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Repercussions of the agri-food crisis at local and regional level

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List of Abbreviations

Abbreviation	Full name
ASAJA	Association of young farmers
CAP	Common Agricultural Policy
COMTRADE	UN International Trade Statistics Database
CPI	Consumer Price Index
ECB	European Central Bank
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
IGC	International Grains Council
MAPA	Spanish Ministry of Agriculture
NUTS	Nomenclature of Territorial Units for Statistics
OEC	Observatory of Economic Complexity
TFEU	Treaty on the Functioning of the EU
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value Added Tax
WITS	World Integrated Trade Solution

Executive summary

Russia's full-scale invasion of Ukraine has had a considerable impact on the EU food market, which had already been suffering from disrupted supply chains in the wake of the global COVID-19 pandemic. As most EU countries benefit from well-developed agricultural production, the availability of grains and food is not at stake in the European Union. However, certain EU countries show some trade dependencies on supplies from Ukraine and Russia, while others are also vulnerable to losing export destinations in Eastern Europe, including Ukraine, Russia and Belarus. Moreover, the ongoing war is continuing to have a considerable effect on prices.

This report aims to assess, in qualitative and quantitative terms, how the Russian invasion of Ukraine is affecting the EU countries and regions that are among the most impacted by the consequences of the war. Among the most negatively affected countries and regions, the study reviews Poland and Spain by taking into account (i) the border with Ukraine and Russia; (ii) their reliance on food supplies from Ukraine and/or Russia; and (iii) their vulnerability to increasing inflation due to supply shortages. As for the most resilient countries, we consider Hungary and Germany, based on their strong local production levels and low dependency on imports from Ukraine and Russia.

Overall, the analysis suggests that in terms of grain supplies Spain is the most exposed country to the devastating effects of the war, and Hungary the least, due to its self-sufficient grain production and export controls introduced since the outbreak of the war. However, export controls do not provide a long-term sustainable solution and maintaining resilience is proving to be difficult for all considered countries overall. This is either because of the absence of strong local production of the commodity groups affected by sanctions and supply shortages, and/or due to a large dependence on Russian energy supplies, which makes it impossible to avoid price increases on basic commodities such as food and agricultural products. Even Germany, which has strong production at local level and does not have a large trade dependence on Ukrainian supplies, still remains highly vulnerable to growing inflation, mainly stemming from the increased prices of energy and fertiliser supplies from Russia. Hungary, which is a self-sufficient grain producer, is also unable to avoid spikes in prices for the same reasons. The increase in prices, moreover, is hitting the affordability of basic consumer goods, particularly among those low-income households for whom affordability of proper meals was already an issue before the outbreak of the war. Among others this refers to Hungary, where the prevalence of food insecurity is the most severe among the countries included in the study.

Further challenges include the lack of seasonal workers coming from Ukraine, shortages in Ukraine's commodity supplies for feeding farm animals, and the loss of the main destinations for the EU's key export categories. For instance, Germany, in particular the regions of Mecklenburg-Vorpommern, Saxony-Anhalt, Lower Saxony and Brandenburg, is suffering from an insufficient number of seasonal workers from Ukraine, who used to contribute to harvesting cherries. Spanish regions, particularly Catalonia and Galicia, show a high level of vulnerability to Ukraine's supplies of maize, which is largely used for feeding farm animals. And Polish regions have been hit by decreasing exports of their major export products to Eastern Europe, including Ukraine, Russia and Belarus. The Mazowieckie region (Grójecki in particular), which is specialised in the production and export of apples, and the Lubelskie region, which specialises in the production and export of hops, are the best examples of such regions.

The effects of the ongoing war in Ukraine are aggravated by the systemic problems related to climate change and the unsustainable use of natural resources, which risk further distortions of agricultural production in all of the regions under consideration.

As the study shows, having strong local production of grains and fertilisers (and their components) is very helpful in providing sufficient local supplies of food and agricultural produce during such crises. In addition, diversifying both import and export markets by unlocking trade potential with like-minded countries, as well as moving towards smart specialisation, are very important for boosting resilience at the regional level. Expanding production capacities, however, should not materialise at the expense of compromising environmental concerns, as climate-related problems are already challenging in these regions. The prevention of food waste should be promoted, including by increasing public awareness, and more sustainable use of resources should be encouraged. To this end, the newly adopted Spanish Bill on the Prevention of Food Loss and Waste could serve as a good example on how to minimise food waste in the EU.

Mobilising financial support schemes at national and EU level should continue to ease the pressure of supply shortages and rising prices, particularly on low-income families and small-scale farmers in the EU Member States. Financial support should be better tailored to the regions that show high exposure to the effects of the war.

When designing policy interventions, having a strong regional dimension could be an effective tool for addressing challenges at local level. Pursuing protectionist policies by introducing price caps and export controls, as Hungary is currently doing, does not provide sustainable and long-term solutions to systemic economic challenges.

1 Introduction

1.1 Causes of the crisis

Russia's full-scale invasion of Ukraine has had a huge impact on the EU food market, which had already been suffering from disrupted supply chains in the wake of the global COVID-19 pandemic. A negative impact stemming from the outbreak of the pandemic has been seen, for example, with Chinese manufacturers restricting exports of fertilisers in as early as summer 2021 (Brown and Wang, 2022). Currently, due to drastic production and transportation constraints caused by the ongoing war in Ukraine, the EU is concerned about how to maintain food supply and affordability threatened by global supply shortages, high market prices and inflationary trends.

Ukraine, a major global supplier of maize, wheat, rapeseed and sunflower oil, is currently facing the destruction and illegal appropriation of its agricultural production by Russia, Russian attacks on its transport infrastructure, and the Russian blockade of its Black Sea ports. Moreover, Ukraine is witnessing a significant diversion of its labour force away from the agricultural sector (Financial Times, 2022), as many Ukrainian farmers are fighting in the ongoing war, have left the country or do not have access to land, inputs or equipment as a result of the war.

The sanctions imposed by the EU against Russia exclude critical supplies from the agricultural and food sector, and are not responsible for the food security crisis[1]. However, trade is still affected by difficulties in settling payments when dealing with Russian banks that are subject to the EU's financial sanctions. Nevertheless, it is Russia, with its own restrictions on food and fertiliser exports, that is driving up prices even more, both in the EU and globally.

[1] So far, the EU sanctions have only targeted vodka, caviar and fertilisers, and exclude all other supplies from the agricultural and food sector (European Council, 2022a).

1.2 What are the shortages?

The main products currently in short supply are basic commodities such as maize (corn), wheat, rapeseed and sunflower oil, of which Ukraine is one of the leading producers and exporters in the world. In 2021, Ukraine produced 50% of global exports of sunflower seed oil (making it the number one global exporter of that product), 16% of maize global exports and 12% of wheat global exports (European Council, 2022b). Before the outbreak of the war, Ukraine was an important supplier of maize to the EU countries. In 2020 and 2021, Ukraine provided around one third of EU imports of maize (42% in 2019, 30.5% in 2020 and 29.1% in 2021. See Table 1). Imports of vegetable fats and oils from Ukraine were also sizeable, as Ukraine provided around a quarter of EU imports in this product category before the war (around 24% between 2019 and 2021. See

Table 2).

Table 1. The EU's top cereal import partners, import share as %

Year	Partner	Barley (%)	Partner	Maize (%)	Partner	Wheat (%)
2019	France	41.6	Ukraine	42	France	25.1
2019	UK	13.0	Brazil	13.9	Canada	9.2
2019	Germany	9.2	France	9.3	Germany	7.7
2019	Ukraine	8.3	Hungary	5.3	Hungary	6.2
2019	Hungary	4.0	Romania	5.0	Bulgaria	5.8
2020	France	32.0	Ukraine	30.5	France	20.6
2020	UK	20.5	Brazil	13.2	Canada	13.9
2020	Germany	10.7	France	12.9	Germany	8.7
2020	Hungary	7.9	Hungary	8.4	Hungary	7.3
2020	Denmark	4.3	Romania	5.6	US	6.7
2021	France	24.8	Ukraine	29.1	France	21
2021	Germany	17.7	France	11.8	Canada	10.8
2021	UK	11.0	Brazil	11.7	Germany	9.0
2021	Hungary	7.4	Hungary	7.2	Hungary	6.2
2021	Denmark	5.2	Romania	6.8	Czechia	5.8

Source: Authors' calculations using UN COMTRADE data (2022).

Disruptions in global supplies of these commodities, together with restricted energy trade with Russia, have been raising the prices of food and agricultural produce. Since the Russian invasion of Ukraine, prices on wheat futures markets have increased by 70%. The global food industry has shown an 8 to 20% price increase. By February 2022, food prices in the EU were already 5.6% higher compared to the same period in 2021 (European Parliament, 2022). Grain and oilseed prices surge, as it is difficult to forecast how long the disruptions in supplies will last and how severe they will be. Some also argue that the war in Ukraine was anticipated, among others, by the four large multinational corporations (the Americans Archer-Daniels-Midland, Bunge and Cargill, and the French Dreyfus, collectively known as the ABCDs) which control most of the

grain trade. It is estimated that they control between 70 and 90% of the international grain market and hold stocks of global significance. Thus, since they are powerful on the financial markets, they could have profited from speculations on wheat prices (Bourgeois, 2022).

As for Russian supplies, the country is also a major global exporter of vegetable oils, wheat and barley, as well as an important player in the fishery sector. The EU's dependence on Russian supplies is mainly on energy resources and fertilisers.

Table 2. The EU's top fertiliser and vegetable oil import partners, import share as %

Year	Partner	Vegetable fats and oils	Partner	Inorganic fertilisers
2019	Ukraine	23.0	Russia	19.6
2019	Spain	17.1	Germany	8.4
2019	Netherlands	7.0	Belgium	6.4
2019	Germany	6.8	Egypt	6.2
2019	Tunisia	4.8	Belarus	6.0
2020	Ukraine	23.9	Russia	16.3
2020	Spain	13.1	Germany	8.8
2020	Germany	7.5	Belgium	7.3
2020	Netherlands	7.1	Morocco	7.1
2020	Tunisia	6.6	Egypt	6.0
2021	Ukraine	24.2	Russia	17.4
2021	Spain	12.4	Belgium	7.5
2021	Germany	8.3	Egypt	7.5
2021	Netherlands	6.2	Germany	7.2
2021	Hungary	4.8	Morocco	6.8

Source: Authors' calculations using UN COMTRADE data (2022).

Before the war, Russia was on average the source of around a fifth of EU imports of inorganic fertilisers (19.6% in 2019, 16.3% in 2020 and 17.4% in 2021. See

Table 2). In addition, Russia is also a global supplier of potash, an important component in the production of fertilisers. As, together with Belarus, Russia provides more than a quarter of global potash supply (Government of Canada, 2022), it can directly affect the supply and prices of potash as well as fertilisers. This can be destabilising for the EU countries, with their extensive use of fertilisers. For instance, the use of inorganic fertilisers is high in all of the countries considered, particularly Germany, Hungary and Poland (see Table 3 below).

