INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

IFPRI

IFPRI Discussion Paper 01284

August 2013

The Impact of Food Price Shocks in Uganda

First-Order versus Long-Run Effects

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ABSTRACT

In developing countries, all too often policies formulated in response to high food prices are inspired by ideology instead of evidence-based policy research. We look at the immediate effects of these shocks faced by households in Uganda on their poverty and well-being. In addition, we look at the economywide impact in the long run when all markets have settled at a new equilibrium. We find that in the short run, poverty has increased substantially. However, in the longer run, we find welfare levels of rural farm households in particular to rise sharply, primarily as a result of increased returns to farm labor and agricultural land coupled with improved market prices for output sold. These results call for policies that aim to protect the most vulnerable against high food prices and extreme volatility in the short run, without eliminating the incentives of steadily rising commodity prices for longer-run structural agricultural development.

Keywords: food prices, well-being, poverty, general equilibrium, Uganda

1. INTRODUCTION

Both 2008 and 2011 saw unprecedented spikes in the prices of most basic commodities, and Uganda was not spared. According to the Uganda Bureau of Statistics (UBOS), food prices increased 40 percent in the 12 months leading up to November 2011. Furthermore, nominal food prices were 143 percent higher in November 2011 than the average for 2005–06. Within research and policy circles in Uganda, some surmised that as a result of these rising prices, poor people would soon become unable to afford basic needs. Others hoped that an age of higher commodity prices finally meant the farmer's terms of trade were on the increase. Politicians also made conflicting statements about the dangers and opportunities of higher prices for the Ugandan society. Early in 2011, higher prices were cited as one of the main reasons for the social unrest witnessed in postelection Uganda. Clearly, although higher price levels are obvious throughout society, their immediate effect on well-being is hotly debated.

The confusion is understandable if one realizes that, at the micro level, price changes have different short-run effects on different types of people. For example, the immediate effect of a price change of a particular commodity (often referred to as the first-order effect) critically hinges on whether one is a net buyer or a net seller of the product. A farmer who has enough land may produce *matooke* (cooking bananas) for the market in addition to what he or she will consume. If the price of *matooke* rises, this would translate to a higher income, and he or she would be better off. On the other hand, an urban dweller with no land would have to turn to the market to buy *matooke*. For him or her, a price increase means that for the same quantities of *matooke*, he or she would now spend more money (or that for the same money, he or she would be able to buy less *matooke*). Clearly, this individual would be worse off than before the price change.

But also on a more aggregate economywide level, rising global food prices and their causes have been a topic of intense discussion and debate, with the food crisis of 2007–08 having been of particular interest. Expenditures on agricultural and processed food products comprise an important part of Ugandan households' consumption budgets. More than half of rural households' disposable income is spent on food, whereas for urban households the share is close to 40 percent.[1] Given the prominence of food in the consumption basket, and also the importance of the agriculture and food-processing sectors in the Ugandan economy, shocks affecting these sectors have important economywide effects.[2]

To get an idea of to what extent international price movements affected domestic prices in Uganda, one can look at Uganda's trade intensities. A country's export intensity expresses exports as a share of domestic output, whereas its import intensity is its imports as a share of domestic demand. Since developing countries typically export primary goods such as agricultural produce and import manufactured goods, their export intensities for agriculture are typically higher than those for the rest of the economy, and vice versa for import intensities. This is confirmed in Table 1.1, which compares trade intensities across several eastern African countries. The table further shows that Uganda is not necessarily more or less isolated from world markets compared with other countries in the region; in fact, despite its landlocked status, Uganda's trade intensities are closer to those of its coastal neighbors Kenya and Tanzania, for example, than to those of landlocked Ethiopia. The implication is that Uganda would have been no more or less affected by international price movements than its neighbors.

[1] Consumption shares derive from the 2007 Uganda Social Accounting Matrix, which is used as the main data source underlying the computable general equilibrium analysis introduced later in the paper.

[2] Agriculture and food processing contribute roughly one-quarter to GDP measured at factor costs (or value-added) and have strong linkages to other sectors in the economy.

Table 1.1—Export and import intensities in selected southern and eastern African countries

	Exports as Share of Domestic Output (%)		Imports as Share of Domestic Demand (%)	
	Whole Economy	Agriculture Only	Whole Economy	Agriculture Only
Ethiopia	6.7	8.1	25.6	4.1
Uganda	9.9	16.4	21.7	4.6
Kenya	13.7	18.5	22.8	8.9
Tanzania	12.7	14.1	24.3	7.4
Malawi	9.8	15.8	20.8	1.7
Mozambique	9.7	9.6	21.9	3.3

Source: Various IFPRI social accounting matrices.

In this study, we will contrast the impact of prices at two levels (microeconomic versus economywide effect) and associated time frames (immediate versus long-run effect). In a first part, we look at the immediate microeconomic impact of exogenous price changes. At this stage, we will not consider changes in consumer or producer behavior or changes in the structure of the economy at large. We will investigate how welfare is affected by price changes, keeping everything else constant.

To assess the impact of exogenous price changes in the long run, a more in-depth look at the economic structure, trade patterns, price movements in specific commodities, and household consumption patterns is needed. The aim of the second part of the analysis is therefore to better understand the domestic economywide implications of recent international food price changes. It was also necessary to assess the extent to which other factors may have contributed to domestic price changes. These may include external factors such as changes in (1) donor aid flows and foreign direct investments to and from Uganda, which affect the exchange rate and hence domestic prices; (2) regional factors such as increased demand from Kenya and Sudan for Uganda's exports; or (3) domestic issues such as supply shocks, which unsettled the supply–demand equilibrium or producer prices (for example, weather-related shocks or systematic declines in factor productivity over time). We assess the impact of shocks affecting the producer costs as well as shocks affecting domestic agricultural supply in our analysis.

We carry out the economywide analysis with the aid of a computable general equilibrium (CGE) model for Uganda. CGE model simulations explore the manner and extent to which international price changes filter through to the domestic economy via demand and supply channels, allowing us to see how domestic prices of both tradable and nontradable goods are affected. At the macroeconomic level, as a net exporter of agriculture and food commodity items, Uganda is set to benefit from higher world prices (that is, this represents a positive terms-of-trade effect).[3] The analysis also considered how higher fuel costs, rising trade and transport margins, and agricultural productivity or supply shocks reduce the benefits associated with an improvement in the terms of trade.

The next section looks at existing studies on the impact of price changes, in both the short run and the longer run. We will look only at studies on Uganda. We first consider the short-run effects of changes in food prices in Uganda. In particular, we calculate the effect of monthly changes on the welfare of different groups of people in Uganda during the past three and a half years. In addition to the immediate impact, the study also takes a long-term perspective and looks at changes in the entire sectors. It does this by simulating price shocks that mimic the real price changes in Uganda and by running a CGE model to see how land and labor markets, for instance, adjust to the new price reality. A last section concludes.

[3] Trade patterns are discussed in more detail in the following sections.

2. PREVIOUS STUDIES OF THE IMPACT OF HIGH FOOD PRICES

Although global food prices have been on the rise since 2003, there was a dramatic acceleration in 2007 and 2008. Among the factors primarily responsible for this were higher oil prices, the use of food crops for biofuel, increased meat consumption, poor harvests in certain agricultural regions, a depreciating dollar, export bans by key wheat and rice producers, and underinvestment in the agricultural sector in the past (Abbot, Hurt, and Wallace 2008; Benson, Mugarura, and Wanda 2008; Mitchell 2008). From mid-2008 prices started to move downward, but in general they remain high and volatile. In 2011, global food prices spiked again,[4] making studies that aim to assess the impact of high food prices particularly relevant.

Probably the first study on the short-run impact of the food crisis of 2007 and 2008 at the micro level in Uganda was that of Benson, Mugarura, and Wanda (2008).[5] Using data from more than 7,000 Ugandan households surveyed during a 12-month period from the nationally representative Uganda National Household Survey (UNHS) of 2005 and 2006, they determined whether households were net buyers or sellers to gauge the likely impact of the food crisis. They found that the poor purchased only small quantities of food from the market. This fact, coupled with Ugandans' having a varied diet that gives prominence to traditionally nontrade crops and a poor pass-through of world-to-local prices, led the researchers to conclude that the immediate impact was likely to be small. As a follow-up to this study, Simler (2010) disaggregated by regions and individual food items, used more recent price data, and estimated the immediate impact on sales and purchases again. He found that both incidence and depth of poverty increased, by 2.6 and 2.2 percentage points, respectively, higher than the impact found by Benson, Mugarura, and Wanda (2008).

Matovu and Twimukye (2009) used a recursive dynamic CGE model to look at the effects of rising cereals prices. Their simulated price increases suggested large improvements in well-being, especially for the rural poor. However, we feel that the restriction to cereals may reveal a picture that is overly optimistic. Boysen and Matthews (2012) ran an integrated CGE–micro simulation model to analyze the 2006–08 increase in commodity prices in Uganda. As such, their model is closer to the medium- and long-run impact models discussed later in this study. Indeed, they used the same social accounting matrix (SAM) developed by Thurlow (2012) as we did in this study. Not surprisingly, their results suggest the increased commodity prices had a less negative effect on household welfare than the short-run estimates suggest. They argue, however, that the simultaneous increase in fuel and fertilizer prices reduced Ugandan GDP and increased poverty.

The first two studies mentioned above (Benson, Mugarura, and Wanda 2008; Simler 2010) are closely related to the analysis we present in the next section. Matovu and Twimukye (2009) and Boysen and Matthews (2012) employed a CGE approach, and hence those papers are closer to our long-run impact analysis.

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[4] For instance, in February 2011, the FAO food price index was at an all-time record high (236 points), whereas its cereal price index was at the highest level since July 2008.

[5] In its literature review, this study refers to an earlier multicountry study (Ivanic and Martin 2008). However, that study does not cover the climax of the crisis.

3. SHORT-RUN IMPACT OF FOOD PRICES ON HOUSEHOLD WELFARE

An Index

The impact of price changes on household welfare can be measured using the compensating variation (CV), defined as the amount of money necessary to compensate the household for the impact while leaving utility unchanged (Deaton 1989). Although studies using the CV to assess the impact of price changes usually restrict to two periods in time (before and after the price change), the monthly nature of the price data we have at hand allows us to construct monthly CVs. If we compare the CV using the price of each month to a base period, we can construct some kind of index that shows the evolution of the welfare impact of changing prices.

A first-order estimate of the CV of a change in prices can be calculated as follows:

$$CV_{t=a} = \sum_i L_i \left(w_{i,t=a} - w_{i,t=b}\right) - \sum_j q_j \left(p_{j,t=a} - p_{j,t=b}\right) \tag{1}$$

where

Li = a measure of the output from income-generating activity i;

wi,t=x = the sales price of the income-generating activity i, meaning the net return per unit of output, with time subscript t=b indicating before the change (the reference period or base year) and t=a at some other point in time;

qj = a measure of the quantity of commodity j purchased by the household; and

pj,t=x = the consumer price of a unit of the commodity j, with subscript t=b indicating before the change (the reference period or base year) and t=a at some other point in time.

It is convenient to express welfare changes as a fraction of the income of the household in the reference year. As income is notoriously difficult to measure, we approximated household income by total household consumer expenditure, as is usual in the poverty measurement literature. This yields the following expression:

$$\frac{CV1_{t=a}}{y_{t=b}} = \sum_i \frac{L_i \left(w_{i,t=a} - w_{i,t=b}\right)}{y_{t=b}} - \sum_j \frac{q_j \left(p_{j,t=a} - p_{j,t=b}\right)}{y_{t=b}} \tag{2}$$

Furthermore, if we define *rj* as the share of total net income coming from activity *i* and *sj* as the share of total consumption expenditure spent on commodity *j*, we can rewrite equation (2) as

$$\frac{CV1_{t=a}}{y_{t=b}} = \sum_i r_i \frac{\left(w_{i,t=a} - w_{i,t=b}\right)}{w_{i,t=b}} - \sum_j s_j \frac{\left(p_{j,t=a} - p_{j,t=b}\right)}{p_{j,t=b}} \tag{3}$$

We will call the resulting time series of CVs relative to a base year the *welfare impact index.* It can be interpreted as the weighted average of the proportional changes in prices, where the weights are the income shares in the first term and the budget shares in the second term. It is closely related to a price index, a terms-of-trade index, and the net benefit ratio (NBR) used to simulate the distributional impact of price changes:

- The expression contains, in the second term, a base-weighted (Laspeyres) price index, with pj,t=a representing the base year and sj representing the budget-share weights of the index. Typically, the budget shares represent the average across a large group of households such as urban households. Unlike a price index, this measure also takes into account the effect of price changes on household income.

- The expression is similar to the terms-of-trade index used in studies of international trade in that it measures the impact of price changes of goods sold (exported) and goods purchased (imported). Although terms-of-trade indexes are usually expressed as a ratio of the proportional change in export and import prices, this expression is based on the difference in the proportional change in selling and buying prices. This formulation has the strong advantage of having a direct interpretation for the welfare impact: It is equal to the amount of money required to compensate the household(s) for the price change, expressed as a percentage of original income. The terms-of-trade index has no direct welfare interpretation.
- This expression is similar to the NBR, used in studies of the impact of price changes on income distribution and poverty (Deaton 1989; Barrett and Dorosh 1996). The NBR assumes that the percentage change in the farmgate price of a commodity (wi) is equal to the percentage change in the retail price of the commodity (pj). In this case, the expression can be simplified as

$$\frac{CV1_{t=a}}{y_{t=b}} = \sum_k (r_k - s_k)\frac{(p_{k,t=a} - p_{k,t=b})}{p_{k,t=b}} \tag{4}$$

where the index k incorporates all the income-generating activities (i) and the consumer goods (j) and (r_k– s_k) is the NBR, defined as the value of net sales of commodity k as a proportion of income. This welfare measure is often calculated at the household level, allowing the estimation of the effect of price changes on poverty and inequality.

