

KIEL POLICY BRIEF

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Long-Run Impacts of the Conflict in Ukraine on Food Security in Africa

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- While the overall share of Africa's trade with Ukraine and Russia is small, the concentration of imports in products such as wheat, other grains and fertilizer is critical to food security.
- We use a long-run general equilibrium trade model to study three scenarios that may evolve as a consequence of the conflict: 1) Heavily reduced Ukrainian productivity in wheat and other grains, 2) Rising trade costs with Ukraine and Russia due to disrupted trade routes in the Black Sea and sanctions, and 3) A hypothetical ban on Russian grain export.
- The model simulations show that the conflict will severely compromise food security in some African countries. We document important cross-country heterogeneity in the severity of impacts.

OVERVIEW/ÜBERBLICK

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Keywords: Food security, Grains, Fertilizers, Africa, Ukraine conflict, General equilibrium trade model

- Russlands Invasion der Ukraine gefährdet die weltweite Verfügbarkeit von Getreide aufgrund reduzierter Produktion, geringeren Exporten, und gestiegenen Handelskosten. Dieser Policy Brief untersucht die möglichen langfristigen Auswirkungen des Konflikts auf die Ernährungssicherheit in Afrika.
- Während der Gesamtanteil des afrikanischen Handels mit Ukraine und Russland gering ist, sorgt die Konzentration von Importen aus diesen Ländern bei Produkten wie Weizen, anderen Getreiden und Dünger für eine Gefährdung der Ernährungssicherheit.
- Wir verwenden ein langfristiges allgemeines Gleichgewichtsmodell, um drei Szenarien, die in Folge des Konflikts entstehen könnten, zu analysieren. 1) Eine deutlich reduzierte Produktivität der Getreideproduktion in der Ukraine 2) Steigende Handelskosten mit der Ukraine und Russland aufgrund der gestörten Handelsrouten im Schwarzen Meer und 3. Ein hypothetisches Verbot russischer Getreideexporte.

- Die Modellsimulationen zeigen, dass der Konflikt die Ernährungssicherheit in einigen afrikanischen Ländern gefährdet. Wir dokumentieren wichtige Länderunterschiede in der Schwere der Betroffenheit.

Schlüsselwörter: Ernährungssicherheit, Getreide, Dünger, Afrika, Ukraine-Konflikt, Allgemeines Gleichgewichtsmodell

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1 Introduction

The global disruptions created by the Russian invasion of Ukraine comes on top of two already existing crises. First, global food prices have been soaring in recent years (IFPRI, 2022). Second, the COVID-19 pandemic has disrupted global supply chains and has had lasting consequences of livelihoods, especially of the urban poor, who have not yet recovered financially. In addition, increasingly poor harvests resulting from droughts and climate change have affected local producers and caused price increases. The “Desert locust swarm” in East Africa increased the pressure, affecting Somalia (which heavily relies on wheat imports from Ukraine and Russia), Kenya, Ethiopia, and Sudan.

These adverse shocks have spurred global demand for existing grain stocks which has put upward pressure on food prices around the globe. Currently, almost 50 countries worldwide are at risk of failing to reach the goal of zero hunger by 2030, according to Welthungerhilfe (2021). Their Global Hunger Index indicates a worrying situation arising from the combined impact of the COVID-19 pandemic, climate change, and conflicts that disrupt agricultural production. In 2021, the index showed that hunger remains an especially urgent issue for many African countries that already struggle with several macroeconomic challenges in the aftermath of the pandemic. Following these crises, the policy space in several countries has reduced, and debt vulnerabilities have increased amid growing financing needs.

Adding to these existing challenges, the situation for many African countries may severely worsen due to the conflict between Russia and Ukraine – two of the largest producers of agricultural commodities in the world (FAO, 2022). Together, Russia and Ukraine make up more than 10% of global wheat production and exports, and, while geographically distant from Africa, many African countries depend on imported grains from Russia and Ukraine to meet their consumption needs (see Section 2 for details).

There are several channels through which the conflict in Ukraine can affect food security in Africa.

First, the conflict directly impacts wheat imports and food security in some African countries. In Ukraine, factors of production are shifted towards defensive uses or missing for conflict-related reasons, and fields cannot be used due to the conflict. This leads to falling production

and export of grains. At the same time, Russia has temporarily banned grain exports to the Eurasian Economic Union states, a trading bloc of former Soviet countries, to protect its domestic market as a result of the massive sanctions that have been placed upon the country (World Grain, 2022). The invasion of key ports and the fighting along the Black Sea are disrupting trade routes, and infrastructure is being destroyed. This makes trade more difficult and costly. The disruption of agricultural production, agricultural inputs, and exports more generally will decrease the supply of grains on world markets and cause an increase in prices.

Second, there are indirect consequences of the conflict arising from the disruption of the markets for agricultural inputs, such as natural gas and fertilizers. This will reduce access to or increase prices of important yield-enhancing agricultural production technology, reducing producers' capacity to produce grains and leading to even higher food prices. Given the current situation, in which prices are already high, the conflict is likely to profoundly impact African households – especially net consumers of food at the bottom of the income distribution, i.e., poor landless workers in the countryside and especially in the cities. While all net consumers of food will be hit, the poor are the hardest hit by any given food price increase because they tend to spend a higher proportion of their income on food than richer households (see, e.g., Muhammad et al., 2011; Nsabimana et al., 2020). This means the effects will be especially pronounced in the poorest countries, and among these, the ones that import more relevant commodities and agricultural inputs. In this policy brief, we therefore put particular emphasis on African Development Fund (ADF) countries.

The conflict-induced rise in food prices will add to already existing inflationary pressures. Global inflation rose by 1.2 percentage points (from 3.2 to 4.4 percent) between 2020 and 2021. For countries that are net importers of food and energy, higher prices coupled with prolonged disruptions in global supply chains could exacerbate inflation. The most vulnerable countries are those where a large share of the population spends a high proportion of their incomes on food and, in particular, wheat, or depend heavily on fertilizer imports. For instance, the populations of countries such as Kenya and Nigeria spend more than 50% of their incomes on food consumption, according to data from 2016 (Our World in Data, 2016). Moreover, wheat consumption has increased during the last 20 years due to growing populations, changing food preferences, and other socioeconomic circumstances associated with urbanization and middle-class growth.¹ Notably, there are vast differences in African countries' import patterns from Russia and Ukraine. For example, Egypt's share of wheat imports from Russia and Ukraine

¹In some instances, there may be locally guaranteed prices on goods such as bread via private associations to counteract the inflationary pressures. Such guarantees, however, may put additional pressure on firms that may be forced to exit the market (see, e.g., Reuters, 2022). If such dynamics are at play, the long-term negative impact of the conflict may be even worse.

amounts to roughly 80%, whereas the corresponding share in Eritrea is only 40% (UNCTAD, 2022). On average, ADF countries are especially affected by the crisis through wheat imports, which made up 87% of the value of all agricultural products imported from Russia in 2020.