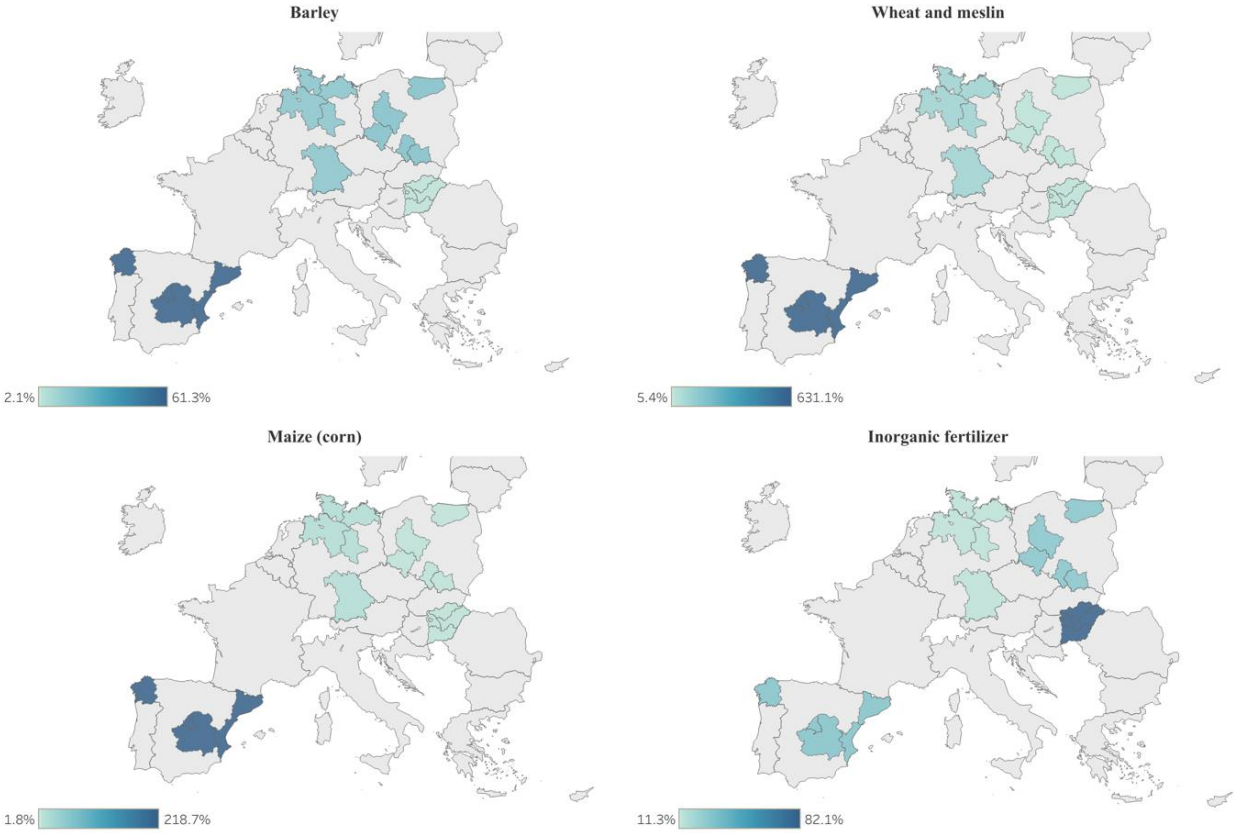
Table 3. Fertiliser indicators: use of chemical or mineral fertilisers

Year	Member State	Use per area of cropland			Use per value of agricultural production		
		nitrogen	phosphate	potash	nitrogen	phosphate	potash
2019	Germany	115.18	20.80	35.22	27.47	4.96	8.40
2020	Germany	106.68	16.20	37.63	25.05	3.80	8.84
2019	Hungary	92.67	25.50	22.25	45.19	12.44	10.85
2020	Hungary	106.71	26.85	23.31	50.12	12.61	10.95
2019	Poland	90.70	31.49	49.06	33.23	11.53	17.97
2020	Poland	80.92	28.57	43.92	26.96	9.52	14.63
2019	Spain	60.34	28.63	22.02	19.24	9.13	7.02
2020	Spain	63.64	29.24	24.00	18.30	8.41	6.90

Source: Authors' calculations using data from FAO (2022).
Note: Use per area of cropland is measured as the ratio between the totals of agricultural use of chemical or mineral fertilisers and the area of cropland (kg/ha). Use per value of agricultural production is measured as the ratio between the totals of agricultural use of chemical or mineral fertilisers and value of agricultural production (kg/USD thousand).

Import dependency measured as the ratio of import-export balance illustrates the drastic difference in resilience among the countries and regions under consideration across different commodities. In 2021, the most import-dependent commodities were wheat and meslin, whereas the least import-dependent commodity was barley (see Figure 1). In terms of resilience, Spain is the most import-dependent country in the sample, and thus less resilient and more vulnerable to foreign supply shocks. In 2021, annual imports of wheat and meslin in Spain were 631.1% higher than its exports. Spain's import dependency shows similar patterns for maize (imports 218.7% higher than exports) and barley (imports 61.3% higher than exports). Hungary is identified as the least exposed Member State to foreign supply volatility. In terms of wheat, barley and maize, Hungary's imports are less than 6% of its exports in the same commodity categories (2.1% for barley, 5.4% for wheat and meslin, and 1.8% for maize). However, Hungary remains highly dependent on imports of inorganic fertilisers (82.1%). In Germany and Poland, imports in all selected commodity categories remain below the exports.

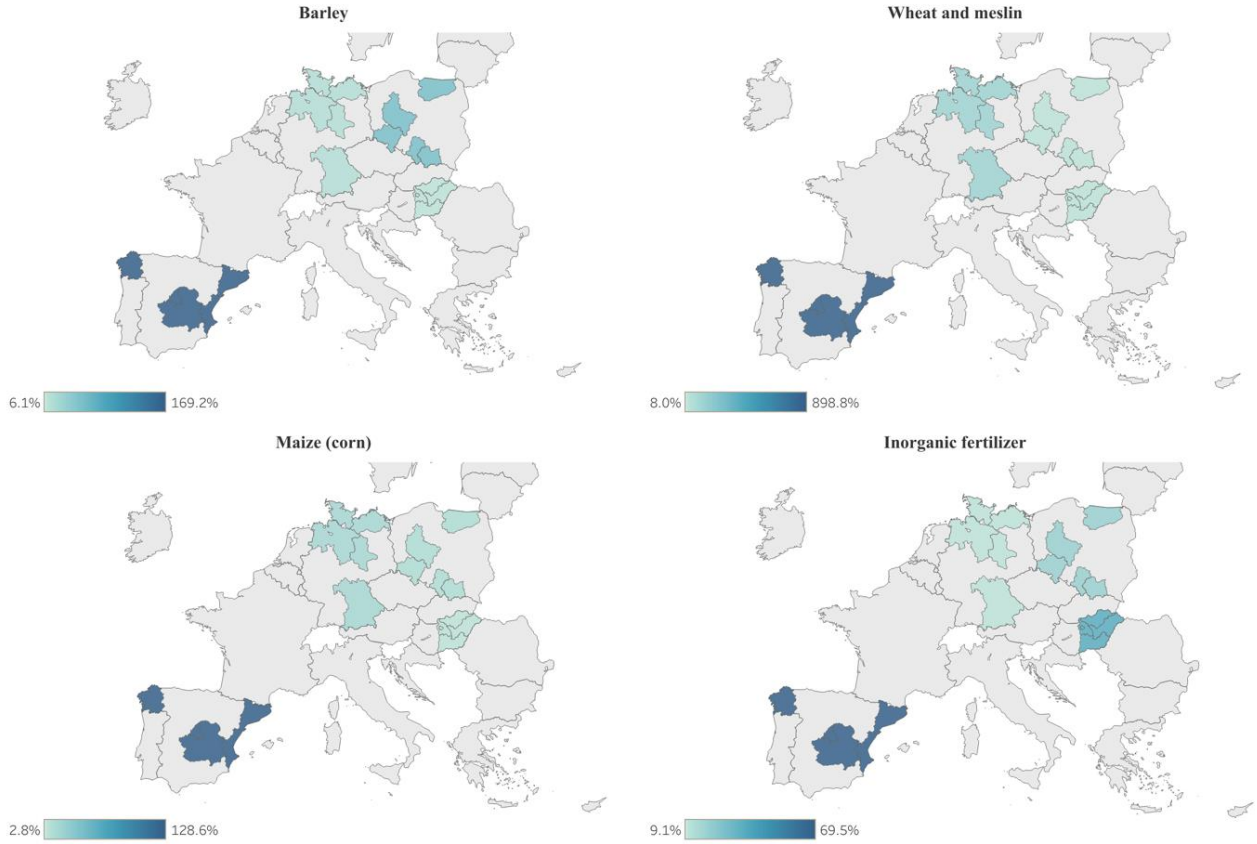
Figure 1. Import dependency in selected commodities as ratio of annual imports to exports in 2021, %



Source: Authors' calculations using UN COMTRADE data (2022).
Note: Limited variation within country is due to lack of regional data and resulting data projection exercise.

Data projections for the first quarter of 2022 show a similar pattern to the annual data for 2021 (see Figure 2). According to the data projections, Spain is identified as the most import-dependent Member State, and Hungary as the least. In Spain, in all categories except for maize, import dependency increased compared to the first quarter of the previous year (169.2% for barley, 898.8% for wheat and meslin, and 69.5% for inorganic fertilisers). Hungary's import dependency of inorganic fertilisers seems to decrease to 35.8% from 82% in 2021.

Figure 2. Import dependency in selected commodities as ratio of quarterly imports to exports in Q1 2022, %



Source: Authors' calculations using UN COMTRADE data (2022).
Note: Limited variation within country is due to lack of regional data and resulting data projection exercise.

Distorted trade of basic commodities should also be considered in the context of the food insecurity that existed in the EU before the outbreak of the war. According to the data provided by Eurostat, between 2019 and 2021, food insecurity was assessed as a moderate to severe problem by more than 10% of the Hungarian population, more than 8% in Spain, more than 7% in Poland and more than 3% in Germany. The highest share of food insecurity as a severe issue was registered in Hungary (see Table 4). These numbers hint at the vulnerabilities of the countries in the study to the increase in the prices of basic consumer goods as a result of the outbreak of the war.

Table 4. Food security indicators: prevalence of food insecurity in the total population of the Member States, three-year average

Year	Member State	Prevalence of food insecurity (%)		Number of food-insecure people (million)	
		moderate to severe	severe	moderate to severe	severe
2018-2020	Germany	3.4	0.7	2.9	0.6
2019-2021	Germany	3.5	1.1	2.9	0.9
2018-2020	Hungary	8.6	1.4	0.8	0.1
2019-2021	Hungary	10.6	2.1	1.0	0.2
2018-2020	Poland	5.8	N/A	2.2	0.2
2019-2021	Poland	7.4	0.9	2.8	0.4
2018-2020	Spain	8.8	1.8	4.1	0.9
2019-2021	Spain	8.6	2.0	4.0	0.9

Source: Author's calculations using data from FAO (2022).

Note: Food insecurity: A situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life (FAO, 2022). Prevalence of food insecurity is calculated as the percentage of people in the population who live in households classified as severely (or moderately to severely) food insecure.

1.3 EU response

As the EU countries have their own well-developed agricultural production, the availability of grains and food is not at stake in the EU. However, certain EU countries have some trade dependencies on supplies from Ukraine and Russia, and are also vulnerable to losing export destinations in Eastern Europe, including Ukraine, Russia and Belarus. The most important issue at the moment is the rapidly growing prices of grains, fertilisers, energy supplies and food, mainly caused by Russia's efforts to weaponise food, restrict its supplies of fertilisers and block Ukrainian ports. This puts the affordability of basic commodities at risk, particularly for low-income households, and disrupts the production capacities of agricultural producers in the EU.

The EU is taking steps to avert the crisis and – as a first priority – to enable Ukraine to supply its exports to the EU. One idea put forward by the European Commission consists of so-called 'solidarity lanes' to facilitate food exports from Ukraine by other means than through the blocked Black Sea ports. In this way, Ukraine may remain integrated in the world's agricultural market and continue contributing to global food security.

Simultaneously, measures have been taken within the EU itself to ensure food security and reinforce the resilience of food systems. Some of these are activities of an ad hoc nature, such as market measures under the Common Agricultural Policy (CAP), enabling set-aside areas to be mobilised to increase production within the CAP, as well as a temporary crisis framework for state aid. On the other hand, more systemic proposals are being put forward, with a particular focus on boosting sustainable production, resilience and food system transformation.
The war has provoked mixed reactions towards moving forward with the EU's Green Deal. On the one hand, there have been claims (e.g. from the Czech Republic) that the suspension of certain regulations could help boost productivity in the short term, in order to get through the crisis relatively safely (Foote, 2022). On the other hand, the European Commission has maintained its position, according to which 'food security can only come through sustainability', as an agricultural sector that is not sustainable cannot be resilient to crises such as the COVID-19 epidemic or the outbreak of war at the EU's doorstep (Morrison, 2022; European Commission, 2020). The European Greens take a similar view, pointing out that moving towards agro-ecological farming practices should be the EU's response to the war in Ukraine and to the global food crisis (European Greens, 2022). As outlined in the case studies later in the report, the EU's dependence on Russian supplies of energy and fertilisers is a fundamental problem. To this end, organic farming, which requires less of these resources, could be one of the most powerful tools for building resilience against such crises in the long term.

2 Objectives and methodology

This report aims to assess, in qualitative and quantitative terms, how the Russian invasion of Ukraine is impacting the EU countries and regions that are among the most affected by the negative consequences of the war. Every case study on the selected countries provides a qualitative as well as quantitative analysis, reviews the measures taken to address the current changes at the national, regional and EU level, and puts forward conclusions and actionable recommendations.

2.1 Methodology

As the study analyses quite recent phenomena, on which there is very little empirical literature available, the qualitative analysis mostly relies on reports, announcements and news on the effects of the ongoing war in Ukraine on the supply and prices of the key export commodities of Ukraine and Russia. The quantitative analysis relies strictly on data availability and provides data projections for the regional analysis due to the limited data available at the regional level.

Both the qualitative and quantitative analyses focus on the mapped countries that are (i) the most affected and (ii) the most resilient to the negative effects of Russia's full-scale invasion of Ukraine. The mapping exercise is done by analysing the annual and monthly (wherever possible) data on imports from Ukraine and Russia to the EU countries. In addition, the following criteria are considered to identify the countries and regions that are most affected: (i) bordering Ukraine and Russia; (ii) mostly reliant on food supplies from Ukraine and/or Russia; and (iii) most vulnerable to increasing inflation due to supply shortages. As for the most resilient countries, these are selected based on their strong local production levels and low dependency on imports from Ukraine and Russia.