The welfare impact index described above makes two important assumptions. First, it is a first-order approximation in that it does not take into account changes in household behavior as a result of the price change. As such, it can be considered the short-term welfare impact of the price change. A second-order approximation would take into account household response and be more accurate, but the information requirements are much higher since it would be necessary to estimate or assume a full matrix of own- and cross-price elasticity. Given that the consumption of staple foods and the supply of many agricultural commodities are generally price inelastic in developing countries, this assumption is not as restrictive as it might be in other contexts. The second-order approximation will always give a more positive welfare impact than the first-order approximation, so the welfare index provides an upper limit on the negative welfare impacts and a lower limit on positive welfare impacts. In the second part of this paper, we will incorporate second-order effects in our general equilibrium model.

Second, because w_i is defined as the net returns per unit of output from income-generating activity i, it implicitly assumes that the proportional price changes for each income-generating activity is the same for outputs and purchased inputs. This is a plausible assumption for trading activity, in which the same good is purchased and then resold. However, it is not realistic for farmers who may purchase fertilizer and labor to produce crops. The welfare index expression can be expanded to take into account the changes in input prices, but it is not clear that this modification would make much difference in a country with low levels of purchased inputs in agriculture, such as Uganda.

Application: Calculating a Welfare Index in Uganda

To calculate a welfare impact index for agricultural households, we needed information about output prices (w_i), consumer prices (p_j), the share of income from different activities (r_i), and the budget shares of different consumer goods (s_j). It was also necessary to select the activity categories (i) and consumer good categories (j) that would be included. A longer list means the index reflects reality better (as generally households are faced with a multitude of changing prices) but also increases the data requirements. On the other hand, it is often instructive to single out one commodity and look at the welfare impact of a price change of this commodity in isolation. We will use two data sources for our application.

For output prices (w_i) and consumer prices (p_j), many crop and animal product prices are available from market information systems such as FIT-Uganda. FIT-Uganda collects and distributes 44 prices from 23 towns and cities throughout Uganda, though not every commodity is covered in every market. For many commodities, both wholesale and retail prices are available. Although these generally represent urban prices, changes in the wholesale prices are probably the best possible estimate of changes in farmgate prices received by farmers (w_i). We thought the welfare index should initially use the prices of about 10 of the most important crops for farm income in Uganda, though the list could be expanded later. One important price that did not seem to be available from FIT-Uganda was the average wage rate for agricultural or unskilled labor. We decided to weight consumption by retail prices and production by wholesale prices.

For the income (r_i) and consumption (s_j) shares, we calculated the share of income from each activity from a typical household survey, which has a detailed agricultural module allowing calculation of the importance of each crop. The Living Standard Measurement Survey–Integrated Surveys on Agriculture (LSMS-ISA), implemented as a yearly panel from 2009 and 2010 onward, provided a unique dataset for this purpose. Each year, with the release of additional waves, the consumer and producer shares can be easily updated to the most recent behavior.

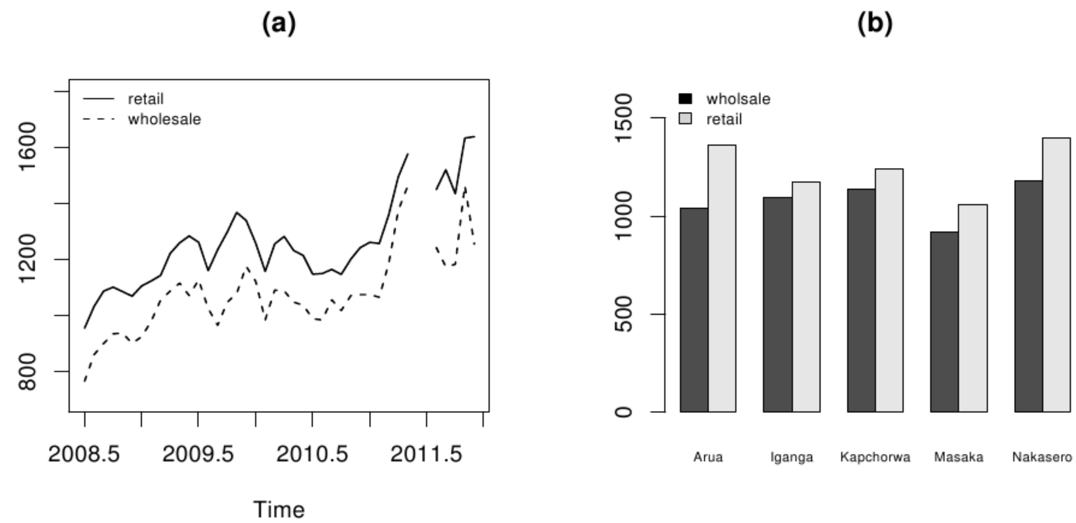
The analysis described above can be used to generate a monthly welfare index for broad categories of households, such as urban and rural. In this use, it would be similar to the consumer price index (CPI) except that it takes into account the effect of price changes on income, thus representing a welfare index rather than a CPI. However, because the income and consumption shares are calculated from the Uganda National Panel Survey, which collects additional socioeconomic data apart from consumption and production, the welfare index could be calculated for more narrowly defined categories of households as defined by, for instance, region, farm size, income level, sex of head of household, and main crop or income source. It is even possible to calculate the welfare index for types of households defined by more than one characteristic, such as farm households in the southwest with less than two hectares of land. The only constraints on this disaggregation are that (1) the type of household must be defined based on variables that exist in the household survey data and (2) there must be a large enough number of households of each type to provide reliable estimates of mean CV in each group.

Price Trends during the Past Few Years

We first look at the evolution of prices using two sets of prices, namely, retail prices and wholesale prices. The price data we used have three dimensions (time, space, and commodity), each of which is interesting in its own right. Figure 3.1(a) graphs the time dimension, averaging over space and commodities.[6] Although the average price level during the entire period is UGX 1,076 for wholesale prices and UGX 1,256 for resale prices, such an average was clearly not representative anymore in 2011. World prices for staple foods were on the rise between 2006 and 2008 and accelerated sharply in the beginning of 2008. Although food prices dropped significantly by the end of 2008, they rose again in 2009 and remain high by historical standards in both international and local markets (Headey and Fan 2010). Thus, the 2011 spike happened on top of historically high prices. Another interesting feature is the difference between wholesale and retail prices. Although prices at both the wholesale and the retail level rose sharply at the beginning of 2011, wholesale prices fell back more than retail prices. In fact, around May 2011, retail prices and wholesale prices seemed to move in opposite directions. An increasing gap between wholesale and retail prices is likely to hurt farmers, as their revenue from sales decreases whereas the cost of purchases increases.

[6] Although in theory we should have calculated the average over all possible commodities and locations, this was not feasible in practice due to missing information. For instance, prices of fuel started to be collected only in 2011. If we had taken just averages over all commodities, we would have seen a price spike at the end of 2011, but this might have been caused by this period's inclusion of a relatively high-value commodity like fuel—which was not there in previous years. The same reasoning holds for other dimensions of the data. We therefore decided to base the averages on a limited and unchanged set of commodities (*matooke,* maize, and groundnuts) and markets (Nakasero in Kampala, Arua, Masaka, Kapchorwa, and Iganga).

Figure 3.1—Prices over time and by location

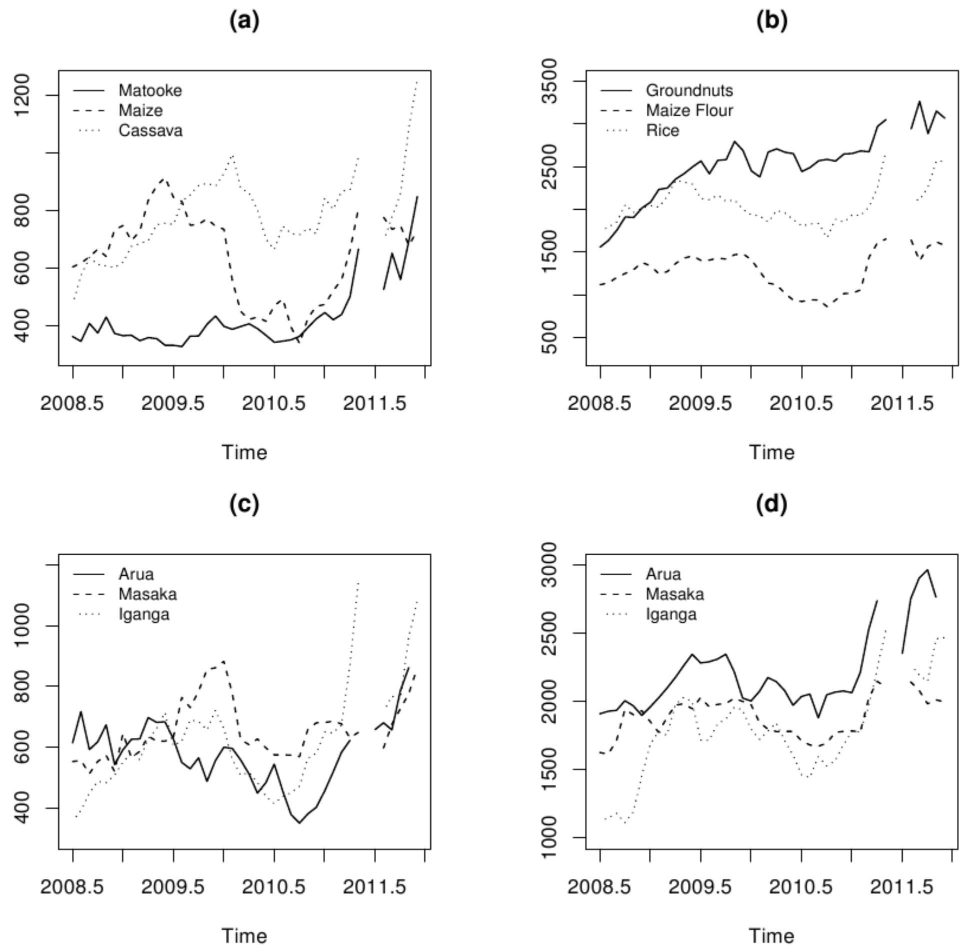


Source: Own calculations based on price data from FIT Uganda.

Prices also varied by location, with consumer centers' usually having higher prices for commodities due to higher demand, lower supply, and the existence of often-substantial transaction costs. Figure 3.1(b) plots bar charts for the wholesale and retail prices collected in selected markets around Uganda. The prices are averaged over products and over time (here, the average price in 2011 is used). In Arua, the difference between retail and wholesale prices was rather high (average retail prices were more than 30 percent higher than wholesale prices). Nakasero, which is a market in the capital Kampala, registered the highest prices and Masaka the lowest. The third dimension, the different commodities for which we had prices, was not so interesting in its own right. Wholesale prices for staple foods were lowest, generally around UGX 1,000 per kilogram. On average, retail prices were about 20 percent higher than wholesale prices, suggesting substantial transaction costs.

The prices for different commodities become more interesting when we combine them with the time dimension. Figure 3.2(a) shows the evolution of three unprocessed staple foods over time (averaged over the different market locations). Since these are all staple foods, one would expect these prices to move closely together as substitution of low-price staples for high-price alternatives would increase demand and also drive up the price of the initially lower-priced staple. However, there were some episodes when prices for different staple crops moved in a different direction. For instance, from June 2009 to November 2009, maize became cheaper whereas cassava became more expensive. This is likely to affect the terms of trade of households and is particularly bad news for households that sold maize and bought cassava with the revenues. Figure 3.2(b) shows the evolution over time of higher-value or lightly processed commodities. Also here, there are marked differences. The price of groundnuts had been increasing over time, whereas the price of maize flour increased less clearly. In other words, one might argue that the mean price level of UGX 1,281 is an apt description of the price during the entire period under study.

Figure 3.2—Price evolution of selected crops



Source: Own calculations based on price data from FIT Uganda.

Figures 3.2(c) and (d) show the evolution of prices in selected market locations over time (this time averaged over the different commodities). Panel (c) aggregates the commodities in panel (a), and panel (d) plots averages in different markets for the three commodities from panel (b). Also here, you can see the co-movement of prices in different locations in the long run, especially for the higher-value or processed commodities in panel (d). Co-movement of prices is a sign of market integration, meaning that markets are connected through a process of trade. In other words, traders buy commodities in areas where there is an abundance of them (and hence lower prices) and take them to markets in areas where there is a shortage of them (where they can sell them at higher prices). However, it also seems that this process is far from perfect, as there were also large deviations from the general trend. For instance, for unprocessed commodities, prices in Arua seemed to go down during much of the period, whereas they went up in Masaka and Iganga through the end of 2009.[7] The consequence of these differences is that the effect of an aggregate price change was not uniform for households in different locations. During that period, net selling households in Arua improved less in well-being than similar households in Masaka. A visual inspection between panels (c) and (d) suggests that this was especially a problem for the basic staple foods.

[7] This feature suggests a reversal of trade between the two locations. Although at the beginning of the period, profits could be made by buying staple foods in Masaka and selling them in Arua, in 2009 it became profitable to buy in Arua and sell in Masaka.