The conflict, beyond its impact on the import and prices of agricultural commodities, may have cascading effects. For instance, previous research shows that adverse shocks to food access and higher food prices lead to child malnutrition (Arndt et al., 2016), poorer health among children (Woldemichael et al., forthcoming), and lower educational attainment (Wodon and Zaman, 2010). The rise in food prices due to the conflict also raises memories of the 2007–2008 food riots and the 2011 Arab Spring when sharply rising food prices sparked violent social unrest (e.g., Soffiantini, 2020). And currently, the prolonged conflict and civic unrest in Sudan is exacerbated by the rising prices of bread.

This Policy Brief aims to quantitatively shed light on how the conflict in Ukraine affects food security in Africa, especially the poorer ADF countries, and investigate its impacts across countries subject to different baseline dependency of grains import. To this end, we use the Kiel Institute Trade Policy Evaluation (KITE) trade model (Felbermayr et al., 2022). In short, the model simulates the possible long-term consequences of the conflict for African countries, depending on their initial dependency on Ukrainian or Russian imports. We consider three scenarios that plausibly could evolve as a result of the conflict:

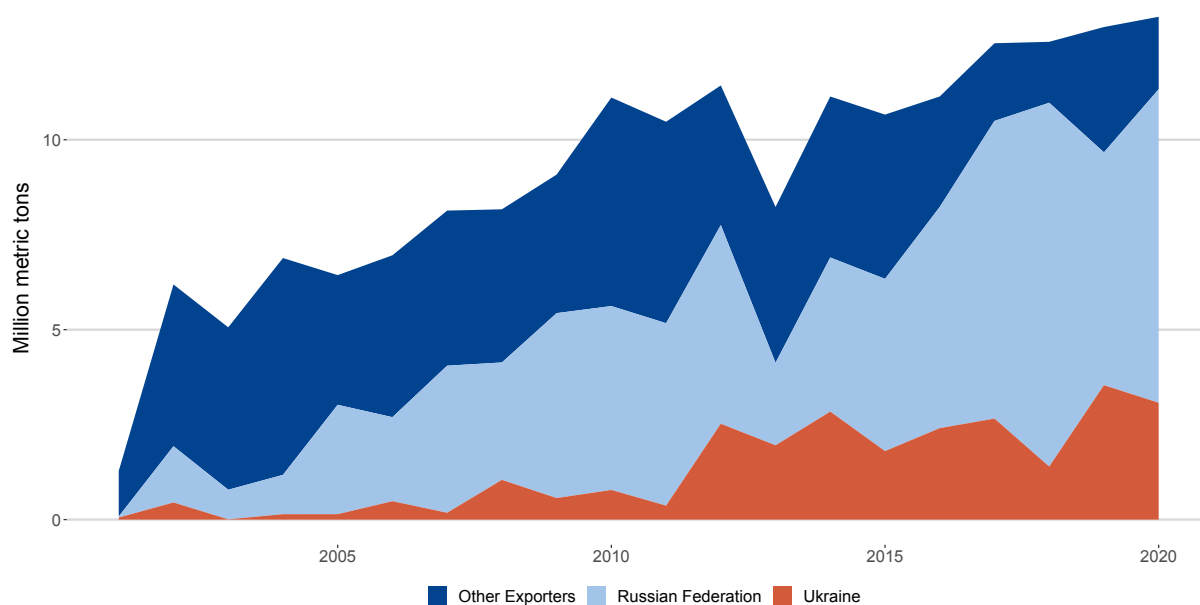
The first scenario solely looks at the effects of a decrease in productivity in Ukraine, which will result in lower production. The second scenario adds an increase in trade costs of exports from Ukraine and Russia to the first scenario. The third scenario puts a Russian export ban on wheat and other cereals on top of the two previous scenarios.

2 Ukraine's and Russia's Importance for African Food Security

In 2020, Russia's top five exports to ADF member countries consisted of wheat, petroleum oils, fertilizers, primary forms of iron (or steel), and maize. Wheat alone accounted for 31.5% (US\$1.13 billion) of ADF countries' total wheat imports of almost US\$3.2 billion. For Ukraine, wheat, maize, and vegetable fats and oils made up 43% of total goods exports to ADF countries. Of the US\$1.13 billion worth of agricultural products that ADF countries imported from Russia in 2020, about 87% was wheat, and 7% was sunflower oil. The main ADF countries that import wheat from Russia include Sudan, Tanzania, and Kenya. When including the richer non-ADF countries, Egypt is the lead wheat importer. Both Russia and Ukraine account for roughly 40%

of ADF countries' total wheat imports. These figures suggest that the disruption of agricultural production caused by the conflict between Ukraine and Russia will significantly impact ADF countries relying on grain imports.