The following countries and regions are considered the most affected:

- Poland: Dolnośląskie, Warszawski stołeczny, Małopolskie, Wielkopolskie, Śląskie
- Spain: Castilla y León, Galicia, Valencia Cataluña, Madrid

The following countries and regions are considered the most resilient:

- Hungary: Észak-Magyarország, Budapest, Dél-Alföld, Pest, Észak-Alföld
- Germany: Niedersachsen, Mecklenburg-Vorpommern, Sachsen-Anhalt, Bavaria, Schleswig-Holstein

Due to data unavailability, regional figures on trade and agricultural production are projected by apportioning available national values. The projection exercise takes into account annual regional population and regional agricultural land use data provided by Eurostat (2022), and delivers indicators on the annual change in regional production and trade flows for 2019-2020 and 2021-2022. For trade flow projections, data apportioning is conducted using regional population shares (as the regional population divided by the national population in a given year), and constructed shares are multiplied by the import (export) values in a given time-commodity-partner dimension. For agricultural production projections, data apportioning is conducted using regional land use shares (as regional land use divided by total agricultural land in square kilometres), and constructed shares are multiplied by gross production figures in tonnes. The study also analyses the price effects of the outbreak of the war in selected countries.

In terms of the period of the analysis, the study covers the years from 2019 to capture the time period before the pandemic and war-related supply shocks. In terms of product groups, the study mainly focuses on wheat, maize, barley, sunflower oil and fertilisers, as these are the key products supplied by Ukraine and Russia to the EU. The study also considers other product categories representing the main production and export categories for the selected countries, such as apples, hops, pork, cherries and others.

2.2 Empirical data

The United Nations International Trade Statistics (COMTRADE) database is used for goods import and export flows. COMTRADE provides annual and monthly data for a large set of countries in as much as six-digit-level detail. The information contains destination (partner) country, current USD trade value, and quantity and weight of the imports and exports. The annual data covers the period between 1962 and 2021, and the monthly data covers the period till April 2022.

For this analysis, the period January 2019 to March 2022 is chosen, as it covers over one year since the initial COVID outbreak. Five main commodity categories are discussed in this report:

- Wheat (041 - Wheat (including spelt) and meslin, unmilled)
- Barley (043 - Barley, unmilled)
- Maize (044 - Maize (not including sweet corn), unmilled)
- Vegetable oils (42 – Fixed vegetable fats and oils, crude, refined or fractionated)

- Inorganic fertilisers (56 - Fertilisers (other than those of group 272), which includes mineral or chemical fertilisers that are either nitrogenous, phosphatic or potassic

Since the trade flows are reported in current USD values, the data is converted to EUR by employing European Central Bank (ECB) annual and monthly reference exchange rates. In order to compare import flows over the years, quarterly import and export values and shares are computed. Import/export shares in a specific commodity category are calculated by dividing the imports/exports of the country by the total imports/exports of the world. Due to missing observations in terms of import/export quantities and respective prices in selected commodity categories (wheat, barley and maize), incorporating production figures with import/export quantities produces inconclusive results. Thus an alternative import dependency index is created as imports in current values divided by exports in current values. Furthermore, an alternative import dependency index is created as imports of goods as a percentage of gross domestic product (GDP), using Eurostat data.

For agricultural production, agri-food data from the European Commission's agricultural and rural development department is employed. Agri-food data is expressed in terms of area harvested in square kilometres, gross production and yields in tonnes for wheat, barley and maize. The figures are available annually till 2022.

The food price monitoring tool developed by the Eurostat is used for the consumer and producer price indices in the selected consumption categories: Bread and cereals, oils and fats, and food. The data is available monthly till April 2022.

The analysis regarding food security and risk of poverty is conducted by using annual data from the United Nations Food and Agriculture Organization (FAO) (2022b) and Eurostat (2022d). The FAO (2022b) dataset contains annual data till 2021 on a number of (severely or moderately to severely) food-insecure people and the prevalence of (severe or moderate to severe) food insecurity (percentage of people who live in households classified as severely or moderately to severely food insecure) in the countries under consideration. For the regional analysis, Eurostat's at-risk-of-poverty rate is employed. The data is broken down in NUTS-2 regions, and is available for Hungary, Poland and Spain. The at-risk-of-poverty rate is measured as the percentage of the total population below the risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income (after social transfers).

3 Poland

3.1 Trade dependence

Poland's agri-food industry is one of the key pillars of the country's economy. In 2019, before the outbreak of the COVID-19 pandemic and Russia's full-scale invasion of Ukraine, the sector accounted for more than 9% of total output produced and 6% of total gross value added (Spożywcze technologie, 2021). Poland is the biggest importer of Ukrainian products of all EU countries, yet it is only the fourth one in terms of imports of agri-food products from Ukraine. Throughout 2019 to 2021 (see Table 5), Ukraine was the source of nearly half of Poland's vegetable fat and oil imports. For instance, in 2019 Polish imports from Ukraine included mainly processed goods such as soybean oil (USD 91 million), oilcake (USD 83 million), soybean oilcake (USD 73 million), rapeseed (USD 71 million) and sunflower oil (USD 50 million)[2]. In the first quarter of 2022, imports of soybean oil, sunflower oil and corn from Ukraine increased by 92% compared to 2021 (Polish Ministry of Agriculture and Rural Development, 2022).

As for imports from Russia, Poland has high shares of Russian supplies in imports of inorganic fertilisers. From 2020 to 2021, Russia supplied nearly a third of Polish inorganic fertiliser imports. The level of domestic production makes it possible to almost fully satisfy the needs of Polish agriculture in terms of nitrogen and phosphorous fertilisers, while potassium fertilisers are mainly imported (Chemia i Biznes, 2021). In 2019, almost 23% of these were imported from Belarus and Russia, 6% from Germany and the rest from other countries (World Bank, 2019). As Poland is the third largest market for fertiliser consumption in the EU (after France and Germany), it is vulnerable to restricted imports as well as rising prices of fertilisers.

Table 5. Annual import shares with respect to commodity and partner in Poland, %

Year	Partner	Wheat (%)	Barley (%)	Maize (%)	Vegetable fats and oils (%)	(Inorganic) Fertilisers (%)
2019	EU-27	97.97	82.16	78.72	54.83	42.98
2019	Rest of the world	0.83	17.73	7.19	4.19	23.38
2019	Russia	0.03	0	0	-	-
2019	Ukraine	1.18	0.11	14.09	40.98	0.34
2020	EU-27	98.23	89.60	91.23	51.14	47.10
2020	Rest of the world	0.79	10.40	8.61	4.28	24.85
2020	Russia	0.27	0	0	0.10	27.53
2020	Ukraine	0.71	0	0.17	44.48	0.51
2021	EU-27	98.68	97.48	86.70	48.55	45.15
2021	Rest of the world	0.28	2.52	11.91	9.03	26.50

[2] State Statistics Committee of Ukraine.

2021	Russia	0.10	0	0	0.09	27.48
2021	Ukraine	0.94	0	1.39	42.33	0.87

Source: Authors' calculations using UN COMTRADE data (2022).

The war has also had a direct effect on Polish exports. Poland is one of the EU's leading food exporters, with the highest share of exports of poultry, apples and dairy and confectionery products during the period 2018 to 2020. Poland is one of the leading apple producers in the world and the largest in Europe. According to the Central Statistical Office's estimates for the 2020-2021 season, Poland's apple production reached 3.8 million tonnes. According to statistics compiled by the Agricultural Market Information System, Polish apples are exported mainly to Belarus, Egypt, EU countries and Eastern European countries like Kazakhstan, Ukraine and Russia. The war in Ukraine has led to increased difficulties in the export of apples, also breaking the chain of deliveries to other countries. In 2022, exports of apples to Eastern European countries accounted for 30% of the exports observed before the war (Sadownictwo, 2022b). This hints at the vulnerability of the country to trade sanctions imposed on Russia and Belarus and obstacles to the supply of apples to Ukraine.

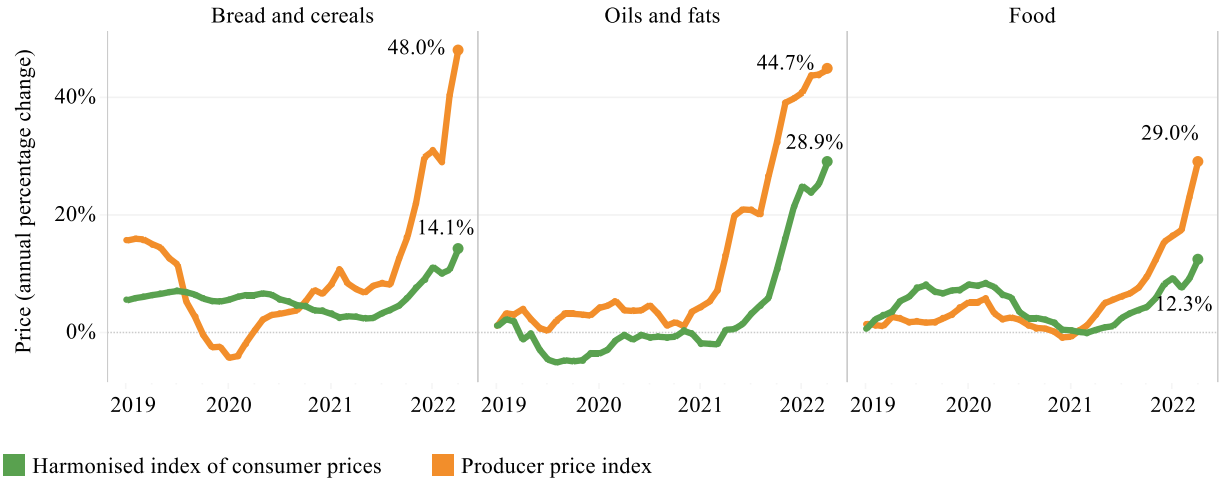
Poland is also the third biggest producer of hops in the EU. Hops, both in Poland and in the world, are classified as a niche crop. Setting up a plantation requires a lot of work and money (Kowalczyk, 2019). Already in 2020-2021 due to the COVID-19 pandemic, the quantity of hops purchased and their prices significantly decreased when compared to previous years. According to data from the Integrated Agricultural Market Information System of the Ministry of Agriculture and Rural Development, the average annual purchase of hops in the 2020-2021 and 2021-2022 seasons amounted to about 2 600 tonnes, about 20% lower than the average annual purchase of hops in the two previous seasons, with the purchase of aromatic hops falling by about 40%. At the same time, the purchase prices of hops in this period fell by an average of 10%. Hops semi-products in 2020 were mainly exported to Germany, Russia, Ukraine and the Netherlands (Polish Ministry of Agriculture and Rural Development, 2020; Farmer.pl, 2022)[3]. This also illustrates Poland's exposure to the shocks related to limiting its exports of hops to Russia and Ukraine.

[3] The hop market, the Ministry of Agriculture and the development of the countryside [Original: Rynek chmielu, Ministerstwo Rolnictwa I Rozwoju Wsi, zintegrowany system rolniczej informacji rynkowej] (2020).

3.2 Effects on prices

Like the other EU countries, Poland has been hit by increasing prices. By April 2022, food prices registered a 12.3% increase according to the consumer price index (CPI) and 29% rise according to the producer price index compared to April 2021. The increase in prices is larger in bread and cereals, in which producer prices seem to have risen by 48% and consumer prices by 14.1% in April 2022 compared to the same period in the previous year. The increase in the prices of oils and fats is even higher, reaching 44.7% in terms of producer price index and 28.9% in CPI increase in April 2022 compared to April 2021 (see Figure 3).

Figure 3. Annual changes in the producer price index and consumer price index in Poland, %



Source: Eurostat, Food price monitoring tool (2022b).

