INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IFPRI

GLOBAL CRISIS
COUNTRY SERIES

COUNTRY BRIEF 5

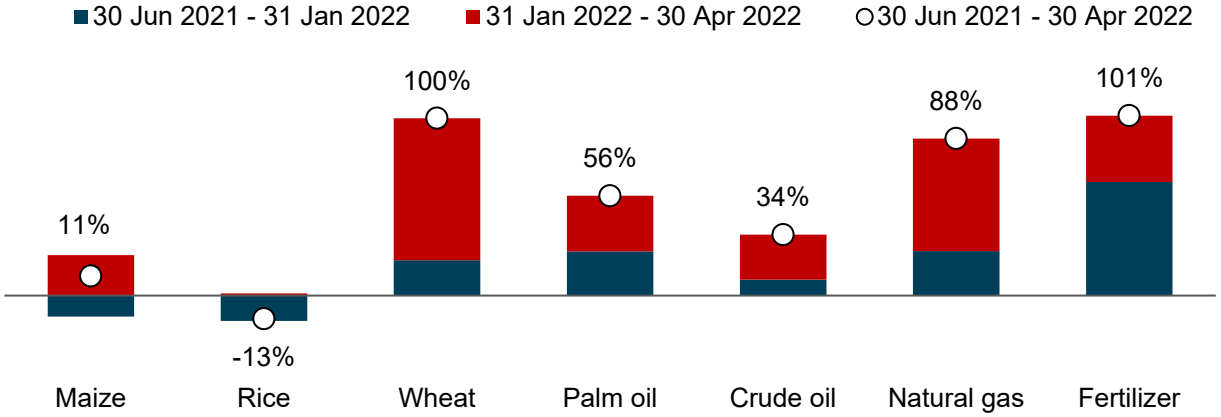
Rwanda: Impacts of the Ukraine and Global Crises on Poverty and Food Security

Xinshen Diao, Paul Dorosh, James Thurlow, David Spielman, Jenny Smart, Gilberthe Benimana, Serge Mugabo, and Gracie Rosenbach[1] ***International Food Policy Research Institute, Washington, DC***

1. World Price Shocks and Domestic Price Transmission

Global food, fuel, and fertilizer prices have risen rapidly in recent months, driven in large part by the fallout from the ongoing war in Ukraine and the sanctions imposed on Russia. Other factors have contributed to the crisis, such as export bans and continued supply chain disruptions from the COVID-19 pandemic. For example, between June 2021 and April 2022, the global prices of palm oil and wheat increased by 56 and 100 percent in real terms, respectively. At the same time, the price of fertilizer doubled, while crude oil and natural gas prices have also risen substantially. However, wide variation also exists across commodities, with real maize prices increasing by only 11 percent, and rice prices declining by 13 percent (Figure 1).

Figure 1. Changes in global real commodity prices since mid-2021 (US dollars)



Source: Authors' calculations using data from World Bank Commodity Price Data (The Pink Sheet, https://www.worldbank.org/en/research/commodity-markets).

Note: Nominal prices in US dollars from World Bank Commodity Price Data (The Pink Sheet) are converted to real prices, which account for the overall increase in world prices over this period, deflated by the US consumer price index, which rose by 7.2 percent between June 2021 and April 2022.

[1] This study was conducted by IFPRI with financial support from BMGF, FCDO, and USAID. The study uses models developed with ongoing support from BMGF, USAID, and the CGIAR's "Foresight and Metrics" initiative. The study also benefitted from working with IFPRI's Rwanda country program, a partnership with the Ministry of Agriculture and Animal Resources (MINAGRI) that is supported by the European Union. For further information, please contact David Spielman (d.spielman@cgiar.org), Paul Dorosh (p.dorosh@cgiar.org), and James Thurlow (j.thurlow@cgiar.org).

2. Measuring Impacts on Rwanda's Economy and Population

We use an economywide model of Rwanda to estimate the impact of global price shocks on the agrifood system and households in the Rwandan economy.[2] The model captures a range of considerations that determine the overall impact of the crisis, including: the contribution of imports to a commodity's total supply; whether local producers and consumers can readily substitute away from higher-priced imports; and the commodity's share of household consumption. Data are drawn from several data sources produced by the National Institute of Statistics of Rwanda (NISR), namely the updated (2019) Rwanda social accounting matrix (SAM), the Fifth Integrated Household Living Conditions Survey (EICV5) 2016/17, and the 2020 Seasonal Agricultural Survey.

For Rwanda, the IFPRI analysis focuses on four main commodity groups that have experienced rising world prices: (1) edible oils, most of which are imported for domestic use, including use in food processing sectors and in household consumption; (2) maize and wheat, which are imported in modest amounts and processed domestically into flour for domestic consumption and export; (3) oil products (crude oil and processed petroleum, both of which are imported); and (4) fertilizer, also entirely imported.

