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Simulating the Impact of Exogenous Food Price Shock on Agriculture and the Poor in Nigeria: Results from a Computable General Equilibrium Model

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Abstract

Motivated by the recent global economic crisis, this paper simulated the impact of a rise in the price of imported food on agriculture and household poverty in Nigeria using a computable general equilibrium (CGE) model and the Foster, Greer and Thorbecke (FGT) class of decomposable poverty measures on the 2006 social accounting matrix (SAM) of Nigeria and the updated 2004 Nigeria Living Standards Survey (NLSS) data. Results show that a rise in import price of food increased domestic output of food, but reduced the domestic supply of other agricultural commodities as well as food and other agricultural composites. Furthermore, a rise in the import price of food increased poverty nationally and among all household groups, with rural-north households being the least affected by the shock, while their rural-south counterparts were the most affected. A major policy implication drawn from this paper is that high import prices in import competing sectors like agriculture tend to favour the sector but exacerbate poverty in households. Thus, efforts geared at addressing the impact of this shock should strive to balance welfare and efficiency issues.

Keywords: economic shocks, food price, CGE model, poverty, simulation

1. Introduction

Economic shocks such as food price shocks have often been known to cause social distress, which manifests directly or indirectly in increased poverty and inequality levels, among other welfare issues, as a result of a fall in outputs and real incomes associated with them (Lustig, 1999 and 2000; Skoufias, 2003; Damuri & Perdana, 2003; Essama-Nssah, 2005; Conforti & Sarris, 2009). Empirical evidence shows that the poor who are predominantly found in agriculture are most vulnerable to economic shocks, especially food price shocks, as they spend 50 to 70 percent of their income on food and have little capacity to adapt as prices rise and wages for unskilled labour fail to adjust accordingly (Decaluwe, Patry, Savard, & Thorbecke, 1999; National Bureau of Statistics (NBS), 2005; von Braun, 2008; Boccanfuso & Savard, 2011). In view of these facts, agriculture and indeed production of abundant food becomes very important in the context of development policy, which major goal is poverty alleviation (United Nations, 2000; Yusuf et al., 2008).

In the wake of the recent global economic crisis, a number of macroeconomic shocks were experienced worldwide. In Nigeria, these exogenous shocks included increased food prices, fall in oil revenues (following the sudden plunge in oil prices in the international market), and depreciation of the real exchange rate, among others (see, Soludo, 2009). The food price shocks experienced during the crisis, and attributed to increasing global demand for food, high fuel prices and adverse supply movements could have had diverse impacts on agriculture and the poor, especially their impact on substitutability of factor inputs in different production sectors and on households' real incomes. According to Reyes et al. (2008), world food prices had risen by 53 percent (as shown in Figure 1, below) during the crisis, based on the Food and Agriculture Organisation (FAO) food price index for the first three months of 2008, and this had led to increased social tensions and political upheavals in net food

importing countries, and food export restrictions in net exporting countries.

To cushion the effect of the food price shock on consumers in Nigeria, the Federal government responded by announcing a removal of import tariff on rice, the single most important staple food import in the country, for six months. This intervention by government was not only a temporary measure of mitigating the social cost of an adverse price shock, but was also hardly informed by facts regarding the segments of the economy that needed the most help and how the food sector would have responded to the shock. Thus, there is need for an empirical investigation of the impacts of the food price shocks on agriculture and household groups in Nigeria. Furthermore, the fact that over 50 percent of total population in Nigeria, are poor should be of concern to policymakers and researchers, alike and thus any economic phenomena that is likely to aggravate this already precarious situation deserves attention and proper evaluation with a view to deriving implications for policy. Consequently, this paper is an attempt to quantitatively trace the impacts of food price shock occasioned by the global economic crisis on the agricultural sector and Nigerian households in terms of poverty, using general equilibrium techniques with a view to providing empirical evidence to guide policy intervention and stimulate further inquiry in this area of study.

The remainder of the paper is structured as follows. Section two which is next presents the empirical approach, describing the data and analytical framework, while section three presents the results and discussion. Finally section four concludes the paper and provides some policy implications.

