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How Does Food Price Increase Affect Ugandan Households?

An Augmented Multimarket Approach

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ABSTRACT

Almost unaffected by the 2008 wave of soaring world food prices, Ugandan local market prices exhibit signs of high price volatility in the first quarter of 2009. At the household level, while net producers may reap some benefits from this increase in food prices, net consumers are more likely to suffer from it. However, the net consumption impact of food price increase is not as straightforward as reported in previous studies. In this paper, we extend Singh et al. (1986) multimarket model by adding demand elasticities from the Almost Ideal Demand System (AIDS). We use the integrated Ugandan National Household Survey (UNHS) 2005/2006 to estimate a measure of net consumption impact that includes both price and profit effects. Overall, we found that household welfare is expected to decrease with loss in consumption and increase with income gain as a result of higher food prices for the cereals producers. Simulating change in cereals consumption induced by a 50 percent increase in cereals price and taking into account the profit effect, our results predict a 23 percent decrease in food consumption for net sellers, compared with 44 percent when using the consumption approach alone. Accounting for such substitution effects, our results suggest that the impact of rising food prices may be mitigated because some households will attempt to substitute more expensive food items with cheaper ones; however, this apparent coping strategy often leads to a much poorer diet. The results suggest that the majority of households with expected positive income impact, the gainers, live in rural areas. These households also tend to have better access to agricultural services than the nongainers.

Keywords: Consumption, Demand, Elasticity, Price, Household, Multimarket, Supply

1. INTRODUCTION

According to the International Monetary Fund (IMF; 2008), the global economy is in the midst of the broadest and most buoyant commodities price boom since the early 1970s. Oil prices have risen from $30 a barrel in early 2003 to around $140 by the end of June 2008, some 35 percent above the earlier record high in real terms in 1979. Prices of food commodities only started booming in 2006—much later than those of oil, metals, and other minerals—and are generally still far below their 1970s highs. Among food prices, those of grains, edible oil, and protein meals accounted for the bulk of the increase in the IMF's overall price index. The price of maize has gone from US$102.7 per metric ton in January 2006 to US$287.1 in June 2008. Similarly, the price of rice increased from US$284.5 in January 2006 to US$834.6 in June 2008. From March 2007 to March 2008, the export prices for wheat increased by 130 percent, for rice by 98 percent, and for maize by 38 percent.

The soaring food prices affect some countries more than others. Net exporting and self-sufficient countries benefit from such crisis by increasing the value of their exports. Net importing countries, most of them developing countries, suffer from the crisis. Riots and political instability erupted because of the crisis. Walt (2008) reported food crisis related riots in Mexico, Pakistan, Burkina Faso, Senegal, Mauritania, India, and West Bengal. In general, both exporting and importing countries have responded with policies aimed at reducing domestic food prices. Exporting countries have increased export taxes or imposed quotas on food exports, while importing countries have reduced import tariffs and other food taxes or introduced price controls. Some of these policies, like exports restrictions, yield to more increase in the global food prices. Several studies have documented the causes beyond the crisis and estimate its potential impact (von Braun 2008; IMF 2008; Heady and Fan 2008; Mitchell 2008)

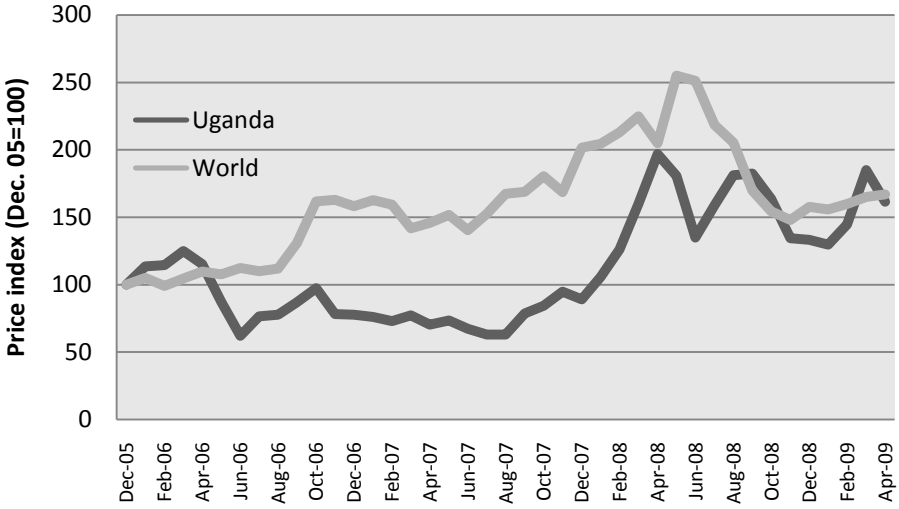
At the household level, while net producers are expected to collect some benefits from the current food price increase, net consumers are more likely to suffer from it. The net food-selling households will see an increase in income that may compensate for the rise in the price of foods they purchase. Net food-buying households, however, which generally make up the majority of the population in most developing countries, are likely to be adversely affected by the global food crisis (Todd et al. 2008).

Understanding the nature and size of price effects on both producers and consumers has important policy implications. Since resources are not always equally distributed among all household members, with women and girls often being disadvantaged (Quisumbing 2003), it is more likely that the welfare impact of a food crisis will differ across household members. Similarly, within a given country, effects of food price increase may widely vary across regions, provinces, or districts. Most previous studies failed to highlight these heterogeneities and their implication in terms of policy response.

Unlike other African countries, local cereals prices in Uganda seem to have been unaffected by the 2008 wave of soaring food price. Uganda is relatively isolated from global markets principally because of the high transfer costs traders face in shipping commodities to and from landlocked Uganda (IFPRI 2008). In addition, Uganda is self-sufficient in food production nationally. As shown in Figure 1, from 2005 through most of 2008, the Ugandan maize price index has been consistently below the world maize price index. However, signs of trend shift have been observed since December 2008; indeed, while the world maize price grew on average by only 2.5 percent between December 2008 and April 2009, the local maize price increased by 4.6 percent. According to a recent report from FEWSNet (2009), food items such as *matooke*, cassava, millet, and sorghum are also experiencing price increase. As predicted by IFPRI (2008), increasing regional demand—mainly from Uganda's neighbors—may have driven up local food prices, particularly for maize. Moreover, the price of nontraded staples that are part of the Ugandan diet may also increase inasmuch as households are substituting food items such as maize for cheaper ones.

According to FEWSNet (2008), approximately 2.15 million people remain moderately to highly food insecure in northeastern, northern, and eastern Uganda, mostly due to lack of available food stocks. Hence, a surge in food prices is likely to affect the country's food security situation.

