.02	675,608.94
Losers	48.0%	1.9%	2.3%	417,621.96	27,179.86
All households	100.0%	-0.2%	-12.4%	373,141.41	364,345.57
		Avg. Annual Change in Petrol Prices			
Gainers	55.9%	-1.5%	-8.7%	301,279.75	621,136.22
Losers	44.1%	0.4%	0.6%	464,385.19	38,294.81
All households	100.0%	-0.2%	-4.6%	373,141.41	364,345.57

Focusing on the welfare effects of real price changes induced by the global trends in food prices and domestic policy actions between 2007 and 2012, Table 3 reveals, *ceteris paribus*, that an average household in Nigeria recorded a welfare loss of about 3.7% of the household expenditure in an average year between 2007 and 2012 as a result of a general increase in world food prices and a 5.7% welfare loss as a result of exchange rate devaluation. However, increases in domestic narrow money supply (M1) and pump price of petroleum products (proxy for subsidy withdrawal), *ceteris paribus*, were respectively found to have been linked to a 12.4% and 4.6% welfare gain for the typical household. In most cases, the majority of households were gainers, except in the case of higher world food prices; an increase in money supply and pump price of petroleum product (subsidy withdrawal) favored farm households with net food surpluses in the long run, while exchange rate devaluation and higher world food prices tended to favor net food buyers.

Further evidence on the distribution of households that suffered welfare losses, disaggregated by household type, are summarized in Table 4. Overall, 47% of households suffered a welfare loss that amounted to an average of 1.3% of the household's budget in an average year between 2007 and 2012 as a result of changes in the real price of food and non-food commodities. Welfare loss associated with higher world food prices was estimated to have affected the majority (55.5%) of households, while domestic policy-induced real price changes caused slightly less than half (44.1 – 48.0%) of households to suffer welfare losses. In general terms, the incidence of welfare losses due to real price changes was higher among households that were primarily engaged in non-farm activities (77.2%), located in the southern part of Nigeria (44.3-69.7%), female-headed (56.8%), and smallholder food crop farmers (45%).

Table 4: Mean Compensating Variation among Losers of Policy-Induced Real Price Changes

Description	Mean Annual Expenditure	Domestic Prices		World Food Prices		Exchange Rate		Money Supply		Petrol Price	
		Losers%	CV%	Losers%	CV%	Losers%	CV%	Losers%	CV%	Losers%	CV%
National Average	373,141.41	47.0	1.3	55.5	7.1	47.6	13.0	48.0	2.3	44.1	0.6
Geo-political Zone											
North central	372,014.73	42.3	1.4	60.4	12.7	51.3	21.7	44.2	2.5	41.5	0.6
North east	355,705.08	32.5	1.5	69.2	9.6	62.8	18.6	34.1	3.1	29.9	0.6
North west	354,780.66	33.6	1.3	69.5	10.5	62.0	19.2	34.0	3.0	31.1	0.7
South east	324,709.07	44.3	1.1	58.6	2.0	52.6	3.0	46.1	1.8	39.1	0.4
South south	440,093.56	57.2	1.1	40.7	1.1	35.3	1.7	63.1	1.9	49.4	0.5
South west	394,383.93	69.7	1.4	35.9	1.5	23.8	3.6	65.0	2.0	70.7	0.7
Household type											
Male Headed	385,515.99	45.6	1.3	57.2	7.7	49.6	14.0	45.8	2.2	43.3	0.6
Female Headed	288,377.98	56.8	1.4	43.2	1.3	34.1	3.0	62.8	2.3	49.4	0.6
Main Enterprise											
Non-Farm	444,673.24	77.2	1.2	24.0	0.2	12.8	0.2	80.0	2.3	75.8	0.5
Smallholder Crop	286,993.66	45.0	1.5	58.8	1.2	61.0	3.8	35.1	2.1	41.2	0.7
Smallholder Livestock	339,807.18	29.1	1.1	76.1	2.7	58.0	3.1	36.8	2.0	21.8	0.6
Smallholder Crop & Livestock	298,191.76	18.9	1.2	84.2	2.1	81.0	4.0	18.4	2.1	14.3	0.5
Commercial Crop	353,659.85	14.0	6.8	93.5	5.4	95.7	17.8	4.3	8.0	9.7	7.9
Commercial Livestock	366,643.28	0.9	0.4	98.3	60.0	97.4	64.5	1.7	16.4	0.9	3.9
Commercial Crop & Livestock	320,657.27	3.1	5.7	98.4	19.0	99.1	34.5	1.6	12.1	2.7	4.7