2. The Empirical Approach

2.1 Data

Two databases were used in this paper. In the main, the 2006 Social Accounting Matrix (SAM) for Nigeria by the International Food Policy Research Institute, IFPRI (Nwafor et al., 2010) provided the database for the implementation of the CGE model, while the updated 2004 Nigeria Living Standards Survey (NLSS) by the National Bureau of Statistics (NBS, 2005) supplied the database for the analysis of poverty.

2.1.1 Description of the Social Accounting Matrix

The data for the implementation of a CGE model derive from the SAM, which provides a snapshot of the economy by showing the circular flow of income and expenditure, usually for a given year (Pyatt & Round, 1985; Nwafor et al., 2010). The equations for the CGE model follow the structure of the SAM.

The 2006 Nigeria SAM is the latest and the most detailed SAM of the Nigerian economy, especially with regards to the agricultural sector. The original 2006 Nigeria SAM is made up of 147 balanced matrix accounts comprising 61 activity sectors, 62 commodities, 3 factors of production, 12 different households, 4 tax accounts, as well as, transaction costs, enterprises, government, saving and investment and the rest of the world accounts. Of the 61 activities, 34 are in agriculture, 12 in manufacturing and 13 service sectors. For the purpose of achieving the objectives of the current paper, the original SAM was aggregated to one with 4 production activity sectors (food, other agriculture, crude oil, manufactures/services), 4 commodities (food, other agriculture, crude oil and manufactures/services), 2 factors of production (labour and capital), 4 different household categories (rural-south, rural-north, urban-south and urban-north), 4 tax accounts (direct tax, indirect sales tax, import tax and activity tax), government, saving and investment and the rest of the world accounts. In the end, a balanced SAM of 21 square matrix accounts was obtained and used in the subsequent analysis. From the modified SAM, all the data needed for calibration of the CGE model, aside the “free” parameters were obtained.

2.1.2 Nigeria Living Standards Survey Data

In addition to the SAM database, the paper made use of household expenditure data from the Nigeria Living Standards Survey (NLSS) of 2004, to carry out poverty analysis.

The nineteen thousand, one hundred and fifty-eight (19 158) housing units reported in the survey were disaggregated into the four household groups with the following sample sizes: 5907 for rural-south; 8605 for rural-north; 2733 for urban-south and 1913 for urban-north. These formed the 4 household groupings (earlier mentioned in the SAM) used for the study.

2.2 Analytical Framework

This paper used a macro-micro analytical framework, comprised of a computable general equilibrium (CGE) model and a module for poverty analysis. Since we are studying the impact of food price shocks on agriculture as well as households’ poverty, we used the CGE model to generate the economy-wide (macro) impacts of the shocks on the agriculture sectors and the distributional impacts on households’ incomes and expenditures. After which we estimated poverty measures nationally and for the four household groups on the basis of the

households (micro) data (Cockburn, Decaluwe, & Robichaud, 2008).

Thus, with some modifications, this study adopted the extended representative household (ERH) approach proposed by Decaluwe, Patry, Savard and Thorbecke (1999) and Decaluwe, Savard and Thorbecke (2005) and applied widely in the context of many African countries¹. One of the key features of the model is that the poverty line is endogenized, so that it changes with changes in relative prices in the CGE model following an exogenous shock. This allows us to by-pass the problem of constructing and re-constructing (outside the model) poverty lines used in poverty analysis after each simulation run.

The actual implementation of this modelling approach involved two major steps. First, a CGE model, based on the 2006 social accounting matrix (SAM) for Nigeria, containing four representative household groups from the Nigeria Living Standards Survey (NLSS), was built. This allowed us to get the benchmark equilibrium (base) solution to the model and to perform simulation experiments, in order to mimic the impact of food price shock. From the simulations, we obtain the sectoral results and the average household expenditure variations (distributional impacts) following a shock as estimated at the household category level in the CGE model. In the second step, the expenditure variations were then applied to individual households within each category using base-year expenditure data from the (NLSS) household survey. The resulting new expenditure values were afterwards compared with initial expenditure values through the estimation of standard Foster-Greer-Thorbecke (FGT) poverty indicators. This enabled us to calculate the impact of the shock on poverty before and after the simulations.