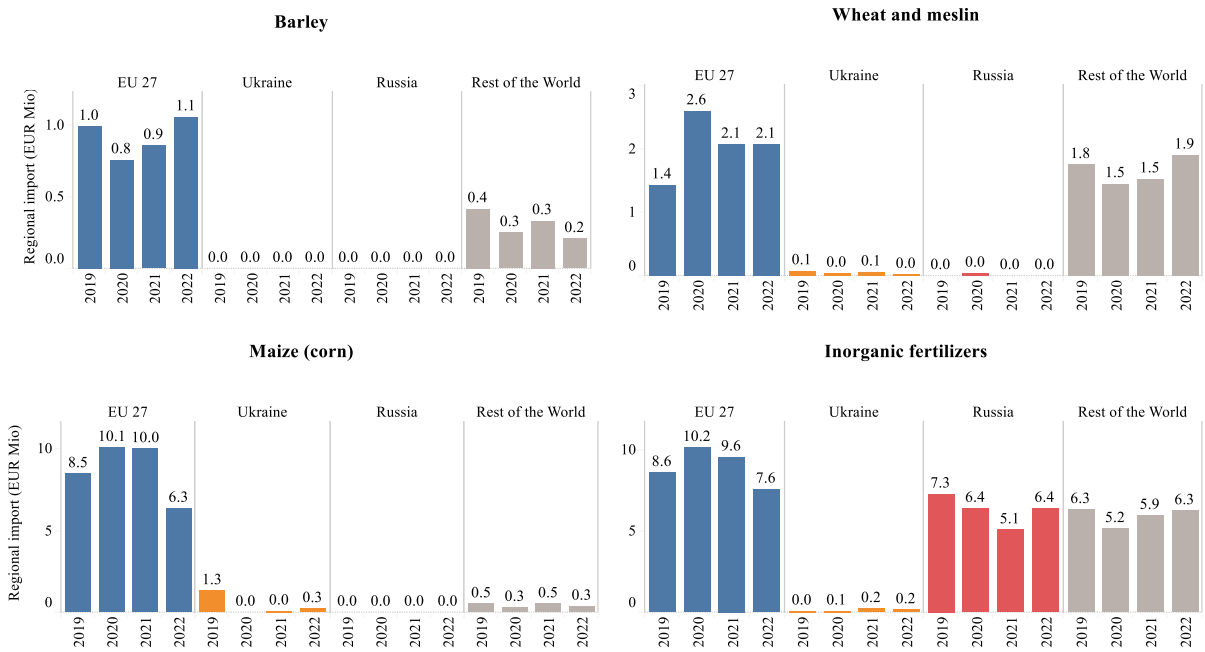
Poland is the third largest market for fertiliser consumption in the EU (after France and Germany), and the use of fertilisers is crucial to maintain adequate soil production potential and ensure high, good quality crop yields (Sadyogrody.pl, 2021). Therefore, one of the biggest challenges identified by Polish public authorities is the impact of the rapidly increasing prices of fertilisers on agricultural production. Domestic production of mineral fertilisers in Poland is heavily dependent on imported raw materials: natural gas, phosphate and potassium chloride. Already in December 2021, fertiliser prices were at a record high on the global markets, and due to the ongoing war in Ukraine and sanctions imposed on Russia, these prices have increased even more. These risks limiting the production of food domestically and causing an increase in prices.

3.3 Regional dependences

Data projections (see Figure A 16 – A Figure A 20 in Annex I) highlight that imports of barley, wheat and maize are mainly provided by the EU-27 for all Polish regions. The import dependence is mainly visible in terms of Russia's supplies of inorganic fertilisers, which makes the country largely vulnerable to the restricted supplies as well as rising prices of fertilisers.

For instance, in Śląskie, between 2019 and 2022 Russian supplies of inorganic fertilisers were nearly as high as imports from the EU-27 and exceeded supplies from the rest of the world (see Figure 4). According to the data projections, this trend – reflecting Poland's exposure to imports of inorganic fertilisers from Russia – is characteristic to all Polish regions (see Figure A 16 – A Figure A 20 in Annex I). The stability of supplies and prices of fertilisers is particularly important for Wielkopolskie, Dolnośląskie and Warmińsko-Mazurskie, as these three regions show quite high use of inorganic fertilisers (see Table 6).

Figure 4. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Śląskie, Poland, EUR million



Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022a).

Table 6. Consumption of inorganic fertilisers in Poland in 2020

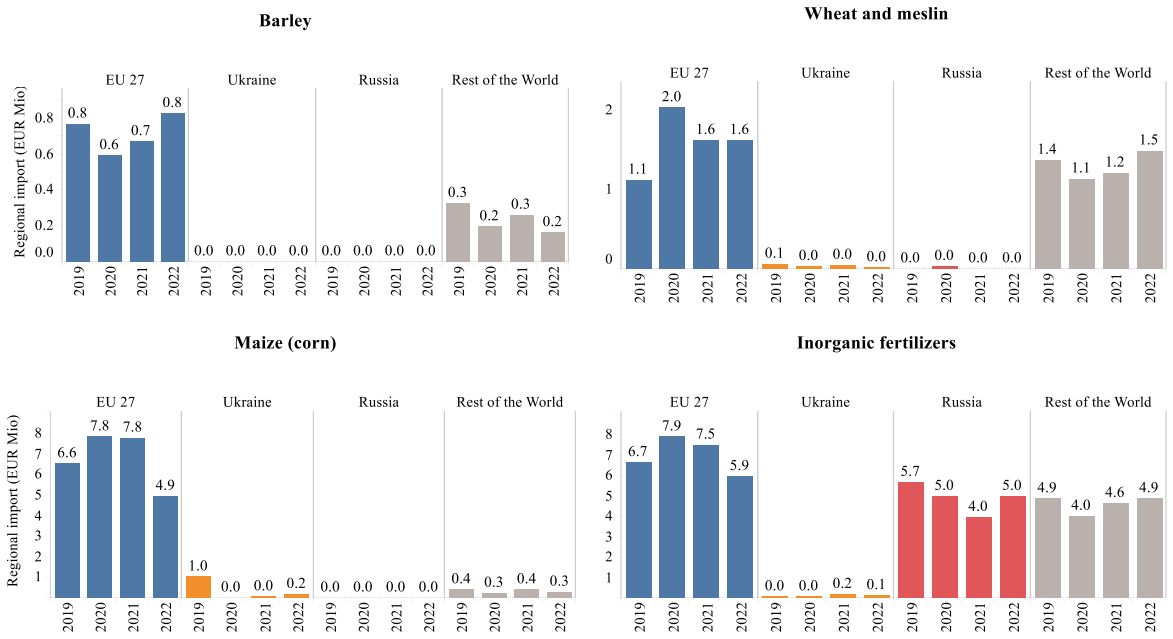
Region	Nitrogen		Phosphorus	
	1 000 tonnes	Growth rate	1 000 tonnes	Growth rate
Dolnośląskie	78.8	3.7	11.5	5.5
Małopolskie	21.4	-8.5	4.5	-8.2
Śląskie	25.1	6.4	4.0	8.1
Warmińsko-Mazurskie	69.2	27.7	7.7	20.3
Wielkopolskie	145.0	8.0	20.9	10.6

Source: Authors' calculations using data from Eurostat (2022).

Other challenges faced by the regions relate to trade sanctions imposed on Russia, which could threaten Poland's export destinations in the product categories in which Poland relies on large-scale production and exports. This mainly refers to apples and hops.

Poland is the largest apple producer in Europe. The war in Ukraine has led to a break in the chain of Polish apple deliveries to their usual export destinations: Belarus, Egypt and Eastern European countries like Kazakhstan, Ukraine and Russia. This broken chain is affecting Polish regions that are heavily dependent on apple production, including Mazowieckie (mainly the Warecka-Grójecki region), which in 2019 provided nearly half of Poland's national production (44%), Lubelskie, home to one third (36%) of Poland's apple production in 2019, and Świętokrzyskie and Łódzkie, which provided the remainder – around one fifth (20%) of total national production in 2019 (Nosecka and Bugała, 2019). These regions, specialised in the production of apples, remain with a significant surplus of unsold fruits in 2022. According to the World Association of Apple Producers, the stock of apples was by 5% higher in May this year than in the same period in 2021 (Sad24.pl, 2022). The increased supply might lead to a price decrease of the product, which in turn will have a detrimental effect on the profitability of existing orchards, especially with the higher costs of production (PKO Bank Polski, 2022). Polish regions also specialise in hop production, in which Poland is the third largest producer in the EU. Russia and Ukraine were among the main export destinations of hop semi-products in 2020. Wielkopolskie, Opolskie and Lubelskie are the regions specialised in the production of hops, and thus show vulnerability to the collapse of exports to their usual export destinations, which include Russia and Ukraine. This particularly refers to the Lubelskie region, which on average produce 90% of Polish hops. Like the other regions, these regions also depend on Russia's supplies of inorganic fertilisers, which increases their exposure to the effects of the ongoing war in Ukraine (see Figure 5).

Figure 5. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Wielkopolskie, Poland, EUR million



Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022a).

The production of other grains, such as barley, wheat and maize, does not show much fluctuations across the Polish regions (see Figure A 36 - Figure A 40 in Annex I).

In Poland, regional vulnerability to poverty, measured as the at-risk poverty rate, varied between 10.7% and 19.9% in 2019 and between 9.5% and 20.1% in 2020 (see Table 7). The at-risk-of-poverty rate is defined using the EU threshold of 60% of equivalised median disposable income (after social transfers), and indicates the percentage of the total population below this threshold. Hence, being at risk of poverty implies having an income that is significantly lower than the population as a whole. The data shows that the Warmińsko-Mazurskie and Małopolskie regions had a higher risk of poverty in 2019. In all regions except for Małopolskie and Śląskie, at-risk-of-poverty rates increased by between 0.2 and 1 percentage points. The highest increase was observed in the Wielkopolskie region. The Dolnośląskie (Lower Silesian Voivodeship) and Śląskie (Silesian Voivodeship) regions exhibited a relatively lower risk of poverty in 2019 and 2020 (respectively 11% and 10.7% in 2019, and 11.3% and 9.5% in 2020). Both regions are characterised by high urbanisation and higher population density (WBG, 2016a).

Table 7. At-risk-of-poverty rate in Poland, %

Region	2019	2020
Dolnośląskie	11.0	11.3
Małopolskie	16.0	13.7
Śląskie	10.7	9.5
Warmińsko-Mazurskie	19.9	20.1
Wielkopolskie	14.6	15.6

Source: Eurostat (2022d).
Note: At-risk-of-poverty rate is measured as the percentage of the total population below the risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income. Data for 2021 is not available.

3.4 Addressing challenges at national and regional level

In response to the rapidly increasing prices of fertilisers, Poland was the first country in the EU to ask the European Commission for permission to subsidise fertiliser payments within the State Aid Temporary Crisis Framework adopted by the Commission on 23 March 2022. In April 2022, the European Commission approved a EUR 836 million (PLN 3.9 billion) Polish scheme to support the Polish agricultural sector (European Commission, 2022c). As a result, eligible beneficiaries were entitled to receive aid up to EUR 107 (PLN 500) per hectare of agricultural land (Polish Agency for Restructuring and Modernisation of Agriculture, 2022; Wysoczańska, 2022). The regional Agencies for Restructuring and Modernisation of Agriculture (ARiMR) were authorised to manage the resources. They announced the calls for local farmers and were responsible for gathering and evaluating applications, as well as dividing the funds. Over the course of two months (between mid-May and 30 June 2022), 426 000 applications were submitted. The results of the evaluation will be announced around September-October 2022 (Wysoczańska, 2022).

To address the drop in sales of apples due to the closure of global markets, the Polish government has undertaken the following actions. First, financial Emergency Adjustment Aid for apple producers was introduced on 22 April 2022 by the Council of Ministers (Agrodoradca24, 2022). Second, new alternative destinations to increase the export of apples have been quested (Sadownictwo, 2022c). The subsidy for orchardmen amounts to 30 groszy (approximately 6.5 eurocent) per kilogramme of dessert apple. According to the Agency for Restructuring and Modernisation of Agriculture, between May and June 2022 over 90% of apples covered by the emergency aid mechanism for fruit producers, i.e. over 180 000 tonnes, were delivered to processing plants. The programme expired at the end of June 2022 (Tvp.pl, 2022). Third, the region of Grójec, where the production of apples is the highest in Poland, made an attempt to bring orchardmen and business together to elaborate alternative ways of using and processing apples, in order to diversify the channels and modes of supply. In May 2022, they organised a meeting at local level with representatives of fruit

associations and investors to look for solutions to help manage the surplus of apple supply in an alternative way. One of the proposed ideas was to convert some of the existing orchards into industrial juice orchards, from which even 100% of fruits might be used to produce apple juice. An agreement has been reached between the apple associations and private investors, and the orchards' interest is being gathered right now (Kobieta w sadzie, 2022).

In parallel, Polish authorities are looking for new markets to export Polish agri-food products to, apples included. The Polish Minister of Agriculture (deputy Prime Minister) announced in the middle of May 2022 that Poland would seek to sign a bilateral agreement with African countries in order to diversify its trade by reaching out to new markets (Sadownictwo, 2022d). In June 2022, the Ambassador of the Kingdom of Saudi Arabia was hosted by the Minister of Agriculture, with the aim of discussing potential future collaboration in terms of trade opportunities. The Ambassador acknowledged that Poland was an important trading partner for Saudi Arabia. He expressed his belief that ensuring food security was very important for many countries today. In this context, he referred to the possibility of deepening cooperation with Poland in terms of trade in agri-food products. He also mentioned the possibility of establishing cooperation on the use of modern technologies in agricultural production (Sadownictwo, 2022c). Exports of apples to Egypt are also restricted, as the Egyptian Central Bank has blocked transactions in foreign currencies without its direct permission in order to control the flow of foreign currency out of the country. Polish national authorities have been in regular dialogue with the Egyptian Ministers of Agriculture in order to negotiate import conditions (Sadownictwo, 2022a).