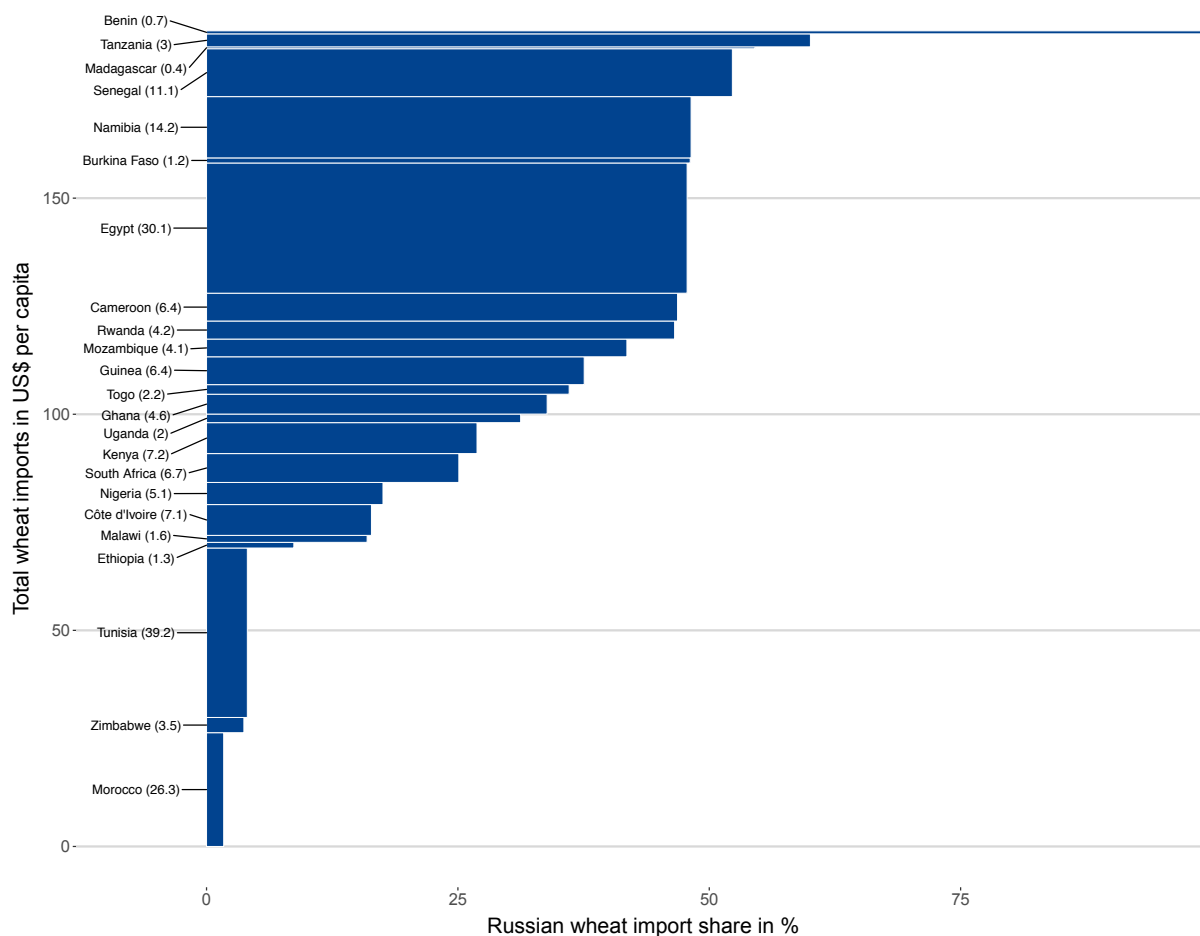
The most vulnerable ADF countries are those whose populations spend a larger proportion of their incomes on food consumption. For instance, in Ethiopia, Sudan, Comoros, and Sao Tome and Principe, households spend more than 60% of their income on food consumption and across ADF countries, wheat consumption has steadily increased during the past 20 years because of growing population, changing food preferences and socioeconomic change associated with urbanization and growth in the middle class. The importance of imported grain for food security also extends to some non-ADF countries. In Egypt, for instance, wheat represented over 35% of caloric intake per person in recent years (see IFPRI, 2022 and also Figure 1).



Source: Comtrade, Own Calculations.

Figure 1: Egypt's Wheat Imports

As Figure 2 shows, in per capita terms, the two countries that are most dependent on imports from Russia are Benin and Mozambique. However, in countries like Sudan, Tanzania, and Kenya that have higher per capita consumption and larger populations, the overall dependence in volumes is far greater. Partly also driven by their larger populations, the greatest absolute import dependence can be found in larger non-ADF countries such as Senegal, Namibia, and Egypt.



Source: Comtrade (2019), WDI (2019), Own Calculations.

Figure 2: Share of Wheat Imports from Russia (Total Wheat Imports per Capita in Brackets)

Given the central role of Ukraine and Russia in global food production and the dependence on some African countries on imports from them, to get an overview of the severity of the situation, it is crucial to investigate the impact of the conflict on countries while accounting for the differences in dependency on the particular crops imported from Russia and Ukraine.

3 Model, Scenarios, and Results

We carry out our scenario analyses with the Kiel Institute Trade Policy Evaluation (KITE) model (Felbermayr et al., 2022), which is based on the trade model proposed by Caliendo and Parro (2015). KITE is a computable general equilibrium model of international trade that pays particular attention to the intra- and international input–output linkages, important characteristics of today’s world economy, where countries are closely linked through global value chains. The

model quantifies the effects of changes in bilateral trade barriers on 65 sectors in 141 countries, covering more than 90% of economic activity worldwide. We use standard sources of data to calibrate this model. The global input-output-database GTAP 10 provides us with detailed information about intra- and international input-output linkages and, thus, about global value chains. Furthermore, standard sources such as the UN Comtrade database for trade data as well as WITS and MacMap for tariff data are used to define the baseline scenario (status-quo) in our model. Therefore, direct and indirect trade effects such as trade diversion and real income effects can be quantified, and international value chains are explicitly taken into account.

The KITE model provides long-run estimates. That means the results indicate the new equilibrium after producers in other countries have adjusted their production in response to changes in the prices of products and inputs. Short-term price increases and the transition paths to a new equilibrium cannot be investigated using the model and are hence not part of our analysis. For this type of analysis, other model types can provide estimates. The model also features full employment and a friction-less transition from one sector to another. This highlights the long-run horizon of the model. Therefore it underestimates the short-term consequences of the subsequent scenarios.

Although grain is traded on the world market, differences in price impacts between countries can arise because of differences in trade costs. Compared to an otherwise identical country A, if country B faces higher trade costs, B will benefit less from other producers stepping in to make up for shortfalls in supply from Ukraine or Russia. The long-run price increase in B will then be higher than in A in the new equilibrium.

The model is used to examine three scenarios of how Russia's invasion of Ukraine affects imports and prices of wheat and cereals in Africa in the long run.

3.1 Scenario 1: Reduced Ukrainian productivity due to the conflict

What are the long-run effects of Russia's invasion of Ukraine on African grain imports? To estimate the impact of such a scenario, we assume a baseline setting in which the invasion hampers Ukraine's production capabilities. Due to the invasion, Ukraine can no longer use part of its land for agricultural production, and relevant production inputs such as energy must be shifted towards defensive purposes. We model this scenario as Ukraine's productivity falling by 50%. As Ukraine is one of the largest grain exporters in the world – and especially relevant to Africa – and sowing season is approaching, such an adverse shock will noticeably reduce the access to grains across the African continent.