Figure 1. Uganda and world maize price indexes



Source: Authors from FAO (2009) database

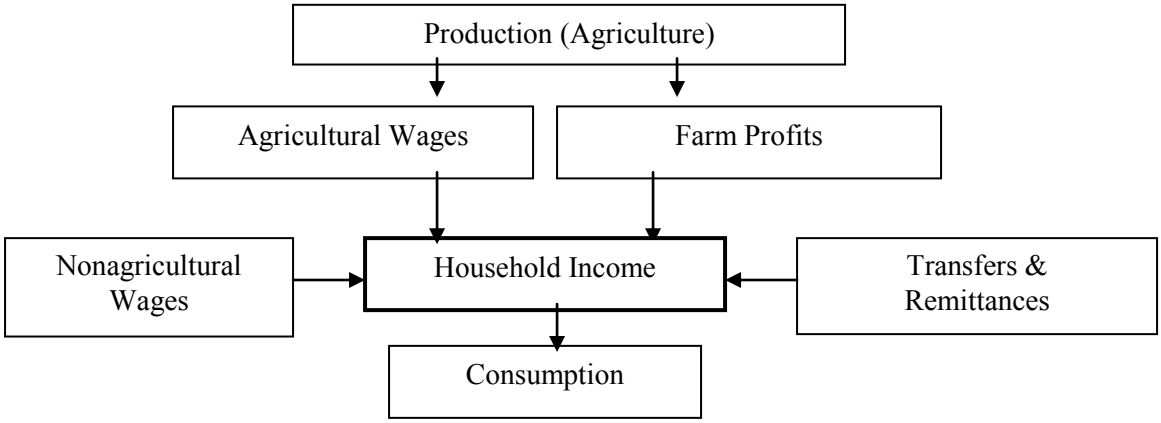
In this paper, we extend the multimarket approach developed by Singh et al. (1986) by adding demand elasticities from the Almost Ideal Demand System (AIDS) to estimate a measure of net consumption impact that includes both price and profit effects. The net impact is measured using the integrated Ugandan National Household Survey (UNHS) 2005/2006.

The rest of the paper is structured as follows: Section 2 describes the theoretical model and provides an overview of the multimarket approach and its advantage in analyzing the net impact of rising prices. In Section 3 we present the UNHS 2005/2006 and discuss key nonparametric results. The estimated results, elasticities and net consumption impact are discussed in Section 4. In Section 5 we highlight key findings and possible policy implications.

2. AUGMENTED MULTIMARKET APPROACH

Agricultural profit, in addition to agricultural and nonagricultural wages and any other transfers such as remittances, constitutes the household's income on which the consumption decision is based (Figure 2). Therefore, the overall price effect on household consumption comprises the traditional price effect whereby household demand decreases as a result of price increase, and a profit effect that may increase household consumption. The latter is zero for household not involved in production activities. In this paper, we estimate both effects to determine the net impact of soaring food prices on household consumption.

Figure 2. Interactions between demand and supply sides



The multimarket framework developed by Singh et al. (1986) incorporates both the production and the consumption sides, integrates the price effects on different markets, and takes into account the interactions between them (Collin and Crawford 2000). Such comprehensive effect is not captured within a single-market approach that considers separately the consumers and producers. In addition, the multimarket approach provides an *ex ante* analysis to determine the direct and indirect effects of different policies on consumption, production, income, and poverty. Unlike Computable General Equilibrium (CGE) models, multimarket models are less complex and do not require a large amount of data. They are an intermediate framework between the single-market approach and the CGE approach (Stifel and Randrianarison 2006; Croppenstedt et al. 2007).

The multimarket models have been widely used to analyze the impact of the agricultural policy reforms. Braverman and Hammer (1986) use the theory of farm household to study the impacts of pricing policies on the distribution of income, consumption, agricultural production, and foreign trade in Senegal. Stifel and Randrianarison (2006) assess the impacts of alternative agricultural policies on household welfare using the multimarket approach. Siam and Croppenstedt (2007) use a multimarket approach to quantify the effects of complete wheat market liberalization on cropping pattern, prices, household income, and calorie intake in Egypt.

Following Singh et al. (1986) and Singh and Subramanian (1986), we consider a sequential basic decision-making process model of agricultural household where, first, the production decisions are determined by maximizing agricultural profit; and second, the consumption is determined by estimating a complete demand system. The results of the two parts are integrated to determine relevant elasticities and interactions between the two sides.

Let's assume a multi-output and multi-input household producer. Given difficulty to allocate inputs by crops, Mckay et al. (1983) suggested the use of a joint-production function. Hence, a given

+household, that produces *n* outputs using *m* inputs chooses the optimal level of output (y_i) and input (x_i)to maximize the following profit function, given the price (p_i) of output *i* and the price (q_j) of input *j*:

$$\pi(p;x) = \sum_{i=1}^{n} p_i y_i - \sum_{j=1}^{m} q_j x_j,\ i = 1,\dots,n; j = 1,\dots,m. \quad (1)$$

Applying Hotelling's Lemma to (1) yields output supply and input demand that maximize the household welfare:

$$y_i = \frac{\partial \pi}{\partial p_i}, x_j = \frac{\partial \pi}{\partial q_j},\ i = 1,\dots,n; j = 1,\dots,m. \quad (2)$$

Following Mckay et al. (1983), we use a transcendental logarithmic specification for the profit function that takes the following form:

$$ln\pi = A + \sum_i a_{i0} lnp_i + 0.5 \sum_i \sum_h a_{ih} lnp_i lnp_h + \sum_j b_{j0} lnx_j + 0.5 \sum_j \sum_k b_{jk} lnx_j lnx_k + \sum_i \sum_j c_{ij} lnp_i lnx_j. \quad (3)$$

Maximizing the above profit function with respect to the output prices and the fixed quantities of inputs yields to the following output and fixed input share equations:

$$S_i = a_{i0} + \sum_h a_{ih} lnp_h + \sum_j c_{ij} lnx_j + \varepsilon_i \quad (4)$$

$$R_j = b_{j0} + \sum_k b_{jk} lnx_k + \sum_i c_{ij} lnp_i + \mu_j, \quad (5)$$

Where S_i is the share of the output *i* in the revenue, while R_i is the share of fixed input *j* in the total cost. In order to identify all the parameters and verify the homogeneity of the profit function with respect to prices and inputs, the following constraints are imposed:

$$a_{ih} = a_{hi};\ \sum_i a_{i0} = 1;\ \sum_i a_{ih} = 0, \forall\ h \neq 0 \quad \text{(i)}$$

$$b_{jk} = b_{kj};\ \sum_j b_{j0} = 0;\ \sum_j b_{jk} = 0, \forall\ k \neq 0 \quad \text{(ii)}$$

$$\sum_j c_{ij} = 0;\ \sum_i c_{ij} = 0\ . \quad \text{(iii)}$$

Equations (4) and (5) are estimated as a system under the above restrictions.

The elasticity of commodity i *with respect to price of commodity* h *is given by*

$$\xi_{ih} = S_h + a_{ih}/S_i - \delta, \quad (6)$$

where δ is the Kronecker delta, which is unity if i = h , and zero otherwise.