2.2.1 Description of the CGE Model

The CGE model for this paper is inspired by the class of poverty-based models of the Poverty and Economic Policy Network (see, for instance, Decaluwe et al. (1999) and 2005; Cockburn et al., 2008; etc). The model assumes that producers maximize profits subject to production functions, while households maximize utility subject to their budget constraints. Furthermore, factors are mobile across activities, available in fixed supplies, and demanded by producers at market clearing prices. The model satisfies Walras' law and it is homogenous of degree zero in prices. The model comprises six blocks of equations describing production and factor demand, income and savings, demand for commodities, prices, international trade as well as equilibrium and market clearing². Without going into extensive detail, we discuss the main features of the CGE model below.

Using a CES production function for value-added, we assume that producers have a profit-maximizing behaviour which is subject to the production function. Since the production system in the model is nested, at the top level of aggregation, value-added and intermediate inputs combine in fixed proportions, via a Leontief aggregator function to produce gross sectoral output. At the next level of aggregation, value-added is a constant returns to scale constant elasticity of substitution (CES) function of labour and capital, as factors of production and intermediate inputs in Leontief technology.

In this model, households derive their income from three sources: primary factor (labour and capital) payments, transfers from the government and transfers from the rest of the world (remittances from abroad). Household savings is specified as a fixed proportion of household's disposable income. Government revenue is generated from direct taxes collected on household income, indirect taxes on domestic goods and production activities, and taxes levied on imports, plus dividends paid to government as well as foreign transfers to government. Government savings are obtained from the difference between government income and expenditures; made up of government consumption and transfers made to households.

Household expenditure is derived from maximizing the Stone-Geary linear expenditure system (LES) subject to the household's budget constraint. This demand system is better suited for poverty analysis since it allows us to differentiate between minimum (subsistence) consumption and discretionary consumption. In this system, a household-specific minimum consumption bundle which represents the minimum quantity of each of the four commodities in the model is postulated. This allows us to determine the poverty line endogenously given the monetary value of the committed minimum consumption. Household's total consumption expenditure is given by household's disposable income less savings. Government demand for commodities as well as investment demand is modelled using a Cobb-Douglas utility function.

We assume in a standard fashion that Nigeria is small open economy and thus we follow the Armington (1969) assumption of imperfect substitutability between domestically produced and imported goods to model import demand, using a CES function. In a similar manner, exports are modelled using a constant elasticity of transformation (CET) function, with the belief that exports are also not perfect substitutes for domestically produced goods in importing countries, thus characterising the relative facility of a producer to switch between producing for the domestic and foreign markets.

In this model, we ensure equilibrium in the factor markets for labour and capital, product markets for the commodities as well as balance of payments equilibrium of the foreign sector.

As earlier indicated, the economy has no impact on international markets, and so takes the world prices as given. Thus, world prices of imports and exports and dividends paid to the rest of the world are exogenously fixed. The next closure condition is that the supply of labour and capital are also exogenous to the model, as are the nominal exchange rate (which is the model numeraire) and foreign savings, as well as, government savings and transfers to households. The price index is endogenous and allows for the clearing of the foreign savings (or the current account balance). The model therefore follows the classical closure, as savings is investment-driven. The CGE model described above was implemented with the aid of the General Algebraic Modelling System (GAMS) software package³ by GAMS Development Corporation (2009).

2.2.2 Poverty Analysis

In this module, we link the macroeconomic CGE model to microeconomic behaviour of the households, as captured in the household survey, and as described in the second step of the analytical framework.

We adopted the Foster, Greer and Thorbecke (1984) class of poverty measures for the analysis of poverty (Damuri and Perdana, 2003; Boccanfuso and Savard, 2003 and 2005). The choice of this measure is informed by the fact that it is additively decomposable, and thus it allows the decomposability of the overall population into sub-groups which helps us in making useful poverty comparisons.