Welfare and Poverty Impact of Price Changes

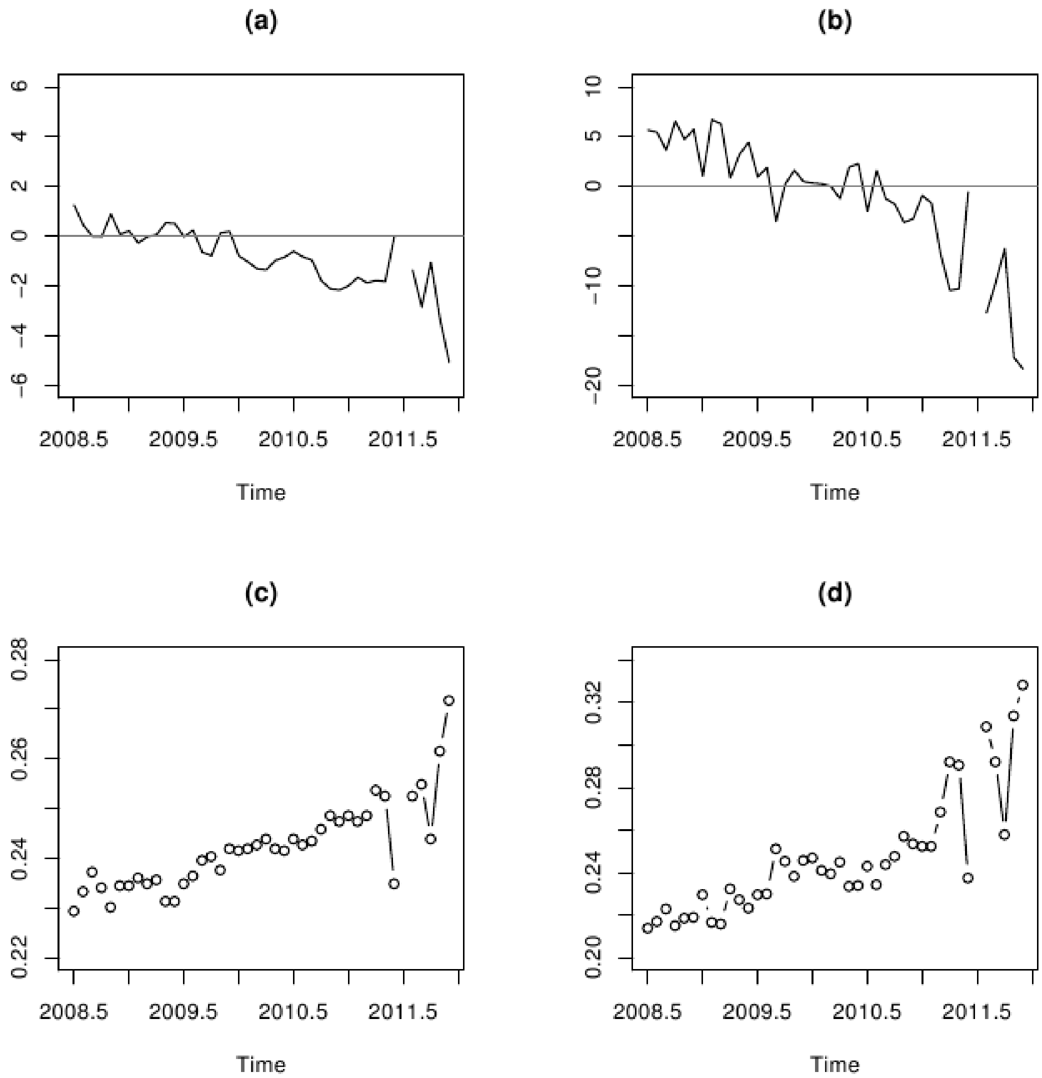
Households in Uganda are typically both producers and consumers of a range of commodities. For instance, a farm household may produce maize for its own consumption and coffee as a cash crop. In addition, it may buy tomatoes on the market. How will changes in the prices affect such a household? A price change of a commodity will affect only the welfare of a household (in monetary terms) if the household buys or sells this commodity. Continuing the example from above, a price change of maize will not change revenue or expenditures of the household. Price changes of coffee and tomatoes will change the money available to the household, albeit in opposite directions. If the price of coffee were to go up, this would be good news for the household. The stock of coffee that the household sells would now increase in value. The increase in money due to the coffee price increase would be the difference between the new, higher coffee price and the previous coffee price, multiplied by the amount of coffee sold minus the amount of coffee bought. The reverse holds for tomatoes: If the price of tomatoes changed, the welfare of the household would decrease, as now more money would have to be spent on tomatoes to retain the same consumption.

Using the above reasoning, we calculated the gain or loss from a price change for each household by calculating the net position for each commodity, multiplying it by the change in price and then taking the total. Since we were concerned about only the short-run impact, we assumed the quantities of the commodities bought and sold did not change with prices, and hence we could compute them from a standard household survey (in our case the LSMS-ISA Uganda National Panel Dataset 2009/2010 (UNPS 2009/10)). For each commodity we thus determine the net position of the household (net buyer or net seller by a certain quantity). We then multiply this by a vector of price changes.[8] For example, a household that was a net seller of 5 kilograms of coffee and a net buyer of 10 kilograms of maize would gain UGX 2,500 if the price of maize increased by UGX 500 and the price of coffee increased by UGX 1,500. In our analysis, we expressed this gain (or loss) as a percentage of total welfare before the price change.

Since we have price data for several commodities on a monthly basis between 2008 and 2012, we can calculate such losses or gains for each month relative to some baseline price level (which we took to be the average price level in 2009, the year in which the survey took place). We can then calculate the average gain or loss for our sample for each month, resulting in some kind of a welfare index of price changes. Figures 3.3(a) and (b) plot the results of such an analysis. The difference between the two graphs stems from how we handled missing price data. In Figure 3.3(a), we assumed that prices on which we did not have data had not changed over time. Since this was an assumption, we reran the analysis assuming that all missing prices changed at a rate equal to the average of all prices for which we did have data. The welfare changes were much more modest if we assumed that only the prices on which we had information had changed. If we assumed a common inflation for all goods, welfare losses were substantial, surpassing 20 percent of initial welfare of the households. Comparing Figure 3.3 to Figure 3.1, it is difficult to determine whether high prices increase or reduce welfare. For instance, the loss of welfare around the end of 2010 seemed to go hand in hand with lower prices. But the higher prices at the end of 2011 also seriously reduced welfare.

[8] The analysis explicitly accounts for price difference over space. All households in a district are linked to one of the 19 markets for which we have price information. The decision of which district is linked to which market is based on the nearest market as traveled by road from the center of the district. The net position of the commodities of a household in a district is then multiplied by the difference in the price vector that prevailed in that market. A more in-depth study on the consequence of poor spatial market integration price effects is Van Campenhout, Lecoutere, and D'Exelle (2011).

Figure 3.3—Well-being and poverty impact of price changes

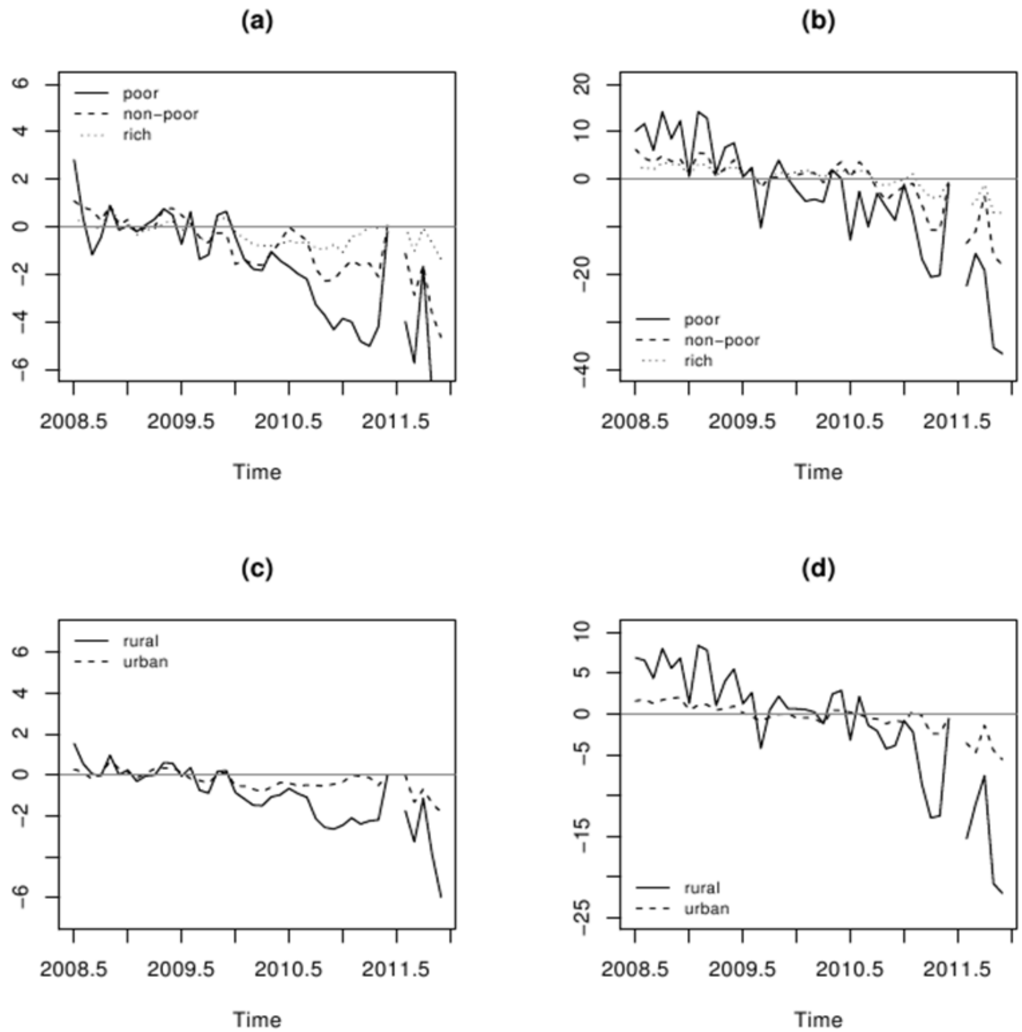


Source: Own calculations based on price data from FIT Uganda and survey data from the UNPS 2009/10.

It is a straightforward matter to extend the analysis to include changes in poverty due to price changes. Figures 3.3(c) and (d) plot the poverty headcount for each monthly set of prices. In the reference period, they show a poverty headcount of 23.5 percent. The poverty changes due to changing prices were substantial, especially if we assumed common inflation. This seemed to suggest that the households that were hurt were only just above the poverty line. During the entire period, higher prices essentially took Uganda back to 2005 and 2006 poverty levels. Again, it is difficult to come to a uniform conclusion about the effect of prices on poverty. Relatively low prices in May 2009 seemed to reduce headcount poverty, at least in panel (d). This contradicts the findings in panels (a) and (b), where low prices seemed to reduce welfare. This observation suggests that it was only the relatively wealthier households that profited from increased revenue from sales of commodities due to higher prices.

The analysis above is based on a general average and may obscure the effect of price changes for some particular groups of people. Indeed, as suggested above, it might have been the case that relatively rich people won more from price increases if they were typically the ones selling to the market, whereas poor people did not produce enough for their own consumption and needed to supplement their crops with foodstuff bought on the market. Such subtle but crucial differences became more apparent when we ran the analysis on different groups of people. Panels (a) and (b) of Figure 3.4 divide our sample into three mutually exclusive groups: poor people living below the poverty line (poor), people with welfare levels between the poverty line and twice the poverty line (nonpoor), and households with welfare above twice the poverty line (middle income and rich). Similarly, we expected that it might have been especially the people in the urban areas who were affected negatively by increasing prices since lack of land reduces the chances of being a surplus producer. To verify this, we divided the sample into households living in rural areas and households living in urban areas and looked at the evolution of welfare separately (see Figure 3.4, panels (c) and (d)).

Figure 3.4—Welfare impact for different types of households

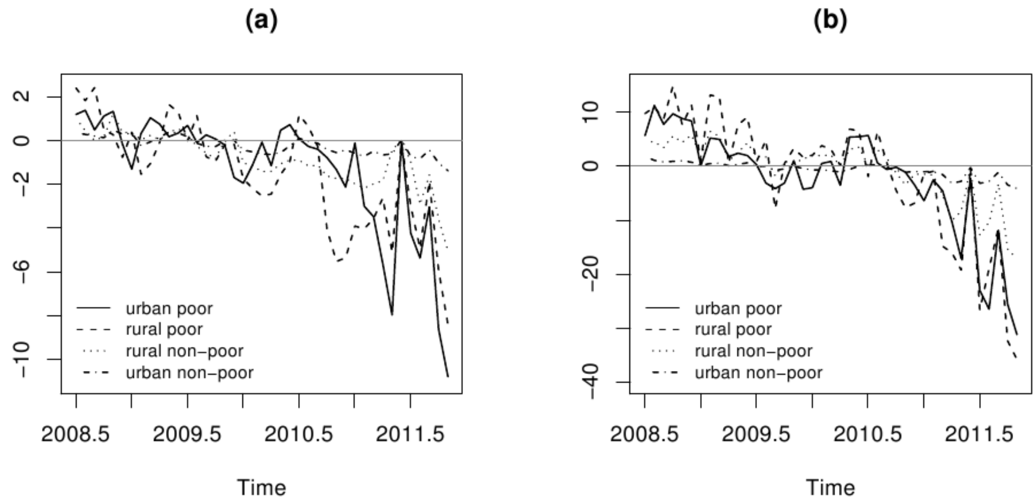


Source: Own calculations based on price data from FIT Uganda and survey data from the UNPS 2009/10.

Panels (a) and (b) confirm our hypothesis from the previous figure. It was especially the poor who were hurt by higher prices. The losses to the poor were substantial, up to half of their baseline welfare if we assumed all prices change at the average rate. The difference in impact between the middle and rich households was small and much less dramatic than for the poor. Panels (c) and (d) show that although the urban population also suffered from higher prices, it was the rural population that suffered most.

Figure 3.5 combines poverty and location. We formed four mutually exclusive groups based on poverty status and location interactions. Panel (a) presents the scenario wherein only prices for which we have data changed. Here, the urban poor were hurt most. They were the ones who were hurt by the rise of prices of commodities that they consume, and this negative welfare effect was not compensated by a positive income effect. The story was different when we assumed all commodities had become more expensive over time (see panel (b)). Now both the urban and the rural poor seemed to be equally hurt by price increases. This is because the consumption basket of the rural poor includes many goods that are not produced by themselves (such as soap and salt). These goods also became more expensive in the common inflation scenario. As a result, the additional expenses on these goods now offset the positive effect of the price increase for the (few) commodities the rural poor marketed.

