

COUNTRY BRIEF 8

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

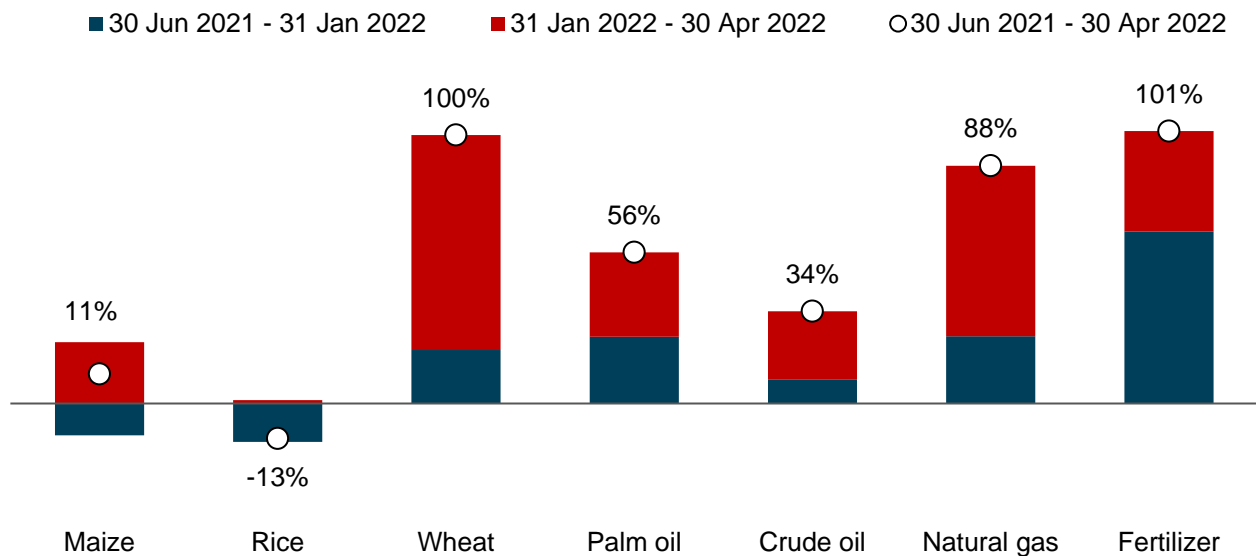
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1. World Price Shocks and Domestic Price Transmission

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, such as export bans, have also contributed to rising prices. Palm oil and wheat prices increased by 56 and 100 percent in real terms, respectively, between June 2021 and April 2022, with most of the increase occurring since February (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>).

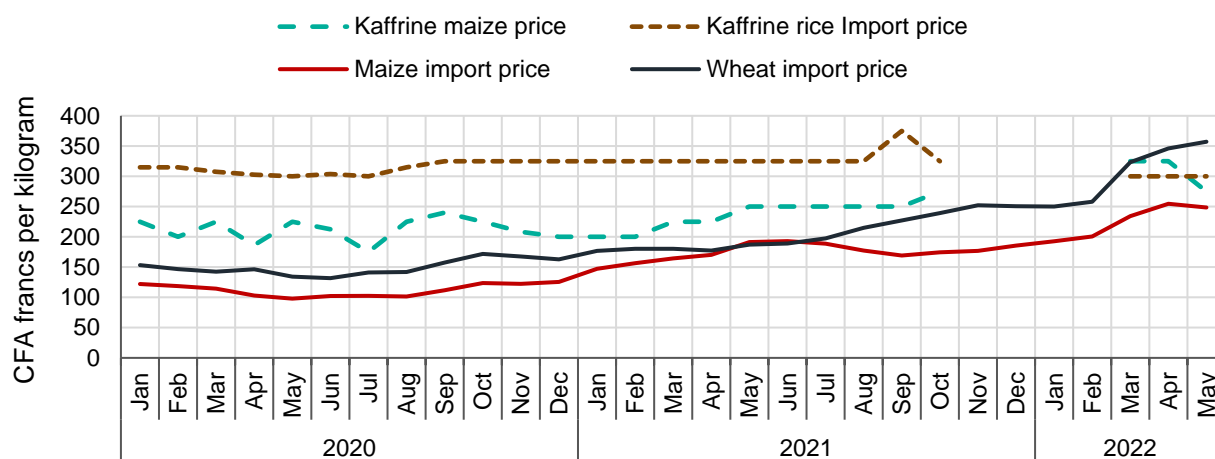
Note: Nominal prices in US dollars from World Bank Commodity Price Data (The Pink Sheet) are converted to real prices, which account for the overall increase in world prices over this period, deflated by the US consumer price index, which rose by 7.2 percent between June 2021 and April 2022.