As shown in Table 4, while households that were mainly engaged in the non-farm sector recorded the highest incidence of welfare losses induced by an increase in money supply (80%) as well as an increase in the price of petroleum products (75.8%), followed by households located in the three zones in the southern part of Nigeria (39.1–70.7%), female-headed households (49.4–62%), and smallholders (18.4 – 41.2%), the reverse is the case with welfare losses induced by exchange rate devaluation and increases in world food prices. Almost all (93.5–99.1%) households that operated the relatively large/commercial farms and the majority (58.0–84.2%) of smallholders recorded welfare losses with increases in world food prices and exchange rate devaluation. The rates of welfare losses associated with higher world food prices and exchange rate devaluation among farm households increased with an increase in the scale of farm operation. Also, the majority (51.3–69.5%) of households in the three zones in Northern Nigeria suffered welfare losses as a result of higher world food prices and exchange rate devaluation.

These results may be explained by the distributional patterns of food production in Nigeria, the demand elasticities, and the influence of various factors inducing rising food prices in Nigeria. First, a close examination of the production and consumption of various commodities (Appendix Table A7) revealed that the typical household in each of the three Northern regions is a net producer of meat, rice, other cereals, and food in general, unlike their counterparts in the three Southern regions, which are net consumers of most food items except other cereals. Hence, farm households in the Northern part of the country benefited more from price increases and featured less among losers from those increases than households in Southern part of the country.

Second, considering that the demand for meat (and most of the other locally produced food items) is price inelastic (Table A6), while an increase in world food prices and exchange rate devaluation is associated with a decline in the real price of meats (Table 2), net meat producers (livestock farmers) are bound to suffer real income loss, and therefore welfare loss, with an increase in world food prices and exchange rates devaluation. The reverse is expected with policy actions that lead to an increase in the real price of meat, as is the case with an increase in money supply and subsidy withdrawal (increase in pump price of petroleum products). This, most likely, explains why most large-scale/commercial livestock farmers suffered some welfare losses with the increase in world prices and exchange rate devaluation and were gainers in money supply as petrol price-induced increases in real prices.

It is worth noting that while domestic policy actions relating to money supply and subsidy removal between 2007 and 2012 were Kaldor–Hicks efficient, in that the gains by those that benefited from these policies sufficiently exceeded losses by those that were negatively affected (Table 3), the tendency to resort to exchange rate devaluation is revealed to be inefficient in the Kaldor–Hicks sense. Hence, exchange rate devaluation with a view to discouraging imports and promoting exports tends to be harmful for farm households that were purportedly being protected.

A number of reasons may be adduced for the negative welfare impact of exchange rate devaluation. First, the Nigerian government's trade and exchange rate policy actions are primarily driven by concerns about raising and/or maintaining external reserves at some levels. "Protection" of domestic farms is considered relevant only because more agricultural exports and fewer food imports would enhance trade balance. Second is the fact that maize (a crop in the other cereals group), which is one of the few crops in which Nigerian farmers have a marketable surplus, has been placed on the export prohibition list since the 2007-08 global food crises. This obviously limits the ability of Nigerian farmers to benefit from an increase in world food prices.

Another important point to note is the fact that a large proportion of smallholder households and/or livestock farmers (14.3–84.2%), as well as female-headed households (34.1–62.8%), featured prominently as losers from all the policy actions whose welfare impacts were analyzed. This is an indication that these policies might be contributing substantially to the rising incidence of poverty in Nigeria. If this fact is considered together with earlier results suggesting that most of the policy actions tend to make most locally produced food more expensive in real terms, our results would suggest that most of these policy actions (particularly exchange rate devaluation, subsidy withdrawal, and monetization of excess oil revenue) are not in tandem with poverty reduction pursuits.

5. SUMMARY AND CONCLUSIONS

This study has sought to empirically examine the role of government policies 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 5,000 households covered in the recently released General Household Survey (Panel) 2010-11 for Nigeria.