Figure 3.5—Effects by poverty status and location

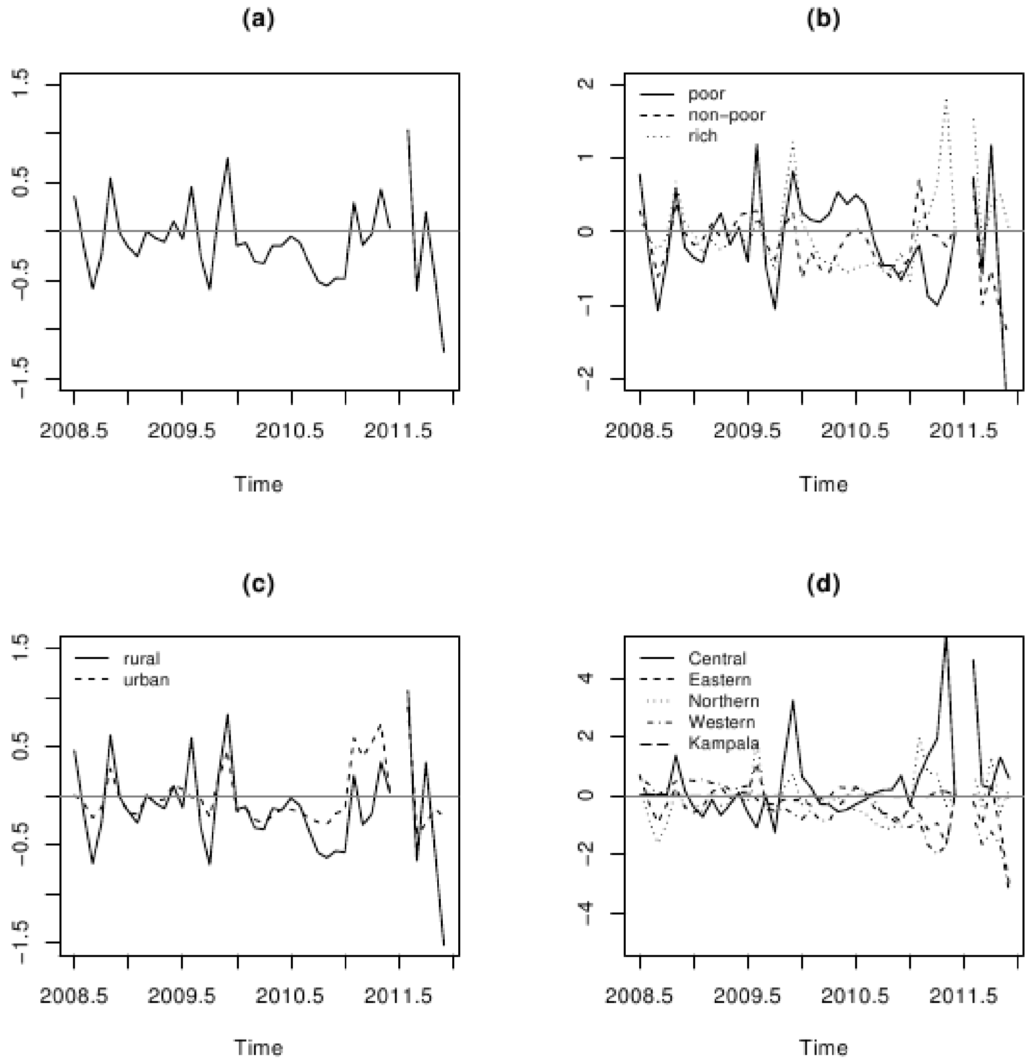


Source: Own calculations based on price data from FIT Uganda and survey data from the UNPS 2009/10.

One can also look at the impact of prices of a particular crop in isolation. Although this is a purely theoretical situation (prices rarely move alone), it may be instructive to identify the main drivers of the general welfare movements. We present graphs for *matooke* and maize. *Matooke* is a staple food that is bulky and has a lower value per kilogram (kg) than does maize. It is therefore mostly produced for home consumption. Maize is typically both consumed at home and marketed. We look at the average impact of price changes of *matooke* (see panel (a)). We also disaggregate by poverty status (see panel [b]), rural or urban residence (see panel [c]), and region (see panel [d]).

Figure 3.6 does not suggest that *matooke*, one of the most important staple foods in Uganda, is a major driver of the changes in welfare in the period under investigation. This may be because the price of *matooke* was much less volatile than prices of other staple foods.

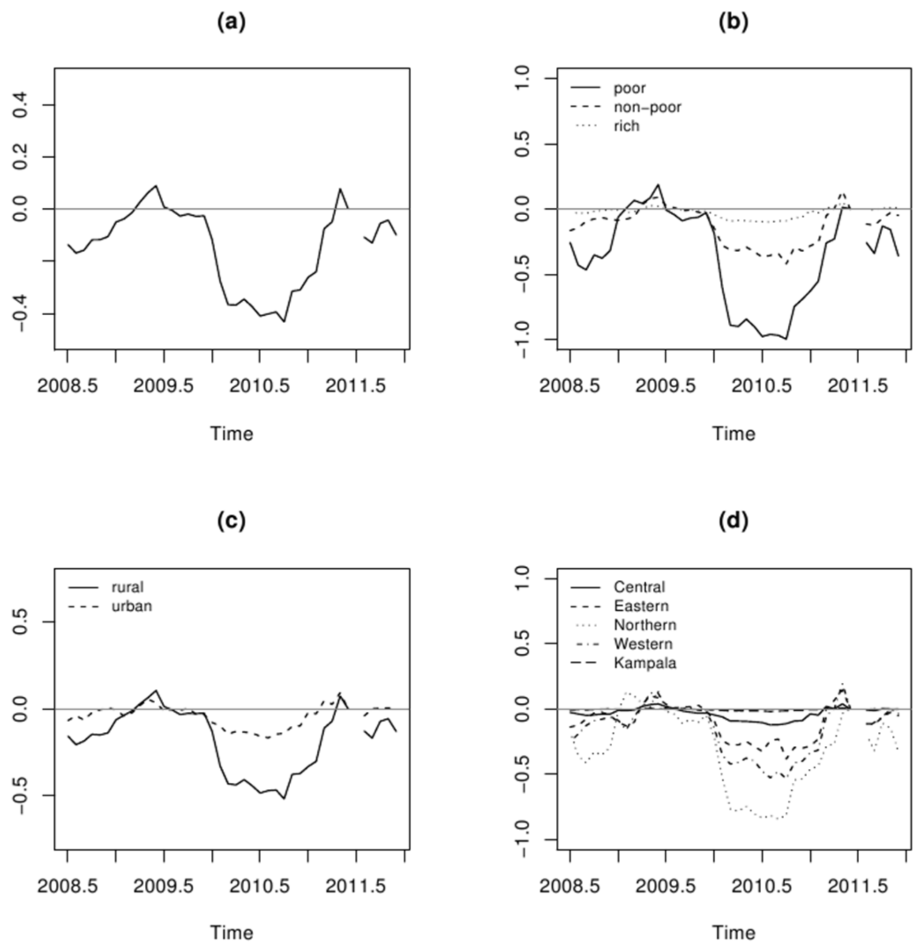
Figure 3.6—The effects of price changes of matooke



Source: Own calculations based on price data from FIT Uganda and survey data from the UNPS 2009/10.

The effect of maize is an interesting one, shown in Figure 3.7. The low prices of maize seemed to hurt farmers, especially the poorest. For this commodity, the price increase was a welcome change. Unfortunately, as was the case during the entire period, the price of maize followed its own trends and seemed to go down during the last few months.

Figure 3.7—The effects of price changes of maize



Source: Own calculations based on price data from FIT Uganda and survey data from the UNPS 2009/10.

Deaton (1989) noted that the NBR—(r_k–s_k) in equation (4)—can be interpreted as the cost of living for the price of good *k.* Thus, from a policymaking perspective, the NBR is interesting in its own right. Table 3.1 shows the NBR for different commodities for all of Uganda as well as with rural and urban separated. We learn that maize has a positive NBR: An increase in the price would on average increase welfare. The effect is strong: A 1 percent increase in the price of maize would increase welfare by about 18 percent. This result is consistent with the result for maize reported in Figure 3.7. Also as expected, we saw that the positive effect is especially present in the rural areas. However, even urban households stood to gain considerably from an increase in the price. For most other crops, the elasticities are much smaller.

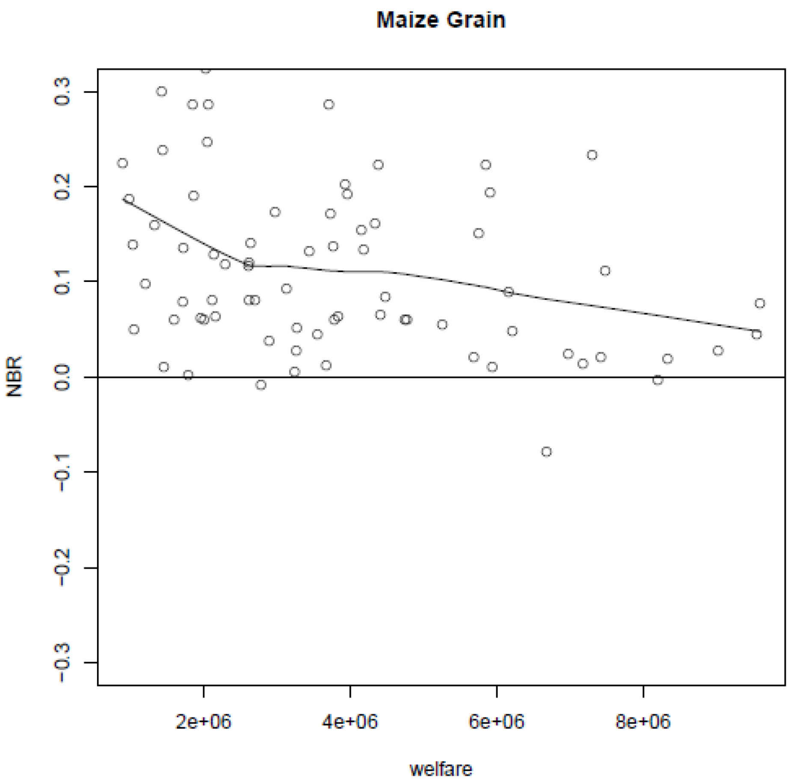
Table 3.1—Welfare elasticity

	All	Urban	Rural
Maize grains	0.18	0.13	0.18
Matooke	–0.05	–0.06	–0.03
Beans	0.03	–0.01	0.04
Groundnuts	0.04	0.00	0.05
Cassava	–0.04	–0.03	–0.05
Rice	–0.03	–0.04	–0.02

Source: Own calculations based on price data from FIT Uganda and survey data from the UNPS 2009/10.

But these elasticities are averages over the entire welfare distribution. The losses to or benefits of welfare may be different for poor and rich households. Therefore, we also investigate how the NBR changed with wealth as a continuous variable. Instead of just looking at poor versus nonpoor, we decided to run nonparametric regressions where we let the data map out the relationship between welfare and the NBR. Figure 3.8 suggests that the welfare-increasing effect of maize is pro-poor: Although the elasticity is positive for all levels of welfare, it is highest for the poorest.

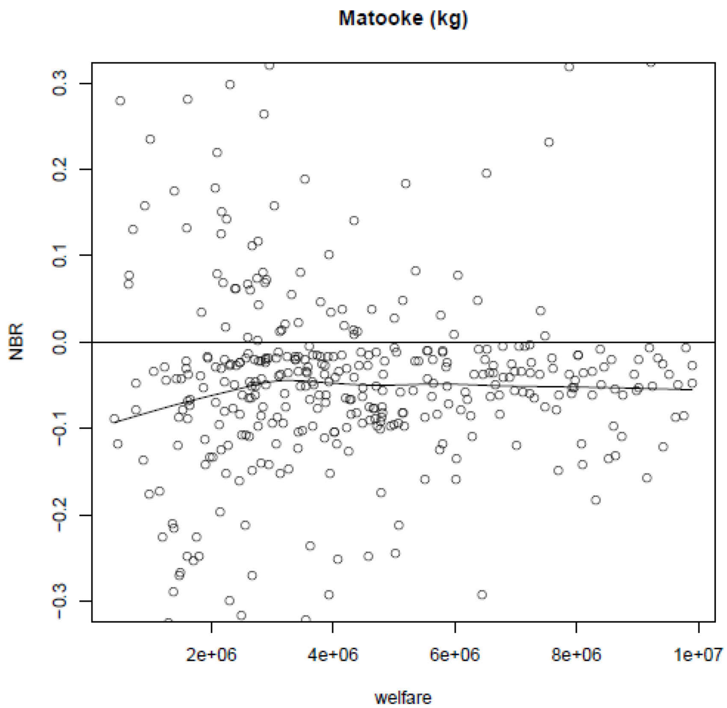
Figure 3.8—Relationship between welfare and net benefit ratio (NBR) for maize



Source: Own calculations based on price data from FIT Uganda and survey data from the UNPS 2009/10.

The situation for maize looks rather different than the one for *matooke*, as Figure 3.6 and Figure 3.7 show. The elasticity in this case was negative. This means that an increase in the price reduced welfare. Moreover, a price increase hit harder in urban areas: A 1 percent increase in the price of *matooke* reduced welfare in urban areas on average by about 6 percent. The reduction in welfare in rural areas was only half of that, which seems reasonable. Rural households needed to rely less on the market for consumption of *matooke*. Figure 3.9 shows the relationship between welfare and the NBR for *matooke*. It shows that the elasticity was generally around –5 percent. However, what is troubling is that for the poorest people, the elasticity went up (in absolute value). For the poorest Ugandans, a 1 percent increase in the price of *matooke* reduced welfare by almost 10 percent.

Figure 3.9—Relationship between welfare and net benefit ratio (NBR) for matooke



Source: Own calculations based on price data from FIT Uganda and survey data from the UNPS 2009/10.

Beans are also an interesting crop. Although it might seem that a price increase for beans would lead to an increase in welfare overall, this effect comes from the rural areas. Indeed, the land-constrained urban dwellers were unlikely to be net sellers, and hence a price increase hurts them. We also disaggregated the welfare elasticity by region as shown in Table 3.2. The table is broadly consistent with expectations. For instance, it shows that the welfare elasticity of cassava was negative and very high (in absolute value) in the north. This is because cassava is an important part of the diet in that region.