The elasticity of the commodity i *with respect to quantity of input* j *is given by*

$$\eta_{ij} = R_j + c_{ij}/S_i. \quad (7)$$

The elasticity of the fixed input j's shadow price with respect to price p_i is

$$\varphi_{ij} = S_i + c_{ij}/R_j. \quad (8)$$

As pointed out earlier, we augment the traditional multimarket approach with demand elasticities derived from the AIDS, based on expenditure function (Deaton and Muellbauer 1980). These elasticities are presented in Table 1. For each commodity *i*, the expenditure share is given as follows:

$$w_i = \alpha_i + \sum_{k=1}^{n} \gamma_{ik} lnp_k + \beta_i ln(M/P), \quad (9)$$

where *M* represents consumers' total expenditures or income, and *P* is a price index defined as

$$lnP = \alpha_0 + \sum_{i=1}^{n} \alpha_i lnp_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{k=1}^{n} \gamma_{ik} lnp_i lnp_k. \quad (10)$$

Table 1. Demand elasticities derived from AIDS

Type	Formula
Expenditure elasticity	$e_i = 1 + {\beta_i}/{w_i}$
Uncompensated price elasticity	$e_{ik} = -\theta_{ik} + \{\gamma_{ik} - \beta_i(w_k - \beta_k ln(M/P))\}/w_i$
Compensated price elasticity	$e_{ik}^* = -\theta_{ik} + \frac{\gamma_{ik}}{w_k} + w_k$
Income elasticity	$\vartheta_i = e_i \Omega$

Note: θ_{ik} is the Kronecker delta, which is unity if $i = j$ and zero otherwise; ϑ_i is the income elasticity for good *I*; Ω is the elasticity of expenditures on the commodity group as a whole with respect to income.

A change in the price of a given commodity affects both the supply and the demand decisions. The net impact on household welfare depends on the importance of the commodity in terms of both consumption and profit. The induced change in the quantity of commodity *i* as a result of price change can be decomposed as follows:

$$\frac{dq_i}{dp_i} = \left(\frac{\partial q_i}{\partial p_i}\right) + \left(\frac{\partial q_i}{\partial R^*}\right)\left(\frac{\partial R^*}{\partial p_i}\right) \quad (11)$$

The first term of the right-hand side is the standard price effect, and it is always negative for normal goods. The second part is the profit effect due to the fact that the change in price affects the farm profit, which then affects full income available for the household. This profit effect is assumed to be positive. The final impact of that increase in price on the quantity consumed depends on which effect is the most important.

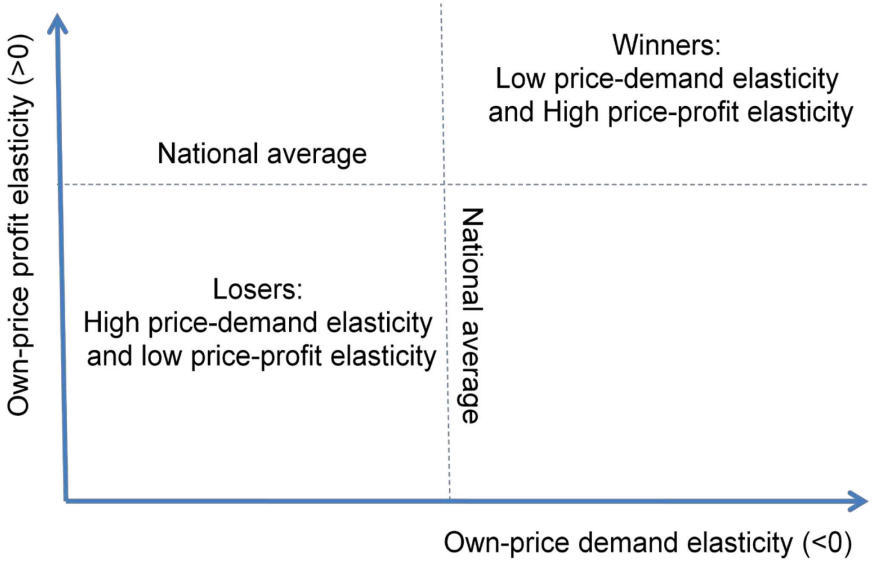
Equation (12) can be rewritten as follows:

$$\frac{dq_i}{dp_i}\frac{p_i}{q_i} = \underbrace{\underbrace{\underbrace{\left(\frac{\partial q_i}{\partial p_i}\frac{p_i}{q_i}\right)}_{\substack{Own\ price\\ elasticity\\ <0}} + \underbrace{\left(\frac{\partial q_i}{\partial R^*}\frac{R^*}{q_i}\right)}_{\substack{Income\\ elasticity\\ >0}}}_{AIDS\ MODEL} * \underbrace{\left(\frac{\partial R^*}{\partial p_i}\frac{p_i}{R^*}\right)}_{\substack{Profit\\ elasticity\\ >0}}}_{\substack{Transcendental\\ profit\ function}} \quad (12)$$

Hence, the net impact of food price is a function of own-price elasticity, income elasticity, and profit elasticity. Equation (13) provides a consistent way of differentiating between producer households for whom profit elasticity is assumed positive and nonproducers whose profit elasticity is zero.

Based solely on supply and demand elasticities, a policy-relevant typology of winners and losers of a given food price change can be developed as shown in Figure 3.

Figure 3. Typology of price effect on consumption



Data

The integrated household survey we use in this paper has been carried out by Uganda Bureau of Statistics (UBOS) every other year since late 1980s. The UNHS 2005/2006 covered about 7,400 nationally representative households (UBOS 2006). The survey was comprehensive and had five modules: socioeconomic, agriculture, community, market and qualitative.

The UNHS 2005/2006 includes data on production and sales of some crops produced by the Ugandan households such as rice, maize, millet, sorghum, matooke, potatoes, cassava, bananas, coffee, and beans. Among the surveyed households, bananas account for the highest share of overall production (28.4 percent), and they come only second in terms of sales (Table 2). Most household sales originate from maize (41.8 percent), bananas (18.1 percent), and beans (13.3 percent).

Table 2. Shares of production and sales by crops (%)

Crops	Production	Sales
Bananas	28.4	18.1
Beans	2.6	13.3
Cassava	13.5	7.6
Coffee	2.0	0.0
Groundnut	1.9	0.0
Maize	21.3	41.8
Matooke	0.6	2.4
Millet	1.5	1.6
Potatoes	25.7	5.6
Rice	0.8	8.2
Sorghum	1.5	1.5
Yams	0.3	0.0

Source: Authors' calculation from UNHS data

Maize, bananas, and beans account for most of farming income in both urban and rural areas (Table 3). Combined, they represent 70.5 percent of total sales: 63.1 percent in urban areas and 71.3 percent in rural areas. For the estimation of supply elasticities, we selected only traded crops grouped as follows: (1) cereals including rice, maize, millet, and sorghum; (2) roots and plantains including potatoes, cassava, and matooke; and (3) other. Cereal sales represent the highest revenue share (41.4 percent), compared with 18.5 percent for roots and plantains. The difference between urban and rural areas is significant only for roots and plantains: 26.1 percent among urban households and 17.7 percent for rural households.