Hop producers were already heavily affected by the COVID-19-related restrictions and lockdowns, and these negative effects are now being aggravated by the reduced demand for hops and the increase in prices of fertilisers and electricity. Regional authorities mainly from the Lubelskie region, where on average 90% of Polish hops are produced on a yearly basis, sent appeals to the Polish Prime Minister to request financial support for the hop industry (Marshal Office of Lublin, 2021). In order to respond to hop producers' needs in those regions mainly specialised in hop production (Lubelskie, Wielkopolskie and Opolskie), the aid was offered to farmers under the formula of *de minimis aid* from June 2022. Given the conditions outlined, farmers are eligible to request aid of around EUR 1 700 per hectare of hop production. It is proposed that aid in the amount of PLN 11 million will be financed by reallocating funds from the special reserve 'Guarantee Fund in Agriculture' (Topagrar.pl, 2022).

3.5 Conclusions and recommendations

Russia's full-scale invasion of Ukraine has heavily affected the production, trade and prices of agricultural produce in Poland. Poland's agri-food industry is one of the key pillars of the country's economy. In 2019, before the outbreak of COVID-19 and Russia's full-scale invasion of Ukraine, it accounted for more than 9% of total output produced and 6% of total gross value added (Spożywcze technologie, 2021). The country is the third largest market for fertiliser consumption in the EU, and remains sensitive to restricted supplies as well as rising prices of fertilisers. This trend is characteristic for all regions in the country, as Russian supplies of inorganic fertilisers are considerable. Another challenge stemming from import dependence relates to imports from Ukraine. Before the war, Ukraine provided nearly half of all vegetable fat and oil imports into Poland, making the country dependent on its supplies in this product category.

The country is also sensitive to lost export destinations due to the outbreak of the war. These refer mainly to the regions that specialise heavily in one type of agricultural product and its exports to Eastern Europe, including Russia, Ukraine and Belarus. Mazowieckie (the Grójecki region in particular), which is specialised in apple production, and Lubelskie, specialised in hop production, are the best examples of such regions. They are among the hardest-hit regions by trade barriers and broken supply chains due to Russia's full-scale invasion of Ukraine. Similar to all other regions in Poland, these two regions are also sensitive to Russia's supply of fertilisers, which are used across their agricultural production. This requires regional and national authorities to devote special attention and support to producers in these regions during the war, which is taking place on the doorstep of Poland and causing a food security crisis.

To this end, the Polish national and regional response to the current challenges seems to be relevant, but it is still too early to assess its effectiveness. The solutions provided at national level were immediate, and the involvement of the regional authorities seemed responsive to the increasing needs. The national government reacted effectively when, as a first country in the EU, it requested financial support within the State Aid Temporary Crisis Framework and then gave the tools to the regional agencies to facilitate the operational functioning of farms. The actions taken included providing financial support as well as finding other solutions, such as unlocking new export destinations and seeking alternative channels and modes of supply of unsold products in stock (surplus in apples).
The regional authorities have also been engaged with a diverse group of regional stakeholders to establish collaboration between the public and private sectors, farmers and businesses. This is a forward-looking approach, not only for diversifying and expanding local production, but also for promoting employment and entrepreneurship at the regional level.

Poland should continue looking for solutions at national and regional level by focusing on the most affected regions, such as Mazowieckie and Lubelskie. Poland should also increase its production capacity in inorganic fertilisers, which are provided by Russian imports. Increasing production capacity should also be tailored to those regions that have high exposure to Russian supplies, for instance the Śląskie region.

Poland should pay attention to the diversification of agricultural production and exports from one specific type of agri-food product to several product categories. This could be reflected in smart specialisation, which could make Poland and its regions more resilient to global shocks. This approach will require every region to first identify its several competitive advantages (European Commission, 2017) and then develop production and trade capacities in the mapped product categories. While doing so, Poland should prioritise moving to organic farming to ensure a sustainable and long-term approach to developing its production capacities.

4 Spain

4.1 Import dependence

Ukraine is one of the most important trade partners of the Spanish agricultural sector, providing almost 30% of the country's corn and 70% of its sunflower oil imports in 2021. Spain is a net importer of both products, and Ukraine's shares in its imports are considerable. In 2021, the country imported nearly a third of its corn imports from Ukraine (29.4%), around a quarter from Brazil (23.1%) and the remainder mainly from Romania (16.8%) and France (15.8%). Ukraine is an even larger supplier of sunflower oil to Spain, providing around two thirds of Spain's imports (69.2%), while the rest is provided by Bulgaria (8.2%) and Moldova (7.7%) (Maqueda and Navarro Soler, 2022).

In the first quarter of 2022, Spain still sourced two thirds of its maize imports from Ukraine, which is similar to the import levels observed in the first quarters of 2019 and 2020 (see Table 8). It is also promising that Spain was the first country to which Ukraine managed to ship 18 000 tonnes of Ukrainian corn in June via the Baltic Sea, circumventing Russia's blockade.

Russia mainly provided Spain with inorganic fertilisers, but the shares of its supplies are not as high as the combined shares of supplies from the EU-27 and the rest of the world. No drop was registered in Russia's shares of inorganic fertiliser supplies in the first quarter of 2022 (see Table 8).

Table 8. Q1 Cereals and vegetable oil imports from respective regions of Spain, import share as %

Partner	Commodity	2019 (%)	2020 (%)	2021 (%)	2022 (%)
EU-27	(inorganic) Fertilisers	3.5	3.5	3.8	4.2
Rest of the world	(inorganic) Fertilisers	5.1	5.4	4.1	2.8
Russia	(inorganic) Fertilisers	6.4	5.4	5.0	12.0
Ukraine	(inorganic) Fertilisers	0	0	4.5	5.7
EU-27	Barley	13.0	11.3	18.2	12.8
Rest of the world	Barley	13.7	4.8	0	2.8
Ukraine	Barley	0	50.8	0	24.2
EU-27	Maize	2.9	3.3	4.8	2.4
Rest of the world	Maize	1.3	0.4	1.5	1.1
Russia	Maize	1.4	0	0	0
Ukraine	Maize	59.2	62.3	39.7	67.9
EU-27	Wheat	4.6	6.8	7.0	6.0
Rest of the world	Wheat	3.5	2.2	1.4	1.9
Russia	Wheat	0	1.9	3.2	2.1

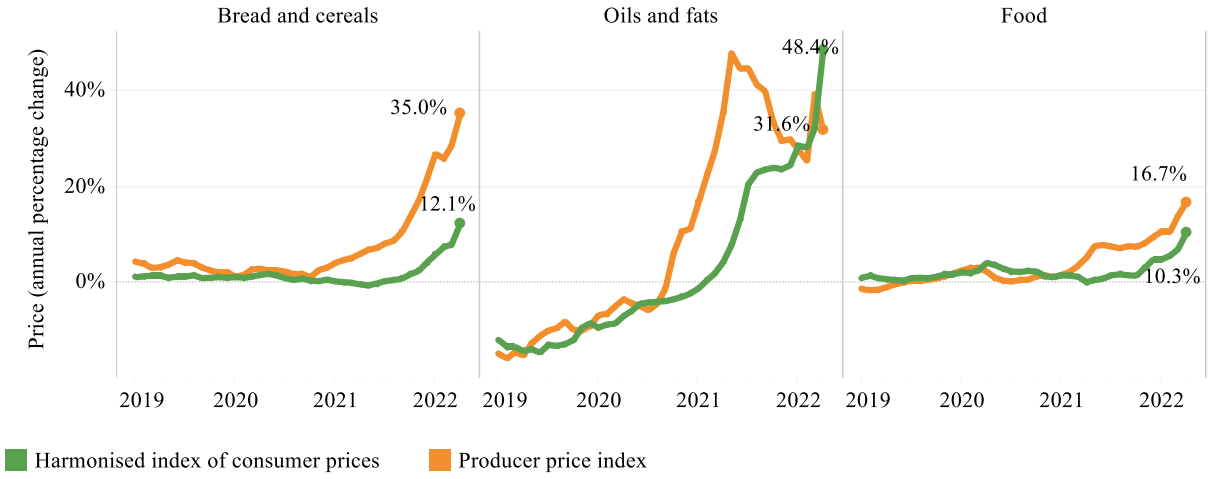
Ukraine	Wheat	34	3.9	0	6.6

Source: Authors' calculations using UN COMTRADE data (2022).

4.2 Effects on prices

Increasing prices are already alarming in Spain (Feás, 2022). The Russian invasion of Ukraine has pushed up prices in every sector, and groceries, in particular,[4] have shown the largest year-on-year increase since 1994. By April 2022, consumer prices were up by nearly 17% (16.7%) and producer prices by 10% (10.3%) compared to April 2021.

Figure 6. Annual changes in the producer price index and consumer price index in Spain, %



Source: Eurostat, Food price monitoring tool (2022b).

An annual percentage change of consumer prices in bread and cereals surpassed 12% in 2022 and the producer price index stood as high as 35%. Changes in producer prices are significantly higher in this product category as cereals (20% of which are imported from Ukraine) and corn are essential commodities for Spain's powerful livestock and feed sector (Agroberichten Buitenland, 2022c). The country is a major exporter of pork around the world, but pigs require a huge amount of grain and oilseed to remain marketable. Therefore, shortages in supplies from Ukraine have direct pass-through on producer prices, as the production of pork relies significantly on cereals and corns imported from Ukraine. Inflation in this sector is also affecting the profitability of livestock producers. Although producers are trying to strike deals with supermarkets to reduce the price increase to be paid by consumers when buying the final goods, meat prices will inevitably rise as a result of shortages in cereal and corn imports (Shike, 2022).

[4] See also: https://murciatoday.com/cereal_harvest_in_spain_falls_21_per_cent_as_a_result_of_war_in_ukraine_1788959-a.html .

The agrarian association ASAJA has further warned of upcoming spikes in prices of cereals, as they foresee a significant cut of 21% in the autumn-winter 2022 cereal harvest compared to 2021 (Murcia Today, 2022). In addition, prices are more likely to continue to rise considerably if the grain stores in Ukraine are not released for export to the rest of the world (Kiratas, 2022).

Price increases are the highest for oils and fats, in which Spain's consumer prices increased by as much as 48.4% and producer prices by 31.6% compared to April 2021. Among the regions, Catalonia has significant dependence on sunflower oil coming from Ukraine, which together with corn is widely used to feed farm animals in the region, bringing further pressure on increasing prices in this category.

In addition, the Spanish agri-food sector faces problems related to climate change. In the last three months of 2021, the country recorded only 35% of the average rainfall compared to the same period from 1981 to 2010. The extreme shortages of water for the large areas, particularly in the south, distort the irrigation of crops and consequently the agricultural produce. Experts say that rain-fed crops, including cereals, could lose 60% to 80% of their production because of the droughts (Euronews, 2022).

On top of these challenges, many individuals in Spain are still exposed to deficiencies in Spain's social security system. This issue has become more pressing since the emergence of COVID-19 and later by the war in Ukraine. Food banks have had to step in to assist those affected and in need. According to data from Spain's major food bank network, the amount of food distributed in 2020 increased by 48% compared to the previous year, resulting in the greatest levels of food aid granted since 2014, when the global financial crisis pushed the country's unemployment rate above 25% (Jones, 2022; Human Rights Watch, 2022).