Table 3.2—Welfare elasticity by region

	Central	East	North	West
Maize grains	0.18	0.11	0.18	0.30
Matooke	–0.06	–0.04	–0.03	–0.01
Beans	0.05	0.05	0.01	–0.03
Groundnuts	0.05	0.05	–0.01	0.20
Cassava	0.00	–0.02	–0.12	0.08
Rice	–0.03	–0.05	–0.03	0.06

Source: Own calculations based on price data from FIT Uganda and survey data from the UNPS 2009/10.

We can summarize the results of our short-run case study as follows. If we look at the effect of the evolution of prices of a range of commodities together, we find that poverty has increased substantially during the recent price hike. In fact, price changes increased poverty levels in 2011 to the levels of 2005/06. There are marked differences in how much welfare reduces for different types of households. If we restrict price changes to the most important food crops, the urban poor are hit hardest. But if we assume that all prices have been changing at the mean of the food crop price changes, the rural poor are worst off. We also find marked differences if we look at the effects of price changes for commodities separately. For instance, price increases for maize are pro-poor, with poorest households increasing wealth most.

4. LONGER-RUN IMPACT OF FOOD PRICES ON THE UGANDAN ECONOMY

We now turn to the impact of price changes on the long run. Instead of calculating the impact at each point in time, we now simulate what happens if food prices increase by, for instance, 100 percent.

Model and Data

CGE models have several advantages in the analysis of shocks with economywide effects. First, they simulate the functioning of the whole economy, including markets for labor, capital, and commodities, thus showing how the effects are transmitted in the form of price and output changes throughout the economy. Second, the structural nature of the models enabled the decomposition of multiple shocks, such as simultaneous increases in food prices across several products. Third, the disaggregated sectoral breakdown allowed us to analyze the impact of food price changes on each sector, including the nonagricultural sector. Finally, these models provided a theoretically consistent framework for analyzing the welfare effects of alternative policies and external shocks.

For this study we calibrated the model to a 2007 SAM for Uganda developed by Thurlow (2012). A SAM is built on the principle that when economic agents engage in transactions, financial resources exchange hands. The SAM organizes this information in a complete and consistent manner so that all transactions are captured and receipts and payments match. A SAM therefore presents a snapshot picture of the economic and social structure of an economy in a specific period, such as a calendar year.

SAM accounts define the economic agents and markets included in the CGE model. These agents and markets include production activities, commodity markets, factor markets, current accounts of domestic institutions (including households, government, and incorporated business enterprises), a capital account (savings and investments), and a rest-of-the-world account. Production, employment, household income, and consumption linkages, which are crucial for understanding how prices affect producers' and consumers' welfare, are captured via the detailed account structure of the Ugandan SAM. Given the context of the study it is important to note that household consumption estimates in the SAM include consumption of home-produced goods. This is largely consistent with the treatment of home consumption in national accounts and poverty analysis, with the exception that we now effectively value home consumption at consumer prices (that is, inclusive of taxes and transport margins for those who buy from the market) rather than exclusively at producer prices. In instances in which we directly influence indirect taxes or transport margins our choice to price home goods at market prices rather than producer prices may have implications for our income distribution analysis. However, the wedge between market and producer prices is unaffected by the world price changes, which form the core of our simulations here. The alternative approach would entail fixing either the share or the quantity of home consumption, which is also problematic as it would prevent farmers from selling their produce in response to local or international price shocks.

The Uganda SAM includes 50 activity and 50 commodity accounts, including 21 subsectors in the agriculture, forestry, and fishing sector as well as 5 agroprocessing sectors. There are also six types of production factors (family farm labor, unskilled labor, skilled labor, capital, cattle stock, and land) and five representative household groups (rural farm, rural nonfarm, urban farm, urban nonfarm, and Kampala households). A listing of the activity/commodity, factor, and household accounts is provided in Table 4.1.

Table 4.1—Key accounts in the 2007 Uganda Social Accounting Matrix

Activities (a-) and Commodities (c-)					
Agriculture, forestry, and fishing			*Mining and other manufacturing*		
amaiz	cmaiz	Maize	Amine	cmine	Mining
Arice	crice	Rice	Atext	ctext	Textiles & clothing
aocer	cocer	Other cereals	Awood	cwood	Wood & paper
acass	ccass	Cassava	Afuel	cfuel	Petrol & diesel
Aipot	cipot	Irish potato	Afert	cfert	Fertilizer
aspot	cspot	Sweet potato	Achem	cchem	Other chemicals
amato	cmato	*Matooke*	Amach	cmach	Machinery & equipment
Aoils	coils	Oilseeds	Afurn	cfurn	Furniture
abean	cbean	Beans	Aoman	coman	Other manufacturing
avege	cvege	Vegetable			
Afrui	cfrui	Fruits & other tree crops			
Aflow	cflow	Flowers	*Services*		
acott	ccott	Cotton	Autil	cutil	Energy & water
atoba	ctoba	Tobacco	Acons	ccons	Construction
Acoff	ccoff	Coffee	Atrad	ctrad	Trade
Altea	cltea	Tea, cocoa, & vanilla	Ahotl	chotl	Hotels & catering
acatt	ccatt	Cattle & sheep	Atran	ctran	Transport
apoul	cpoul	Poultry	Acomm	ccomm	Communications
aoliv	coliv	Other livestock	Abank	cbank	Banking
afore	cfore	Forestry	Areal	creal	Real estate
afish	cfish	Fisheries	Acsrv	ccsrv	Community services
			Aosrv	cosrv	Other private services
Food and agroprocessing			Ardev	crdev	Research & development
ameat	cmeat	Meat processing	Aadmn	cadmn	Public administration
aprfi	cprfi	Fish processing	Aeduc	ceduc	Education
aprgr	cprgr	Grain processing	Aheal	cheal	Health
aprfd	cprfd	Other food processing			
abvtb	cbvtb	Beverages & tobacco			

Factors of Production and Households			
Factors of production		*Households*	
lab-self	Self-employed labor	hhd-r-f	Rural farm
lab-unsk	Unskilled labor	hhd-r-nf	Rural nonfarm
lab-skll	Skilled labor	hhd-k-nf	Kampala metro
cap	Capital	hhd-u-f	Urban farm
cat	Cattle stock	hhd-u-nf	Urban nonfarm
lnd	Land		

Source: 2007 Uganda Social Accounting Matrix (Thurlow 2012).

Model Behavioral Assumptions

Although the accounts of the SAM determine the agents that are included in the CGE model, and the values recorded in the SAM identify the transactions that took place, the CGE model itself is defined by behavioral relationships. These relationships are a mix of nonlinear and linear relationships that govern how the economic agents in the model respond to changes in the model parameters, exogenous variables, or both. We used the static version of the International Food Policy Research Institute standard CGE model, which is a descendant of the approach to CGE modeling described by Dervis, de Melo, and Robinson (1982). A detailed model description, including parameter, variable, and equation listings, can be found in Löfgren et al. (2002). Below is a short description.

Producers (activities) maximize profits when combining intermediate inputs with primary factors of production such as land, labor, and capital. Production is specified using nested constant elasticity of substitution (CES) functions. These reflect sector-specific technologies and allow for imperfect substitution between factors of production, with elasticity applied exogenously to the model. Factor incomes are distributed to their owners. Returns to capital accrue primarily to incorporated business enterprises. Income from self-employed farm labor, land, and cattle stock goes to farm households. Income from the remaining labor categories primarily accrues to nonfarm and urban households.

Apart from factor income, households also earn income from government transfers or transfers from other households (either abroad or domestically). Households save and pay taxes at fixed rates and use the balance of income for consumption expenditure. Consumption behavior is governed by a linear expenditure system of demand, which allows for nonunitary income elasticity and fixed marginal budget shares. Exogenously estimated income elasticity determines how much the demand for different household consumption items responds to income changes.

Economic outcomes are affected by trade and movements in market prices. The standard CGE model assumes that producers supply their output to national product markets. Transaction costs and taxes separate producer and consumer prices. International trade is captured by allowing production to shift imperfectly between domestic and foreign markets depending on the relative prices of exports and domestic products. This is modeled with the aid of a constant elasticity of transformation (CET) function. Similarly, consumers choose between imported or domestically supplied goods, depending on relative import prices. This substitution process is modeled with the aid of a CES function, also known as an Armington function. The degree of substitutability in the CES and CET functions is determined by import and export elasticity, which are set exogenously.

When agricultural production contracts (due to, say, declining factor productivity or adverse weather shocks), the result is that farm households, which derive income from land ownership and on-farm employment, are likely to experience a decline in crop revenues. (This may be partially offset, however, by rising producer prices due to the resulting supply–demand mismatch.) Rising prices, in turn, harm consumers, particularly nonfarm households, but also net-consuming farm households (that is, those producing less than they consume). When price shocks originate from outside of the economy (for example, rising international commodity prices), producers of import-competing or export goods may benefit, but international price increases will ultimately filter through to domestic prices to the detriment of consumers. Rising prices of key inputs such as fuel or fertilizer, which are almost exclusively imported, inflate production costs and have a dampening effect on the economy as consumer demand declines in response to higher prices. The effect is more severe for goods produced in sectors that use fuel and fertilizer intensively.

The use of aggregate household groups in CGE models prevents a nuanced analysis of the differential poverty effects on households. The Ugandan model therefore incorporates a poverty module in which modeled changes in prices and consumption at the representative household group level are linked to corresponding member households in the underlying survey data, where changes in standard income poverty measures are computed.

Modeled Simulations

We conducted a total of nine core simulations (labeled *sim*1–*sim*9) to explore the impact of exogenous changes to international prices and economic shocks that affect endogenous domestic prices. We also ran several variations on these simulations to test the robustness of results to different assumptions about the extent of the shock or the behavior of the model. We changed international prices exogenously by changing the world import and export prices of select commodities based on actual observed price changes during 2008–2011. Domestic prices were endogenously determined in the model; hence we ran several simulations thought to affect domestic prices, including (1) fuel price shocks,[9] (2) direct changes in trade and transport margins, and (3) agricultural land supply shocks and negative agricultural productivity shocks. These domestic price shock simulations complemented earlier CGE analyses in Uganda that focused only on international price shocks (see Boysen and Matthews 2012; Matovu and Twimukye 2009). Table 4.2 summarizes the shocks modeled under the nine core simulations.

In so-called medium-run scenarios, agricultural land was fixed (or activity specific), whereas in the longer-run scenarios farmers were able to reallocate land toward the production of crops that are more profitable. We assumed capital stock, employed largely in the nonagricultural sectors and hence not a focus in this analysis, was always fully employed and activity specific. This meant the productive capacity of the economy remained fixed in this static analysis, whereas we did not allow for any reallocation of productive capacity among sectors. All labor factors were fully employed and mobile across economic sectors, although the movement of family farm labor was restricted to agricultural subsectors (that is, family farm laborers cannot be redeployed in nonagricultural sectors). The model was appropriate for evaluating relative price changes but was not suited to studying inflation. The domestic CPI, which is usually used as an indicator of inflation, was treated as the so-called numéraire in the model, which means all price changes were expressed relative to a fixed CPI

[9] Technically we imposed this as an international price shock, but fuel prices have a potentially important impact on domestic transport margins.

Table 4.2—Summary of simulations

	Core Simulations	Simulation Description	Simulation Variations	Note on Simulation Variations	Price Changes for International Price Shocks: Maize 50%	Rice 25%	Other Cereals 25%	Coffee 100%	Tea, Cocoa, & vanilla 300%	Meat Processing 25%	Fish Processing 25%	Grain Processing 35%	Other Food Processing 25%
International price shock scenarios	*sim1*	Cereals crops price shocks	*sim1a*	Fixed land (medium term)	□	□	□					□	
			sim1b	Flexible land (long term)									
	sim2	Export crops price shocks	*sim2a*	Fixed land (medium term)				□	□				
			sim2b	Flexible land (long term)									
	sim3	Processed goods price shock	*sim3*	—						□	□		□
	*sim4**	Combined international scenario	*sim4**	Combined *sim1b*, *sim2b*, and *sim3*	□	□	□	□	□	□	□	□	□
			sim4e1	Low export elasticity (–50%)									
			sim4e2	High export elasticity (+50%)									
			sim4m1	Low import elasticity (–50%)									
			sim4m2	High import elasticity (+50%)									
Domestic price shock scenarios	*sim5*	Fuel shock	*sim5a*	6% increase in world petroleum prices									
			sim5b	30% increase in world petroleum prices									
			sim5c	65% increase in world petroleum prices									
	sim6	Trade and transport margins	*sim6a**	5% increase in domestic trade and transport margins, nontraded sectors†									
			sim6b	10% increase in domestic trade and transport margins, nontraded sectors†									
	sim7	Agricultural supply shock	*sim7a*	6% decline in agricultural land									
			sim7b	5% decline in productivity, nontraded sectors†									
			*sim7c**	Combined *sim7a* and *sim7b*									
	*sim8**	Combined domestic scenario	*sim8**	Combined *sim5a*, *sim6a*, *sim7c*									
Combined	*sim9**	Combined international and domestic scenarios	*sim9**	Combined *sim4** and *sim8**									

Source: Authors' calculations.

Notes: †Nontraded food sectors include cassava, Irish potatoes, sweet potatoes, matooke, vegetables, fruits and other tree crops, cattle and sheep, poultry, and feed stock sectors.

*These are considered the five key simulations (that is, sim4, sim6a, sim7c, sim8, and sim9) for which more detailed results on household welfare and poverty are reported in this study.

The first four simulations explore the impact of international price increases for cereals (*sim1*), agricultural export crops (*sim2*), and processed foods (*sim3*), and a scenario (*sim4*) combines the shocks from *sim1* through *sim3.* Table 4.3 provides more detailed sectoral information about value-added and output shares, employment shares, and trade shares and intensities for the different subsectors, which provides useful context for interpreting the results from these simulations.