The Foster-Greer-Thorbecke (FGT) index allows us to measure the proportion of the poor in the population (the headcount ratio). Furthermore, it provides a measure of the depth of poverty (poverty gap), which provides information regarding how far households are from the poverty line, as well as a measure of the severity of poverty (squared poverty gap), which takes into account not only the distance separating the poor from the poverty line, and also the inequality among the poor. The FGT measure for the i^{th} sub-group is given as:

$$P_{\alpha i} = \frac{1}{n_i} \sum_{j=1}^{q_i} \left[\frac{Z - y_{ji}}{Z} \right]^{\alpha} \quad (1)$$

Where:

α = degree of concern for the depth of the poverty line; for this study $\alpha = 0, 1, 2$

n_i = total population in the i^{th} sub-group

q_i = number of the poor in the i^{th} sub-group

Z = poverty line

y_{ji} = expenditure of the j^{th} sub-group

$\frac{Z - y_{ji}}{Z}$ = poverty gap ratio

An α value of zero gives the poverty incidence, which is the share of the population whose income or consumption is below the poverty line, that is, the share of the population that cannot afford to buy a basic basket of goods (World Bank, 2011). The headcount ratio is not sensitive to the changes in the welfare among the poor.

On the other hand, an α value of one gives the depth of poverty, which is the ratio of the poverty line that is required to lift a poor person out of poverty. Unlike the headcount ratio, this measure is sensitive to the welfare among the poor. Lastly, the severity of poverty takes on an α value of two. This measure takes into account not only the distance separating the poor from the poverty line (the poverty gap), but also the inequality among the poor. As α increases, more importance is given to the shortfalls of the poorest households and the measure becomes more distributionally sensitive. The analysis of the poverty indices was executed with the use of the software for Distributive Analysis (DAD) by Duclos, Araar and Fortin (2008).

3. Results and Discussion

In this section, we report the simulation results of the impact of a 50 percent rise in the import price of food on agriculture (divided into food sector and other agriculture sector in the current model), household income and expenditure distribution and poverty status of households. The level of the price increase is informed from the average food price index increase reported by the FAO (see Reyes et al., 2008), as indicated in the introduction. We begin with sectoral results before moving to the poverty results.

3.1 Sectoral Impacts

Table 1 is a summary of the sectoral impacts of food price shock on the four activity sectors considered in this paper. We emphasize the two sectors in agriculture in the course of our discussion. A 50 percent rise in the price of food imports as was experienced during the crisis leads to an increase in domestic food production by approximately 5.2 percent while the output of other agriculture sector falls by 1.14 percent. This result is very much as expected because as output price rises, there is expected to be an accompanying rise in output response as more resources will now be put into the production of food; this shock causes factor demand in the food sector to increase relative to other agriculture as well as the other sectors of the economy. Particularly, capital demand in the food sector went up by 3.7 percent while labour demand rose by 6.2 percent. However, we find that both capital and labour demand fall for the other sectors as there is a shift of these factor inputs from those sectors to the food sector as a result of the rise in the price of food imports which in turn caused the domestic price of composite food commodities to rise.