4.3 Regional dependencies

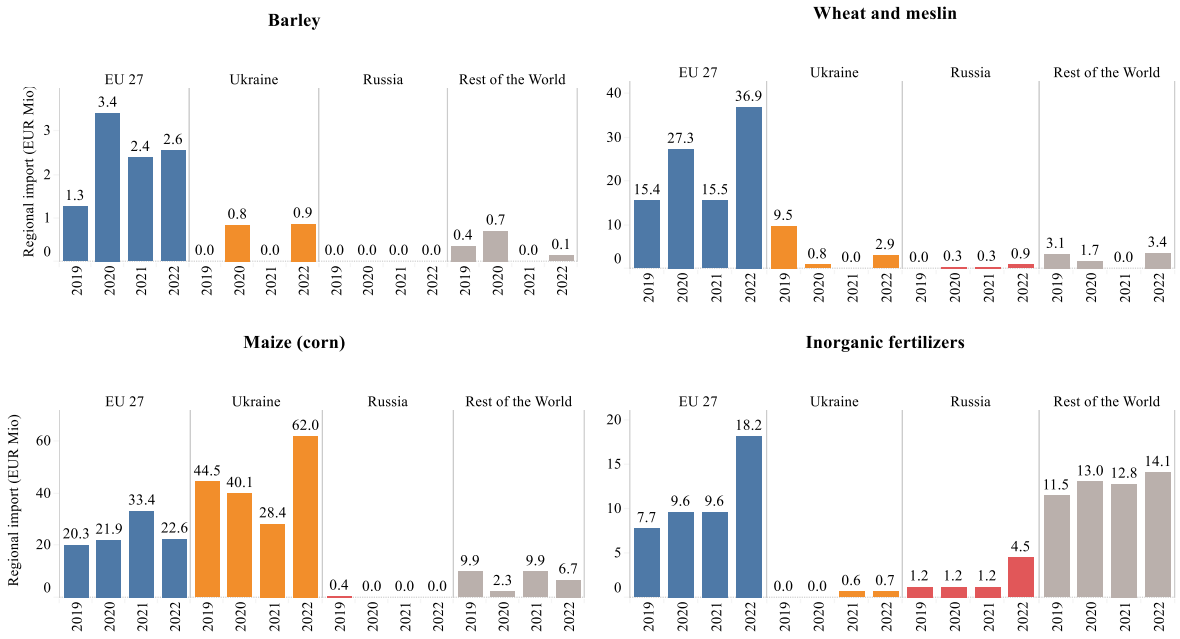
4.3.1 Catalonia

In general, Catalonia does not have a large trade dependence on Russia or Ukraine. They only provide around 0.6% and 0.4% respectively of Catalonia's total imports, and do not receive more than 0.8% and 0.2% respectively of Catalonia's exports) (Catà Figuls, 2022). Most of the region's imports of wheat, barley and fertilisers come from the EU-27 and countries other than Russia and Ukraine.

However, Catalonia's import dependence on corn supplies from Ukraine is significant, as the region needs large inputs of corn to feed its farm animals (see Figure 7. Ukraine's corn supplies have been consistently twice as large as supplies from the EU-27 between 2019 and 2022 (see
Figure 7. For instance in 2020, around 35% of Catalonia's corn and 44% of its sunflower oil imports came from Ukraine, indicating strong dependence on Ukraine's supplies in this sector (Catà Figuls, 2022) . These commodities are of key importance for Catalonia's livestock sector, as the region provides more than half (51%) of total meat exports of Spain (Porcat, 2022). So far, there is no indication of increasing local production of cereals in Catalonia in response to the outbreak of the war in Ukraine (see
Figure 8).

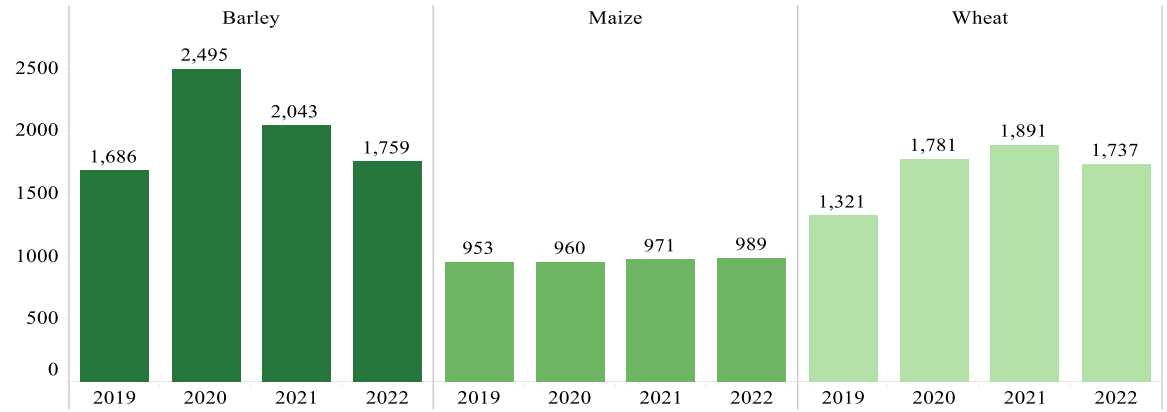
Catalonia's imports of inorganic fertilisers also show some small dependence on Russian supplies, but the import volumes are small and do not register drops in the first quarter of 2022 (see Figure 7)

Figure 7. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Catalonia, Spain, EUR million



Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022a).

Figure 8. Cereal gross production by crop type in Catalonia, Spain, 1 000 tonnes



Source: Authors' calculations using EC (2022d) and Eurostat (2021).

4.3.2 Other regions

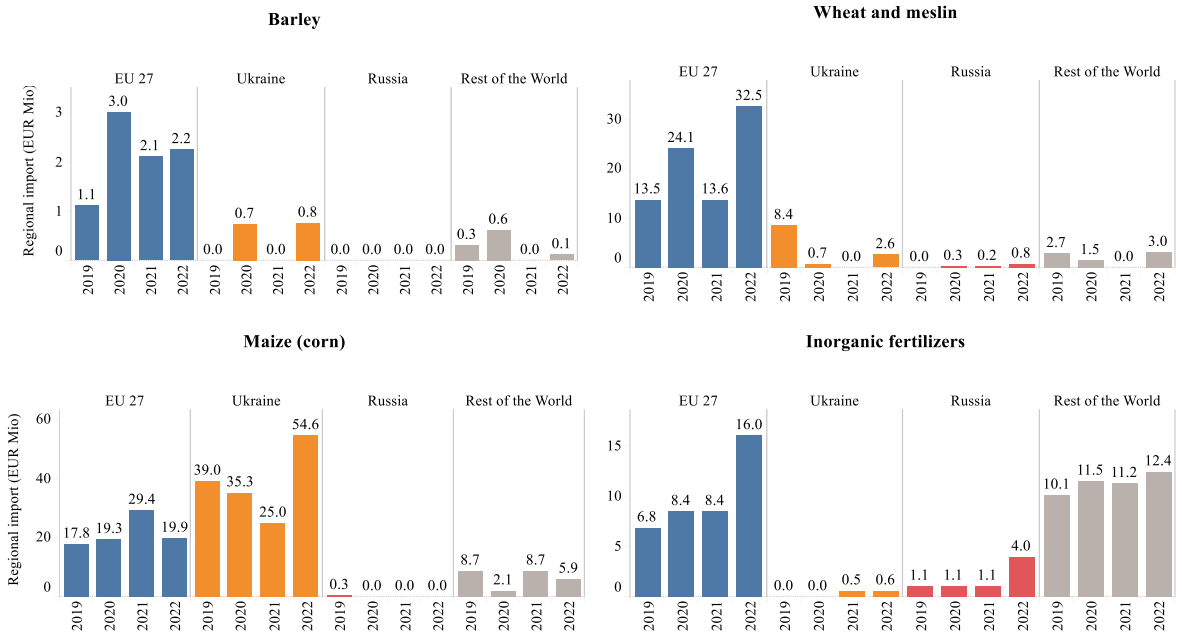
The regions of Madrid, Galicia, Valencia and Castile-La Mancha show the general trend observed across the country on import dependence on corn from Ukraine and inorganic fertilisers from Russia. Compared to Catalonia, however, the dependence of these regions on corn supplies from Ukraine is lower, and imports of inorganic fertilisers from Russia are small in volume compared to imports from the EU-27 and the rest of the world (see Figure 9 and Figure 10). Galicia has more exposure to corn supplies from Ukraine, as before the outbreak of the war the region sourced on average 40% of its corn imports from Ukraine (Economía Digital Galicia, 2022; Vigario, 2022). There is no clear indication observed in increasing local production of crops in these regions in response to the war (see Figure A 26 -
Figure A 30 in Annex I). The use of inorganic fertilisers is higher in Castilla-la Mancha and Valencia than in other regions, hinting at their vulnerability to supply shortages in fertilisers (see Table 9).

Table 9. Consumption of inorganic fertilisers in Spain in 2020

Region	Nitrogen		Phosphorus	
	Tonnes	Growth rate	Tonnes	Growth rate
Castilla-la Mancha	82.3	-1.8	20.4	-62.9
Catalonia	49.5	11.2	10.6	15.2
Madrid	16.2	118.9	8.7	-69.3
Valencia	76.7	-1.8	15.1	-6.2
Galicia	25.0	1.6	4.8	2.1

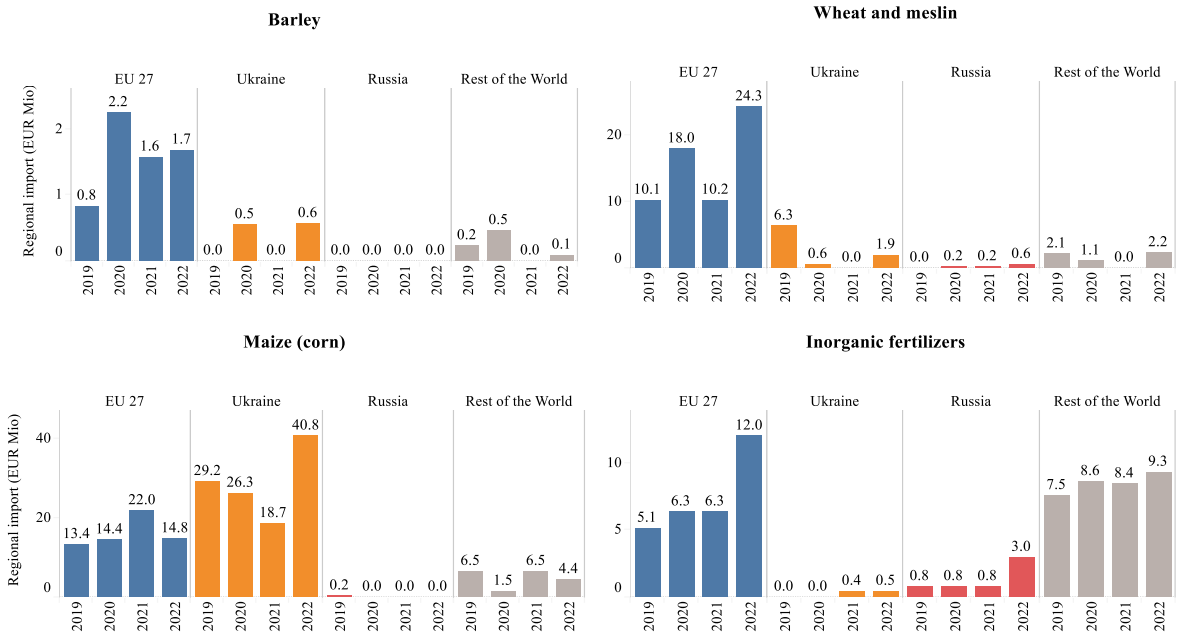
Source: Authors' calculations using data from Eurostat (2022).

Figure 9. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Madrid, Spain, EUR million



Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022a).

Figure 10. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Valencia, Spain, EUR million



Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

In terms of resilience, it is noteworthy that the autonomous community of Castilla y León – the 'Spanish barn' – usually produces 40% of the national production of wheat. However, this year the volume of cereal production is expected to fall by 10 to 15% as a result of the increase in production costs (e.g. triple increase in prices of fertilisers) and the drop in yields (Ayuso Santamaría, 2022).

Since March 2022, the transport sector has seen workers' strikes lasting for several weeks due to the increased price of fuel, which has further disrupted food supply chains. Supermarkets experienced food shortages and the Spanish government decided to allow retailers to temporarily limit the number of goods that could be bought by customers (Soto, 2022). Before this measure, some markets and supermarkets had already restricted the sale of sunflower oil, a top import category from Ukraine. The regions most affected by the combination of import disruption and transport strikes were the Costa del Sol and Canary Islands, which during those weeks received 70% less cargo than normal from the Spanish mainland (Marshall, 2022). In addition to supermarkets, strikes also caused problems for operations in the hospitality (restaurants) and tourism sector.

4.3.3 Risk of poverty

The poverty risk indicator measures the percentage of the population below the poverty threshold, which is defined by the EU as 60% of the national median equivalised disposable income (after social transfers). The data available in Spain shows that in recent years the risk of poverty has been relatively high, and regions differ substantially in their poverty risk. In Castilla-la Mancha, Valencia and Galicia, the at-risk-of-poverty rates were well over 20% between 2019 and 2021, indicating that at least one out of five people were at risk of poverty and social exclusion (see Table 10). In all regions, the poverty risk increased between 0.2 percentage points (in Galicia and Madrid) and 1.4 percentage points (in Valencia) from 2019 to 2021.

Table 10. At-risk-of-poverty rate in Spain, %

Region	2019	2020	2021
Castilla-la Mancha	26.2	25.1	27.4
Cataluña	13.9	16.7	14.8
Madrid	15.0	15.4	15.2
Valencia	23.7	24.6	25.1
Galicia	20.0	22.1	20.2

Source: Eurostat (2022d).
Note: At-risk-of-poverty rate is measured as the percentage of the total population below the risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income.