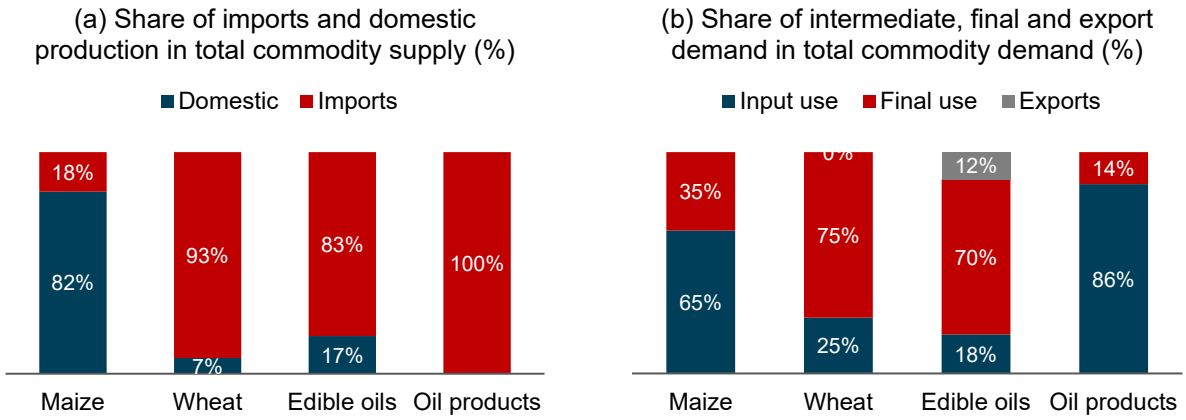
The relative importance of each commodity group for the Rwandan economy is already well understood, but the model allows us to produce a more quantitative analysis of the overall impact of the crisis on the country. For example, the effect of higher world prices on Rwanda's economy depends on how important the affected products are in the total supply of each commodity, and whether local producers and consumers can readily substitute away from higher-priced imports.

Among the three food products with rising world prices, Rwanda imports most of wheat grain and edible oils consumed domestically and also exports a small amount of wheat flour that is processed domestically, while imports of maize are about 18 percent of total maize supply (Panel A and B in Figure 2). Wheat and edible oils are not dominant food staples for most households, and we may expect that changes in world prices do not have a large effect on domestic prices. On the other hand, maize is mainly domestically grown but likewise is not a dominant food staple in most households, at least not to the extent observed in many neighboring countries in eastern and southern Africa.

However, all oil products (crude oil and processed petroleum) used in Rwanda are imported, possibly indicating a larger effect on the economy from rising oil prices. That said, the impact of higher oil prices on households cannot be directly assessed by looking at the share of petroleum products in households' consumption baskets. This is because oil products are primarily used as an input into the production of other goods and services. In fact, 86 percent of total demand for oil products in Rwanda is for input use (Panel B in Figure 2). Most petroleum products, for example, are used by the transport sector, the cost of which affects the price of all marketed goods and services in the economy. IFPRI's model tracks the flow of domestic and imported inputs between sectors and estimates the net effect on final product prices.

[2] Information on the Rural Investment and Policy Analysis (RIAPA) data and modeling system can be found here. The Rwanda Computable General Equilibrium Model (the "Rwanda CGE") used in this study is an adaptation of RIAPA to Rwanda, and was developed by IFPRI, MINECOFIN, and NISR, with input from MINAGRI and financial support from the German Society for International Cooperation (GIZ), Rwanda. For further information, please contact David Spielman (d.spielman@cgiar.org) or James Thurlow (j.thurlow@cgiar.org),

Figure 2. Breakdown of commodity supply and demand in Rwanda, 2019

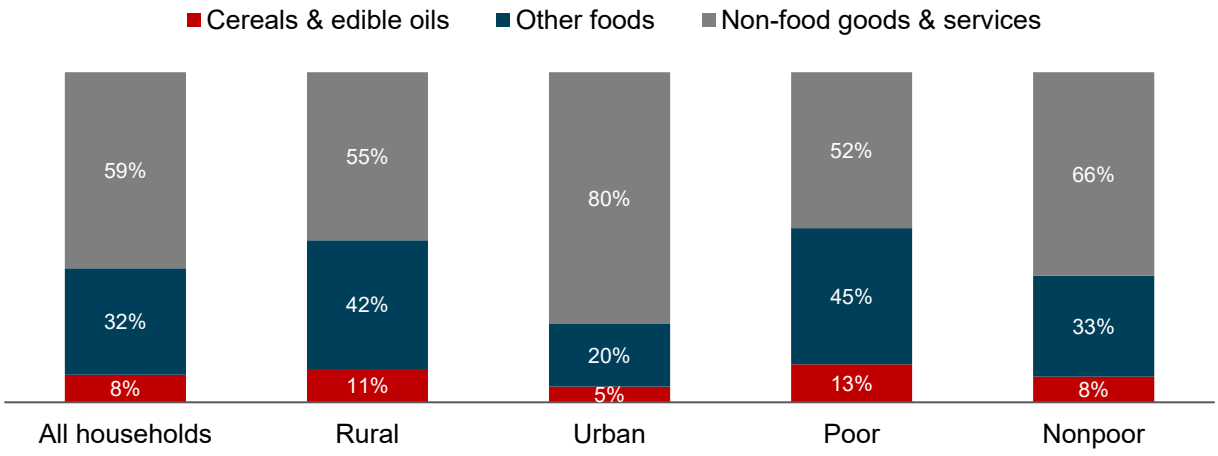


Source: Authors' calculations using the Rwanda CGE model, including updated social accounting matrix (SAM) data used in the model.