Table 1. Sectoral results

Variable	Base Solution	Percentage Change from Base Level 50% Rise in Food Prices
<i>Gross Domestic Output</i>	₦' Million	
Food	6 456 533.705	5.185
Other Agriculture	549 607.186	-1.141
Crude Oil	745 559.864	-9.421
Manufactures/Services	13 083 842.85	-4.401
<i>Domestic Production to Home market</i>	₦' Million	
Food	6 451 123.349	5.182
Other Agriculture	520 779.206	-1.311
Crude Oil	118 662.781	-4.476
Manufactures/Services	12 618 307.4	-4.644
<i>Domestic Sales of Composite commodity</i>	₦' Million	
Food	7 019 982.205	-0.594
Other Agriculture	629 509.364	-1.852
Crude Oil	120 016.425	-4.401
Manufactures/Services	17 151 628.25	-6.734
<i>Imports</i>	₦' Million	
Food	375 861.240	-54.690
Other Agriculture	99 233.417	-4.422
Crude Oil	1353.644	2.200
Manufactures/Services	449 0615.278	-12.500
<i>Exports</i>	₦' Million	
Food	5410.356	8.519
Other Agriculture	28 827.980	1.902
Crude Oil	7 336 897.083	-9.501
Manufactures/Services	465 535.454	2.145
<i>Factor Demand (Capital)</i>	₦' Million	
Food	2 235 632.720	3.686
Other Agriculture	166 128.654	-2.521
Crude Oil	6 841 676.980	-9.430
Manufactures/Services	1 565 438.960	-7.070
<i>Factor Demand (Labour)</i>	₦' Million	
Food	3 280 392.103	6.222
Other Agriculture	231 495.882	-0.136
Crude Oil	18 713.492	-6.086
Manufactures/Services	5 569 053.743	-3.639
<i>Price of Domestic Output</i>		
Food	1.000	-1.548
Other Agriculture	1.000	-1.504
Crude Oil	1.000	0.022
Manufactures/Services	1.000	-1.642
<i>Price of Domestic Output to Home Market</i>		
Food	1.000	-1.549
Other Agriculture	1.000	-1.589
Crude Oil	1.000	1.360
Manufactures/Services	1.000	-1.705
<i>Price of Composite Commodities</i>		
Food	1.000	1.271
Other Agriculture	1.000	-1.318
Crude Oil	1.000	1.344
Manufactures/Services	1.000	-1.268

Source: CGE Model Simulation Results

Domestic production for the domestic market, which represents the proportion of domestic production not exported, follows almost the same trend as the domestic output. We find that for the same reasons stated above, a rise in the price of food imports by 50 percent increased domestic production of food to home market by 5.2 percent while it reduced domestic production of other agriculture to home market by 1.3 percent. The increase in domestic output and domestic sales of food to home market causes the price of domestic output of food to fall by a meagre 1.55 percent even when production had increased by 5.2 percent.

However, since domestic consumption is made up of domestic output to home market plus imports, we find that the domestic sale of composite food commodity falls by roughly 0.6 percent following a 50 percent rise in the price of food imports. This is because the price of food composites increased by almost 1.3 percent following the food price shock due to a fall in food imports by a whopping 54.69 percent. As for the other agriculture sector, we find that domestic sales of other agriculture composites fell by 1.85 percent, which is more than the fall in the domestic sales of food composites. This may imply that since people have to eat to live, in the event of a price hike they may cut spending on other non-food items more than they would on food items.

While we find that this shock reduced both the import of food commodities and other agricultural commodities as well, by 54.69 and 4.42 percent respectively, it actually increased the exports from the two sectors by 8.52 and 2 percent respectively which are even higher than the percentage increase in domestic output of the two sectors following this shock. This results shows that while higher import prices can be hurtful to consumers in general as we would later see, they actually boost local production and export supply especially where there is comparative resource advantage in production of import substitutes in the long-run. Although cheaper imports potentially reduce consumer prices and thus benefit consumers, it may be harmful in the case of some countries where production base is weak as local production may never be able to compete with imported products. However, high import prices may tend to have the opposite effect as a reduction in imports forces resources to be channelled to import competing sectors thereby boosting domestic production and exports (Ekeocha and Nwafor, 2007).

3.2 Distributional Impacts

In this sub-section, we examine how the impact of food price shock distributes among households' incomes and expenditure as well as the impact on the households' minimum consumption from the LES demand function, representing the monetary poverty line. From the results in Table 2, we find that a 50 percent rise in the world price of food imports causes households disposable incomes and consumption expenditures to fall, as the shock forces the price of food composites to increase thus reducing real disposable incomes and accordingly lowering their consumption of food. We observe that the income and expenditure of rural-north households decreased the least while those of the urban-north households fell most. Apart from suggesting that all household groups were net consumers of food, these results may also imply that rural-north household consumed much less of imported food plus, produced much of what they consumed compared with other household categories.