The study found that an increase in the narrow money supply (M1), an increase in the official exchange rate of Naira per US Dollar, and the withdrawal of subsidies from premium motor spirit (petrol) are the main policy actions driving rising food prices in Nigeria. Other key factors seems to be linked with the production and marketing constraints faced by farmers. The study also found 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, the study found that the response of domestic real prices to changes in domestic policy variables – official exchange rate, monetary policy (interest) rate, narrow money supply and withdrawal of subsidies – were mixed. The policy directions enacted since 2007 were found to have caused the real prices of most locally produced food commodities to rise and made most imported food commodities relatively cheaper. They also made animal protein-rich foods (fish and meats) relatively more expensive.

On the average, a typical Nigerian household was found to have a recorded welfare gain from real price changes induced by an increase in narrow money supply and subsidy removal, but a recorded welfare loss from exchange rate devaluation and higher world food prices. Overall, a typical household achieved an estimated welfare gain of 7.8% of the mean annual expenditure (about US$2, 618.72) in an average year between 2007 and 2012. However, a sizeable proportion (44.1–55.5%) of households suffered losses from the policy-induced price changes. These included notably, 14.3–84.2% of smallholder households and/or livestock farmers, as well as 34.1–62.8% of female-headed households, across all policy actions whose welfare impacts were analyzed. Moreover, the study found that while domestic policy actions relating to money supply and subsidy removal were Kaldor–Hicks efficient, exchange rate devaluation was not.

We thus conclude that while inflation targeting and the "guided" trade and exchange rate deregulation by the CBN/FGN have the potential to enhance agricultural income in Nigeria, they

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 take advantage of the economic opportunities. Such measures may include an intensification of efforts to mobilize farmers into appropriate cooperative/economic interest groups and the strengthening of such groups with capacity building, legislation, and possibly performance/target-based input subsidies. For example, farmers' groups that could provide verifiable evidence of collaboration to develop local development plans (LDC), pull together a sizeable area of land for mechanized farming, mobilize some counterpart funding for productive asset acquisition or LDC project implementation, etc. may be given take-off grants revolving loans, and or subsidies for their operations. Such interventions had already been experimented with under the Fadama Development Project sponsored by the World Bank. The Nigerian government now needs to pull together experiences gathered from all such interventions to enact results-oriented actions to mobilize and transform the huge number of smallholders in the country into viable and self-sustaining agribusiness units.

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APPENDIX

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)	-18.87*	-20.93*	-65.76*	-66.83*
Fishes	-10.55*	-14.44*	-69.03*	-68.40*
Meats	-7.18*	-5.94*	-74.68*	-76.40*
Milk (Beverages)	-22.21*	-26.03*	-66.02*	-66.99*
Other Cereals (Maize, Sorghum & Millet)	-13.52*	-15.75*	-68.43*	-69.71*
Pulses (Cowpea, Groundnut &Soybean)	-23.36*	-31.34*	-61.05*	-61.81*
Rice (local & imported)	-4.98*	-15.27*	-67.36*	-68.26*
Tubers (Cassava products, yams & others)	-25.96*	-32.90*	-65.90*	-65.86*
Other Food	-11.24*	-24.14*	-65.77*	-61.78*
Non-food CPI (Cross section ADF t-stat)	-2.27	-1.66	-11.90*	-8.37*
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 (Pt)	Group (Gt)
Exogenous Variables (X)	5.37	5.37	8.43	-12.35	-2.03
Real Price of Item & X					
Bread	-24.41*	-22.71*	-23.23*	-27.54*	-4.40*
Fish	-20.70*	-21.47*	-22.06*	-25.39*	-4.18*
Meats	-19.10*	-18.60*	-18.68*	-21.07*	-3.37*
Milk	-24.44*	-24.81*	-27.89*	-25.38*	-4.26*
Pulses	-27.54*	-26.80	-31.70*	-29.00*	-4.93*
Rice	--16.51*	-15.74*	-15.81*	-25.67*	-4.25*
Tubers	-31.66*	-29.52*	-35.93*	-29.97*	-5.06*
Other Cereals	-22.16*	-21.96*	-22.23*	-22.74*	-3.47*
Other Foods	-27.86*	-27.02*	-30.63*	-28.57*	-4.82*
Non-food CPI	-16.96*	-16.96*	-18.67*	-24.55*	-4.04*

Note: X = (LNWP$_i$, LNEXR, MPR, LNM1, LNPPET)
*The Null hypothesis of no cointegration is rejected at 1% level