Note: Wheat includes wheat flour, and edible oils include edible oilseeds in Panel B. The 8 percent of wheat exports are wheat flour exported to the Democratic Republic of the Congo. Input use includes grains as intermediates in flour processing, while grain flours can also be used as intermediates in the production of other processed foods (excluding flours) by some service sectors, such as restaurants and hotels. Final use includes private and public consumption and gross capital formation.

Impacts on households also depend on the importance of commodities in their consumption baskets. Cereals and edible oils make up just 8 percent of the total value of household consumption in Rwanda, which is about one-fifth of total food expenditures (Figure 3).[3] IFPRI's model tracks incomes and expenditures for different population groups and is linked to a survey-based micro-simulation tool that tracks the consumption patterns of individual households. Unpacking population groups in Rwanda is crucial, because cereals and edible oils are more important for rural and poor households than for other groups.

Figure 3. Composition of household consumption spending in Rwanda, 2019



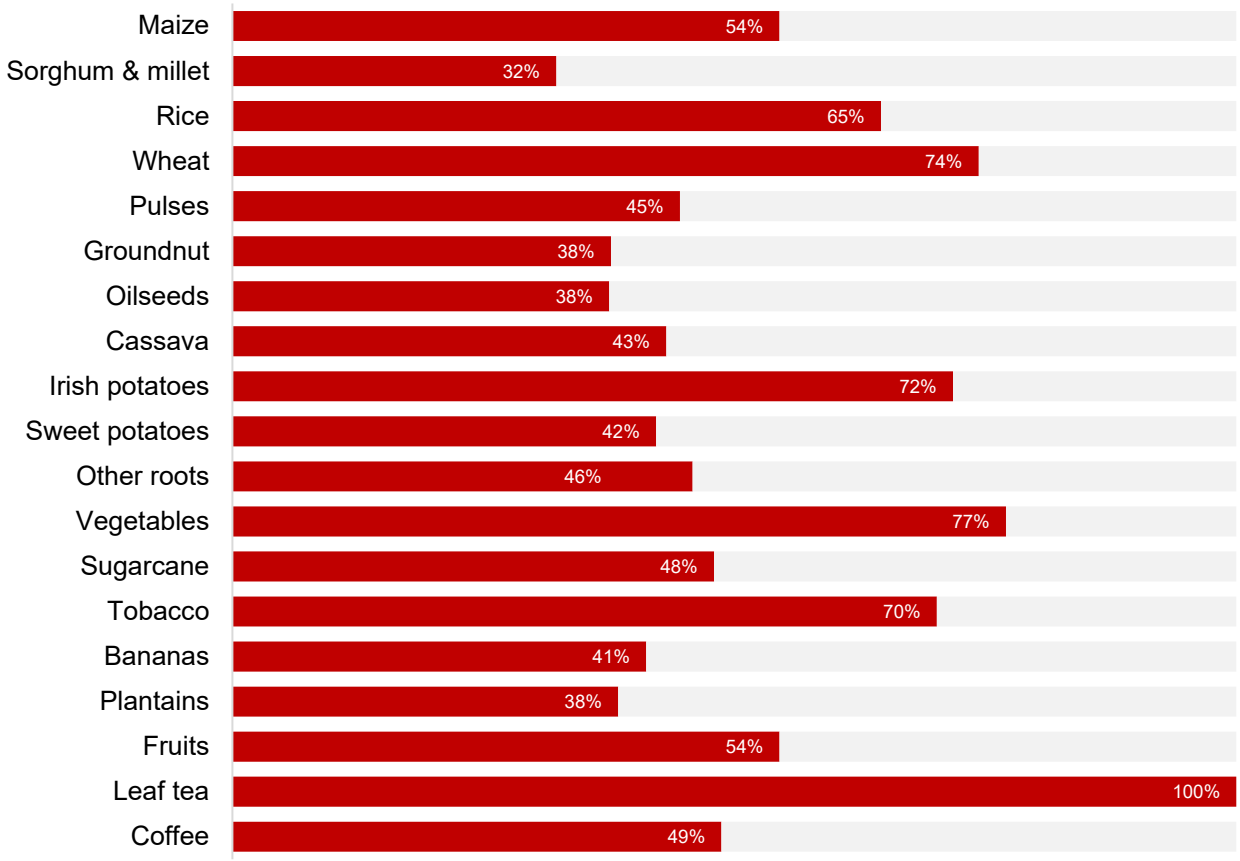
Source: Authors' calculations using the Rwanda CGE model.

Rising prices of fertilizer may cause some farmers to reduce their use of this input, leading to lower agricultural production and higher food prices. The magnitude of this decline depends on: (1) the responsiveness of fertilizer demand to changes in prices; (2) the amount of fertilizer currently used to grow crops; and (3) the expected productivity losses for farmers who reduce their use of fertilizers.

[3] These figures include the imputed value of home consumption, which is also tracked within the RIAPA model.