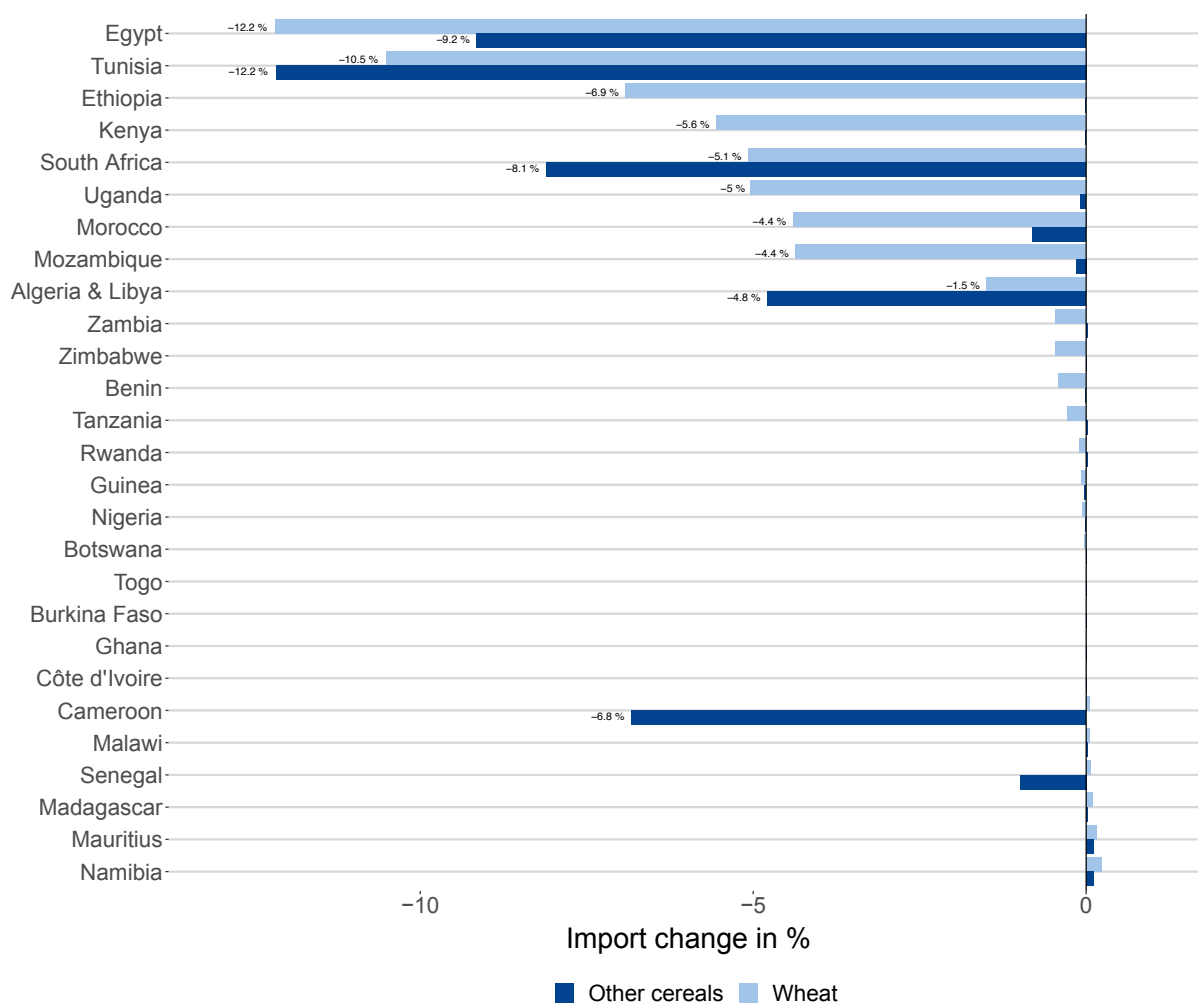


Figure 3: Scenario 1: Change in Wheat and Cereals Imports

Figure 3 shows the model’s predicted change in wheat and cereals² import by country. Importantly, these are total imports, not just imports from Ukraine. In the new equilibrium, countries will source their wheat and other cereals from other producers, but price changes and sectoral reallocation will induce changes. In terms of reduced wheat imports, the most heavily affected countries are Egypt (−12.2%), Tunisia (−10.5%), and Ethiopia (−6.9%). For other cereals such as corn or sorghum, the most heavily affected countries are Tunisia (−10.5%), Egypt (−12.2%), and South Africa (−5.1%). Overall, these results suggest that halving Ukraine’s productivity would significantly impact African grain imports, but there are important heterogeneities across countries. The effect is especially pronounced in countries that consume grains they buy on the world market. As a result of contracted grain production, prices will rise, in some cases dramatically.

²Other cereals: maize (corn), sorghum, barley, rye, oats, millets, other cereals.