Table A4: Estimated QUAIDS Model (Coefficients of Economic Variables)

Budget Share (w_i)	**Intercept**	**Log of Commodity's Price (γ_{ij})**										**Log of Budget Size**	
	α_i	Rice	Bread	OCer	Fish	Meat	Milk	Pulses	Tubers	OFood	NFood	(β_i)	(λ_i)
Rice	0.143	-0.002										-0.013	-0.000
	(6.63)**	(0.21)										(1.80)	(0.42)
Bread	0.013	-0.005	0.001									-0.002	0.000
	(1.28)	(1.33)	(0.53)									(0.50)	(0.36)
OCer	-0.077	0.022	-0.006	-0.039								-0.041	-0.004
	(2.64)**	(3.37)**	(1.47)	(4.86)**								(4.28)**	(5.19)**
Fish	-0.067	-0.001	-0.003	-0.003	0.004							-0.042	-0.003
	(2.60)**	(0.16)	(2.12)*	(0.63)	(1.26)							(5.14)**	(3.91)**
Meat	-0.013	-0.026	0.002	0.016	0.010	0.012						-0.040	-0.006
	(0.55)	(3.80)**	(0.63)	(2.53)*	(2.65)**	(1.41)						(5.68)**	(10.68)**
Milk	0.118	0.034	-0.002	0.003	0.013	-0.031	-0.015					0.004	0.000
	(5.40)**	(4.66)**	(0.84)	(0.51)	(3.89)**	(5.05)**	(1.66)					(0.57)	(0.22)
Pulses	-0.031	-0.006	0.001	-0.003	-0.003	0.023	0.009	0.001				-0.012	-0.001
	(2.31)*	(1.06)	(0.55)	(0.64)	(1.46)	(5.31)**	(2.02)*	(0.13)				(2.71)**	(1.64)
Tubers	0.111	0.003	0.001	0.036	0.014	0.015	-0.021	-0.007	-0.015			-0.025	-0.002
	(4.42)**	(0.37)	(0.35)	(5.24)**	(3.60)**	(2.30)*	(3.03)**	(1.81)	(1.45)			(2.97)**	(3.13)**
OFood	0.093	-0.010	0.011	0.000	-0.007	0.009	0.007	-0.003	-0.010	0.013		0.020	0.005
	(3.21)**	(1.52)	(3.76)**	(0.07)	(1.99)*	(1.41)	(1.09)	(0.75)	(1.59)	(1.52)		(1.84)	(5.17)**
NFood	0.710	-0.010	0.000	-0.028	-0.025	-0.029	0.003	-0.011	-0.016	-0.010	0.126	0.152	0.011
	(17.47)**	(3.01)**	(0.16)	(5.63)**	(5.75)**	(7.25)**	(0.95)	(5.15)**	(3.90)**	(2.08)*	(12.25)**	(13.93)**	(13.72)**

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

Table A5: Estimated QUAIDS Model (Coefficients of Demographic Variables)