The fertilizer adoption rate varies significantly by crop in Rwanda. For example, fertilizer is applied on about 72 percent of Irish potatoes-cultivated area, a relatively large crop in Rwanda, compared to only 32 percent of sorghum- and millet-cultivated area, also relatively important crops in the country (Figure 5). Variation also arises in the amount of fertilizer used on different crops. For our initial impact analysis, we adopt a conservative set of assumptions regarding farmers' responses to rising fertilizer prices. We assume an own-price elasticity of fertilizer demand of −0.15, implying that a 100 percent increase in real fertilizer prices leads to a 15 percent decline in fertilizer use. Drawing on recent survey analysis, we assume that farmers who do not use chemical fertilizers are about 20 percent less productive than farmers who do.[4]

Figure 4. Share of cropland using inorganic fertilizers in Rwanda, 2020



Source: Authors' estimates based on data from the NISR's Seasonal Agricultural Survey, 2020.

Rwanda has two main seasons and planting for season B (with long rains) begins in mid-March to end April, with harvesting during June and July. The surge in fertilizer prices may therefore have already led to a reduction in fertilizer use in much of Rwanda.[5] The link between world fertilizer prices, local fertilizer use, and agricultural productivity is therefore an important impact channel for the current crisis.

We simulate the effects of both higher world prices (recall Figure 1) and the potential productivity losses from reduced fertilizer use in the current growing season. Simulation results should be interpreted as "medium-term" impacts; that is, after the immediate spillover effects across sectors and

[4] The final impact on crop productivity is: [Change in domestic market price] × [Price elasticity of demand] × [Share of cultivated land using fertilizer] × [Productivity gain from using fertilizer per hectare].

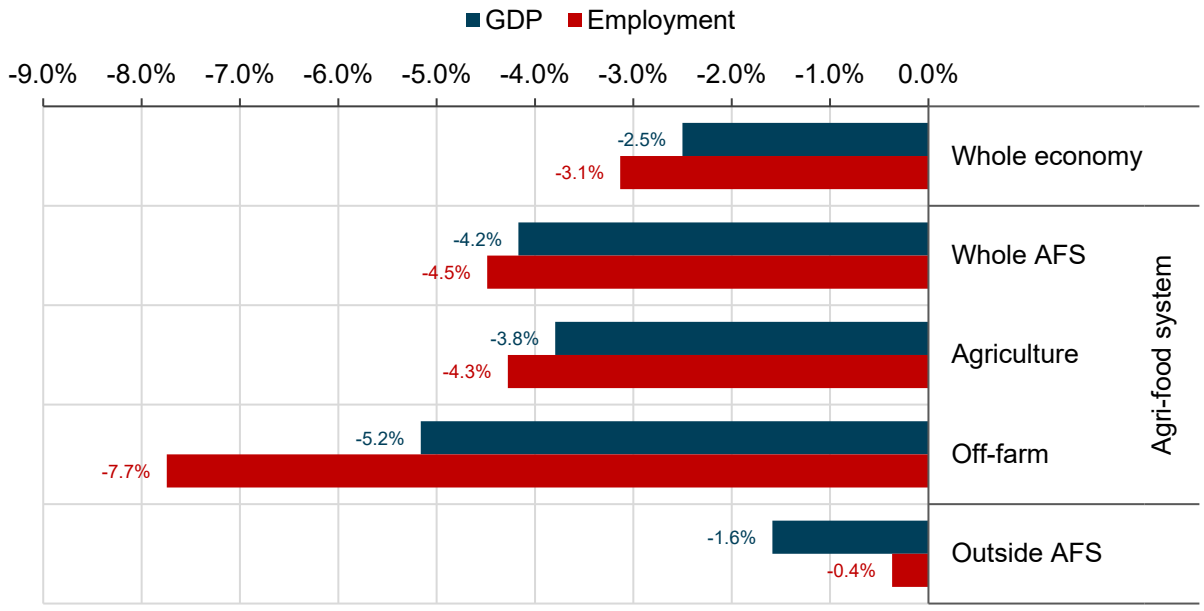
[5] See IFPRI's recent analysis of the impact of increasing fertilizer prices and subsidies in Rwanda here: https://doi.org/10.2499/p15738coll2.135073.

households have occurred, but before the government and private sector make significant changes to their investments and policies in response to the crisis (see Section 5 for next steps).

3. Impacts on Rwanda's Economy and Agrifood System

The effects of the world price and fertilizer demand shocks on GDP and employment are significant. Real GDP falls by 2.5 percent due to the combined effects of the negative terms-of-trade shock (that is, the negative effect of higher import prices outweighs the positive effect of higher export prices) and rising import costs that reduce spending on domestically produced goods (Figure 5). Employment also declines by 3.1 percent, as falling production leads to job losses. The percentage decline in agricultural GDP is much larger than the decline in total GDP; given the large size of the agriculture sector, this accounts for close to 40 percent of total GDP losses in the country. Employment falls much more in the off-farm sector of the agrifood system in percentage points, with job losses concentrated in food processing and food-related services, including trade and transport. However, the off-farm agrifood system is small compared to on-farm employment. At the national level, about 85 percent of the decline in total employment occurs on-farm.