In Cataluña and Madrid, the risk of poverty is significantly lower than in the rest of Spain. This indicates that inequality between the regions depends on the type of economic activity and urbanisation. Both regions, Cataluña and Madrid, have a high urbanisation and population-density rate in comparison to the rest of Spain. Furthermore, sectoral decomposition shows that the agricultural sector in these regions are 1.4% and 0.2% respectively, significantly lower than the national average of 4.1% (Palomino et al., 2021).

4.4 Addressing challenges at national and regional level

To support the agricultural sector, the Spanish government provided a total of EUR 430 million in aid as part of the National Response Plan to the Economic and Social Consequences of the War in Ukraine (Spanish Ministry of Agriculture, Fisheries and Food, 2022a). Nearly half of the support is directed towards farmers and the agricultural sector (EUR 193.47 million). This includes financial contributions from two sources: the Spanish Ministry of Agriculture (MAPA), which provided EUR 128.98 million[5], and EU support worth EUR 64.49 million[6] as part of the EUR 500 million package to support producers affected by market disturbance caused by the war in Ukraine. This package of support is dedicated to ease the increased costs of production stemming from increasing prices of raw materials for animal feed, energy and fuel. Overall, beef cattle farms will receive EUR 110 million, sheep and goat meat farms EUR 31.7 million, poultry meat producers EUR 10 million, rabbit farms EUR 3 million and citrus producers EUR 38.7 million. The amount will be distributed among farmers according to the number of animals and hectares of land they own. The other half of the aid (EUR 169 million) is provided for milk producers, while the fish sector receives only around 15% of the total national aid (EUR 68.18 million).

The largest recipient is the region of Castilla y León with EUR 35 million, followed by Extremadura (EUR 30 million) and Andalucia (EUR 27 million). As for the other regions analysed, Galicia will receive EUR 11 million, Valencia EUR 26 million, Catalonia EUR 11 million and the Madrid region EUR 1 million. Furthermore, the European Commission has approved aid worth EUR 169 million[7] for producers of cow, sheep and goat milk, as well as EUR 68.18 million[8] to support fishing vessel companies. Both of these aids, approved under the State Aid Temporary Crisis Framework, aim to enable producers to overcome the difficulties they are experiencing because of the increase in production costs as a result of the war in Ukraine.

On 14 March 2022, the Ministry of Agriculture published a resolution to temporarily relax the specific requirements for corn imports from Argentina and Brazil (Spanish Ministry of Agriculture, Fisheries and Food, 2022e). This measure temporarily lifts an EU ban on importing crops with traces of herbicides from markets including Argentina and Brazil, and allows Spain to buy corn for

[5] Spanish Ministry of Agriculture, Fisheries and Food, 2022b; ibid., 2022c.
[6] European Commission, 2022b; Spanish Ministry of Agriculture, Fisheries and Food, 2022f.
[7] Spanish Ministry of Agriculture, Fisheries and Food, 2022d.
[8] Ibid., 2022g.

animal feed in the main producing countries in the world outside Ukraine and Russia.

Moreover, the Minister has also asked for 'CAP measures to be made more flexible so that cereal sowing can be increased in Spain and other European countries' (Spanish Ministry of Agriculture, Fisheries and Food, 2022h). This would imply, for instance, decreasing the area under set-aside, which in Spain amounts to half a million hectares.

Due to the high expectation that crop prices will increase further, farmers in Castilla y León have increased the land intended for sunflowers (by 63% in 2022 compared to 2021). The planting of corn, however, has decreased due to the heavy investment needed to fertilise the plant (La Nueva Crónica, 2022).

The government is also promoting the prevention of food waste and encouraging better use of resources under the Prevention of Food Loss and Waste Bill. According to the Ministry of Agriculture, 20% of food is wasted (40% of which occurs at retail or household level), so the newly adopted bill[9] aims to raise public awareness of food waste and make it mandatory for supermarkets and restaurants to have a specific plan of production, sale or distribution that allows them to minimise waste.

More recently, on 13 June 2022, a cargo ship carrying 18 000 tonnes of Ukrainian corn arrived in Spain via the Baltic Sea to circumvent Russia's blockade. Spain was the first destination of this new export route, which is helping Ukraine export the 30 million tonnes of grain stored in its territory (Reidy, 2022). This shipment of corn will be used to ease the deficiencies of Spanish farmers.

[9] News Desk, 2022.

4.5 Conclusions and recommendations

The analysis shows that Spain has a large dependence on corn and sunflower oil supplies from Ukraine. The country is also an importer of inorganic fertilisers from Russia, but the volumes are small and most imports of these product categories come from the EU-27 and the rest of the world, rather than Ukraine and Russia.

In terms of regions, Catalonia shows high exposure to the shortages in Ukrainian supplies of corn and sunflower oils, which are used across the agricultural sector. Among others, corn is broadly used to feed farm animals, as Catalonia has a strong livestock sector, providing more than half of Spanish exports of pork. Galicia also has exposure to restricted corn imports from Ukraine.
Moreover, the increase in prices is considerable across the country, particularly in food, crops, oils and fats. This is already reflected in strikes in the transport sector, which are further disrupting food supply chains and the hospitality and tourism sectors in Spain.

The government is quite involved in adopting measures and aids to support the agricultural sector and ease the pressure of import shortages and skyrocketing prices. To this end, mobilising national financial support schemes and receiving funds from the EU are important. Alternative solutions such as allowing imports from other global suppliers like Argentina and Brazil, promoting the absorption of unused land for planting crops, and helping Ukraine to keep exporting by circumventing blocked sea ports, could also be effective. Raising public awareness of food waste and supporting the prevention of such waste are also useful.

More support should be devoted to the region of Catalonia to make sure that the shortages of Ukraine's supplies of corn and oils do not severely affect livestock production, as Catalonia produces half of Spanish pork exports.

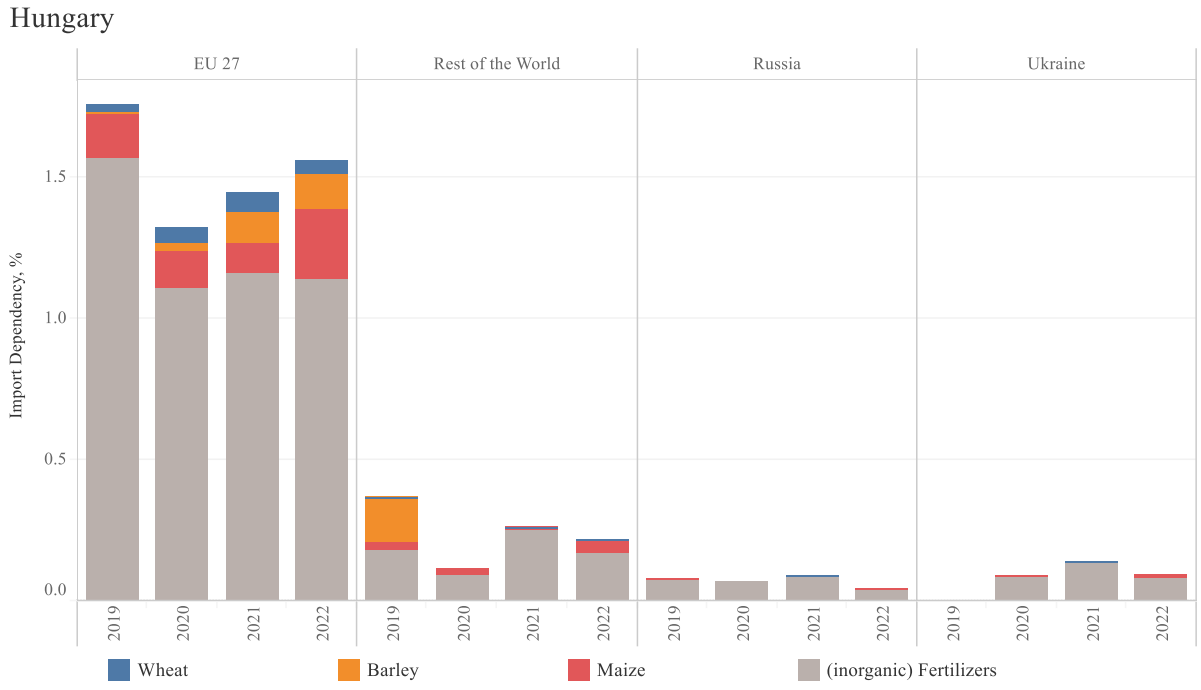
More actions should also be taken to promote the planting of crops in regions with high dependence on Ukrainian imports. This should include providing public funds to farmers to enable them to conduct the planting and fertilising processes needed to start or increase local production of deficient commodities. However, while developing production capacities at the regional level, sustainable use of resources should not be compromised. In particular, organic farming and environmentally friendly solutions should be systematically applied in planning and developing regional farming capacities.

5 Hungary

5.1 Trade dependence

Cereal crop production in Hungary covers domestic demand and leaves a slight surplus for exports (Nemzet, 2022). In 2020, the country imported USD 216 million in cereals, with only a small share coming from Ukraine (2.49%) according to the Observatory of Economic Complexity (OEC) database (OEC, 2022), while the World Integrated Trade Solution (WITS) does not report any imports from Ukraine to Hungary (see Table 11 below). Most of Hungary's imports are sourced from the EU-27 in all product categories: wheat, barley, corn and vegetable oils. Imports of inorganic fertilisers are more considerable but are mostly sourced from the EU-27, with Russia and Ukraine only taking small shares (see Figure 11).

Figure 11. Annual import dependency, calculated as ratio of imports to exports in selected commodities



Source: Authors' calculations using UN COMTRADE data (2022).

In 2020, Hungary exported USD 1.91 billion in cereals, with the main destinations being Italy (USD 625 million), Romania (USD 382 million), Austria (USD 210 million), Germany (USD 187 million) and Russia (USD 71 million, or 3.71% of the total). According to the International Grains Council (IGC), Hungary's total grain production in 2021-2022 will be 13.9 million tonnes, down from 15.3 million in 2020-2021. Wheat production is estimated to be 5.3 million tonnes, up

from 5 million the previous year. Hungary's maize (corn) output is estimated at 6.4 million tonnes, a decrease from the 8.3 million tonne crop in 2020-2021. The estimate for barley output is 1.7 million tonnes, up from 1.4 million the previous year. The IGC's most recent forecast for Hungary's 2021-2022 rapeseed crop is 700 000 tonnes, which was also the production amount for 2020-2021 (Lyddon, 2022). This means that Hungary is self-sufficient in terms of grain production, making it relatively resilient in this respect to the effects of Russian aggression against Ukraine.

Instead, Hungary's agricultural sector could suffer from the collapse of exports to Russia and Ukraine, as Hungary exports 3.4% of its total exports to Ukraine and Russia jointly, which is one of the highest export shares to these destinations across the EU Member States. Until now, about 10% of agricultural and pharmaceuticals exports from Hungary have been going to Ukraine and Russia (European Commission, 2022a). Furthermore, Ukraine is an important supplier of intermediate materials for Hungarian sectors such as electronics and metals, while Russia supplies oil and gas, key inputs for energy, oil refining and chemical industries.

5.2 Regional dependencies

As Hungary is a self-sufficient country in terms of grain supplies, its regions do not show any considerable exposure to imports from Ukraine and Russia (see Figure A 11 – Figure 15 in Annex I). The data projections register some imports of corn from Ukraine and inorganic fertilisers from Russia, but the volumes are quite small and do not make any of Hungary's regions dependent on supplies from the two countries.

Local production in all regions in the study has not decreased in 2022. According to data projections, nearly all regions even showed some increase in local production in the first quarter of 2022 (see Figure A 31 - Figure A 35 in Annex I).

However, there is a very large difference between the capital region of Budapest and the rest of the country in terms of economic activity and distribution of wealth. Similarly, inequalities exist between large and small producers, particularly across the regions.

The outbreak of the war has also raised issues related to climate change. Among others, this refers to fresh water supply, which has already been challenging for some time, as pointed out in the United Nations Framework Convention on Climate Change (UNFCCC) national communications (Hungarian Ministry of

Environment and Water, 2009; Hungarian Ministry of National Development, 2017). This issue is particularly visible in some locations where water supplies are heavily reliant on foreign use, such as the Tisha Valley (Tamás et al., 2019).
In Hungary, regional vulnerability to poverty, measured as the at-risk-of-poverty rate, is relatively low (below 16% in all regions), and regions do not differ significantly in their risk rate (see Table 11). In 2020, the risk of poverty varied between 10.4% (in Budapest) and 15.8% (in Észak-Alföld). In all regions except for Dél-Alföld, the at-risk-of-poverty rate either decreased (in Budapest by 3% and Pest by 3.9%) or remained stable from 2019 to 2021. In Dél-Alföld, the at-risk-of-poverty rate increased by 2.3% during the same period.