Table 3. Shares of crop revenue by rural and urban (%)

Crop	Urban	Rural	Nation
Bananas	17.6	21.9	21.5
Beans	15.4	19.0	18.6
Cassava	12.7	9.6	9.9
Maize	30.1	30.4	30.4
Matooke	1.3	3.2	3.1
Millet	2.2	4.0	3.9
Potatoes	12.1	4.9	5.5
Rice	4.0	3.4	3.4
Sorghum	4.6	3.7	3.8
Grouped			
Roots	26.1	17.7	18.5
Cereals	40.9	41.4	41.4
Other	32.9	40.8	40.2

Source: Authors' calculation from UNHS data

We consider three inputs: land, labor, and manure. Land-related expenditure represents 83 percent of total cost, against 14 percent for labor, and 2 percent for manure. High production cost may explain why 73 percent of producers realize negative profit. Because of data limitation all the inputs are considered as fixed, unlike McKay et al. (1983). We concede that this might be a strong assumption; however, assuming short-run variability of production inputs as a result of food price changes may not be realistic either.

Countrywide, the survey suggests that 45 percent of the household expenditure was on food, beverage, and tobacco (Table 4). Expenditure share of food, drink, and tobacco is higher in urban areas (50 percent) than in rural areas (34 percent). Across regions, the Northern region had the highest expenditure on food, drink, and tobacco.

Table 4. Share of the different expenditures (%)

Item Group	Urban	Rural	Nation
Food, drink, and tobacco	50.0	34.0	45.0
Clothing and footwear	4.0	4.0	4.0
Rent, fuel, and energy	15.0	20.0	16.0
Household and personal goods	5.0	6.0	5.0
Transport and communication	6.0	10.0	7.0
Education	8.0	13.0	10.0

Table 4. (continued)

Item Group	Urban	Rural	Nation
Health	8.0	4.0	7.0
Other consumption expenditure	1.0	4.0	2.0
Nonconsumption expenditure	3.0	5.0	4.0
Total	100	100	100

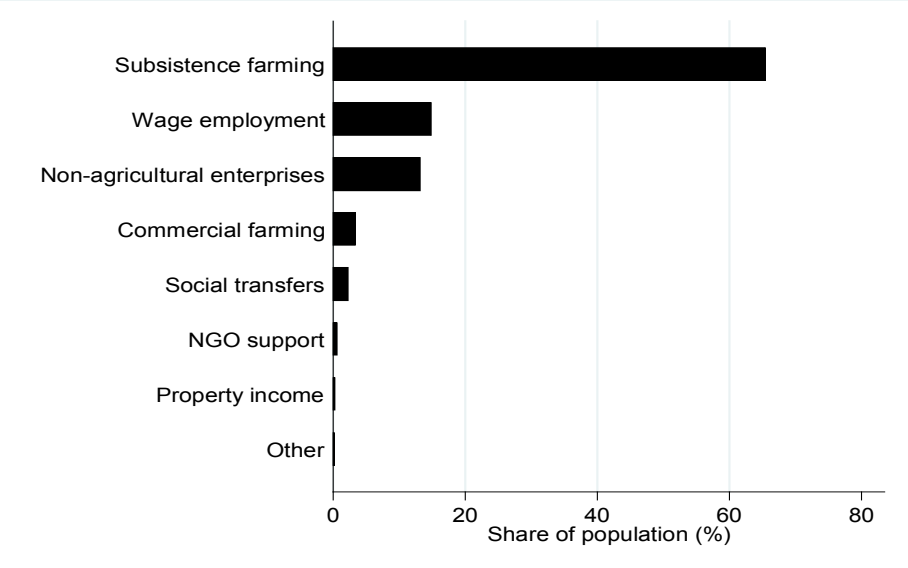
Source: UBOS (2006)

According to Minten and Barrett (2008), over a given period of time, net food buyers include farmers who do not produce enough to cover their own household's consumption requirements. On the other hand, net food producers are households whose income from selling food exceeds their purchase of food items. The matter becomes more complex in terms of policy response to soaring food prices in a sense that the wealthiest are typically net food buyers choosing high-return, nonagricultural occupations (Minten and Barrett 2008). Inversely, the poorest are commonly net buyers who lack access to sufficient land to produce enough to meet their own household consumption needs.

Using UNHS, IFPRI (2008) concludes that only 12 percent of Ugandan households are significant net food producers by Minten and Barrett's definition. This value only rises to 14 percent when rural households are considered alone. In contrast, 66 percent of Ugandan households are found to be significant net food consumers relying on the market for more than 25 percent of the value of the food they consume. In rural areas, the value of food purchase of over 60 percent of households exceeds by far the value of food sales.

The majority (65.4 percent) of net food buyers rely on subsistence farming (Figure 4). Following behind are households whose incomes originate mainly from wage employment (14.8 percent) and nonagricultural enterprises (13.2 percent). These groups share a common characteristic in that their incomes tend to be inelastic to change in food prices. A priori, they are more likely to experience substantial well-being loss as a result of soaring food prices.

Figure 4. Source of income for net buyers



Source: Authors' calculation from UNHS data

3. HOUSEHOLD RESPONSE TO PRICE CHANGE

As mentioned above, the augmented multimarket model simultaneously analyzes both consumption and supply sides of household behavior. Such comprehensive approach sheds more light on how consumers and producers will react to change in food prices. It also allows policymakers to design appropriate responses to change in food prices. Household decisions regarding available food items are not completely independent; as a result, linear equations have correlated error terms. In this case, as suggested by Zellner (1962), seemingly unrelated regression (SUR) is preferred to ordinary least squares (OLS). In addition, SUR permits one to impose the symmetry and homogeneity constraints on the parameters (Moon and Perron 2006). In this section, we discuss elasticities estimated from the joint agricultural production function and the AIDS model. Both models are estimated using the SUR method. The share equations are estimated under the symmetry and homogeneity constraints. The estimated supply and demand elasticities are later used to compute the net welfare impact measured by the change in consumption induced by change in price.

Supply Response to Price Change

The own-price supply elasticities are all of the expected signs and suggest that increase in crop price is an incentive for farmers to increase their production. The own-price elasticity (Table 5a) of cereals supply in urban areas (0.367) is higher than in rural areas (0.257). As for roots and plantains, the supply response in rural areas (0.744) is higher than in urban (0.425). This result suggests that there is a potential for rural Ugandan farmers to benefit from rising food price. Von Braun et al. (2008) report similar results in Vietnam, where the majority of the poor are found in rural areas, but because landholdings are relatively equitable, the adverse effects of higher rice prices in rural Vietnam are largely offset by the increased incomes these households receive for their rice production.

Table 5a. Price elasticities of supply by urban and rural areas

	Roots & Plantains		Cereals		Revenue	
	Urban	Rural	Urban	Rural	Urban	Rural
Roots & Plantains	0.425	0.744	-0.113	-0.113	0.557	0.448
Cereals	-0.121	-0.266	0.367	0.257	0.660	0.639

Table 5b. Inputs quantity elasticities of supply by urban and rural areas

	Land		Labor		Manure	
	Urban	Rural	Urban	Rural	Urban	Rural
Roots & Plantains	0.8985	0.9474	0.0783	0.0237	0.0233	0.0290
Cereals	0.8546	0.8684	0.1322	0.1092	0.0132	0.0224

Source: Authors' calculation from UNHS data

Our findings also suggest a substitution effect between cereals and roots and plantains. Indeed, a 1 percent increase in the price of roots and plantains decreases cereals supply by 0.12 percent in urban areas and 0.27 percent in rural areas. Similarly, a 1 percent increase in the price of cereals leads to 0.11 percent decrease in the supply of roots in both urban and rural areas.