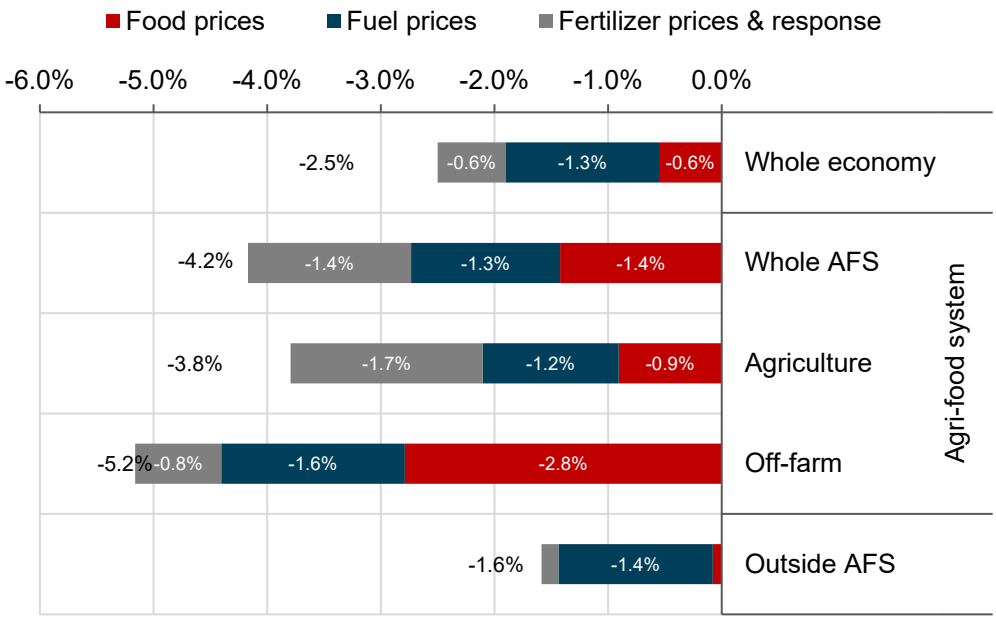
Figure 5. Percentage change in GDP and employment due to food, fuel, and fertilizer shocks



Source: Simulation results from the Rwanda CGE model.

Fuel shocks drive most of the decline in national GDP. Higher fuel prices account for more than one-half (or 1.3 percentage points) of the total fall in real GDP, compared to fertilizer and food price shocks at 0.6 percentage points respectively (Figure 6). On the other hand, agricultural GDP losses are mainly driven by fertilizer shocks, which directly affect primary agricultural production but also cause disruptions in downstream supply chains. However, GDP losses in off-farm agrifood system are mainly led by higher food prices, at 2.8 percentage points, because higher grain and edible oil prices increase the cost of food processing and lower its production and demand for related agri-food services. GDP losses outside of the agrifood system are mostly driven by higher fuel prices, which raise transaction costs and market prices and reduce consumer demand.

Figure 6. Percentage change in real GDP decomposed by food, fuel, and fertilizer shocks



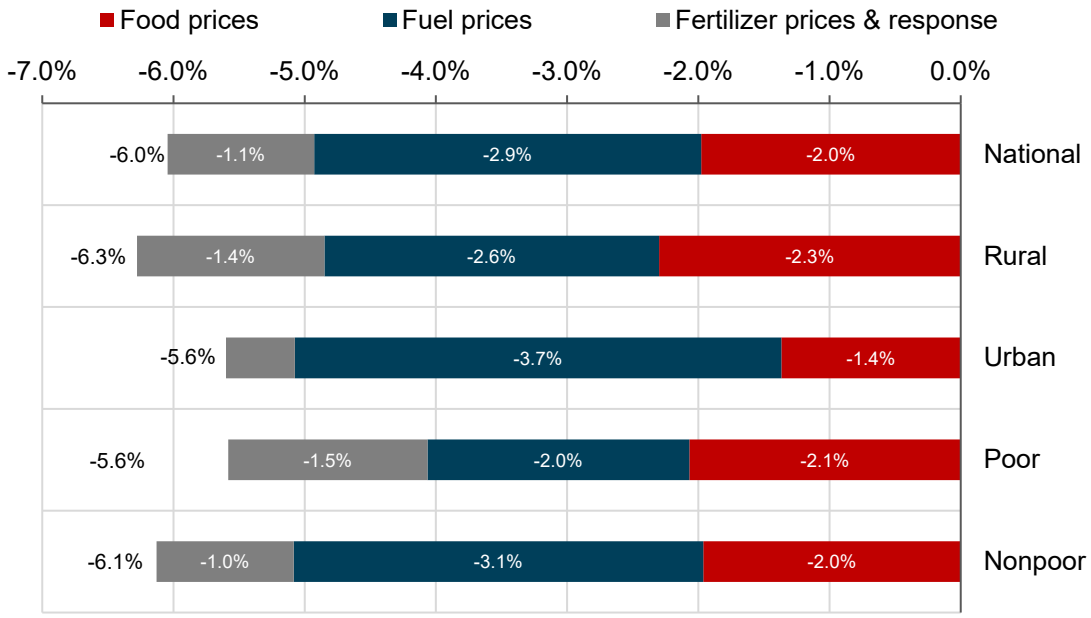
Source: Simulation results from the Rwanda CGE model.

Note: About 50 percent of the effect on agriculture GDP under "fertilizer prices and response" is directly from rising fertilizer prices, while the remaining 50 percent is from the productivity shock caused by lower fertilizer use.