Table 2. Impact on households' income and expenditures

Variable	Base Solution	Percentage Change from Base Level 50% Rise in Food Prices
<i>Household Disposable income</i>	N'million	
Rural south	2 642 927.340	-1.590
Rural north	3 646 169.671	-1.343
Urban south	5 288 615.606	-1.678
Urban north	3 875 486.962	-1.912
<i>Household consumption expenditure</i>		
Rural south	2 631 340.864	-1.590
Rural north	3 598 827.408	-1.343
Urban south	3 597 972.672	-1.652
Urban north	2 959 873.227	-1.891
Minimum Consumption (All)	12 581 493.448	2.001
Poverty Line	N89 867.81	N91 665.166

Source: CGE Simulation Results

Beyond these, this shock however, raises the minimum consumption (defined as the nominal value of the basic needs commodity basket or the monetary poverty line) of all households, taken together by about 2 percent due to an increase in relative prices of commodities that constitute the basic needs basket of households. Expectedly, the impact of this shock on poverty would be higher on rural households but this also depends on several other factors including how much of imported food that the households consumed. Generally, this shock is expected to increase the poverty situation of all the households since there is both a rise in commodity prices following the shock, and a fall in the incomes of all the households, all things being equal.

3.3 Impacts on Poverty

Before determining the impact of the simulations on poverty it is necessary to have an understanding of the poverty status of the households in the base year. This allows us to have a basis for calculating the change in poverty or impact of the shock on poverty after the simulations.

3.3.1 Poverty Status of Households in the Base Year

Table 3 shows the poverty status of the four household categories in the model plus, the poverty status for all households taken together, based on the FGT poverty measures, namely incidence, depth and severity of poverty. In the base year, 55 percent of Nigerians were consigned to poverty in terms of headcount. Rural-north households showed the highest poverty incidence, with 75 percent of its population living in poverty; this is followed by rural-south and urban-north households both with about 47 percent of their populations in poverty. Urban-south households are the least poor, with a poverty headcount of about 40 percent. These results are quite in line with existing evidence (see, for instance, NBS, 2005). Although poverty is generally very high among household groups in both urban and rural areas in Nigeria, it has been found to be more concentrated in the rural areas, especially the rural-north.

Table 3. Poverty status of households in the base year

Poverty Index	All	Rural South	Rural North	Urban South	Urban North
P0(alpha = 0)	0.5500	0.4729	0.7514	0.4038	0.4724
P1(alpha = 1)	0.2259	0.1738	0.3318	0.1650	0.1780
EDE*(Naira/Head)	20 300.91	15 621.57	29 822.94	14 830.46	15 999.04
P2(alpha = 2)	0.1227	0.08712	0.1854	0.0922	0.0928
Poverty Line (Naira/Year)	89 867.81	89 867.81	89 867.81	89 867.81	89 867.81

Source: Extracted from poverty analysis results in DAD software

The above results also indicate that the poverty level of rural-south households is not much different from that of urban-north households, 47.29 and 47.24 percent, in that order.

Further insights can be gained when we analyse the data in terms of absolute number of poor persons in each household category as well as relative contribution of each household group to national poverty incidence. In terms of absolute numbers, 25.4 percent of poor Nigerians in the base year were found in rural-north households alone, while the remaining 29.6 percent of the poor were found in rural-south households (10.45 percent), urban-south households (9.90 percent) and urban-north households (9.25 percent). However, the relative contribution of the household groups to total national poverty incidence shows that rural-north households contribute 46.18 percent, while the remainder of 53.82 percent is shared among rural-south households (19 percent), urban-south households (18 percent) and urban-north households (16.82 percent). Clearly, in the reference period, the challenge of poverty reduction in Nigeria is more evident in the rural-north.