Although rural farmers' supply response for roots and plantains is much higher than that of their urban counterparts, the induced change in their income (0.448) is slightly lower in rural areas compared with farmers in urban areas (0.557). For the cereals, the difference between urban (0.66) and rural (0.63) areas is much lower.

Partial intensity or inputs quantity elasticities suggest that cereals and roots/plantains are very sensitive to change in land, especially in rural areas (Table 5b). An increase of 1 percent in the size of cultivated land is expected to increase the supply of roots and plantains by 0.89 percent in urban areas and 0.95 percent in rural areas. The supply of cereals will increase by 0.85 percent in urban areas and 0.87 percent in rural areas in response to a 1 percent increase in the size of land. Supply response to change in labor is lower compared with land, although unlike land, labor elasticity of supply is consistently higher in urban areas. We found that cereals exhibit the highest labor supply elasticity, 0.13 in urban areas against 0.11 in rural areas. Compared with land and labor, manure has a rather modest impact on the supply of both cereals and roots/plantains.

Supply response differs across the regions (Table 6). The price-supply elasticity is higher in the western region for cereals (0.41) and roots and plantains (1.04) compared with the other regions. A similar pattern holds for a substitution effect between cereals and roots/plantains. The highest expected change in farming revenue (Table 6) as a result of price increase is observed in the northern regions for the cereals (0.80) and roots and plantains (0.59).

Table 6. Price and inputs elasticities of supply by region

	Region	Roots & Plantains	Cereals	Revenue	Land	Labor	Manure
Cereals	Central	-0.1153	0.2910	0.5107	0.8449	0.1071	0.0480
	Eastern	-0.0626	0.2113	0.7343	0.8792	0.1146	0.0062
	Northern	-0.0307	0.1500	0.8051	0.8592	0.1421	-0.0013
	Western	-0.2411	0.4092	0.4908	0.8732	0.0870	0.0398
Roots & Plantains	Central	0.6199	-0.2504	0.4997	0.9047	0.0435	0.0517
	Eastern	0.7786	-0.1659	0.4552	0.9781	0.0144	0.0075
	Northern	0.1874	0.0260	0.5943	0.8934	0.1063	0.0003
	Western	1.0421	-0.5050	0.3453	0.9710	-0.0153	0.0442

Source: Authors' calculation from UNHS data

Across regions, no significant difference is found in land intensity. It is worth mentioning that a decreasing return was observed in the northern region for manure and in the western region for labor.

Demand Response to Price Change

Regardless of income source, all food items are necessity goods whose income elasticity lies between zero and one (Table 7). The results show that the effect on the demand for food due to increase in income is unevenly distributed across households with respect to their main sources of income. Income elasticity is the highest (0.76) among households depending on external assistance from various organizations. This depicts a consumption-dominant behavior consistent with households depending on welfare or social assistance programs.

Across food items, legumes present the highest consumption response to change in income (0.90), while vegetables have the lowest income elasticity (0.20). For the latter, except for households for which organizational support fuels the bulk of income, the demand for vegetables responds very poorly to a marginal increase in income. It is less than 40 percent across households.

Table 7. Income elasticity by food item and main income sources

Main Income Source	Roots & Plantain	Cereals	Meat & Fish	Vegetables	Legumes	Avg.
Subsistence farming	0.81	0.73	0.75	0.24	0.89	0.69
Commercial farming	0.80	0.72	0.76	0.28	0.90	0.69
Wage employment	0.77	0.75	0.75	0.38	0.90	0.71
Nonagricultural enterprises	0.79	0.75	0.75	0.36	0.92	0.71
Property income	0.80	0.56	0.73	0.34	0.90	0.67
Social transfers	0.80	0.76	0.76	0.38	0.91	0.72
Organizational support	0.75	0.75	0.78	0.63	0.88	0.76
Other	0.73	0.79	0.71	0.16	0.92	0.66
Average	0.78	0.73	0.75	0.35	0.90	

Source: Authors' calculation from UNHS data

The uncompensated (Marshalian) price elasticities are reported in Table 8a. In absolute terms, all own price elasticities are less than unity, suggesting that all food items are inelastic with respect to price. However, compared with other food items, cereals exhibit the strongest response to price change (0.88), followed by roots and plantains (0.72) and meat and fish (0.66).

Table 8a. Uncompensated (Marshalian) price elasticities

	Roots & Plantains	Cereals	Meat & Fish	Vegetables	Legumes	Other	Expenditure shares
Roots & Plantains	-0.72	-0.07	-0.05	-0.03	0.03	-0.09	0.29
Cereals	-0.15	-0.88	-0.09	-0.02	0.02	0.24	0.14
Meat & Fish	-0.08	-0.07	-0.66	-0.02	0.01	-0.05	0.11
Vegetables	-0.03	0.02	-0.02	-0.50	0.06	0.07	0.06
Legumes	0.06	-0.01	0.00	0.01	-0.51	-0.57	0.10
Other	-0.46	0.10	-0.14	-0.06	-0.40	-0.58	0.29

Source: Authors' calculation from UNHS data

Although negligible, overall the Hicksian cross-price elasticities reported in Table 8b indicate the possibility of substitution effects between food items. Hence, a 1 percent increase in the price of cereals will lead to a 0.05 percent increase in the demand for roots and plantains. Similarly, a 1 percent increase in the price of legumes will increase the demand for roots and plantains by 0.38 percent. This apparent rigidity in the consumption pattern of the Ugandan households may play in their favor against the propensity to move into cheap, low-food diet items as a result of price increase.

Table 8b: Compensated (Hicksian) price elasticities

	Roots & Plantains	Cereals	Meat & Fish	Vegetables	Legumes	Other
Roots & Plantains	-0.41	0.05	0.15	-0.01	0.38	0.15
Cereals	0.04	-0.75	0.04	0.02	0.16	0.31
Meat & Fish	0.09	0.04	-0.52	0.00	0.17	0.14
Vegetables	0.00	0.01	0.00	-0.53	0.05	0.09
Legumes	0.12	0.10	0.09	0.09	-0.39	-0.14
Other	0.17	0.56	0.24	0.43	-0.37	-0.54

Source: Authors' calculation from UNHS data

We also found a noticeable difference in own-price effect across regions (Table 9). For roots and plantains, the highest price effect is observed in the western region (0.76). The effect of change in the price of cereals is almost evenly distributed across regions, with the highest effect observed in the eastern region (0.88). The western region also records the highest effect for meat and fish, but has the lowest own-price elasticity for vegetables. For legumes, the results indicate a split between low-effect area (central and eastern regions) and high-effect area (northern and western regions).