4. Impacts on Household Poverty, Inequality, and Diets in Rwanda

Household consumption falls, with larger losses for rural households. National consumption, including home consumption, falls by 6.0 percent (Figure 7). The percentage decline in consumption is much larger than that in GDP, mainly because households are hit twice, by rising prices and falling income. Moreover, food accounts for a much larger share of household consumption than of GDP. Similar to the decline in GDP, most of the decline in consumption is driven by the fuel shock, which has a larger negative impact on household income and more positive impact on the prices consumers pay. Overall, the fuel shocks account for about 50 percent of the absolute decline in household consumption (or 2.9 percentage points of decline), followed by the food price shock at 2.0 percentage points, and the fertilizer shock at 1.1 percentage points. Important differences arise in consumption outcomes across population groups, however. The fall in consumption is larger for rural households, which are more negatively affected by the increase in food prices and fertilize shocks. Poor households, including those in urban areas, are more affected by rising food prices and less affected by the indirect effects of the fuel shocks because they consume more foods and less fuel-intensive products. Effects of fuel shocks are much larger for urban and nonpoor households' consumption, because they earn more income from transport services, which are more negatively affected by rising fuel prices, and they also have a more fuel-intensive consumption basket.

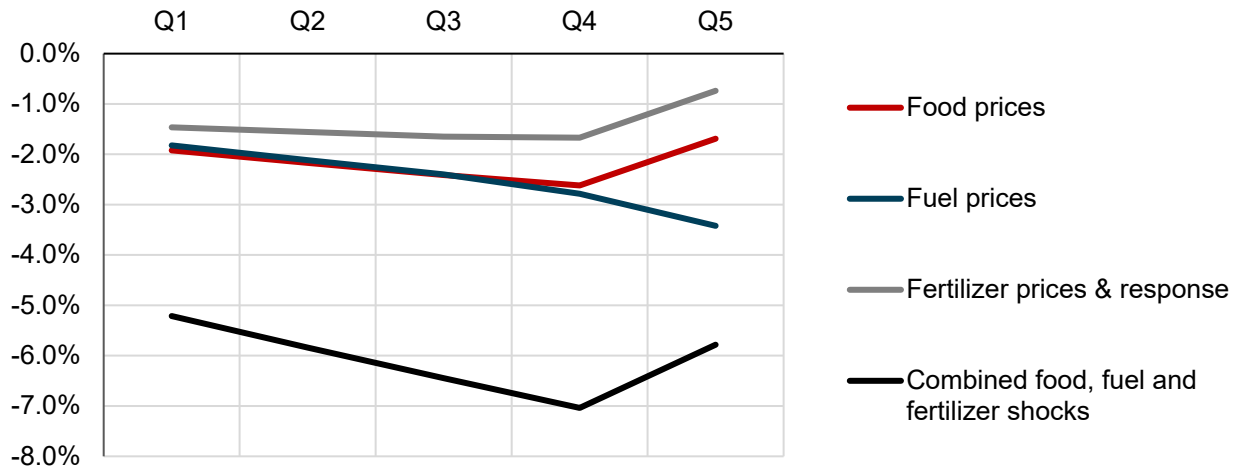
Figure 7. Percentage change in real household consumption due to food, fuel, and fertilizer shocks



Source: Simulation results from the Rwanda CGE model.

Inequality worsens, although all households are adversely affected. The food, fuel, and fertilizer shocks have different implications for (income) inequality in Rwanda. The increase in fuel prices leads to larger consumption losses for households in the top quintile than for poorer households in the lowest quintile (Figure 8). Conversely, the fertilizer shock is most detrimental for poorer households, which rely more heavily on agriculture for their income and spend a larger share of their income on food. Finally, the negative impact of higher world food prices is similar across different income groups, with less impact on the top quintile households. Overall, the combined effect of the world price shocks leads to the largest decline in consumption for households in the fourth quintile, with smaller declines for both the bottom and top quintile households. The result of the global crises is therefore an increase in inequality among households in the second to fourth quintiles within Rwanda.

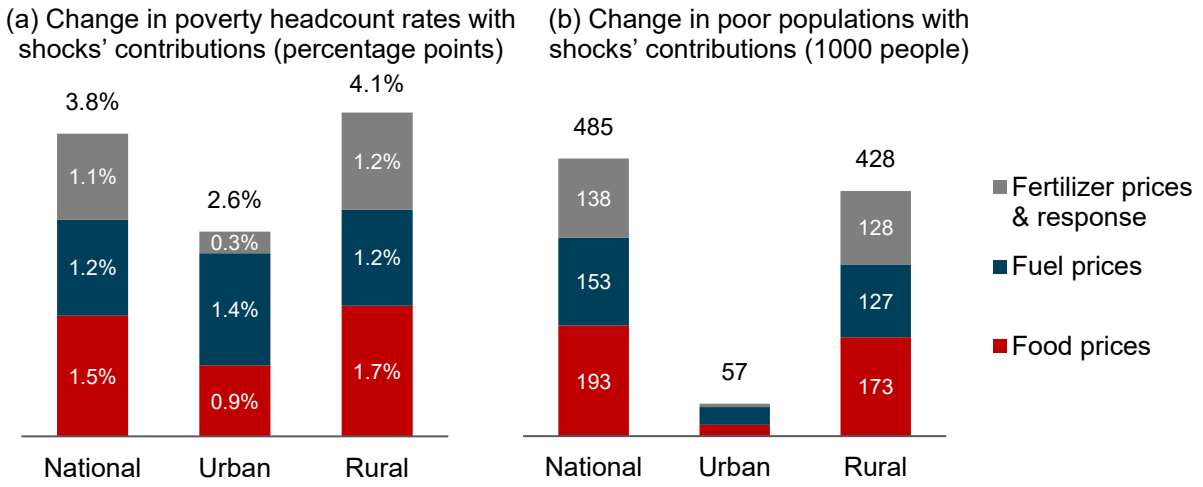
Figure 8. Percentage change in real household consumption across per capita expenditure quintiles