The results for poverty depth follow a similar pattern. However, the poverty depth indicates the ratio or proportion of the poverty line that is required to lift a poor person out of poverty. This thus results in the equally distributed equivalent income; EDE, defined as the average amount of money or resources that would be needed to make a poor person non-poor based on the poverty threshold that was used to classify them as poor (see, Duclos and Araar, 2006; World Bank, 2011). From the table, the poverty depth for Nigeria is about 22 percent. Disaggregating by household group shows that rural-north households have the highest poverty depth of 33 percent followed by 17.8, 17.4 and 16.5 percent for urban-north, rural-south and urban-south, respectively. Thus, on an annual basis, it would require ₦20 300.91 (that is 22.59 percent, which is the poverty gap, multiplied by ₦89 867.81, which is the poverty line) on average, to lift a poor person out of poverty nationally, while it requires ₦29 822.94, ₦15 999.04, ₦15 621.57 and ₦14 830.46 to lift a poor person out of poverty in rural-north, urban-north, rural-south and urban-south, accordingly. Clearly, fighting poverty in the north would require more resources than combating same in the south. Lastly, poverty is most severe within the rural-north households

(18.54 percent) and least severe among the rural-south households (8.71 percent). The severity of poverty among urban-north and urban-south households is 9.28 and 9.22 percent respectively. These results are further highlighted in figure 2 below.

The results for poverty depth and severity conceivably underscore the need for other measures apart from the headcount measure to be used in assessing poverty. For example, in Nigeria, where the poverty headcount is over 50%, it may be practically difficult to target all the poor at once, but with the poverty gap and squared poverty gap measures, it is easier to target those whose poverty depth and severity is higher before others or at least give them higher priority in the allocation of resources and poverty interventions. Next, we discuss the impact of the simulation experiment on the poverty status of households depicted in the base scenario.

3.3.2 Impact of Simulation on Poverty

In this section, the results of the impact of the scenario experiment on poverty using the FGT class of poverty measures are presented and discussed. Table 4 shows the impact of food price shock on poverty, reported as percentage change from the reference period. From the table, a 50 percent rise in the world price of food imports increased the incidence of poverty nationally, and in all the household categories albeit by varying degrees. National poverty headcount increased by 3.254 percent. This increase in poverty headcount is as expected (since Nigeria is a net food importer and is yet to be self-sufficient in food production), although the figure is higher than 2.42 and 0.96 percent increase in poverty recorded by Boccanfuso and Savard (2011) for Senegal and Mali, respectively as a result of a 70 percent increase in the import price of food.

Table 4. Impact of food price shock on poverty (Percent)

Poverty Index	All	Rural South	Rural North	Urban South	Urban North
P0(alpha = 0)	3.254	4.863	2.022	3.863	4.149
P1(alpha = 1)	0.579	6.271	4.219	5.394	6.504
P2(alpha = 2)	0.652	7.323	5.383	5.901	7.424

Source: Extracted from poverty analysis results in DAD software

Rural-south households record the highest increase in poverty incidence of almost 5 percent, followed by urban-north households, which registered a rise in poverty headcount of a little above 4 percent. This shock increased the poverty incidence of urban-south households by 3.86 percent, whereas rural-north households experienced the least increase in poverty headcount of 2 percent. It is worthy to notice that the impact of this shock is higher for each household group than the national average, except for rural-north households. These results are informative as they clearly indicate that the impact of increased food prices was least felt by rural-north households, perhaps due to the fact that the bulk of the staple food grains are produced by the rural-north households. Thus, the increase in the price of food imports like rice, maize, guinea corn, cowpeas, millet, etc, is not wont to affect rural-north households as much as others. This suggests that this region could be harnessed to assure food security in Nigeria.

The results also imply that although rural areas in Nigeria are mostly agrarian, which preoccupation is subsistence production, food production in rural-south households is not impressive as it negates this thesis, and hence the high impact of the shock on this household category. Several reasons may account for this, which include quest for formal education, penchant for engaging in commerce or trading (especially in the south-east) instead of agriculture, poor agricultural conditions and output (especially in Niger-Delta or south-south) due to oil spills and environmental degradation. For example, a recent United Nations Environmental Programme (UNEP) report indicates that it will take 30 years to clean-up oil spills in the Niger-Delta region to make room for cultivating crops and revamping aquatic life (see, The Guardian, 4 Aug, 2011).