¹ This study was conducted by IFPRI with financial support from BMGF, FCDO, and USAID. The study uses models developed with support from BMGF, USAID, and CGIAR's Foresight and Metrics Initiative. For further information, please contact Paul Dorosh (p.dorosh@cgiar.org) and James Thurlow (j.thurlow@cgiar.org).

Wide variation exists across products, with real maize prices increasing by only 11 percent and rice prices declining by 13 percent. The price of crude oil and natural gas has also risen substantially, while the weighted average price of fertilizer has doubled. With these changes in global prices, many developing countries and their development partners are concerned about the implications for economic stability, food security, and poverty.

Wheat and wheat products are not major cereals in Senegal. They account for only 0.5 percent of total use of all commodities. Despite the sharp rise in world wheat prices and more moderate increases in world rice prices, the domestic price of rice remained relatively stable through May 2022 (Figure 2). Wholesale prices of maize have risen steadily since October 2021, however, including an 18 percent increase from October 2021 to April 2022. Further data will be needed to determine whether the changes in world prices of agricultural goods lead to major increases in domestic prices, particularly since many of the major food products produced and consumed in Senegal are not widely traded in international markets.

Figure 2. Nominal maize, rice, and wheat prices in Senegal, 2020–2022



Source: Authors' calculations using data from WFP, IGC, and World Bank Commodity Price Data (The Pink Sheet).

Note: Import prices include carriage, insurance, and freight (CIF).

2. Measuring Impacts on Senegal's Economy and Population

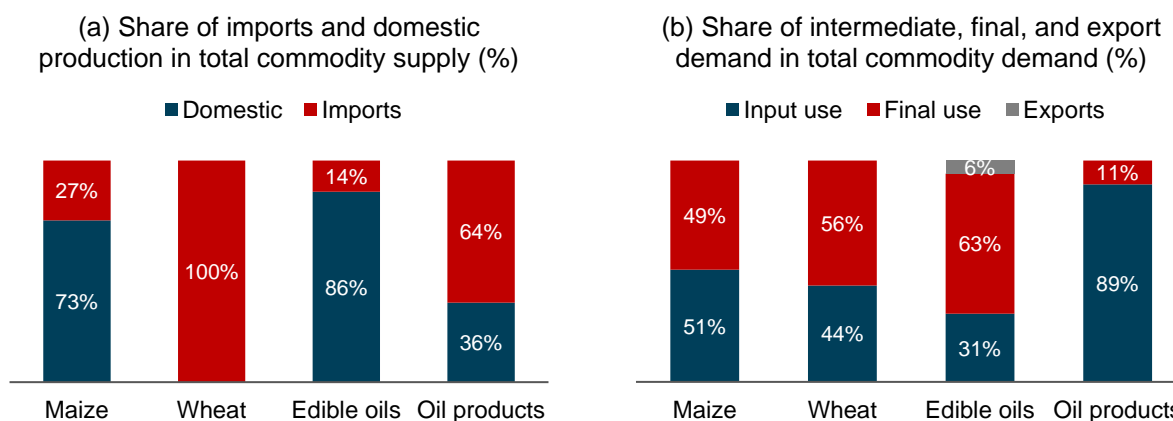
We use an economywide model of Senegal to estimate the impacts of the global price shocks on all sectors, workers, and households.² The model allows us to capture a range of considerations that will determine the overall impact of the crisis on the country. For example, the effect of higher world prices on Senegal's economy depends on the importance of the affected products in the total supply of each commodity, and whether local producers and consumers can readily substitute away from higher-priced imports. Senegal imports 27 percent of its maize and 100 percent of its wheat grain (Panel A in Figure 3), so international price movements are important even if international prices do not lead to corresponding changes in prices of locally produced goods.

Senegal is a small oil-producing country, but its domestic petroleum production accounts for only 36 percent of total supply and there are essentially no exports (Panel B in Figure 3). Higher oil prices benefit petroleum producers and create additional revenues for the government. However, since most oil comes from imports, and oil products are used as inputs into the production of other goods and services (89 percent of oil products in Senegal are used as inputs to other sectors; see Panel B in Figure 3), higher petroleum prices raise costs and reduce profitability throughout the economy.