Source: Simulation results from the Rwanda CGE model.

Falling household consumption leads to greater poverty, particularly in rural areas. According to the most recent household survey in Rwanda, 38 percent of the country's population has an adult equivalent consumption level that falls below the US$1.90 international poverty line. The increase in world prices raises the national poverty headcount rate in Rwanda by 3.8 percentage points (Panel A in Figure 9). This is equivalent to an additional 485,000 people falling below the poverty line (Panel B). While rising food prices account for only 20 percent of GDP losses, they have a more important impact on poverty in Rwanda, accounting for about 40 percent of the total increase in poor people. This is because poor households spend more income on food. Impacts on rural poverty rates are much larger and the difference from the national poverty rate impact is mainly due to the larger impacts from food and fertilizer shocks. Most increase in the number of poor people occurs in rural areas, accounting for almost 90 percent of the increase, although this partly reflects Rwanda's smaller urban population and its lower initial urban poverty rate.

Figure 9. Changes in poverty due to food, fuel, and fertilizer shocks



Source: Simulation results from the survey-based microsimulation module within the Rwanda CGE model.

Note: Poverty headcount rate is the share of the population with daily adult equivalent consumption levels below the US$1.90 poverty line.

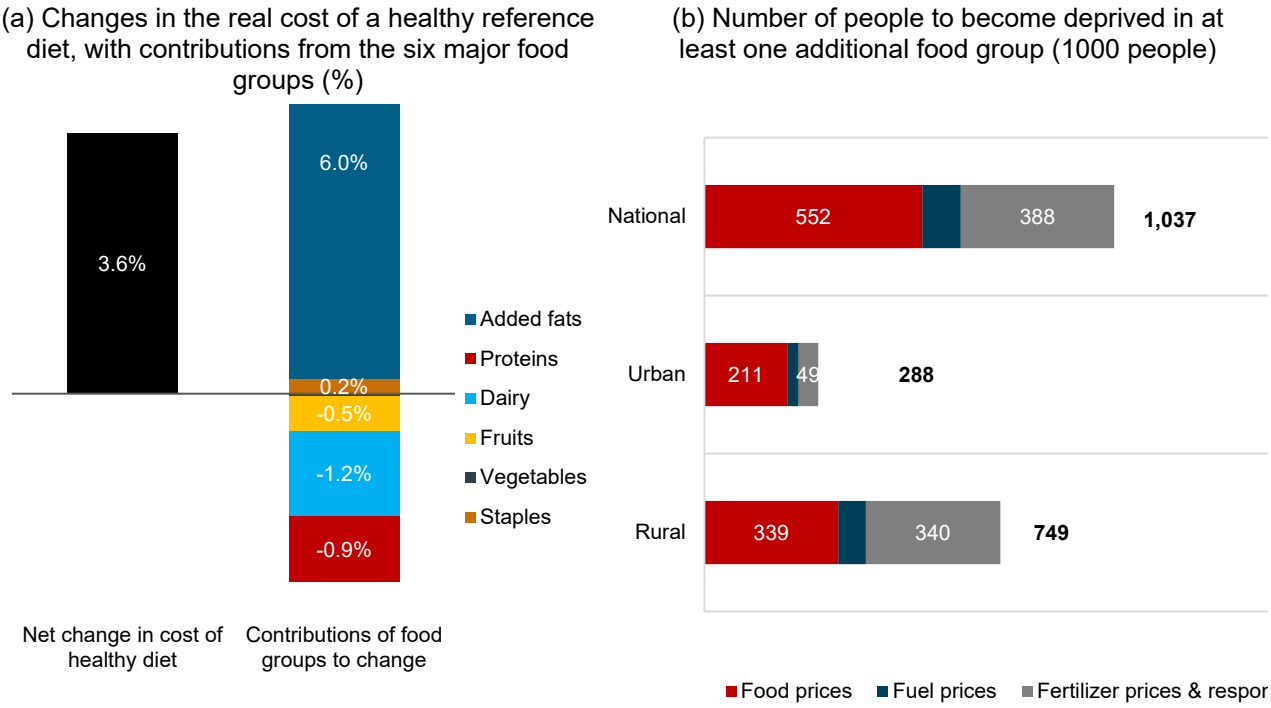
The cost of a healthy diet increases for Rwandan households. The model tracks changes in the cost of a "healthy" reference diet (CoRD) with six major food groups as defined by the EAT-Lancet Commission.[6] The combined food, fuel, and fertilizer shocks increase the CoRD by 3.6 percent in real terms (see Panel A in Figure 10).[7] This is mainly due to the rising cost of edible oils within the "added fats" food group, whose domestic price is heavily influenced by rising edible oil import prices. On the other hand, falling household income reduces demand for fruits, dairy, and proteins (meats and fish), and thus lowers their costs. The "staples" food group includes cereals and root crops, which are modestly affected by higher maize and wheat import prices as Rwanda produces almost all maize consumed and wheat is less important in consumers' food basket. Moreover, staples currently dominate household consumption, mainly due to cereal and root crops, but achieving the diversity of the healthy reference diet requires a relative decline in the share of cereals in the average household diet. As such, the increase in wheat prices has only a modest contribution to the changing cost of a healthy diet. On the other hand, consumption levels of fruits, dairy products, and meats and fish are far below the level required for a healthy diet among many households in