Table 9. Own-price elasticity across regions

	Roots & Plantains	Cereals	Meat & Fish	Vegetables	Legumes
Central	-0.67	-0.87	-0.61	-0.50	-0.33
Eastern	-0.66	-0.88	-0.67	-0.53	-0.44
Northern	-0.52	-0.85	-0.66	-0.50	-0.70
Western	-0.76	-0.87	-0.72	-0.35	-0.63
National average	-0.65	-0.87	-0.67	-0.47	-0.53

Source: Authors' calculation from UNHS data

Our results found no evidence of gender discrimination with respect to own-price elasticity. Indeed, except for vegetables and legumes, for which price increases tend to affect female-headed households more than male-headed ones, the difference between the two genders with respect to price change is rather slim.

Net Impact

Using the estimated demand and supply elasticities, we compute the net impact of increase in the cereals price on cereals consumption. Holding everything else constant, we use cereals consumption as an indicator of household welfare. For nonproducer households, there should be no difference between the consumption approach and the multimarket approach, given that their profit effect is zero. Using the multimarket approach, we found that a 1 percent increase in the price of the cereals decreases cereals consumption by 0.59 compared with 0.72 using the traditional demand theory.

We simulate change in cereals consumption induced by a 50 percent increase in cereals price. The average revenue of all cereals producers, net sellers and net buyers, goes up quite substantially. On average, producer revenue rises by 23.5 percent for net sellers and 16.4 percent for net buyers. Moreover, we found that using our approach, cereals consumption decreases by 37 and 23 percent for net buyers and net sellers, respectively, whereas demand elasticities predict a decrease of 44 percent for both groups. The difference between the two approaches varies across regions (Table 10): +4.3 percent in central region, +12.3 in the eastern region, +8.8 percent in the northern region, and +6.8 percent in the western region when applying the multimarket approach. Hence, policy response based on demand elasticities alone will tend to favor consumers at the expense of producers. The simulated impacts on revenue also differ across regions. Approximately 63 percent of households with net positive response are concentrated in the eastern and the western regions. It is plausible that some households, especially net producers, may attempt to substitute more expensive food items with cheaper ones. Accounting for such substitution effects, our results suggest that the impact of rising food prices will indeed be mitigated (Table 10); however, this apparent coping strategy often leads to a poorer diet.

Table 10. Impact of 50 percent increase in cereals price (%)

Region	Central	Eastern	Northern	Western
Consumption				
Demand approach	-44.0	-45.0	-44.4	-44.2
Augmented multimarket approach				
Without substitution effect	-39.7	-32.7	-35.6	-37.4
With substitution effect	-37.0	-29.0	-32.0	-35.0
Revenue change	12.0	25.0	26.0	10.0
Households with net positive response	19.8	35.3	16.9	27.9

Region	Central	Eastern	Northern	Western
Consumption				
Consumption approach	-44.0	-45.0	-44.4	-44.2
Augmented multimarket approach	-39.7	-32.7	-35.6	-37.4
Revenue change	12	25	26	10
Households with net positive response	19.8	35.3	16.9	27.9

Source: Authors' calculation from UNHS data

Maps 1 and 2 (Appendix) show the spatial distribution of the response of cereals demand to a 50 percent increase in its price with (Map 1) and without (Map 2) the profit effect. The net effect in terms of revenue response is presented in Map 3 (Appendix). For example, the northeast region, known as the most vulnerable region in the country to food security, has the highest average revenue response (56.2 percent). Some districts in the eastern region such as Bugiri, Kamuli, Iganga, and Tororo experience much better fate when the revenue effect is included. Overall, big winners include the districts of Moroto (+20.1 percent), Mayuge (+19.4 percent), Yumbe (+18.6 percent), and Kapchorwa (+17.8 percent). No change is observed in the districts of Kaberamaido, Kitgum, and Pader.

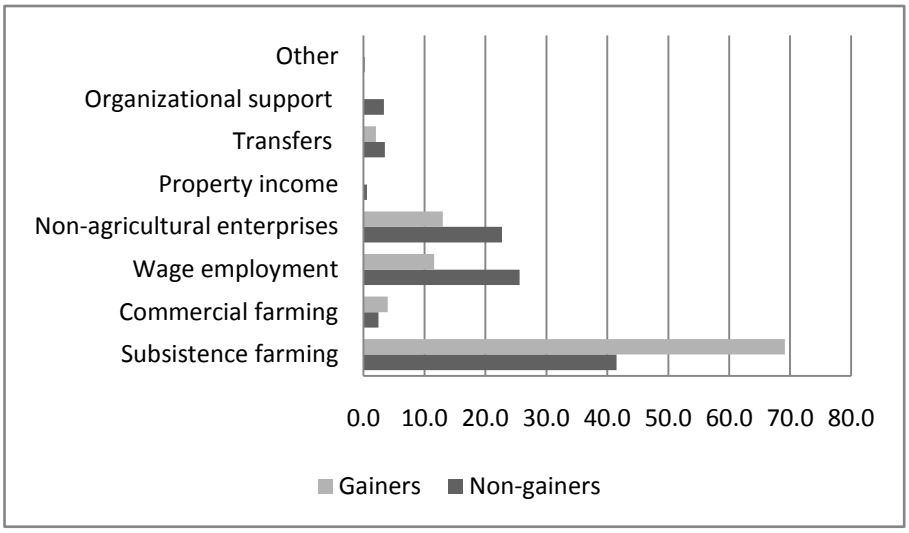
Who Are the Gainers?

The approach followed in this paper shows that even the net buyers can benefit from high food prices if they can manage to increase their production and sell it at the high prices. Therefore, market access will ultimately define losers and gainers from soaring food prices. We consider a *gainer* every household whose income induced by price increase offsets completely or partially the induced decrease in consumption. We found that 90 percent of the gainers live in rural areas.

Access to agricultural cropping and marketing services can also explain the difference in net impact observed between the gainers and the nongainers. The results suggest that except for "improved produce quality/varieties" services, gainers have much better access to agricultural services than the nongainers (Table 11). The difference is particularly pronounced for "disease control" services. On average, their access to extension and National Agricultural Advisory Services (NAADS) is also higher than that of nongainers.

Another characteristic of gainers is that they rely heavily on the agricultural sector as the most important source of earnings (Figure 5). Only 24.6 percent of households with positive income impact mention wage and nonagricultural enterprise as the main source of their earnings, compared with 48.3 percent for nongainers. Less than 3 percent rely mainly on social transfers and organizational support.

Figure 5. Main source of earnings (%)



Source: Authors' calculation from UNHS data

Table 11. Access to crop and marketing services (%)

	Soil fertility management		Crop protection		Farm management		Improved produce quality/varieties		On-farm storage (postharvest)		Improved individual and group marketing		Disease control	
	Gainers	**Others**	**Gainers**	**Other**	**Gainers**	**Others**	**Gainers**	**Others**	**Gainers**	**Others**	**Gainers**	**Others**	**Gainers**	**Others**
No access	50.4	55.7	56.1	61.1	64.8	70.4	41.6	41.6	68.1	72.6	69.9	72.6	46.3	57.3
Access	49.6	44.3	43.9	38.9	35.2	29.6	58.4	58.4	31.9	27.5	30.1	27.4	53.7	42.7
Extension	6.7	4.3	6.4	3.9	4.5	2.1	5.6	4.4	2.7	2.3	2.6	1.4	6.6	4.0
NAADS	8.4	4.6	6.3	2.6	7.1	2.9	6.0	6.0	1.5	3.6	2.3	3.4	3.7	2.5
Mass media	21.8	18.1	17.5	17.8	12.0	13.9	16.4	21.9	7.6	10.0	9.2	11.8	17.1	18.5
Other farmers	11.5	15.6	13.2	13.6	10.5	8.9	28.0	24.7	19.7	10.6	15.4	10.2	26.3	15.7
Other	1.2	1.7	0.5	1.0	1.1	1.8	2.5	1.5	0.2	0.8	0.6	0.6	0.0	2.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' calculation from UNHS data

4. CONCLUDING REMARKS

The poor households that already spend much of their income on food are responding to soaring food price by eating less, buying less nutritious food, and cutting other relevant expenses.