² Information on the Rural Investment and Policy Analysis (RIAPA) data and modeling system can be found [here](#).

The transport sector is especially affected because its heavy use of petroleum products means that higher oil prices raise transport costs significantly. IFPRI's model tracks the flow of domestic and imported inputs between sectors and estimates the net effect on final product prices.

Figure 3. Breakdown of commodity supply and demand in Senegal, 2019

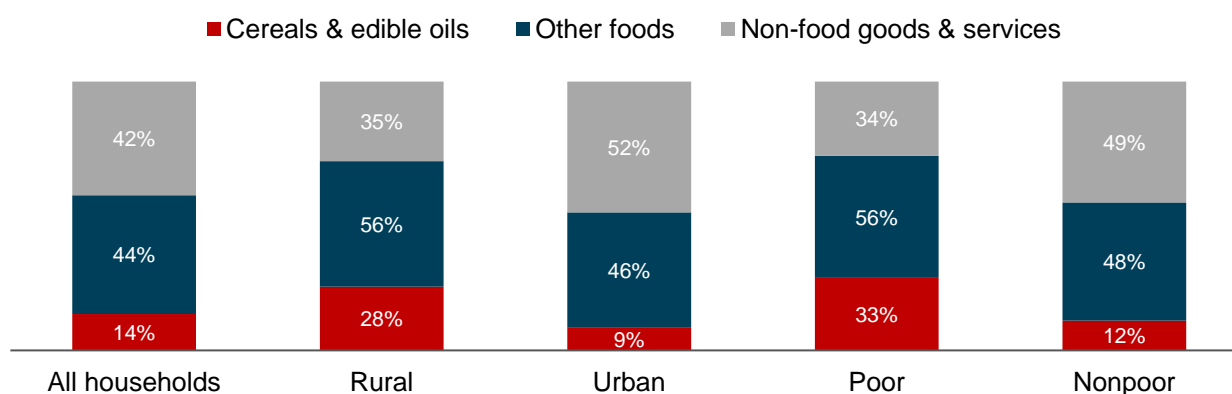


Source: Authors' calculations using social accounting matrix (SAM) data from IFPRI's Senegal RIAPA model.

Notes: Intermediates are products used as inputs in the production of other goods and services; final use includes private and public consumption and gross capital formation.

Impacts of the price shocks on households depend also on the importance of commodities in their consumption baskets. Cereals and edible oils make up 14 percent of the total value of household consumption in Senegal and about one-quarter of total food expenditures (Figure 4). The shares of cereals and edible oils in total food expenditures are much higher for rural households (28 percent) and poor households (33 percent).³ IFPRI's model tracks income and expenditures for these different population groups and is linked to a survey-based micro-simulation tool that tracks the consumption patterns of individual households.

Figure 4. Composition of household consumption spending in Senegal, 2019



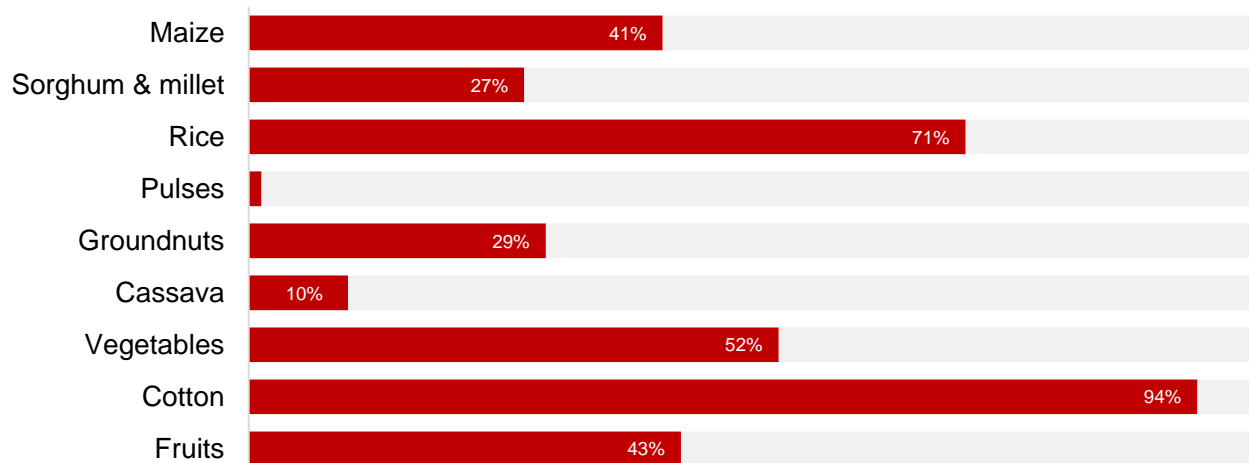
Source: Authors' calculations using social accounting matrix (SAM) data from IFPRI's Senegal RIAPA model.