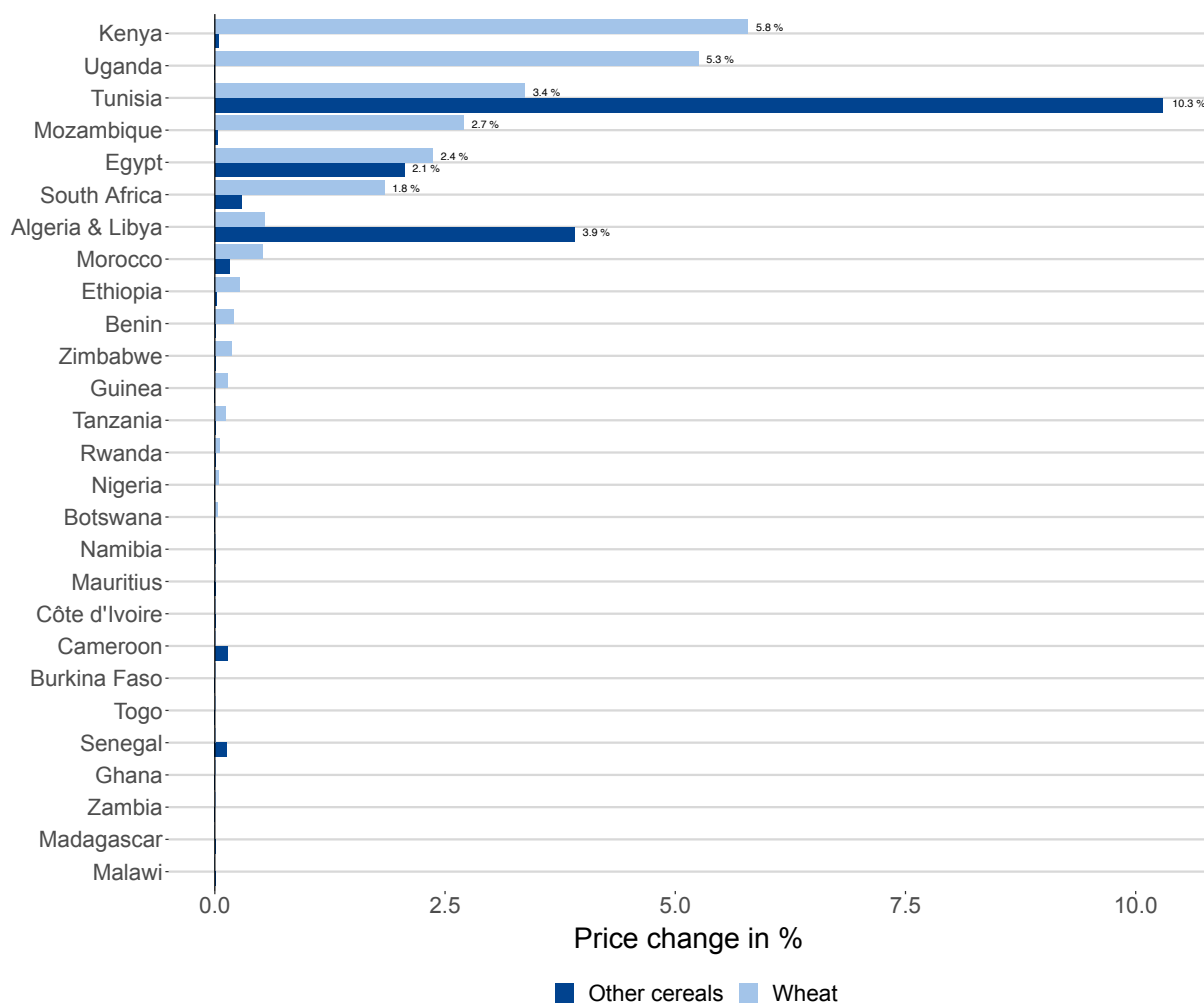


Figure 4: Scenario 1: Change in Wheat and Cereal Prices

Figure 4 shows the corresponding effects on prices. The long-run increase in wheat price would be nearly 6% in Kenya, 8% in Uganda, 5.3% in Uganda, and over 3% in Tunisia. According to the simulation, other cereals would become more than 10% more expensive in the long term in Tunisia, almost 4% in Algeria and Libya, and more than 2% in Egypt. These other cereals comprise, among others, corn and barley, which are imported in substantial volumes by countries such as Tunisia to feed animals and are especially relevant whenever grazing land is stressed. The results under scenario 1 are severe but vary tremendously across countries. The hardest hit ADF countries are Uganda and Mozambique.

3.2 Scenario 2: Reduced Ukrainian productivity and rising trade costs due to the conflict

Consider now the case that, in addition to halving Ukrainian productivity, trade costs with Ukraine increase by 50% and with Russia by 25%. This scenario reflects the fact that the invasion impacts Ukraine's production capabilities and that overall trade costs have risen. Critical infrastructure, such as bridges, roads, and especially ports, have been destroyed in Ukraine, and the cost of shipping in the Black Sea has risen dramatically (see, e.g., FAO, 2022).³ Moreover, due to the heavy sanctions imposed on Russia, the costs of engaging in trade with Russia have increased.

The main difference in mechanisms compared to scenario 1 is that due to an increase in trade costs that affects all sectors of the Ukrainian and Russian economies, spillovers can arise via other supply chains too.

³Rising trade costs reflect both that the insurance cost of shipping goods via the Black Sea has increased and that producers now must use alternative means of transportation such as railway. This raises costs due to the change in means of transportation and the longer travel routes.

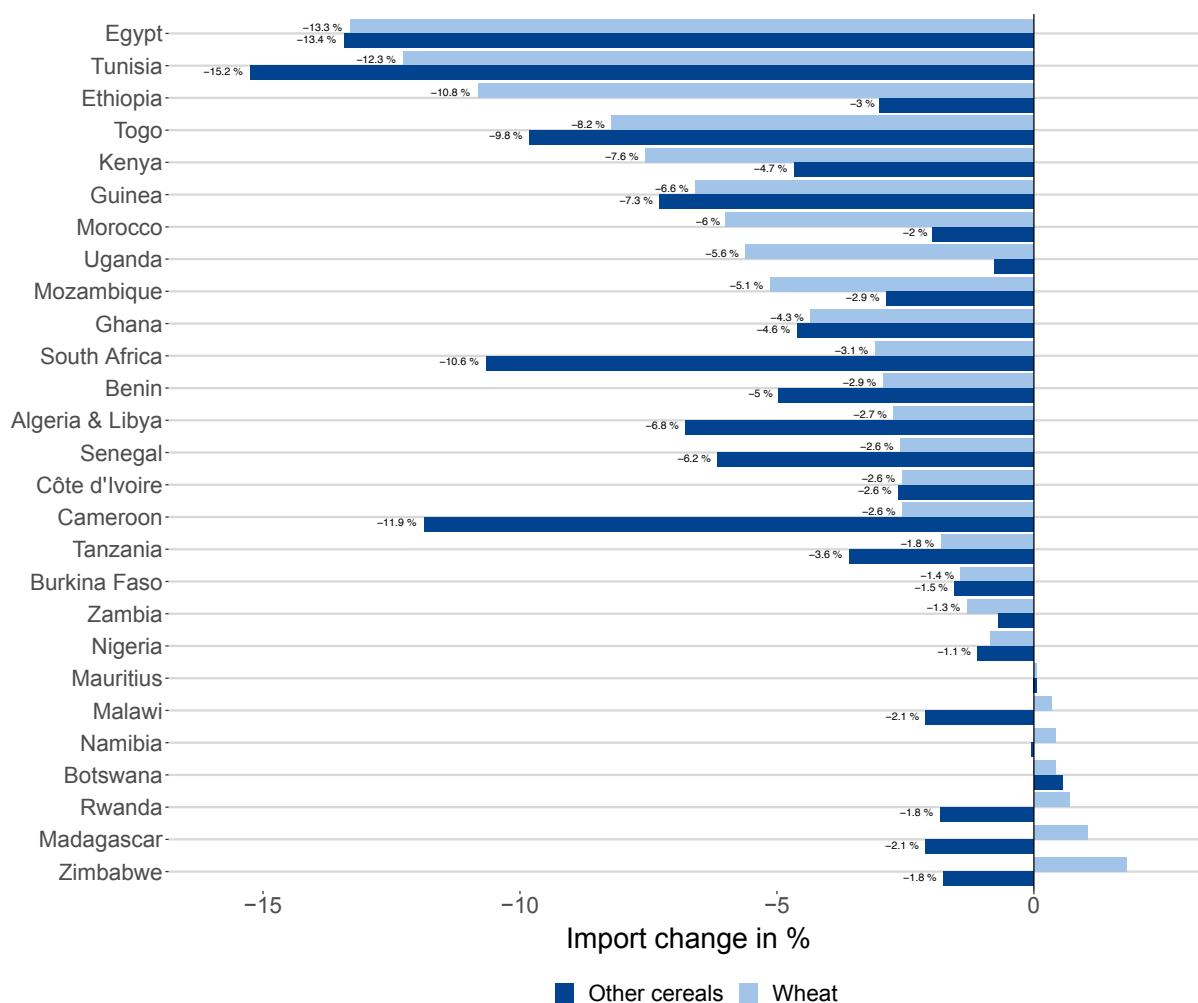


Figure 5: Scenario 2: Change in Wheat and Cereals Imports

Figure 5 displays the model's predictions under scenario 2. Compared to scenario 1, we note that a much larger set of countries are affected. Imports fall across most African countries. The reason is that not all African countries are dependent on Ukrainian production of grains, but the effects of rising trade costs are more widespread because they affect other commodities or goods. For example, among the most important categories of Ukrainian exports are machinery and fertilizer. In this scenario, wheat imports fall most heavily in Egypt (-13.3%), Tunisia (-12.3%), and Ethiopia (-10.8%). For other cereals, Tunisia (-15.2%), Egypt (-13.4%), and Cameroon (-11.9%) are most heavily affected. The figure highlights substantial heterogeneity even within the group of ADF countries.