Uganda has not yet experienced the negative impact of current soaring food prices with similar intensity as other African countries. However, since the beginning of 2008, signs of price hiking start occurring. Using the comprehensive UNHS 2005/2006, we estimated the net impact of increase in food price, accounting for both price and profit effects.

Our results suggest that farmers are expected to increase crop supply in the face of price increase, more so in rural areas than in urban areas. We also found evidence of substitution effect between crops. Using the multimarket approach, decrease in consumption as a result of price increase is offset by a substantial increase in farmers' income. On average, producer revenue rises by 23.5 percent for net sellers and 16.4 percent for net buyers. The profit effect shows potential for the crop producers to improve their welfare or at least limit its loss in the face of price increase.

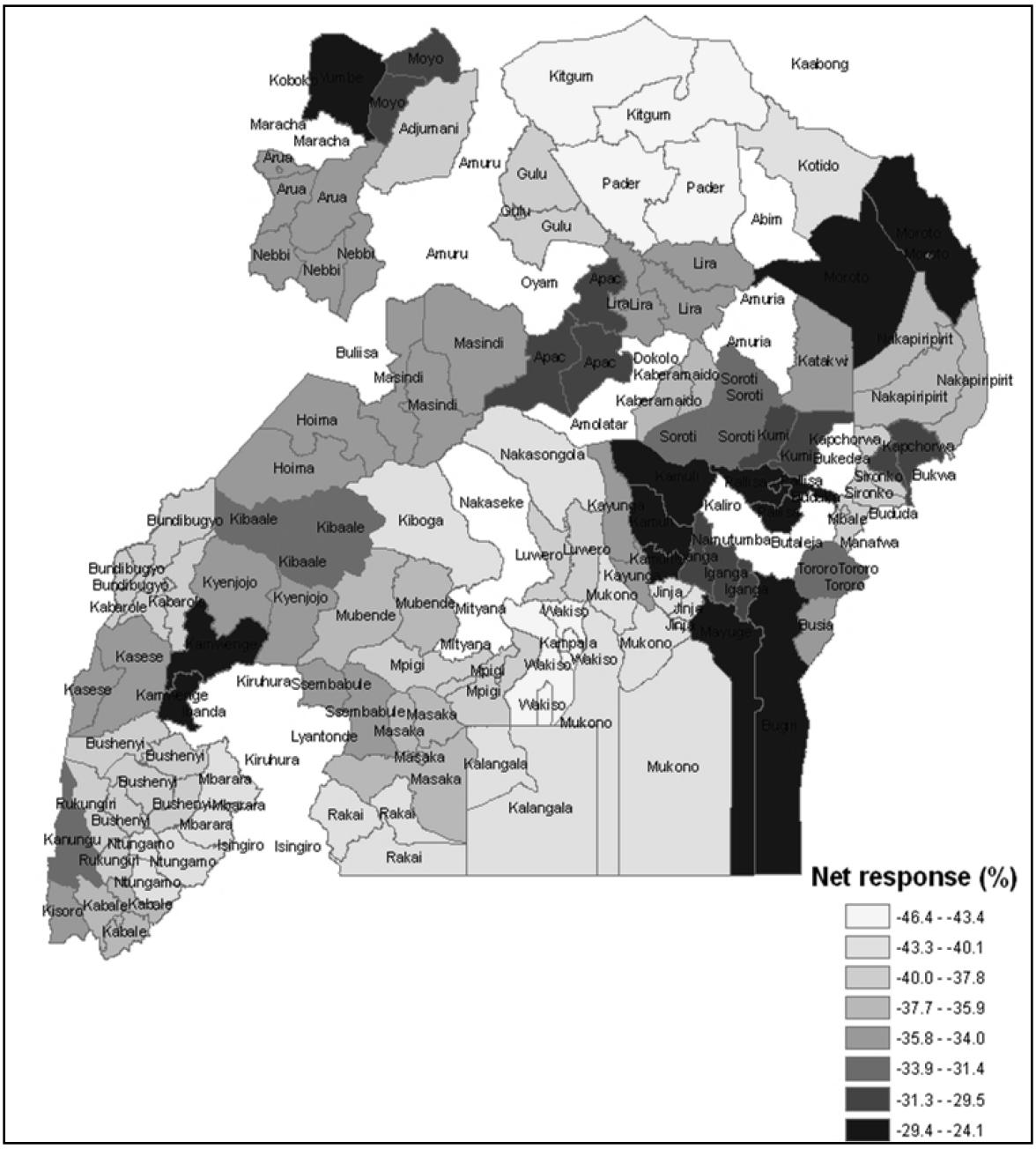
We simulated change in cereals consumption induced by 50 percent increase in cereals price. Using our approach, we found that cereals consumption decreases by 37 and 23 percent for net buyers and net sellers, respectively, whereas demand elasticities predict a decrease of 44 percent for the both groups. Accounting for substitution effects, our results suggest that the impact of rising food prices may be mitigated by some households that will attempt to substitute more expensive food items with cheaper ones.

With respect to access to agricultural cropping and marketing services, our results suggest that households with positive income impact have better access to agricultural services than the nongainers. On average, their access to extension and NAADS is also higher than that of other households.