Rising fertilizer prices 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. The fertilizer adoption rate varies significantly by crop in Senegal, with 71 percent of rice area and

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

almost all Irish potatoes cultivated with fertilizer versus 27 percent for sorghum and millet (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 a 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 5. Share of cultivated land using chemical fertilizers in Senegal



Source: Authors' estimates using data from the Harmonized Survey on Household Living Conditions (EHCVM) 2018/19, Senegal (<https://microdata.worldbank.org/index.php/catalog/4297>)

Most crop production in Senegal takes place between May and December, with planting of maize, millet, and sorghum from May to July and harvesting from September through December, depending on the onset of the rains. Senegal has two production seasons for rice, May through February and January through May, with support from irrigation during the dry season. The surge in world fertilizer prices may therefore have a major impact on fertilizer use and agricultural productivity across much of the country in 2022.

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 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).

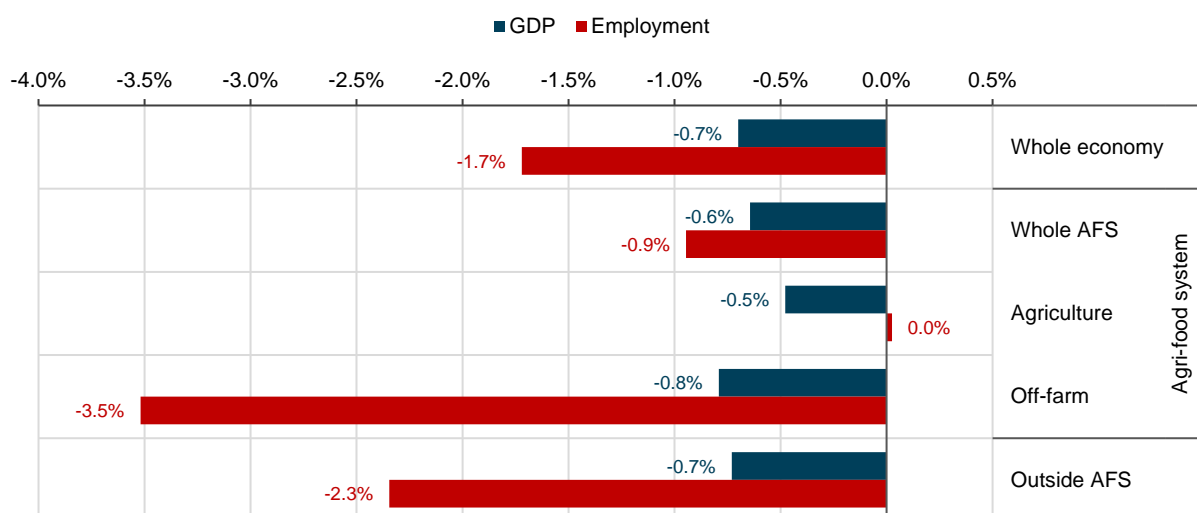
3. Impacts on Senegal's Economy and Agrifood System

The effects of the world price and fertilizer shocks on GDP and employment are significant but are not large compared to the size of the overall economy. Real GDP falls by 0.7 percent due to the combined effects of the negative terms-of-trade shock (that is, the negative effect of higher food and fertilizer import prices outweighs the positive effect of higher oil export prices), and rising import costs that reduce spending on domestically produced goods (Figure 6). Employment declines by 1.7 percent, as falling production leads to job losses. The percentage decline in agrifood

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].

GDP is slightly smaller than the decline in total GDP, and for the agrifood system, GDP losses are larger in the off-farm sector than in primary agriculture. Employment falls mainly in the off-farm sector of the agrifood system, 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 off-farm employment outside the agrifood system. At the national level, about three-quarters of the decline in total employment occurs outside of the agrifood system.