[6] For further information on the RIAPA model's diet module and indicators, see Pauw et al. (2021).

[7] The CoRD is estimated using calorie targets from EAT-Lancet (for major food groups) and the World Bank's International Comparison of Prices (IPC) dataset. The estimated budget shares for the healthy diet include: staples (11.2 percent), vegetables (4.5), fruits (13.2), dairy (33.6), proteins (26.7), and added fats (10.8).

Rwanda. The falling costs of these food groups mask households' deteriorating access to these foods due to falling income.

Figure 10. Changes in diet costs and household diet deprivation due to food, fuel, and fertilizer shocks



Source: Simulation results from the survey-based microsimulation module within the Rwanda CGE model.

Diet <u>quality</u> worsens for many households. The survey-based micro-simulation tool also measures the increased number of people with deteriorated diet quality. People are considered deprived in a food group if they obtain fewer calories from that food group than recommended by the healthy reference diet. Prior to the crisis, few households had the consumption level and diversity needed for a healthy diet in Rwanda. Rising food and fertilizer prices cause more than 1 million people to become deprived in at least one additional food group. The rural population accounts for 750,000 people with a deterioration in their diet quality (Panel B in Figure 10).

5. Summary and Next Steps in the Analysis

Global food, fuel, and fertilizer prices have risen rapidly in recent months, raising concerns about how this will affect economic stability, food security, and poverty in developing countries. We used an economywide model adapted to Rwanda to simulate the impacts of the global crises on Rwanda's economy and population. The model allows us to track the direct and indirect effects of rising world prices, taking account of key considerations that will determine the overall impact. These include, for example: the share of imports in total product supply; the importance of different sectors and products for household employment, income, and consumption levels; and farmers' responses to rising fertilizer prices and the knock-on effect this could have on next season's agricultural production.

Our analysis indicates that the global crises cause GDP and employment in Rwanda to contract. Most of the GDP losses are driven by rising fuel prices, rather than higher food prices. This is

because although the import prices of wheat and edibles oils are rising, Rwanda is less dependent on such imported foods and many food products are self-sufficient in nature. To some extent, rural farmers also benefit from higher prices for agricultural products, but the net effect on their welfare is negative once we account for the effects of higher fertilizer and fuel prices, reduced fertilizer use, and lower agricultural productivity.

Overall, national household consumption falls. Impacts are larger on rural households, leading to an increase in inequality in Rwanda. That said, all households are adversely affected by the crises. Falling household consumption also leads to greater poverty, particularly in rural areas. Finally, the cost of a healthy diet increases for Rwandan households, and the gap between household consumption levels and what is required to achieve a healthy diet widens. Rising food prices are the most important factor for diet quality deterioration. While the global crises will cause a modest slowdown in Rwanda's economic growth, its adverse impacts on poverty and food insecurity are likely to be more pronounced, especially in rural areas.

This study is part of a series of case studies that IFPRI is undertaking using economywide models to capture current world market shocks on developing countries. The analysis presented above is an initial impact assessment designed to gauge the vulnerability of countries and key population groups. Subsequent analyses will simulate the mitigating effects of different policy and investment options, including the potential roles of cash transfers, food aid, and subsidies for food, fuel, and fertilizers. Particular attention will be paid to possible synergies and trade-offs between these policy responses, including their implications for government budgets and longer-term development goals.

ACKNOWLEDGMENTS

This study was conducted by IFPRI with financial support from BMGF, FCDO, and USAID. The study uses models developed with ongoing support from BMGF, USAID, and CGIAR's Foresight and Metrics Initiative. The study also benefitted from working with IFPRI's Rwanda country program, a partnership with the Ministry of Agriculture and Animal Resources (MINAGRI) that is supported by the European Union.

Funding for this work was provided by BMGF, FCDO, and USAID. The study uses models developed with ongoing support from BMGF, USAID, and CGIAR's Foresight and Metrics Initiative. This publication may be updated in the future when more recent price information becomes available, and it has not been independently peer reviewed. Any opinions expressed here belong to the author(s) and are not necessarily representative of or endorsed by IFPRI.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
A world free of hunger and malnutrition
IFPRI is a CGIAR Research Center
1201 Eye Street, NW, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-862-5606 | Email: ifpri@cgiar.org | www.ifpri.org | www.ifpri.info