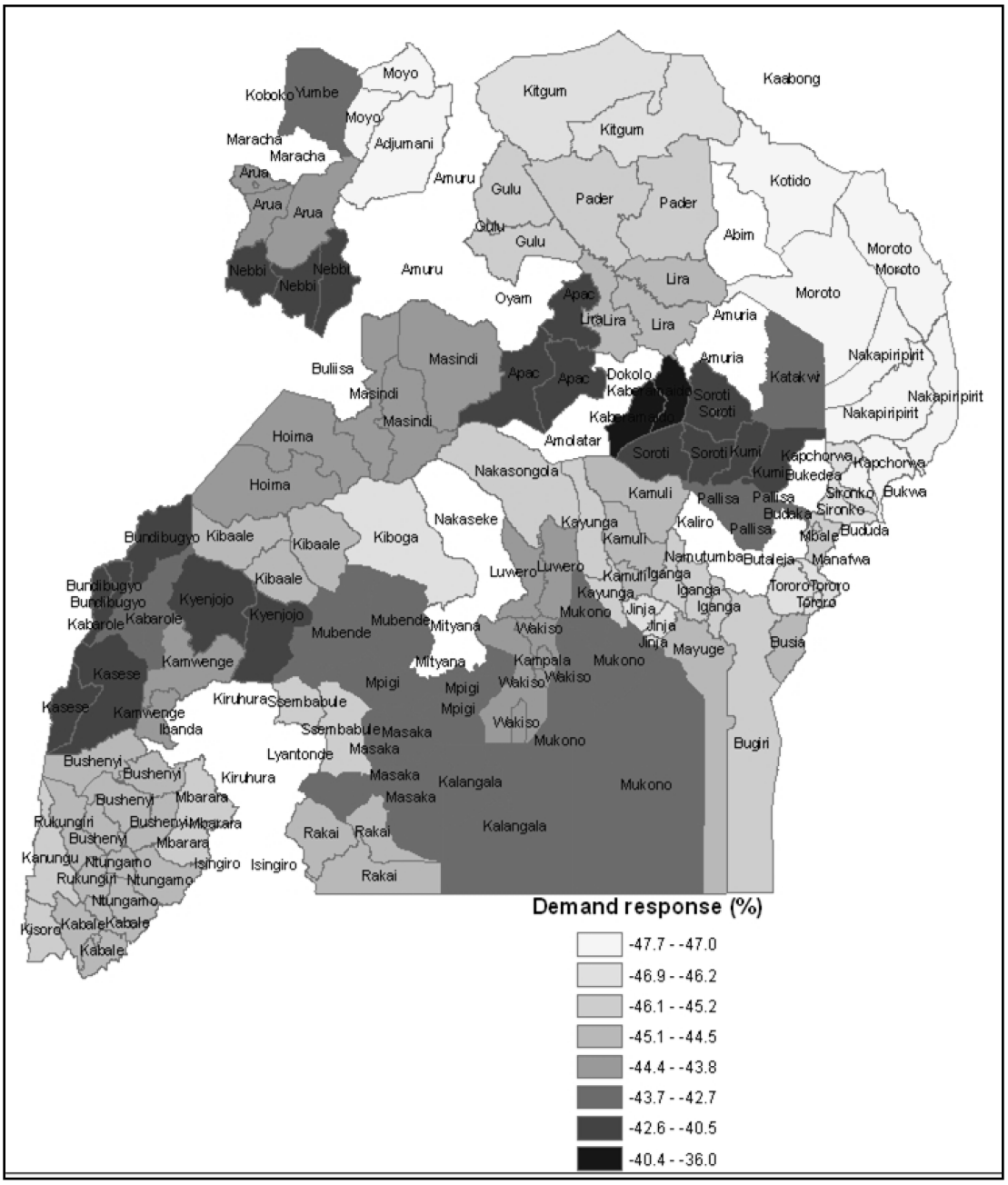
As pointed out by many others, efficient responses should mitigate current as well as potential future impact of high food prices and help poor rural and urban households to benefit from the opportunities that the increased demand for food creates for farmers. Such policy responses should definitely take into account key household characteristics. From our findings, it is obvious that policy response based on demand elasticities alone will tend to favor consumers at the expense of producers. Programs such as food and cash-based social protection systems should target both individual and geographical attributes.

APPENDIX: MAPS

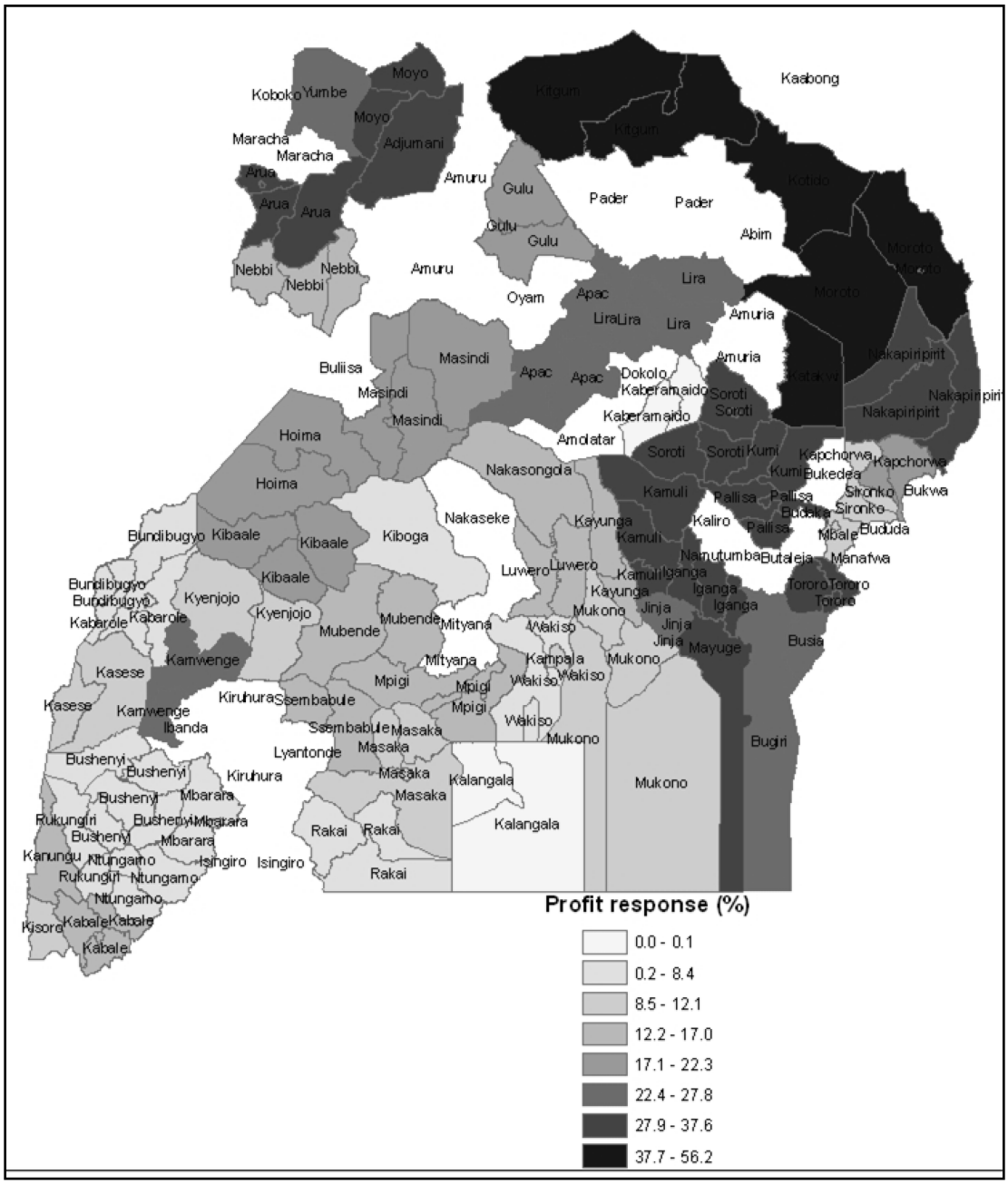
Map 1. Net consumption response to 50 percent increase in the price of cereals (multimarket approach)



Map 2. Consumption response to 50 percent increase in the price of cereals (demand theory)



Map 3. Revenue response to 50 percent increase in the price of cereals



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