Similar to the results on imports in scenario 2, Figure 5 shows that the price impacts too are more widespread than in scenario 1. The most notable long-run price increase for wheat occurs in Kenya (5.8%), Uganda (5.2%), and Tunisia (4.3%). The figure indicates that local prices of certain grains fall slightly for a few ADF countries, which may be the result of producing more

wheat domestically in the long run.

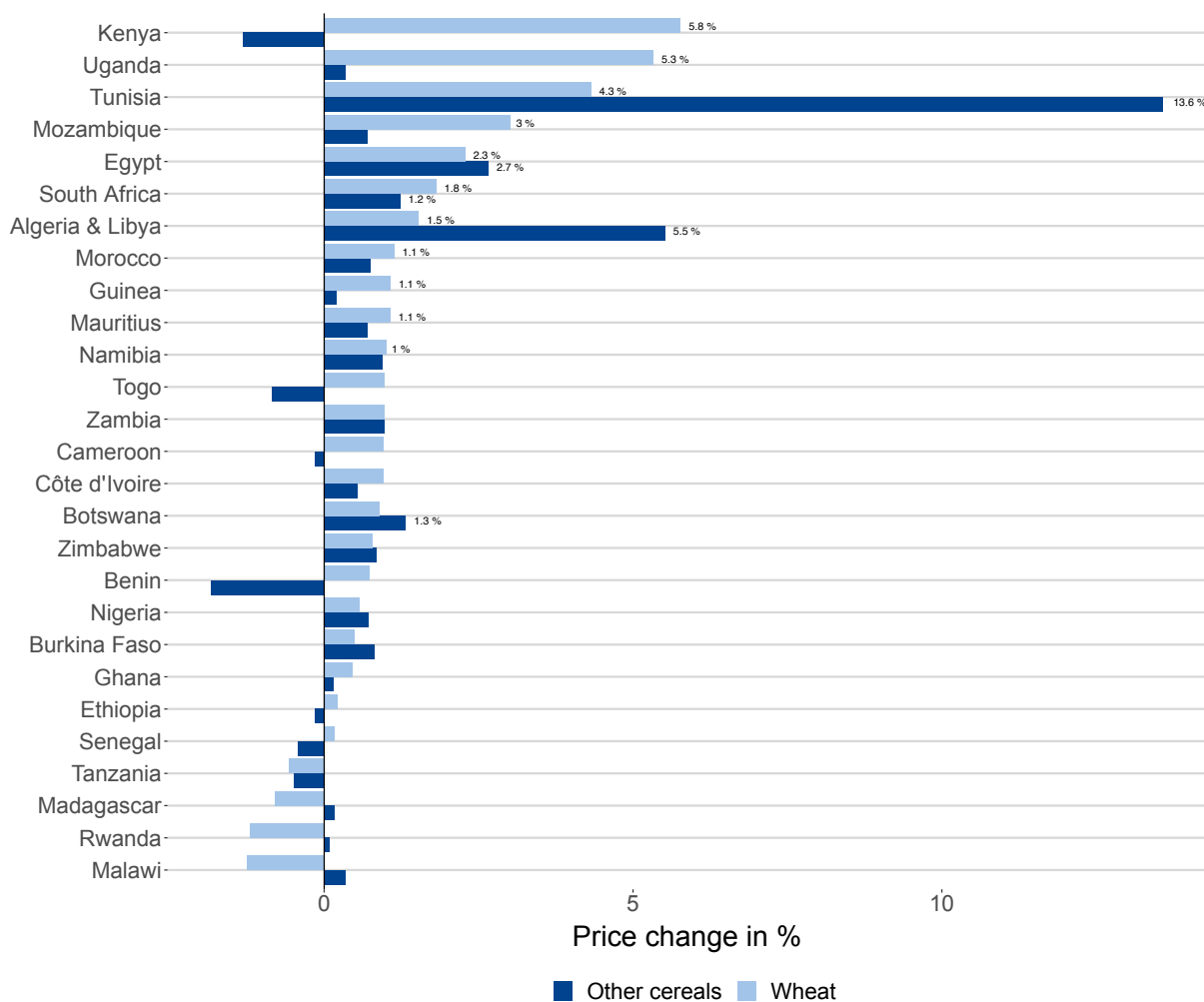


Figure 6: Scenario 2: Change in Wheat and Cereal Prices

3.3 Scenario 3: Reduced Ukrainian productivity, rising trade costs, and a hypothetical export ban of wheat by Russia due to the conflict