Budget Share (w_i)	Seasonal & Regional Dummy Variables						Household Head's			Household Demographics		
	Harvest	**Z1**	**Z2**	**Z3**	**Z4**	**Z5**	**Gender**	**Age**	**Sch. Year**	**HHSize**	**pUnder18**	**pFemale**
Rice	0.013	0.002	-0.000	0.000	0.006	0.009	0.000	-0.000	0.000	0.000	-0.000	0.001
	(23.69)**	(2.10)*	(0.14)	(0.08)	(8.07)**	(10.48)**	(0.29)	(0.79)	(1.68)	(0.03)	(0.30)	(1.43)
Bread	0.005	0.001	-0.000	0.001	-0.002	-0.002	-0.000	0.000	-0.000	-0.000	-0.000	0.000
	(21.88)**	(3.14)**	(0.00)	(3.60)**	(4.65)**	(4.39)**	(1.67)	(3.89)**	(3.01)**	(0.10)	(0.61)	(0.71)
OCer	-0.016	-0.000	0.001	-0.005	0.006	0.005	-0.001	-0.000	0.000	-0.000	-0.002	-0.001
	(23.09)**	(0.42)	(0.55)	(4.73)**	(8.79)**	(6.36)**	(1.64)	(1.18)	(0.92)	(1.74)	(1.77)	(0.97)
Fish	0.000	0.002	0.008	0.012	-0.004	-0.007	-0.001	-0.000	0.000	0.000	0.000	-0.000
	(0.69)	(3.18)**	(9.56)**	(14.21)**	(5.51)**	(8.23)**	(1.48)	(0.58)	(0.86)	(1.22)	(0.43)	(0.31)
Meat	-0.002	-0.003	-0.012	-0.013	-0.001	-0.003	-0.000	-0.000	0.000	-0.000	0.000	-0.002
	(4.87)**	(3.79)**	(9.06)**	(9.54)**	(0.98)	(3.14)**	(0.37)	(1.68)	(1.91)	(0.49)	(0.18)	(1.88)
Milk	-0.000	-0.004	-0.002	0.000	-0.009	-0.006	0.002	-0.000	0.000	0.000	0.001	0.002
	(0.77)	(4.91)**	(2.42)*	(0.25)	(10.73)**	(7.22)**	(2.36)*	(0.04)	(0.31)	(2.64)**	(1.21)	(2.92)**
Pulses	-0.003	0.002	0.002	0.000	-0.000	0.001	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(11.10)**	(4.32)**	(2.67)**	(0.55)	(0.29)	(2.25)*	(0.42)	(0.92)	(0.36)	(1.32)	(0.42)	(0.41)
Tubers	0.001	0.001	-0.001	-0.002	0.004	0.005	-0.002	-0.000	0.000	0.000	0.000	0.002
	(1.44)	(1.01)	(0.82)	(1.86)	(3.99)**	(4.16)**	(1.76)	(0.04)	(4.62)**	(4.57)**	(0.41)	(1.41)
OFood	0.003	-0.007	-0.001	-0.004	-0.000	-0.001	0.001	0.000	0.000	0.000	-0.001	-0.001
	(6.50)**	(7.09)**	(0.86)	(2.90)**	(0.46)	(1.43)	(0.86)	(3.18)**	(1.23)	(1.39)	(1.46)	(0.92)
NFood	-0.001	0.006	0.007	0.011	-0.001	-0.000	0.002	0.000	-0.001	-0.001	0.002	-0.002
	(0.88)	(4.71)**	(5.00)**	(8.40)**	(0.97)	(0.05)	(1.85)	(1.34)	(7.53)**	(4.99)**	(1.36)	(1.23)
Rho	4.291	3.683	65.953	101.235	1.044	1.840	15.323	0.168	-0.561	4.848	-2.681	1.180
	(3.01)**	(1.44)	(3.90)**		(0.66)	(0.86)	(2.52)*	(3.09)**	(4.73)**	(4.99)**	(1.90)	(0.93)
$\chi^2(10)$	1243.7**	132.7**	201.2**	446.8**	226.7**	221.8**	21.29*	45.38**	118.10**	47.85**	14.8	18.25

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

Table A6: Estimated Expenditure and Compensated Price Elasticity of Demand

Commodity	Expenditure Elasticity	Price of Commodity									
		Rice	Bread	OCer	Fish	Meat	Milk	Pulses	Tubers	OFood	NFood
Rice	1.01	**-0.96**	-0.05	0.39	0.05	-0.29	0.56	-0.03	0.18	0.03	0.11
Bread	0.95	-0.13	**-0.93**	-0.14	-0.05	0.15	-0.01	0.10	0.19	0.58	0.24
OCer	1.01	0.32	-0.04	**-1.43**	-0.03	0.18	0.13	0.00	0.52	0.20	0.16
Fish	0.86	0.06	-0.02	-0.04	**-0.94**	0.15	0.29	-0.03	0.34	0.07	0.12
Meats	1.29	-0.27	0.05	0.20	0.12	**-0.87**	-0.32	0.32	0.30	0.34	0.11
Milk	1.02	0.48	0.00	0.13	0.23	-0.29	**-1.09**	0.15	-0.10	0.24	0.25
Pulses	0.90	-0.05	0.05	-0.01	-0.04	0.53	0.27	**-0.95**	-0.01	0.10	0.12
Tubers	1.07	0.09	0.03	0.31	0.15	0.16	-0.06	0.00	**-0.96**	0.10	0.17
OFood	0.75	0.01	0.09	0.11	0.03	0.17	0.13	0.03	0.10	**-0.79**	0.12
NFood	1.08	0.03	0.03	0.06	0.03	0.03	0.09	0.02	0.11	0.09	**-0.51**

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