For the poverty depth measure, we observe that rural-south and urban-north households recorded the largest increase, with urban-north households recording the highest increase in poverty gap of 6.5 percent, whereas rural-south poverty depth increased by 6.2 percent. Urban-south and rural-north households record an increase of 5.3 and 4.2 percent respectively. These results are not surprising as the headcount measure discussed above does not capture the extent to which individual income or expenditure falls below the poverty line; the poverty depth measure does. Jha and Sharma (2003) have noted that certain policy changes or shocks favour one group of the poor and adversely affect another group and that in such cases, the headcount may not register any change but the poverty gap index may get around it to some extent, thus the need to use all three measures in analysis.

The results for poverty depth measure imply that it would require ₦20 823.78 on average nationally to take a poor person out of poverty on an annual basis. If we consider the quantum of resources required on the basis of households groupings, rural-north households would require the greatest level of intervention; specifically, each poor person in this household category would need ₦31 702.14 on average per year to become non-poor. Urban-north households come next, requiring ₦17 381.33 on average per person annually, to step out of poverty. This is then followed by rural-south (₦16 936.76) and urban-south (₦15 940.84) households. These results imply that in terms of targeting, rural-north households require more urgent attention than all other households groups as far as this shock is concerned, in spite of the fact that it recorded the lowest increase in poverty incidence and poverty gap. Clearly, the poverty depth in the reference year based on the distribution for rural-north households is very high, and hence the results.

In terms of poverty severity, urban-north households record an increase of 7.4 percent from the base, followed closely by rural-south households, with an increase of 7.3 percent from the base year. Also, rural-north households record the least increase in poverty severity, as far as food price shock is concerned. Figure 3 is a graphical depiction of the effect of this shock on the various household groups

4. Conclusions and Implications for Policy

Motivated by the recent global economic crisis, this paper simulated the impact of a rise in import price of food on agriculture and household poverty in Nigeria using a macro-micro framework, which comprised of a computable general equilibrium model and a poverty analysis module that relied on the FGT class of decomposable poverty measures.

The results of the study have shown that the impact of a rise in import price of food is largely mixed. While the shock increases domestic output of food, it actually reduces the domestic supply of other agricultural commodities due to a shift of resources from other agriculture sector to the food sector. However, the shock marginally reduced the supply of composite food commodities as well as other agricultural commodities. Furthermore, the simulation experiment reduced both food and other agricultural imports but increased exports of same by a less than proportionate amount.

In terms of poverty, in the reference period, we found that rural-north households were the poorest among the four household categories, while urban-south households were the least poor. Moreover, a rise in the import price of food increased poverty nationally and among all the households, although at varying degrees: rural-north households were the least affected by this shock, while their rural-south counterparts were the most affected. Beyond these, the results also showed that in spite of being the least affected by this shock, rural-north households required almost twice as much resources in terms of money, on average to become non-poor compared with other households.

Consequent upon these results, a major policy implication drawn from this paper is that high import prices in import competing sectors like agriculture will favour the sector but will exacerbate poverty of households, especially those that consume much of imported food commodities. Thus, efforts in addressing the impact of this shock should balance welfare and efficiency issues by providing safety-nets to address the immediate impact of the shock on the households as well as boosting increased productivity in the agricultural sector in order to achieve efficiency gains in the sector. Also, the results have highlighted the need for targeting of poverty alleviation interventions given that some household groups are affected more severely by the shock than others.

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Notes

Note 1. Cameroon by Decaluwe, Savard and Thorbecke (2005); Ghana by Bhasin and Obeng (2004 and 2005); Cote d'Ivoire by Aka (2006); Ethiopia by Aredo, Fekadu and Workneh (2008); among many.

Note 2. The interested reader can obtain the complete specification of model equations from the lead author.

Note 3. The interested reader can also obtain the GAMS code for the implementation of the CGE model from the lead author.