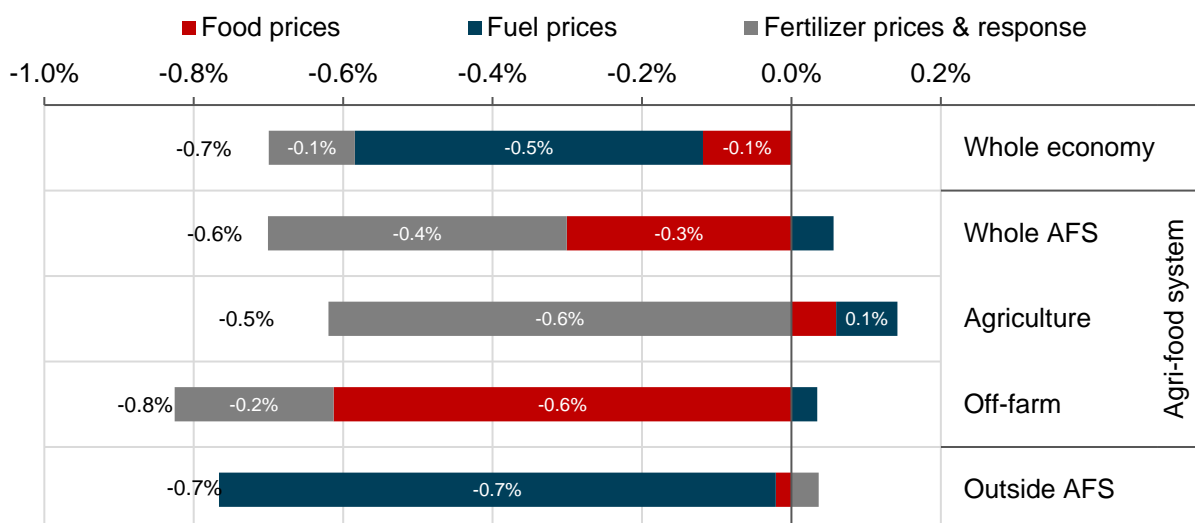
Figure 6. Percentage change in GDP and employment due to food, fuel, and fertilizer shocks



Source: Simulation results from IFPRI's Senegal RIAPA model.

Fuel shocks drive most of the decline in national GDP. However, within the agrifood system, food and fertilizer shocks, rather than fuel shocks, are important. For primary agriculture, fertilizer shocks, including reduced fertilizer use in response to higher prices, account for the entire decline in real GDP, while for the off-farm agrifood sector, food price shocks that increase the cost of food processing and food-related services are the dominant driver of GDP losses (Figure 7). GDP losses outside of the agrifood system are almost entirely driven by higher fuel prices, which raise transaction costs and market prices and reduce consumer demand. This explains why fuel shocks become the most important driver for the decline in total GDP.

Figure 7. Percentage change in real GDP decomposed by food, fuel, and fertilizer shocks