Table 4.3—Production, employment, and trade shares for selected sectors

	Share in National Value-added (GDP)	Share in National Production	Share in Total Employment	Sector Share in Total Exports	Exports as Share in Sector Output	Sector Share in Total Imports	Imports as Share of Domestic Demand
Maize	1.13	0.80	0.92	1.79	19.95	0.85	21.62
Rice	0.29	0.20	0.22			0.34	26.94
Other cereals	1.12	0.82	0.72			2.14	35.53
Cassava	2.04	1.48	1.00				
Irish potato	0.41	0.52	0.28				
Sweet potato	1.53	1.18	0.87				
Matooke	2.37	1.56	1.17				
Oilseeds	0.60	0.39	0.41	0.17	3.81	0.14	7.27
Beans	2.28	2.02	1.15	4.14	17.41		
Vegetable	0.08	0.06	0.06				
Fruits & other tree crops	0.17	0.12	0.12				
Flowers	0.15	0.24	0.09	2.25	100.00		
Cotton	0.13	0.12	0.10	1.15	100.00		
Tobacco	0.66	0.46	0.43	3.88	91.96		
Coffee	0.95	0.82	0.54	7.62	100.00		
Tea, cocoa, & vanilla	0.34	0.26	0.37	2.44	100.00		
Cattle & sheep	1.19	1.13	1.44				
Poultry	0.17	0.22	0.15				
Other livestock	0.27	0.19	0.27	0.23	11.59		
Forestry	3.83	3.43	9.62				
Fisheries	2.93	2.01	3.33	5.56	26.09		
Meat processing	0.09	1.01	0.03	0.70	5.29	0.80	13.67
Fish processing	0.09	0.69	0.14	5.70	59.62	0.55	26.72
Grain processing	0.68	1.64	0.23			1.09	13.12
Feed stock	0.09	0.30	0.07				
Other food processing	1.47	4.18	1.85	9.63	19.17	4.27	21.62
Petrol & diesel	0.01	0.07	0.01			8.27	96.14

Source: 2007 Uganda Social Accounting Matrix.

Sim1 models cereals price changes. Maize, rice, and other cereals are all imported into Uganda, albeit not very intensively, with import intensities ranging from 21.6 percent for maize to 35.5 percent for other cereals. About one-fifth of maize produced in Uganda is also exported, which made Uganda a net exporter of maize in 2007. The import intensity of processed grain is also fairly low at 13.1 percent. On the balance, Uganda is a net importer of raw and processed cereals or grains, with imports amounting to around UGX 320 billion whereas exports are UGX 125 billion. However, compared to overall trade volumes, trade in cereals is almost negligible (see trade shares in Table 4.3).[10] Cereals nevertheless form an important part of the staple diet (although not the most important as in many other African countries). Expenditure on cereals accounts for 4.9 percent of the total consumption budget, compared with the 6.0 percent spent on root crops (cassava, Irish potatoes, and sweet potatoes), 3.0 percent on beans, and 3.5 percent on *matooke*. Between 2008 and 2011 the U.S. dollar–denominated price of maize increased by around 47 percent, whereas rice prices increased 24 percent. In the cereals scenario (*sim1*) we therefore

[10] Overall trade amounted to UGX7,260 billion and UGX3,767 billion for imports and exports respectively.

simulated a 50 percent increase in maize prices and a 25 percent increase in rice and other cereals prices. We also assumed a 40 percent increase in world prices of processed grains (see Table 4.2).

Sim2 focuses on agricultural export crops. Uganda's traditional export crops include flowers, cotton, tobacco, coffee, tea, cocoa, and vanilla. Apart from tobacco, with a 92.0 percent export intensity share, all export crops are fully exported. Traditional export crops jointly contribute 17.3 percent to total merchandise exports. Coffee, which contributed 7.6 percent to export revenue in 2007, experienced a doubling in prices between 2006 and 2010, whereas the tea, cocoa, and vanilla subsector with its 2.4 percent export revenue share experienced roughly a fourfold increase in the same period. This simulation explores the impact of these export price shocks on the Ugandan economy. We do not model changes in other export crop prices. For each of *sim1* and *sim2* we assumed a medium-run closure (*sim1a* and *sim2a*) in which agricultural land is fixed or activity specific as well as a long-run closure (*sim1b* and *sim2b*) wherein agricultural land is flexible and can be reallocated to more profitable agricultural subsectors. Structural shifts in the economy are typically larger under a long-run closure, and increased flexibility acts as a mechanism for the economy to mitigate the effects of price shocks.

Sim3 models the impact of increases in world prices of processed foods (excluding processed grain prices modeled in *sim1*). Although Uganda runs a small trade deficit on meat, substantial exports of processed foods and fish more than make up for this so that the overall processed food trade account is in surplus. Hence an increase in world prices for these three goods will have a positive terms-of-trade effect for Uganda.S*im3* models a conservative 25 percent price increase for all processed goods.

Sim4 models the joint impact of *sim1b, sim2b, and sim3* (that is, it assumes the default long-run closure). We also conducted some sensitivity testing around the level of export and import trade elasticity. The base trade elasticity is from Benin et al. (2008). The low-elasticity scenarios (*sim4e1* and *sim4m1*) assume export and import elasticities are 50 percent lower than their base values, whereas in the high-elasticity scenarios (*sim4e2* and *sim4m2*) they are 50 percent higher. Higher export elasticity makes it easier for domestic producers in the model to shift from domestic to export markets. This elasticity therefore governs the responsiveness of domestic producers to improved terms-of-trade conditions and hence their ability to exploit export opportunities. The opposite is true for lower export elasticity. Lower import elasticity, in turn, makes it harder for consumers to switch from imported to domestic goods when international prices rise. In instances in which domestically produced goods are not good substitutes for imported goods, a lower elasticity is warranted.

For the domestic price scenarios, we introduced a variety of shocks that may affect domestic prices. We were particularly interested in those shocks that affect nontraded food products as many of Uganda's staples are nontraded (that is, sourced only domestically) and have also experienced large price shocks in recent times (see Figure 3.2). Fuel prices have been identified as a major cause of commodity price increases globally (Headey and Fan 2010). Domestically, they cause transport cost increases, which are often rapidly passed on to consumers. For example, *Statistical Abstract 2012* (UBOS 2012) attributes inflation of 18.7 percent in 2011 partly to food, beverage, and clothing price increases but also to high transport costs (transport fares increased by 17.8 percent that year), which in turn have been linked to rising fuel prices and the exchange rate depreciation. Fuel prices spiked in 2008 but retreated to lower levels again, so that the overall increase during the period of interest (2008–2011) was only 6 percent (*sim5a*). Since fuel imports account for only about 8.3 percent of Uganda's imports, we expected the average effect of this price change to be small. However, we also tested the impact of more severe spikes in the fuel price. For example, during 2004–08 fuel prices rose 30 percent (*sim5b*), whereas in 2007–08 they rose by 65 percent (*sim5c*) (Headey and Fan 2010).

Sim6a and *sim6b* continue on a related issue, namely, trade and transport margins. Inefficiencies and weak transport infrastructure in Uganda add significantly to the cost of doing business in the country, and they act as implicit barriers to domestic and international trade. One estimate suggests that excessive transport costs in Uganda vis-à-vis those of competitors are equivalent to a 25 percent tax on Ugandan exports (Wiebelt et al. 2011). Transport efficiency is further hampered by road congestion. For example, in 2011, Uganda saw a 20 percent increase in registered vehicles yet only a 4.9 percent increase in paved roads (UBOS 2012). Another source of trade and transport costs is the actual cost of fuel. The Uganda

SAM shows that fuel costs account for more than one-third of the transport sector's intermediate input costs and more than 10 percent of total production costs. It is understandable that transport margins may be adjusted when fuel prices spike, as was the case in 2008. However, whereas *sim6* captures such effects, it may be equally likely that transport margins fail to adjust downward again once fuel prices normalize. In this way, fuel price shocks have an enduring effect on domestic prices via transport margins. Finally, all of the several layers of middlemen, traders, and retailers in Ugandan agricultural value chains ultimately add to domestic prices. Any increase in the markup demanded by these middlemen would ultimately lead to higher consumer prices. Our simulations model hypothetical increases of 5 percent (*sim6a*) and 10 percent (*sim6b*) in trade and transport margins, respectively, for nontraded commodities, including root crops (potatoes and cassava), *matooke*, fruits and vegetables, certain meat and poultry products, and livestock feedstock.

Sim7 models various agricultural supply shocks. In particular, we modeled a reduction in agricultural land (*sim7a*) and a decline in total factor productivity in nontradable agricultural sectors (*sim7b*). These are the same sectors for which domestic trade and transport margins were adjusted in the previous simulation. One possible cause of domestic price increases is the slow growth in land expansion in Uganda. FAO 2012) data suggest that agricultural land expanded at around 1.8 percent per year during 2006–2010. Population growth, on the other hand, is estimated at 3.4 percent per year. This means that land availability per capita has been declining at a rate of 6 percent per year. S*im7a* therefore models a 6 percent decline in cultivated land to stand as proxy for a situation in which land is expanding at a slower pace than the population. The same FAO data suggest mixed outcomes as far as agricultural productivity or yields are concerned. Root crop yields, for example, declined marginally during 2006–10, whereas other crops had yield gains of between 0 and 1.4 percent per year, which is also well below the population or labor force growth rate. Thus, *sim7b* models a hypothetical 5 percent decline in yields across all nontradable sectors. S*im7c* combines the shocks in *sim7a* and *sim7b.*

Sim8 combines the domestic price shock simulations (that is, *sim5a, sim6a,* and *sim7c*), and *sim9* combines the international and domestic price shocks (that is, *sim4* and *sim8*). Although this report gives detailed GDP growth results for all scenarios, the analysis of socioeconomic impacts focuses on results from *sim4, sim6a, sim7c, sim8,* and *sim9,* which are all marked with asterisks in Table 4.2.

Results and Discussion

Macroeconomic and Sectoral Impacts

World price increases lead to structural shifts in production as consumers demand relatively cheaper, locally produced, import-competing goods whereas producers shift production toward more profitable export goods. Such a structural shift may sometimes result in a reduction in domestic absorption, which is a crude measure of overall welfare in the economy. Absorption is defined as the sum of consumption (*C*), investment (*I*), and government spending (*G*).[11] Reorganization of the GDP equation shows why absorption declines when imports (*M*) decline and exports (*X*) rise (Arndt et al. 2008):

$$GDP + M - X = Absorption = C + I + G$$

If, however, GDP rises by more than the increase in the trade surplus (or the reduction in the trade deficit), absorption may still increase. Although this is fairly unlikely in instances where the international price shock causes the terms of trade to worsen, it may be likely if the terms of trade improve and this leads to an increase in household disposable income and if investment or government spending increase or both increase.

Table 4.4 shows the macroeconomic results for *sim1* through *sim4.* Our results show that absorption does in fact increase in most of the price shock simulations (that is, in *sim2*–*sim4*). In the cereals scenario (*sim1*), however, the terms-of-trade shock is negative and so too is the change in

[11] Government spending (*G*) is fixed in real terms in all our computable general equilibrium simulations.

absorption (for example, –0.2 percent in the medium-run scenario with fixed land and –0.4 percent in the long-run scenario). Exports are unchanged in the medium-run scenario. In the long run they increase marginally in nominal terms as expected, but the nominal exchange rate appreciation causes exports to fall by 1.3 percent in real terms. As in the other scenarios, the nominal exchange rate depreciation comes about as a result of the surplus of foreign exchange caused by rising exports and declining imports as producers and consumers respond to relative price shifts. In both *sim1* and *sim2* the real exchange rate appreciates more when land is flexible since agricultural land is allocated to the production of export crops, thus placing further pressure on the exchange rate to strengthen in an attempt to balance the surplus of foreign exchange. In the other price scenarios (*sim2*–*sim4*) the terms-of-trade shock is also strongly positive, and domestic absorption increases. In relative terms the changes in the export price scenario (*sim2*) contribute most to the change observed in the combined scenario (*sim4*).

Table 4.4—Macroeconomic results: International price change scenarios

	sim1a	*sim1b*	*sim2a*	*sim2b*	*sim3*	*sim4*	*sim4e1*	*sim4e2*	*sim4m1*	*sim4m2*
	Cereals: Fixed Land	Cereals: Flexible Land	Exports: Flexible Land	Exports: Fixed Land	Processed Foods	Combined International Food Price Shock	Combined with Low Export Elasticities	Combined with High Export Elasticities	Combined with Low Import Elasticities	Combined with High Import Elasticities
GDP at market prices (% change)	0.0	–0.5	0.2	0.2	0.1	0.0	0.0	0.0	0.1	–0.1
Absorption	–0.2	–0.4	2.4	2.7	0.5	2.6	2.6	2.7	2.6	2.6
Consumption	–0.3	–0.5	3.5	4.1	1.1	4.2	4.2	4.2	4.2	4.2
Investment	0.0	0.0	–0.7	–0.8	–1.3	–1.9	–2.2	–1.8	–1.9	–1.9
Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exports	0.0	–1.3	–6.0	–5.9	2.7	–2.6	–4.1	–1.9	–1.5	–3.3
Imports	–0.6	–0.4	5.0	6.4	3.1	8.3	7.5	8.8	8.6	8.2
Exchange rate (% change)										
Real exchange rate	0.3	–0.6	–1.3	–2.4	–5.0	–7.2	–8.0	–6.7	–7.3	–7.1
Nominal exchange rate	–1.0	–2.3	–5.0	–5.9	–6.7	–13.6	–14.2	–13.2	–13.7	–13.5
Price indexes (% change)										
World price index	1.2	1.2	4.5	4.5	2.5	8.2	8.2	8.2	8.2	8.2
Domestic price index	–0.1	–0.5	0.6	0.7	0.7	0.8	0.9	0.7	0.7	0.8
Terms of trade (% change)	–0.3	–0.3	13.4	13.4	3.6	16.3	16.3	16.3	16.3	16.3

Source: Computable general equilibrium model results.