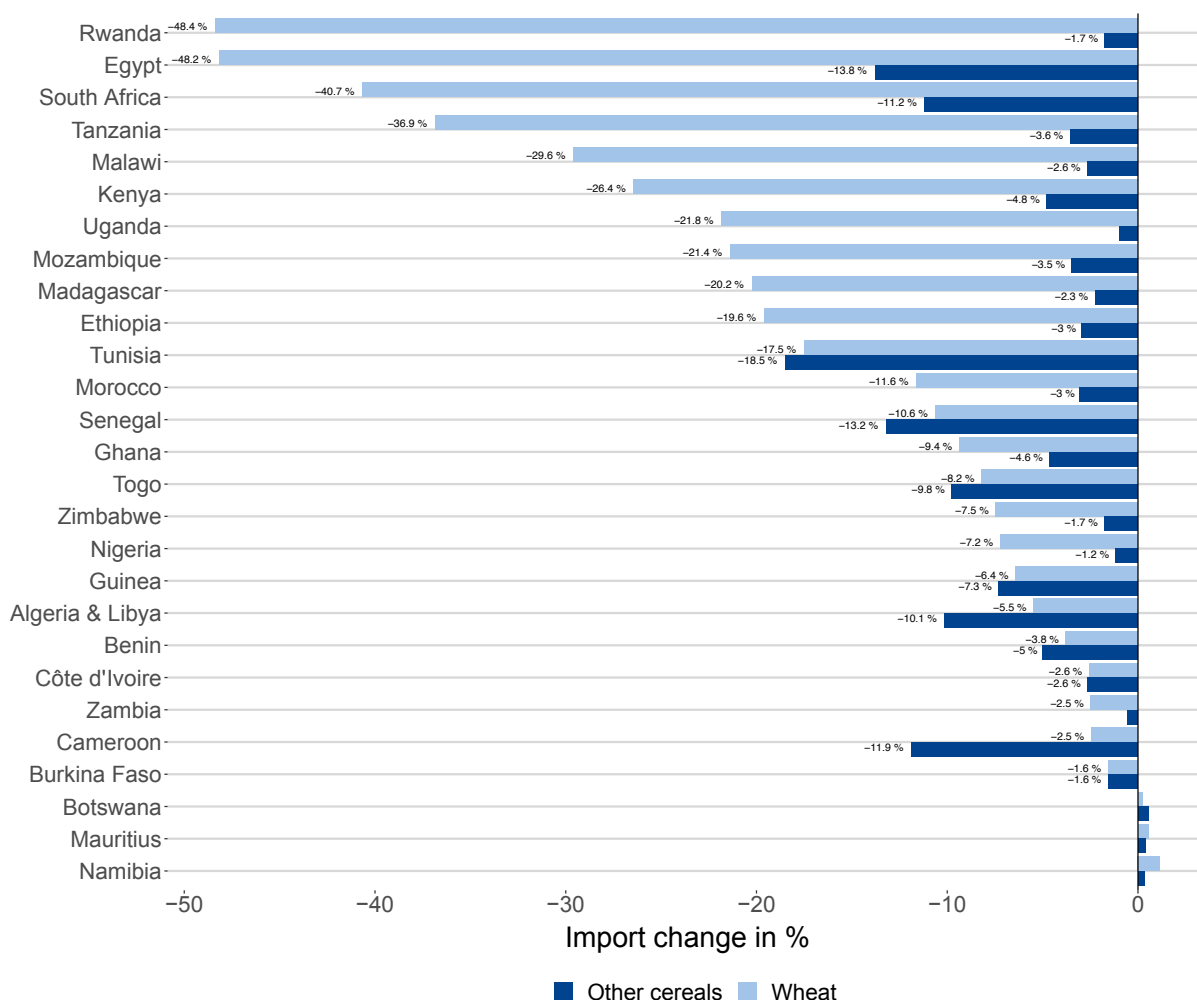


Figure 7: Scenario 3: Change in Wheat and Cereals Imports

As the third and final scenario, we consider the hypothetical case where, on top of scenario 2, Russia bans its producers from supplying wheat to the world market. This scenario is largely hypothetical since there are currently no indications that Russia would impose a ban on grains exports. However, Russia has imposed a temporary ban on a bloc of former Soviet states (World Grain, 2022), rendering this scenario not completely unlikely.

The model predictions from scenarios 1 and 2 are largely reflected also under scenario 3, but the magnitude of impacts is considerably larger. In addition, in this scenario, we note substantial differences across the two categories of grains (Figure 7). This is partly due to Russia being a particularly important exporter of wheat and more specialized in wheat compared to other grains than Ukraine. The estimated impact is thus almost entirely focused on wheat imports

rather than import of other cereals. The reduction of wheat imports under scenario 3 is the largest for Rwanda (−48.4%), Egypt (−48.2%), and South Africa (−40.7%). The hypothesized stop to Russian grain exports would thus amplify the wheat-related effects in the models.

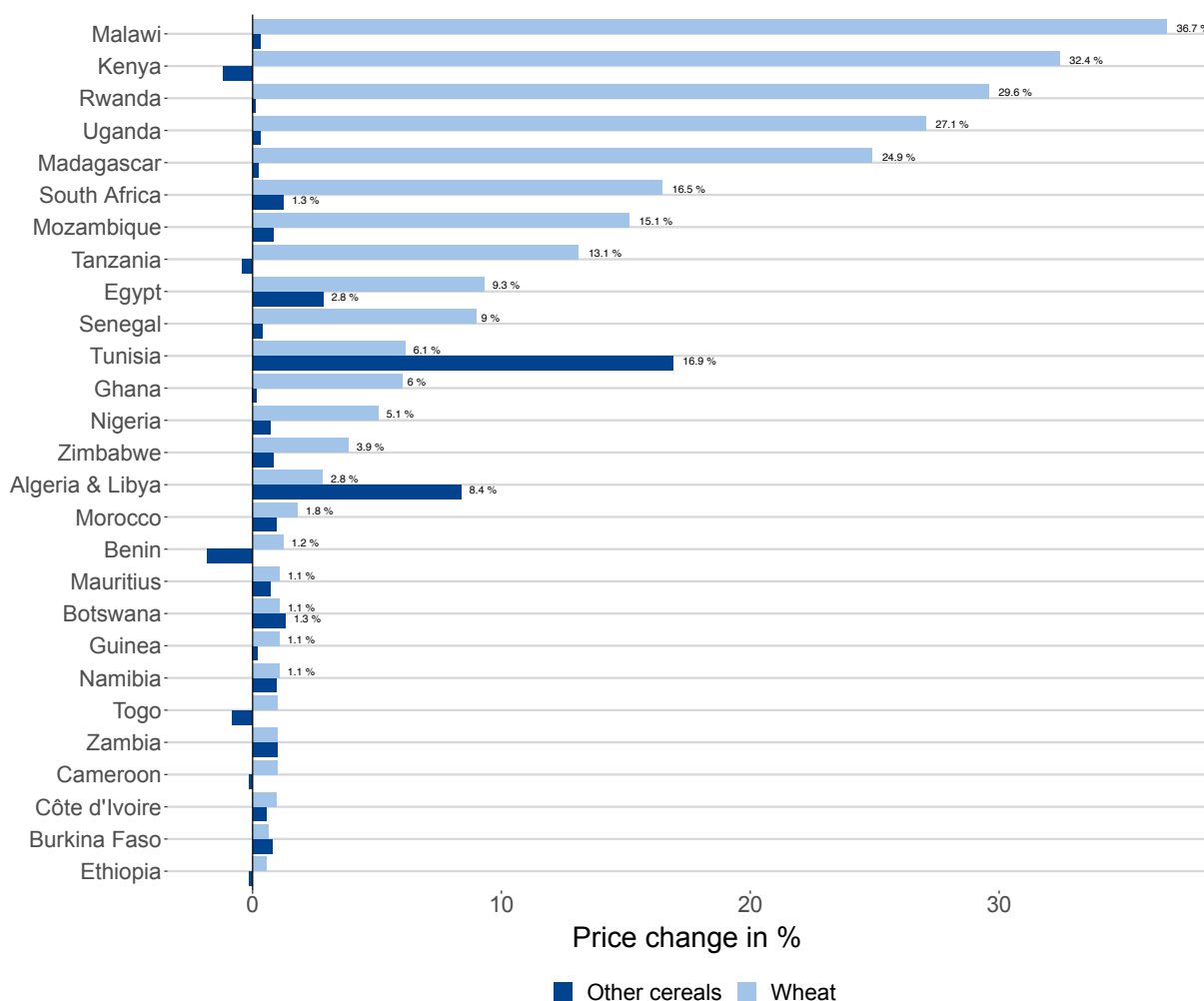


Figure 8: Scenario 3: Change in Wheat and Cereal Prices

The changed impacts on wheat are further reflected in long-run prices. Figure 8 shows that the three most affected countries in terms of wheat prices under this scenario are Malawi (36.7%), Kenya (32.4%), and Rwanda (29.6%).