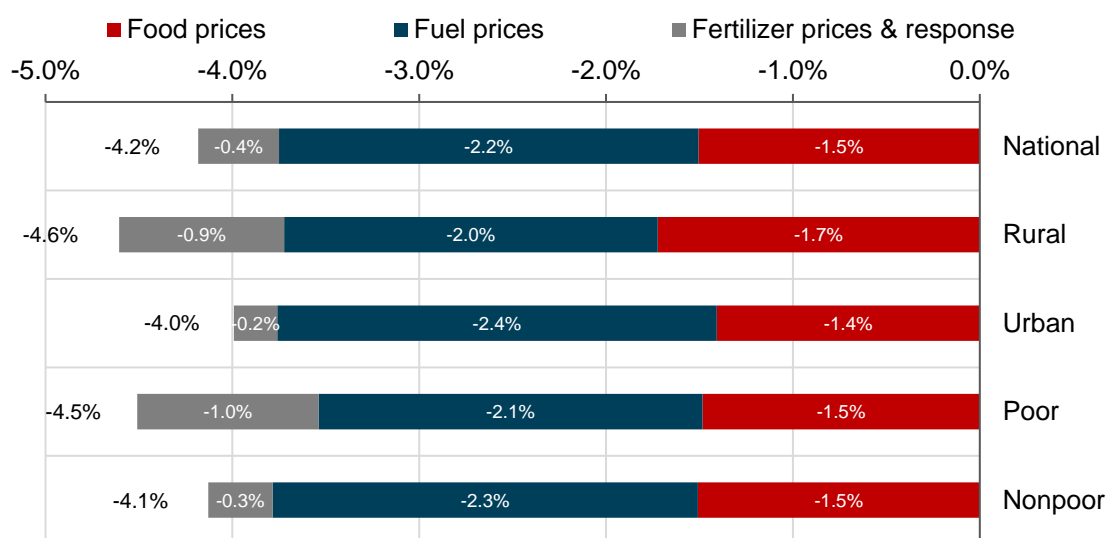


Source: Simulation results from IFPRI's Senegal RIAPA model.

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

Household consumption falls due to the crises, with larger losses for poorer and rural households. National consumption spending, including the value of home consumption, falls by 4.2 percent (Figure 8). 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. Most of the declines in consumption are driven by the fuel shocks, which explain 2.2 percentage points of the absolute decline in total household consumption, followed by the food price shock at 1.5 percentage points. Important differences in consumption outcomes arise across population groups, however. The fall in consumption is larger for poorer and rural households, mainly due to the larger impact of fertilizer shocks. Rural households earn more of their income from farming, and so are adversely affected by the decline in agricultural production following the increase in fertilizer prices. Poor households, including those in urban areas, are also affected by the indirect effects of the fertilizer shock on food supply, as reductions in agricultural income lead to reduced income in nonfarm sectors as well. On the other hand, fuel shocks are more important for explaining the declines in urban and nonpoor households' consumption. Urban and less poor households earn more income outside the agrifood system, have a relatively import-intensive consumer basket, and often consume products with larger transaction cost margins.

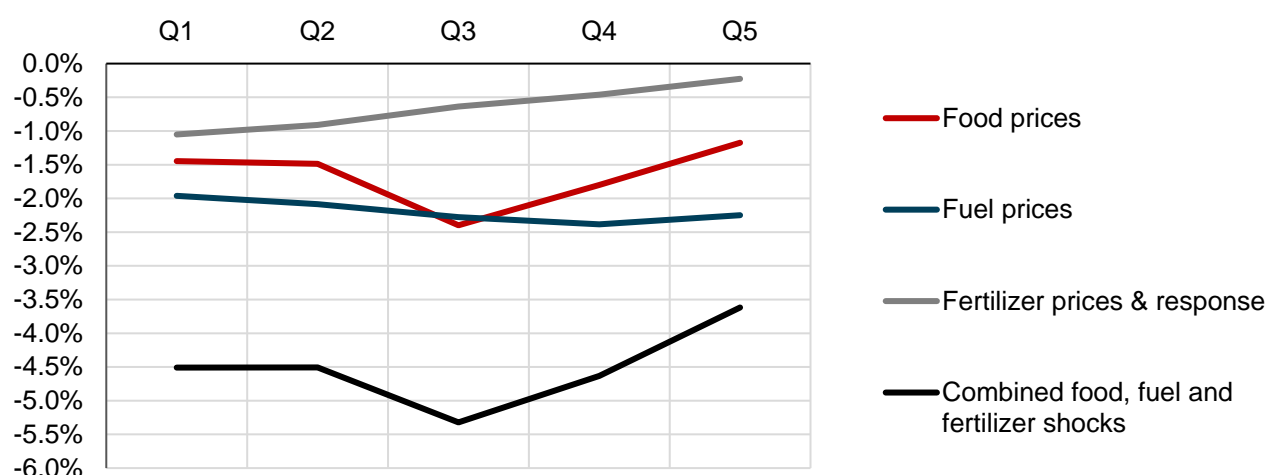
Figure 8. Percentage change in real household consumption due to food, fuel, and fertilizer shocks



Source: Simulation results from IFPRI's Senegal RIAPA model.

Inequality worsens, although all households are adversely affected. The food, fuel, and fertilizer shocks have different implications for (income) inequality in Senegal. The increase in fuel prices leads to slightly larger consumption losses for households in the fourth and fifth quintiles than for poorer households in the first quintile (Figure 9). 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 affects all income groups, with the largest impact on households in the third quintile. Overall, the combined effect of the world price shocks on household consumption is larger for those in the poorer quintiles, and the result of the global crises is therefore an increase in inequality within Senegal.