Table 4.5 reports changes in sectoral GDP, measured at factor cost, for selected subsectors in Uganda. In *sim1* and *sim2* the increase in cereals and export crop GDP at the expense of other agricultural subsectors is evident. This comes about as a result of an increase in production for both the domestic and the export market as farmers reallocate labor resources to the expanding sectors. The structural transformation effects are more pronounced in the flexible land variants of *sim1* and *sim2* when both labor and land are reallocated to either the production of cereals or the export crop sectors, which benefit from price changes in the two respective scenarios.

Table 4.5—Sectoral gross domestic products (GDP) (measured at factor cost): International price change scenarios

	GDP Shares in the Base	*sim1a* Cereals: Fixed Land	*sim1b* Cereals: Flexible Land	*sim2a* Exports: Flexible Land	*sim2b* Exports: Fixed Land	*sim3* Processed Foods	*sim4* Combined International Food Price Shock	*sim4e1* Combined with Low Export Elasticities	*sim4e2* Combined with High Export Elasticities	*sim4m1* Combined with Low Import Elasticities	*sim4m2* Combined with High Import Elasticities
Total	100.0	0.0	–0.4	–0.1	–0.1	0.0	–0.4	–0.4	–0.4	–0.4	–0.5
Agriculture	22.7	0.1	–1.7	–0.1	–0.2	0.1	–1.2	–1.2	–1.2	–0.9	–1.4
Cereal crops	2.5	1.6	21.5	–0.3	–7.8	–1.0	8.5	7.7	9.1	5.5	10.5
Roots crops	4.0	–0.2	–7.2	–0.3	0.7	2.4	–4.3	–4.0	–4.4	–4.0	–4.7
Matooke	2.4	–0.2	–0.2		–0.3	0.0	–0.5	–0.5	–0.6	–0.5	–0.5
Pulses and oil seeds	2.9	–0.2	–13.3	–0.8	–6.1	–1.5	–15.4	–14.8	–16.0	–12.2	–17.4
Horticulture	0.2	–0.2	–5.3	–0.4	0.7	1.1	–3.7	–3.4	–3.8	–3.4	–4.0
Export crops	2.2	–0.4	–12.2	2.4	13.9	–2.0	3.8	3.8	3.9	5.0	3.0
Livestock	1.6	–1.0	–0.9	–1.3	–1.5	1.6	–0.7	–0.8	–0.7	–0.7	–0.7
Other agriculture	6.8	0.4	0.6	0.3	0.4	0.2	1.2	1.0	1.3	1.3	1.1
Industry	27.2	–0.1	0.0	–0.3	–0.3	–0.1	–0.4	–0.5	–0.4	–0.5	–0.4
Meat processing	0.1	–0.8	–0.5	–1.3	–1.5	–0.3	–2.1	–1.9	–2.2	–1.9	–2.2
Grain processing	0.7	–1.4	0.0	0.4	0.0	0.0	0.3	–0.2	0.6	0.4	0.1
Other food processing	1.5	–1.6	–2.0	–1.9	–2.2	8.3	3.7	2.9	4.3	3.1	4.2
Services	50.1	0.0	–0.1	0.1	0.1	–0.1	0.0	0.0	–0.1	0.0	–0.1

Source: Computable general equilibrium model results.

Sim3 reveals strong sectoral growth in the “other food processing” sector thanks to Uganda’s strong initial position as an exporter and despite scarcer and more expensive intermediate inputs required by this sector. GDP at factor costs is at best unchanged or declines in all the world price simulations (*sim1–sim4*). Table 4.4, however, reveals that GDP at market prices generally increases. GDP at factor cost is equal to GDP at market prices net of indirect taxes such as sales taxes and import duties. The latter increase occurs in real terms as a result of the increase in real imports, which explains this apparent anomaly.

Table 4.4 and Table 4.5 show our results are fairly robust for different trade elasticities (that is, variants of *sim4*). Even a significant increase or reduction in export or import elasticity has no significant impact on the change in overall GDP in *sim4.* On the supply side, cereals, exports, and food-processing sectors benefit marginally from higher export elasticity (*sim4e2*). However, demand-side factors and import elasticity appear to be greater drivers of sectoral change in the agricultural sectors as consumers shift demand to either domestic- or foreign-produced goods in response to price changes. For example, when import elasticity is high (*sim4m2*), consumers shift to domestically produced cereals and processed foods in particular, causing a relative rise in these sectors’ GDP.

Table 4.6 shows the results of the domestic price simulations. The three fuel price shocks (*sim5*) all cause a deterioration in the terms of trade, which dampens consumption spending and causes a decline in domestic absorption. However, the weaker real exchange rate allows for higher real exports, which means the decline in overall GDP is not as large as the decline in absorption. The results still show, however, that a severe fuel price shock (*sim5c*) could cause a fairly large decline in GDP (–0.6 percent) even though the fuel import share is small in Uganda. At the sectoral level, fuel price increases have a limited impact (see Table 4.7).

Table 4.6—Macroeconomic results: Domestic price and combined scenarios

	sim5a	*sim5b*	*sim5c*	*sim6a*	*sim6b*	*sim7a*	*sim7b*	*sim7c*	*sim8*	*sim9*
	Fuel Shock 6% (2006–10)	Fuel Shock 30% (2004–08)	Fuel Shock 65% (2008–09)	Trade and Transport Margins 5%	Trade and Transport Margins 10%	6% Land Supply Decline	5% Productivity Decline for Nontradable Sectors	Land Supply and Productivity Shock	Combined Domestic Price Shocks	Overall Combined (*sim4* and *sim8*)
GDP at market prices (% change)	–0.1	–0.4	–0.6	–0.2	–0.5	–0.8	–0.4	–1.1	–1.4	–1.4
Absorption	–0.2	–0.9	–1.7	–0.2	–0.4	–0.7	–0.3	–1.0	–1.4	1.2
Consumption	–0.3	–1.4	–2.5	–0.3	–0.6	–1.0	–0.5	–1.5	–2.0	2.1
Investment	0.1	0.4	0.8	0.0	–0.1	0.2	0.1	0.3	0.3	–1.5
Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exports	0.1	0.8	1.7	–0.4	–0.8	–1.1	–0.1	–1.2	–1.4	–3.7
Imports	–0.4	–1.7	–3.2	–0.2	–0.4	–0.5	0.0	–0.6	–1.2	7.0
Exchange rate (% change)										
Real exchange rate	0.4	1.8	4.0	–0.4	–0.8	0.6	–0.2	0.4	0.4	–7.0
Nominal exchange rate	–0.1	–0.6	–1.3	–0.3	–0.5	0.3	–0.5	–0.3	–0.6	–14.2
Price indexes (% change)										
World price index	0.3	1.4	3.1	0.0	0.0	0.0	0.0	0.0	0.3	8.5
Domestic price index	–0.2	–1.0	–2.1	0.1	0.3	–0.4	–0.3	–0.6	–0.7	0.0
Terms of trade (% change)	–0.4	–2.1	–4.5	0.0	0.0	0.0	0.0	0.0	–0.4	15.9

Source: Computable general equilibrium model results.

Table 4.7—Sectoral GDP (measured at factor cost): Domestic price and combined scenarios

	GDP Shares in the Base	*sim5a*	*sim5b*	*sim5c*	*sim6a*	*sim6b*	*sim7a*	*sim7b*	*sim7c*	*sim8*	*sim9*
		Fuel Shock 6% (2006–10)	Fuel Shock 30% (2004–08)	Fuel Shock 65% (2008–09)	Trade and Transport Margins 5%	Trade and Transport Margins 10%	6% Land Supply Decline	5% Productivity Decline for Nontradable Sectors	Land Supply and Productivity Shock	Combined Domestic Price Shocks	Overall Combined (*sim4* and *sim8*)
Total	100.0	0.0	0.0	0.0	0.0	0.0	–0.7	–0.4	–1.1	–1.1	–1.5
Agriculture	22.7	0.0	0.0	–0.1	–0.1	–0.3	–3.2	–1.6	–4.8	–4.9	–6.0
Cereal crops	2.5	0.0	0.1	0.3	0.6	1.2	–7.0	–1.1	–8.1	–7.6	–1.6
Roots crops	4.0	0.0	–0.3	–0.7	–0.1	–0.1	–5.4	–3.5	–8.7	–8.8	–13.2
Matooke	2.4	0.0	0.0	–0.1	0.0	–0.1	0.4	–4.8	–4.5	–4.5	–5.0
Pulses and oil seeds	2.9	0.0	0.1	0.3	–0.8	–1.7	–8.7	–0.5	–9.2	–9.8	–21.7
Horticulture	0.2	0.0	–0.7	–1.4	–1.2	–2.5	–3.7	–2.6	–6.3	–7.4	–11.3
Export crops	2.2	0.0	0.3	0.6	1.2	2.4	–5.2	–0.8	–6.1	–4.9	–2.1
Livestock	1.6	0.0	0.0	0.0	–0.2	–0.4	0.9	–3.6	–2.6	–2.8	–3.5
Other agriculture	6.8	0.0	–0.1	–0.3	–0.6	–1.2	0.3	0.3	0.6	0.0	1.2
Industry	27.2	0.0	0.2	0.4	–0.1	–0.3	0.1	0.0	0.2	0.1	–0.3
Meat processing	0.1	0.0	–0.1	–0.2	–0.1	–0.1	1.3	–5.7	–4.4	–4.4	–6.6
Grain processing	0.7	0.0	0.0	–0.1	–0.2	–0.4	–0.5	0.0	–0.5	–0.7	–0.6
Other food processing	1.5	0.0	0.2	0.5	–0.7	–1.4	0.4	–0.3	0.0	–0.6	3.2
Services	50.1	0.0	–0.1	–0.2	0.2	0.3	–0.1	–0.1	–0.2	–0.1	–0.1

Source: Computable general equilibrium model results.

Increases in trade and transport margins (*sim6*) raise consumer prices and cause consumption and domestic absorption to rise. Even though we assumed trade and transport margins only increase in nontradable sectors, they adversely affect competiveness across most sectors, particularly those that use nontradable goods intensively as intermediate inputs (for example, food processors). Declining competitiveness ultimately leads to a reduction in real exports, which together with declining absorption causes overall GDP to decline (by 0.5 percent in *sim6b,* for example). Import prices rise due to the real exchange rate depreciation, which in turn causes households' disposable income levels to fall. At the sector level (see Table 4.7) trade and transport margin increases have the largest impact in those sectors directly affected (that is, root crops, *matooke*, and livestock).

The agricultural scenarios (*sim7*) measure the impact of negative agricultural supply shocks in Uganda. The 6 percent decline in land supply has a relatively large negative impact on consumption, exports, and overall GDP, with the latter declining by 0.8 percent. The productivity decline scenarios have a slightly smaller impact (that is, about half that of the land shock scenario). Also, whereas the real exchange rate depreciates when land supply declines, the real exchange rate depreciates in the productivity decline scenario. This relates to our assumption that productivity declines only in the nontradable sectors, thus causing agricultural producers to reallocate land to tradable sectors, including export sectors (for example, Table 4.7 shows how export crop GDP declines significantly more in the land supply shock simulation).

In the combined domestic price simulations (*sim8*), which combine the shocks in *sim5a, sim6a,* and *sim7c,* GDP at market prices declines by 1.4 percent (see Table 4.6), driven largely by a 2 percent decline in consumption. The simulation is also characterized by 0.4 percent exchange rate depreciation in the face of marginally worsening terms of trade (due to higher world fuel prices) and declining competitiveness of domestic producers (due to productivity losses and rising trade and transport margins). At the sector level we see large declines across all agricultural subsectors, although GDP in the export crop sector is buoyed somewhat by the weaker exchange rate. Agricultural GDP contracts by 4.9 percent, driven largely by the decline in supply of agricultural land (see Table 4.7).

Combining *sim4* and *sim8* in *sim9* brings about a change in fortunes for the import-competing cereals and export crops sectors, which now contract less compared to *sim8,* mainly due to the more favorable terms of trade. The net effect for the agricultural sector as a whole, however, is a large negative shock (that is, a 6 percent decline in agricultural GDP) that involves sharp declines in the large nontradable sectors such as root crops and horticulture. Food-processing sectors, in turn, are able to expand, which cushions the impact on overall GDP. Domestic absorption is also positive (1.2 percent), which points at a small rise in domestic welfare. More detailed analysis of the household-level effects is required to fully understand the distributional effects (see further below).

Impact on Prices

Table 4.8 shows changes in producer and consumer prices by economic sector and commodity. Since the CPI is the numéraire in the model, all price changes should be interpreted as changes relative to the fixed CPI. Consider consumer price changes. In the combined world price scenario (*sim4*) maize experiences the largest increase in consumer prices (14.3 percent). This has important price spillover effects into the grain processing (8.8 percent) and animal feeds (6.5 percent) sectors, both of which use maize and other cereals intensively as intermediate inputs. Animal feed, in turn, is an important input in the livestock sector, with cattle and sheep prices increasing 11.2 percent. Prices of key staple crops, such as root crops, *matooke*, and beans, all increase by around 10 percent relative to the fixed CPI. These price shocks reflect producers' shifting productive resources toward import-competing and export crops, thus hampering supply and causing prices to rise.