4 Final Remarks

Our model estimates show that all three scenarios have severe consequences for food security in some African countries. Countries differ in the extent to which they are dependent on Ukraine and Russia in their imports of wheat and other grains. The strength of the effect of wheat

imports depends on the import dependence and the local consumption patterns. Countries that have higher per capita imports of wheat because they consume substantial amounts and produce little are hardest hit.

What policy responses can be used to ensure food security and cushion the effects for consumers? Food prices can be stabilized in the short term through targeted release and replenishment of food reserves and policies that build national food reserve systems. Several countries have in the past shielded their populations from global price increases through subsidies, in particular price controls. However, these kinds of subsidies risk not being well-targeted. Debt sustainability issues also mean that the fiscal space to cushion the population from the price increases is quite limited. In the short-run, several African countries, especially among the ADF countries, will need financial support in dealing with this crisis and the previous ones.

Our model estimations are long-run estimates, so they speak most readily to longer-term impacts of policies. One lesson of the current crisis is that countries should avoid being overly dependent on any single supplier of food and should diversify their imports of crucial goods and commodities to be more resilient to idiosyncratic shocks. Higher diversification was not conducted previously because it used to come at a higher cost for imports. However, the geopolitical risks and consequences for food security that have been laid bare should be considered by policymakers in the future.

The longer-run response can also include creating higher degrees of self-sufficiency in food in African countries and build on trade across the continent. Surplus production in well-suited growing locations in Southern Africa could then be exported to countries like Egypt that are key net importers. An important factor in this will be increasing productivity. For this mechanization, suitable new varieties and complementary infrastructure need to be developed. To ensure that capital, labor, and land are not misdirected, it will be important to consider how competitive wheat production can become. When planning such interventions.

Boosting local cereal production in Africa will be important to mitigate global supply risks. There is evidence that, with the right support, Africa's small-scale farmers can feed themselves and their countries' urban populations. Such interventions often work best if they bring together the private sector, international NGOs, national and international research centers, and governments.

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APPENDIX

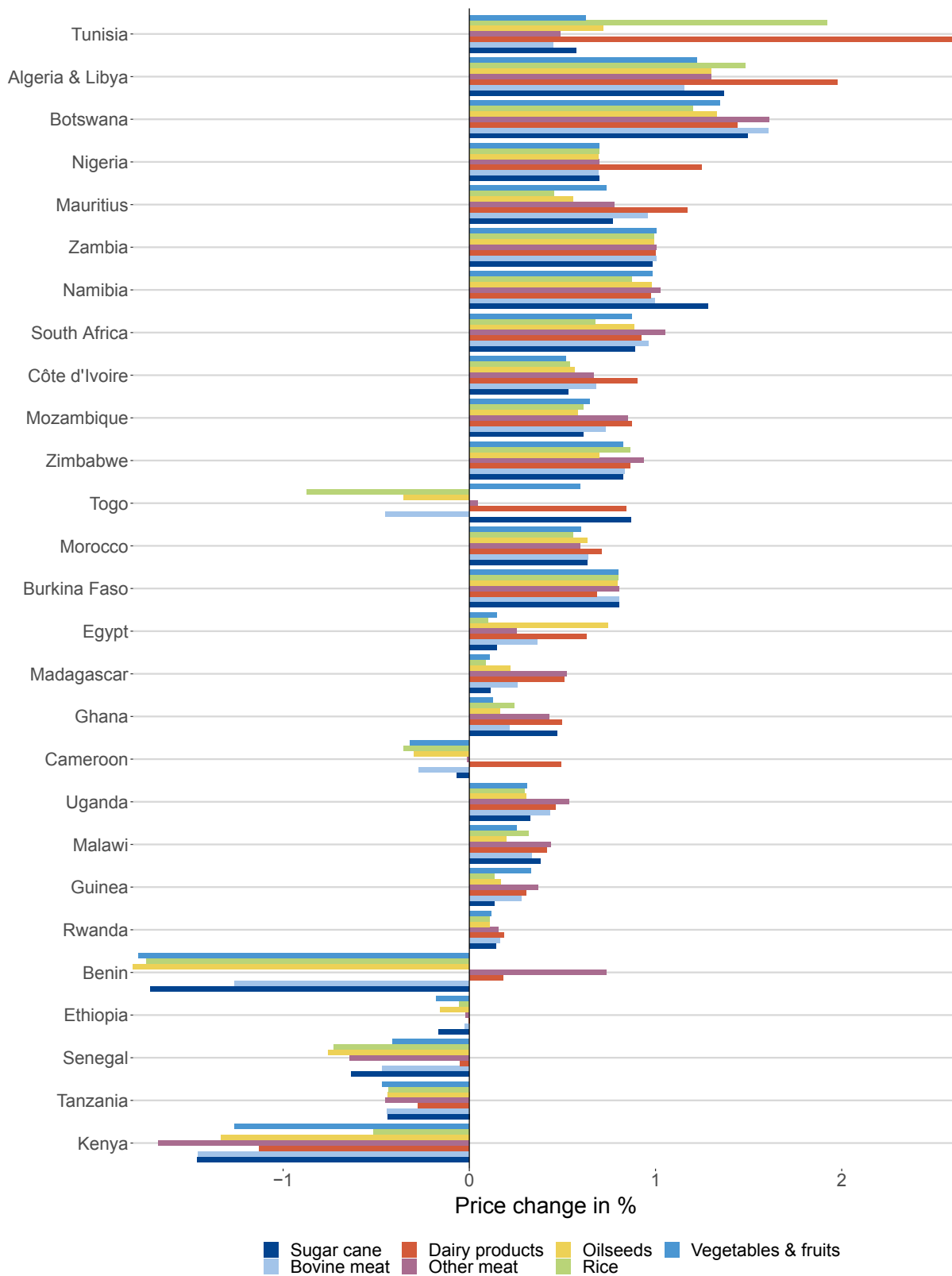


Figure 9: Scenario 3: Change in Other Food Prices

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