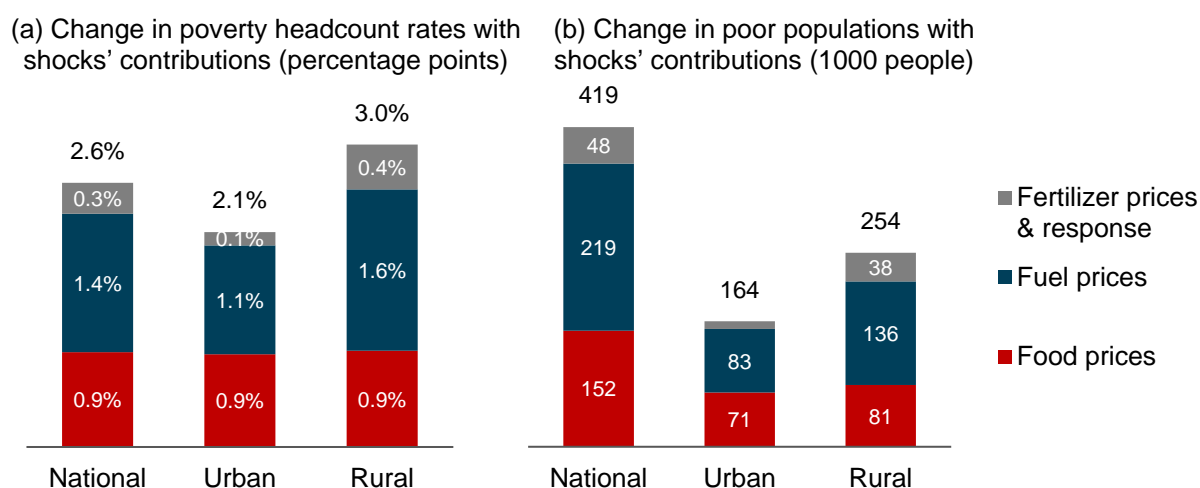
Figure 9. Percentage change in real household consumption across per capita expenditure quintiles



Source: Simulation results from IFPRI's Senegal RIAPA model.

Falling household consumption leads to greater poverty, particularly in rural areas. According to the most recent household survey in Senegal, 39 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 Senegal by 2.6 percentage points (see Panel A in Figure 10), equivalent to an additional 419,000 people falling below the poverty line (Panel B). More than one-half of the increase in poverty is caused by the fuel shock. Impacts on the rural poverty rate are larger and fertilizer shocks become more important than the increase in national poverty, although the dominant drivers are still the rising fuel and food prices. The larger absolute increase in the poor population is in rural areas, although the rural population is only slightly greater than the urban population. One additional reason is that Senegal's urban poverty rate was much lower than its rural poverty rate prior to the crises.