Table 4.8—Prices and output (selected subsectors)

	Producer Prices					Consumer Prices				
	sim4	*sim6a*	*sim7c*	*sim8*	*sim9*	*sim4*	*sim6a*	*sim7c*	*sim8*	*sim9*
	Combined International Food Price Shock	Trade and Transport Margins 5%	Land Supply and Productivity Shock	Combined Domestic Price Shocks	Overall Combined (*sim4* and *sim9*)	Combined International Food Price Shock	Trade and Transport Margins 5%	Land Supply and Productivity Shock	Combined Domestic Price Shocks	Overall Combined (*sim4* and *sim9*)
Agriculture										
Maize	19.2	–1.5	6.2	4.6	23.1	14.3	–0.8	3.8	2.8	17.4
Rice	12.3	–1.5	6.9	5.3	18.6	10.4	–1.0	4.1	3.0	13.7
Other cereals	11.6	–1.6	7.6	6.0	18.6	9.1	–0.8	3.3	2.4	11.9
Cassava	11.8	–1.8	14.3	12.2	26.0	10.1	0.5	11.0	11.1	22.9
Irish potatoes	9.7	–0.3	10.8	10.1	21.4	8.4	1.8	8.0	9.4	19.0
Sweet potatoes	11.7	–1.6	13.6	11.7	25.3	10.4	0.3	11.0	10.9	22.9
Matooke	12.5	–2.0	15.5	13.2	27.9	10.2	1.1	10.9	11.6	23.4
Oil seeds	12.4	–1.7	8.2	6.3	20.0	9.2	–1.1	5.6	4.4	14.1
Beans	9.6	–1.4	7.2	5.6	17.1	10.8	–0.8	5.4	4.4	16.2
Vegetables	11.8	–2.3	13.6	11.2	24.8	7.3	4.4	4.9	8.8	16.9
Fruit	11.6	–2.1	13.1	10.9	24.3	8.5	2.4	7.3	9.3	19.0
Cattle and sheep	12.2	–2.4	9.1	6.5	18.1	11.2	–1.0	7.7	6.4	17.1
Poultry	4.6	–0.8	3.0	2.0	6.3	4.6	–0.4	2.8	2.1	6.3
Processed foods										
Meat processing	8.4	–1.0	4.2	3.0	11.6	6.3	–0.1	0.9	0.6	6.9
Grain processing	9.4	–0.8	0.0	–1.0	8.2	8.8	–0.2	–1.2	–1.6	7.0
Animal feeds	6.5	–0.6	3.7	2.9	9.4	6.5	–0.5	3.6	2.9	9.3
Other food processing	4.8	–0.6	0.1	–0.6	4.0	4.0	0.1	–1.3	–1.5	2.3

Source: Computable general equilibrium model results.

Rising trade and transport margins (*sim6*) in nontradable sectors lead to price increases in these sectors relative to the unaffected sectors. Interestingly, whereas consumer prices of nontradable goods increase, their corresponding producer prices generally decrease, which reflects declining demand for these goods and hence a decline in producers' returns. When land supply and productivity decline, (*sim7c*) there are relatively large increases in consumer prices of nontradable staple crops. The results in *sim8* largely reflect the changes observed in *sim7c* (that is, domestic supply issues appear to be an important driving factor behind rising consumer prices).

Sim9—the combined price effects of international price increases and domestic supply shocks—shows price increases in excess of 10 percent across most agricultural crops, with the largest increases in nontradable staple crops such as cassava, potatoes, and *matooke*, where prices increase by more than 20 percent. Although the international price shocks modeled represent actual observed price changes, the domestic price simulations are more exploratory in the sense that they are designed to identify possible sources of domestic price increases. It is impossible to account for every possible pathway through which domestic prices may have been affected. In our simulations here, international and domestic factors contribute to the overall price change in roughly equal shares. Real price data in Uganda, however, show that *matooke* prices have almost doubled, cassava prices increased by one-third, and poultry prices increased by around 20 percent, which means our combined international and domestic price simulations explain only a part of the actual shock.

Household Income and Welfare Effects

Households derive income from a variety of sources. Agricultural households derive income principally from family farm labor and land, and nonagricultural households derive income from nonfarm labor and other sources such as business profits (returns to invested capital). Table 4.9 shows that farm wages and returns to land increase significantly in the international price simulation (*sim4*), which is a result of increased export prices and increased demand for domestically produced import-competing goods. Returns to other types of production factors also increase marginally in this scenario. Domestic factors such as rising trade and transport margins (*sim6a*) and negative agricultural supply shocks (*sim7c*) generally have a negative impact on all factor returns. However, in *sim7c* there is an increase in returns to land, which becomes scarcer and hence is used more intensively. This simulation also dominates the results on factor returns in the combined domestic scenario (*sim8*). The overall combined effect (*sim9*) of both domestic and international price shocks is a sharp increase in returns to land and farm labor and small positive or negative changes for other factors of production.

The equivalent variation is a useful household welfare measure that takes into account income changes as well as price changes. Despite sharp increases in consumer prices of food items in particular, there is a fairly large increase (4 percent) in welfare due to international price changes for all households (*sim4*), with rural farm households that benefit from selling crops at these inflated prices benefiting most (5.3 percent). In the combined domestic price shocks (*sim8*) all households experience a decline in welfare, with rural nonfarm households being most disadvantaged (–2.3 percent). Also, in the overall combined scenario (*sim9*) this household group experiences a decline in welfare, whereas all other households (rural farm households in particular) benefit. This is consistent with our earlier result, which showed an increase in domestic absorption at the macro level.

Poverty declines for all household subcategories in the international price simulation (*sim4*), with the largest decline among rural farm households. This group also makes up the bulk of Ugandan households, and hence the national poverty rate also drops significantly (by 6 percentage points) in this simulation. In the combined domestic price scenario (*sim8*), poverty increases, with rural farm households once again experiencing the largest absolute change in their poverty rate. Consistent with the welfare results, we find overall poverty declines in the overall combined scenario (*sim9*). Rural farm poverty declines by 5.1 percentage points, whereas rural nonfarm households experience no change.

Table 4.9—Factor incomes, equivalent variation, and poverty

	sim4	*sim6a*	*sim7c*	*sim8*	*sim9*
	Combined International Food Price Shock	Trade and Transport Margins 5%	Land Supply and Productivity Shock	Combined Domestic Price Shocks	Overall Combined (*sim4* and *sim9*)
Factor incomes (% change)					
Family farm labor	21.2	–1.7	–6.4	–8.0	10.7
Unskilled labor	1.4	0.1	–2.4	–2.8	–1.6
Skilled labor	4.3	–0.2	–2.3	–3.1	1.0
Capital	1.0	0.1	–2.5	–2.8	–2.1
Land	18.7	–1.9	6.1	4.1	23.8
Household welfare (*equivalent variation*) (% change)					
Rural farm	5.3	–0.5	–1.3	–2.0	3.2
Rural nonfarm	2.1	0.1	–1.9	–2.3	–0.4
Kampala metro	2.6	0.1	–1.5	–1.7	0.7
Urban farm	4.0	–0.1	–1.4	–1.9	1.8
Urban nonfarm	3.0	0.1	–1.7	–1.9	0.8
All households	*4.0*	*–0.2*	*–1.5*	*–2.0*	*1.9*

		sim4	*sim6a*	*sim7c*	*sim8*	*sim9*
	Base Poverty Rate	Combined International Food Price Shock	Trade and Transport Margins 5%	Land Supply and Productivity Shock	Combined Domestic Price Shocks	Overall Combined (*sim4* and *sim9*)
Poverty headcount (%)						
All households	30.0	–6.0	0.5	1.2	1.9	–4.0
Farm	31.2	–7.1	0.6	1.3	2.1	–4.9
Nonfarm	24.8	–1.5	0.0	0.9	1.0	–0.3
Rural households	33.4	–6.7	0.6	1.4	2.2	–4.6
Rural farm	32.3	–7.4	0.7	1.4	2.3	–5.1
Rural nonfarm	41.9	–1.1	0.0	1.3	1.4	0.0
Urban households	11.6	–2.5	0.0	0.4	0.6	–1.1
Urban farm	17.3	–3.6	0.0	0.4	0.5	–2.1
Urban nonfarm	8.3	–1.9	0.0	0.5	0.6	–0.6

Source: Computable general equilibrium model results.

5. CONCLUSION AND POLICY IMPLICATIONS

This study analyses the impact of recent price changes (roughly between 2008 and 2012) on Uganda in both the short and the longer run. We look at the combined impact of changes in prices of a basket of commodities on wealth and poverty. We also look at partial effects of certain types of crops. These short-run results are then contrasted with a CGE analysis.

We find that commodity price movements had real welfare implications in the short run. Changing prices affected welfare predominantly in a negative way, with welfare losses up to 36 percent of initial welfare for people below the poverty line. The effects were heterogeneous in that for some commodities (maize, for example), price increases were accompanied by welfare increases; however, for most other commodities investigated the effect went in the opposite direction. We also found that it is especially the poor who are hurt by higher prices, although again, this effect was not uniform.

Our analysis also shows that recent international food price changes have resulted in an improvement in Uganda's terms of trade given the country's position as a net exporter of food and agricultural products. In the combined international price simulation the terms of trade improves by 16.3 percent. However, the international price shock also leads to a sharp appreciation of both the nominal and real exchange rates, to such an extent that exports decline in real terms and imports increase on the back of the stronger domestic currency. Although there is little or no change in GDP measured at market prices or factor costs, domestic absorption increases by 2.6 percent, driven by strong growth in consumption (4.2 percent). Welfare levels of rural farm households in particular rise sharply, primarily as a result of increased returns to farm labor and agricultural land coupled with improved market prices for output sold.

Important to note, the particular simulations consider only food price changes. Uganda runs large trade deficits on products such as machinery and services such as transport. Even small increases in the international cost of these goods and services could result in a deterioration of the terms of trade despite beneficial movements in international agricultural and food prices. Also, the simulations do not consider other balance of payments movements in Uganda, which could have had a significant impact on exchange rates. For example, official statistics show a systematically worsening exchange rate during the past few years, with the Uganda shilling trading at around UGX 2,500 per U.S. dollar in 2011 compared to UGX 1,725 per U.S. dollar in 2007 (UBOS 2012). Despite this, Uganda's imports have surged ahead whereas exports have stagnated in U.S. dollar terms, so that by 2011, export revenues accounted for only around 45 percent of the value of imports compared to 55 percent in 2008. Whereas traditionally the country's trade deficit could be sustained by donor aid inflows, a recent reduction in this important source of foreign exchange has placed further pressure on the Ugandan currency. This is most likely the reason the shilling weakened even though international price shocks had a positive terms-of-trade effect.

The domestic price simulations paint a somewhat different picture. At the macroeconomic level they definitely reveal real exchange depreciation, whereas consumption, domestic absorption, and overall GDP at market decline, the latter by 1.4 percent. Although returns to land grow strongly as a result of agricultural intensification, returns to all other factors of production decline sharply (for example, by about 8 percent for farm labor). As a result, welfare levels decrease across the board (–2.0 percent). The final simulation, which combines international food and domestic price shocks, results in the latter's eroding some of the gains from the terms-of-trade improvement associated with international price changes. Countries undergoing structural changes are often at risk of experiencing productivity declines such as those modeled, as some sectors expand rapidly, initially overextending capacity, and others are neglected. In our particular simulation agricultural GDP contracts sharply (by 6 percent), causing overall GDP at factor cost to decline by 1.5 percent. Ultimately, consumer price increases—on the order of 20–30 percent for some of the key staples, which is still somewhat less than what was actually observed in Uganda—offset much of the welfare gains to rural farm households in particular.

So what does this mean for policy? Can we trust that liberalization of commodity markets will increase trade and storage sufficiently to reduce (exceptional) spatial and intertemporal price volatility? At the moment, there is no clear answer to this question. Although politically motivated researchers tend to blame unfettered commodity market liberalization for the increased price volatility, others note opposite effects but also point to other factors that influence these effects, such as tradability and preliberalization interventions to stabilize prices (Dercon 1995; Barrett 1997). Even more, some authors suggest that the imperfect nature of liberalization is responsible for discouraging private investment. Jayne et al. 2002 note unpredictable politically motivated stock releases and import licensing driven by rent seeking as factors depressing private investment. Poorly managed food aid also provides disincentives. A liberalized commodity market without (access to equally liberal) credit markets may also prove ineffective.

Even so, Poulton et al. (2006) argue that there still may be room for state intervention for at least three reasons. First, they suspect that the private sector is currently not ready to engage in interseasonal arbitrage, given the large costs and risks involved. These interseasonal price differences are the ones that are likely to be most damaging. Second, they point to limits to spatial arbitrage. Africa south of the Sahara is characterized by high transaction costs and covariant harvests. But probably most relevant in the current context is that a full liberalization strategy is not a credible strategy for political reasons. Especially in exceptional years of scarcity, politicians will be under immense pressure to be seen doing something. All this may mean that a second best solution of credible state intervention is preferable.

The government of Uganda should look at options to protect the most vulnerable excessive price volatility and extreme price increases. These are likely to be price movements that go beyond the usual intraseasonal price variation. They are the result of exceptional circumstances that happen no more frequently than about once every five years. For such situations, a harvest failure fund could be set up, wherein a financial reserve is kept offshore in fixed interest instruments. Poulton et al. (2006) discuss the technicalities as well as ways to handle the key political requirement that senior politicians respect the integrity and purpose of the fund.

At the same time, the government should look at options to guarantee producers a sufficiently high price to reap the benefits of structural agricultural transformation in the long run. The Ugandan grain trader model has been receiving international acclaim as a way to support prices paid to producers. It involves a public–private partnership between the government of Uganda and a consortium of private grain traders. The government provides infrastructure, such as grain silos, to the traders, who use it in times of glut to prevent prices from collapsing. The weaknesses of this system lie in small farmers' and traders' complaining they are not profiting since there are strict minimum quantity requirements (although they do benefit from the higher prices). The system relies (too) heavily on the World Food Program as a buyer. It is also uncertain whether this initiative can easily be scaled up to other products that are potentially politically more sensitive (for example, *matooke* in Uganda).

Whatever policy the government proposes, one of the biggest problems with direct state intervention is the risk that the intervention may be abused for political gain or direct personal benefit in the form of rent-seeking behavior. As mentioned above, this is the reason many would choose a noninterventionist approach. But in a democracy, this may be difficult, for example, when the electorate demands that the leaders act in an emergency. The government of Uganda should enter into a social contract in which it promises to use market interventions only to protect poor consumers and to promote long-run investment by producers. The most credible way is to draw up an objective emergency scenario, with verifiable and transparent thresholds and targets. The day-to-day management of the instruments (such as the fund) should be left to an independent body (such as an autonomous body within the ministry of finance), to external agents (such as New Partnership for Africa's Development or a donor group), or to an impersonal financial instrument (such as an exchange-traded fund or a tracker).

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