Figure 10. Changes in poverty due to food, fuel, and fertilizer shocks



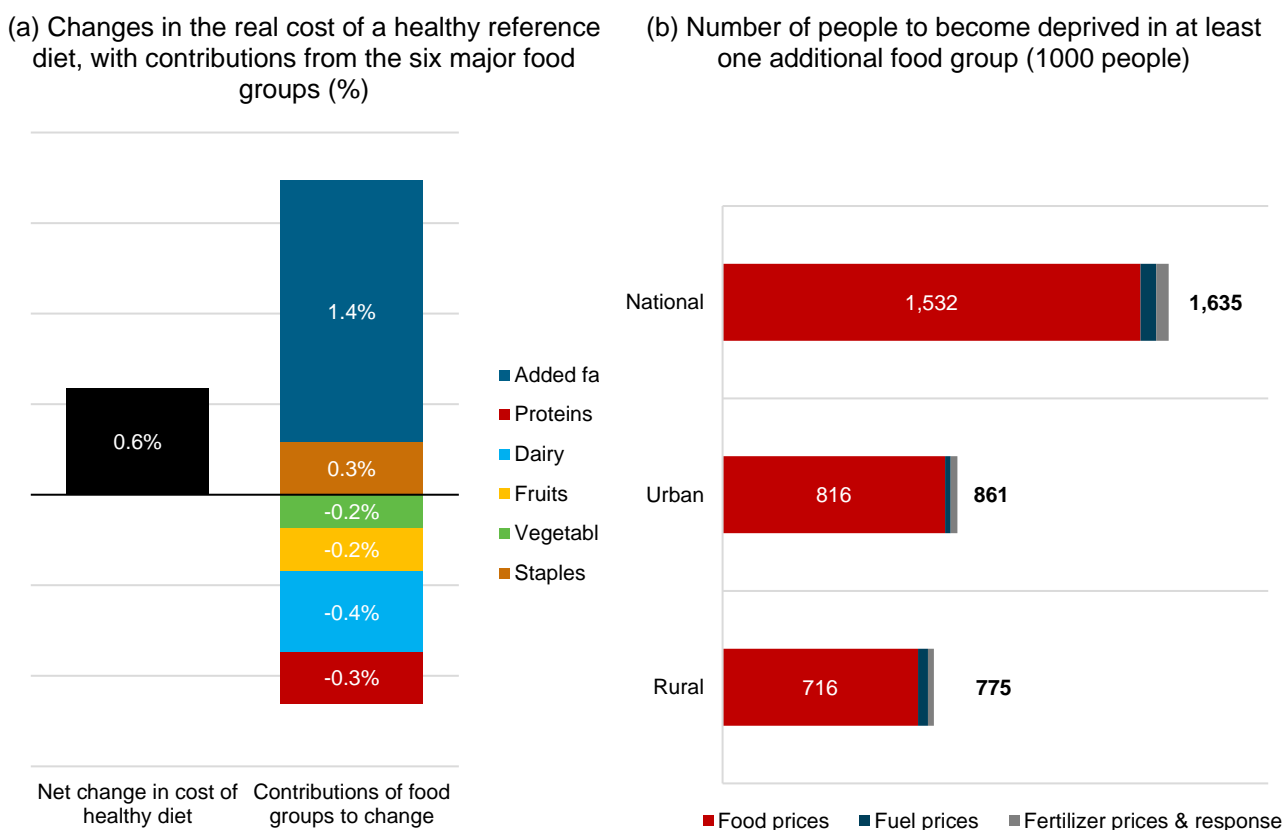
Source: Simulation results from the survey-based microsimulation module within IFPRI's Senegal RIAPA model.

Notes: 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 Senegal's 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.⁵ The combined food, fuel, and fertilizer shocks increase the CoRD by 0.6 per cent in real terms (Panel A in Figure 11).⁶ 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 palm oil import prices. However, falling household income reduces demand for vegetables, fruits, dairy, and proteins (meats and fish), and thus lowers their costs. The “staples” food group is dominated by maize, sorghum, millet, and root crops and is only modestly affected by higher wheat import prices. Moreover, staples currently dominate household consumption, 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 for vegetables, fruits, dairy products, and meats and fish are far below those required for a healthy diet among many households in Senegal. The falling costs of these food groups mask households’ deteriorating access to these foods due to falling incomes.

Figure 11. Changes in diet costs and household diet deprivation due to food, fuel, and fertilizer shocks



Source: Simulation results from the survey-based micro-simulation module within IFPRI's Senegal RIAPA model.

Diet quality 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 levels and diversity needed for a healthy diet in Senegal. Rising food prices cause 1.6 million people to become

⁵ For further information on the RIAPA model's diet module and indicators, see [Pauw et al. \(2021\)](#).

⁶ 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 (15.3 percent), vegetables (20.6), fruits (13.2), dairy (19.4), proteins (17.6), and added fats (13.8).

deprived in at least one additional food group. The urban population accounts for slightly more of the deterioration in diet quality than the rural population (Panel B in Figure 11).

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 IFPRI's economywide model – known as RIAPA – to simulate the impacts of the global crises on Senegal'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 households' 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 Senegal to contract, but that these declines are not large compared to the size of the economy. Most of the total GDP losses are driven by rising fuel prices, while within the agrifood system, rising food and fertilizer prices are the main drivers of GDP losses. For agriculture, fertilizer shocks rather than higher food prices are the main driver. This is because although the import prices of wheat and edibles oils are rising, Senegal is less dependent on food imports and many of its major food staples (sorghum and millet, for example) are less traded internationally. 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 poorer and rural households, leading to an increase in inequality in Senegal. 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 Senegal's households, and the gap between household consumption levels and what is required to achieve a healthy diet widens, mainly driven by higher food prices. While the global crises will cause a modest slowdown in Senegal'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 country 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.

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