Table 11. At-risk-of-poverty rate in Hungary, %

Region	2019	2020
Budapest	10.4	7.4
Dél-Alföld	11.1	13.4
Észak-Alföld	15.8	15.9
Észak-Magyarország	14.3	14.0
Pest	13.3	9.4

Source: Eurostat (2022d).
Note: At-risk-of-poverty rate is measured as the percentage of the total population below the risk-of-poverty threshold, which is set at 60% of the national median equivalised disposable income. Data for 2021 is unavailable in Hungary.

5.3 Effects on prices

Even though Hungary does not import a significant amount of wheat from Russia or Ukraine as it produces most of the grain supplies it needs locally, the disruption in the global value chains is still reflected in rising food prices in the country (Daily News Hungary, 2022). Like other EU countries, Hungary is affected by the shortages in fertiliser supplies, stemming from disrupted exports from Russia, the world's global supplier. This situation is aggravated by difficulties experienced by enterprises in maintaining their production capacities as they face rising energy prices.

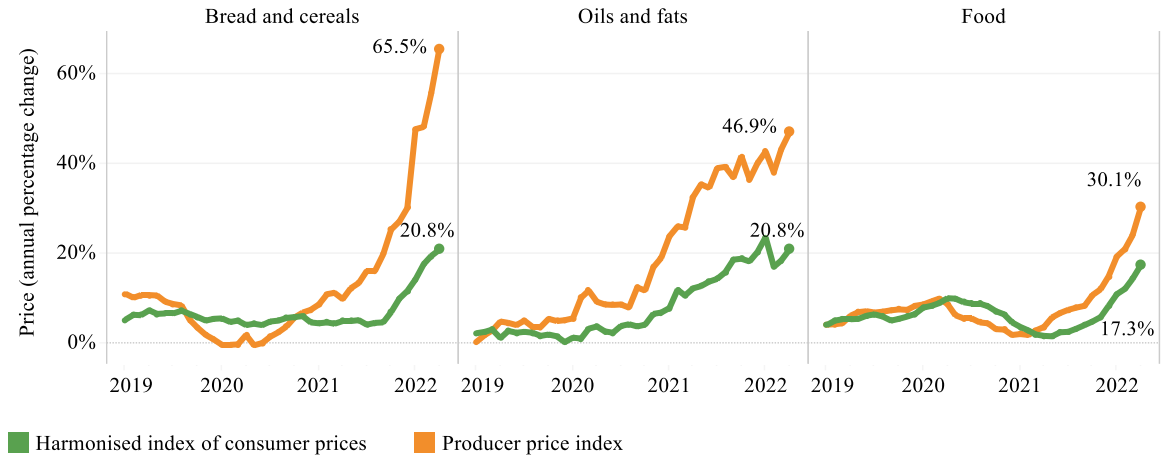
Hungary already had food affordability problems before the current crisis. Data sourced from Eurostat shows that in 2020 nearly 13% of Hungarians could not afford to buy meat, fish or a vegetarian alternative every second day, putting the country in the fifth worst place in the EU in terms of affordability of a proper meal (Licskay, 2022)[10].

In April 2020, the CPI in food saw a 17.3% increase and the producer price index an even sharper 30.1% increase compared to April 2021 (see Figure 12). More

[10] https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220225-1#:~:text=In%202020%2C%208.6%25%20of%20the,vegetarian%20equivalent%20every%20second%20day.

precisely, Hungary has registered a considerable increase in the prices of potatoes (+28%), bread (+25%), pasta (+22%), poultry (+19%), cheese (+18%) and flour (+18%)[1112]. The prices of vegetables, among others bell peppers (+16% increase), pears (+25%) and cucumbers (+24%), have also increased considerably compared to the same period in 2021.

Figure 12. Annual changes in the producer price index and consumer price index in Hungary, %



Source: Eurostat, Food price monitoring tool (2022b).

The price increase in bread and cereals is most drastic in Hungary. The producer price index was up by 65.5% in April 2022, and consumer prices up by 20.8% compared to the previous year. The price of mill wheat per tonne has seen a 56% year-on-year increase. Animal feed wheat has seen an even steeper increase with a 67% year-on-year change. The price of maize has reached a 48% year-on-year increase (Agroberichten Buitenland, 2022b).

Price increases in oils and fats are also considerable. In April 2022, consumer prices were 20.8% higher and producer prices 46.9% higher compared to April 2021 (see Figure 12). Press reports suggest that despite the measures taken by the government, purchasing basic food products remains a problem for many. Shopkeepers are rumoured to be circumventing price regulations, and pensioners have been cited as a particularly vulnerable group (Gutierrez, 2022; Licskay, 2022).

[11] Daily News Hungary, 2022.
[12] See also: https://dailynewshungary.com/food-shortages-in-hungary-here-are-all-you-need-to-know/ .

5.4 Addressing challenges at national and regional level

At the first changes in the global market at the beginning of the war, the government introduced measures to ensure adequate supply to the domestic market. The most important of these were (i) the export declaration mandate, where to safeguard its food supplies Hungary banned all grain exports, and (ii) the price cap, i.e. temporary regulation of the price of certain food items (Agroberichten Buitenland, 2022a; Nemzet, 2022). While the first measure was implemented after the outbreak of the war to prevent food and animal feed shortages due to the sharp increase of global wheat prices, the second was put in place in 2021 to ease the inflation caused by the COVID-19 pandemic, and was extended in April 2022.

In late May 2022, Hungarian Prime Minister Viktor Orbán announced a state of emergency, which he justified by the need to respond to the security and economic threats posed by the war (Yılmaz, 2022). Hungary, together with countries such as Turkey, Argentina and Moldova, was one of the leaders in food protectionism, introducing a ban on grain exports in as early as March. All grain exports must be registered in advance, and the Hungarian State has first purchasing priority (Nemzet, 2022). Until the ban, during the current season Hungary had sold about 127 000 tonnes of soft wheat abroad. That decision, however, aimed at strengthening food security inside the country, is adding to soaring global food inflation (Faiola, 2022; Durisin et al., 2022). Failure to comply with regulations may result in an administrative fine of up to 40% of the crop's net value on the trader or producer in question. It is worth noting, however, that the obligatory notification does not apply to transit transport and humanitarian aid sent from Hungary's territory (Nemzet, 2022). According to the government, the export restrictions were imposed to avert domestic supply shortages due to increased foreign demand (Global Trade Alert, 2022).

The decision has sparked dissatisfaction among buyers in Europe, who question its legality under EU law. For example, Emilio Ferrari, President of the Association of Industrial Millers of Italy (Italmopa) has suggested that 'the measures adopted by Hungary constitute a clear violation of the principle of the free movement of goods in the European internal market, and call into question the fundamental values set out in the EU treaties' (European Food Agency, 2022). Price-capping measures began in Hungary even before Russia's aggression against Ukraine. In November 2021, the government capped the price of motor fuel at EUR 1.27/litre (at the current exchange rate). Later, on 12 January 2022, Mr Orbán proposed new government action aimed at keeping basic essential food costs like sugar, wheat flour, sunflower (cooking) oil, pork (particularly pig

thigh), chicken (breast) and milk (2.8% cow's milk) at their pre-crisis levels of 15 October 2021 (Agroberichten Buitenland, 2022a). The government's actions are very decisive and primarily short term in nature. Predictions of what will happen after the price cap is lifted are cause for concern. According to available calculations, the price of chicken breast may rise from EUR 4.24 to EUR 5.30/kilogramme; the price of pig thigh from EUR 3.71 to EUR 4.24/kg, the price of UHT cow's milk from EUR 0.73 to EUR 0.87, the price of flour from EUR 0.56 to EUR 0.72, and the price of sunflower cooking oil from EUR 1.91 to EUR 2.65 – and these are calculations from 1 May 2022 (Agroberichten Buitenland, 2022a). Right now, price caps are to be in force until October (Reuters, 2022).

government has made a considerable investment in the coming cycle, investing a total of HUF 4 265 billion on modernising the agri-food business.
Due to its geographic proximity to Ukraine, the Hungarian government is a supporter of solidarity lanes, and has repeatedly called for assistance in upgrading its trans-shipment facilities, building new tracks and temporary storage, as well as purchasing new wagons (Tar, 2022).

5.5 Conclusions and recommendations

The analysis suggests that Hungary is a largely self-sufficient country in terms of agricultural production, which makes it resilient to the food security crisis. However, being self-sufficient in grain production (Nemzet, 2022) does not guarantee resilience to soaring prices, as the country remains highly dependent on energy supplies from Russia. Together with growing inflation globally, this is leading to a significant rise in food prices, including on cereals and bread. Together with Russian energy supplies, price increases are also fed by the increasing prices of fertilisers, which are significantly raising the production costs of all goods, including food.

Moreover, protectionist economic policies are undermining the resilience of the country. The government's actions to counter the effects of the war are broadly protectionist and provide only short-term solutions. Banning grain exports goes against solidarity across the EU, and price capping does not address the rising inflation in the medium term. To ease the effects of rising inflation there needs to be a more sustainable medium to long-term approach.

Hungarian agriculture needs to adapt diversified farming practices and apply a more organic farming approach (Hüppi et al., 2022). When introducing long-term solutions to enhance resilience and food security, care must be taken to ensure that these solutions do not conflict with efforts to preserve biodiversity and ecosystem health. This is especially important in the case of Hungary, as the

country’s biodiversity and ecosystem health is deteriorating. Hungary scores below the EU average on used agricultural area under organic farming (6.03%), land share under forest (26.1%) and share of its terrestrial area devoted to protected areas. One of the most important factors contributing to the general degradation of biodiversity in Hungary is its intensive agricultural practices (European Commission, 2022a). To address the issues related to fresh water supply, several actions need to be taken. For instance, a pricing system that encourages water retention could be introduced; excessive irrigation should be reduced, especially in drought-prone areas; and water retention, water regulation and landscape management should be established. To further promote sustainable irrigation, easing infiltration and popularising less water consumption cultures in agricultural production can be very helpful.

A regional perspective is essential when implementing agricultural policy solutions in Hungary because of the very large differences between the capital region of Budapest and the rest of the country. Similarly, inequalities exist between large and small producers. These may be combated by the increased redistribution of direct CAP payments from bigger to smaller and medium-sized farms.

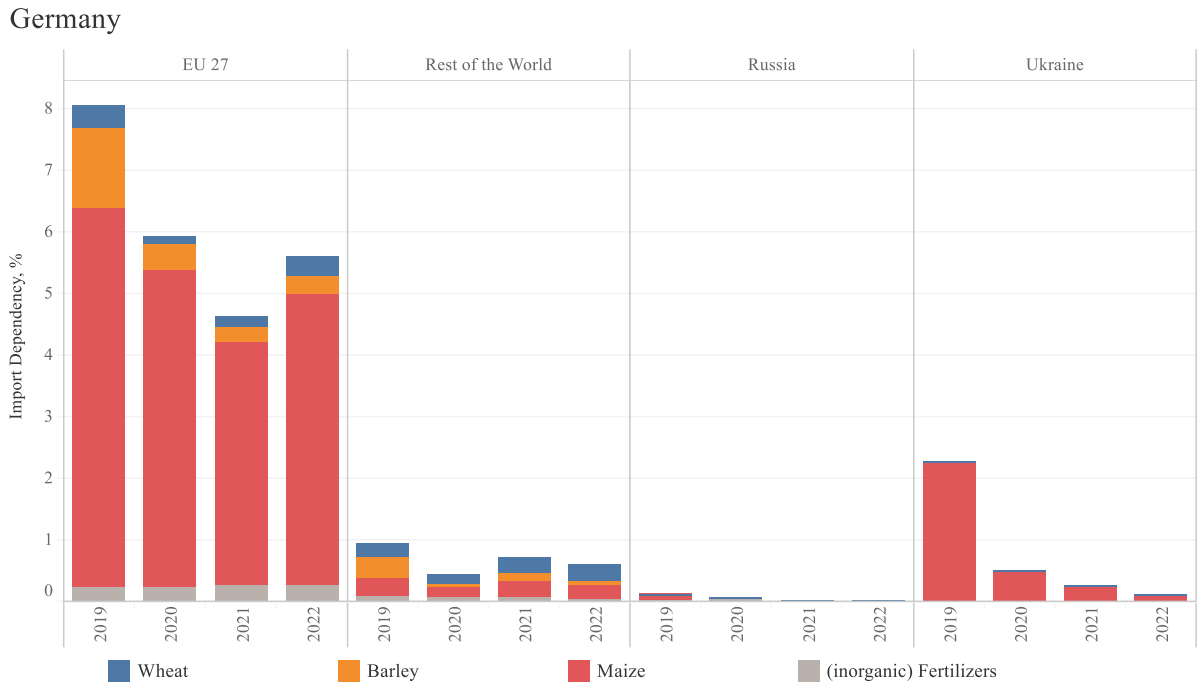
In light of the Russian war against Ukraine, Hungary should consider policy measures that aim to reduce agricultural dependency on fossil fuels, mineral fertilisers and other external supplies, in order to increase its long-term sustainable production capacity

6 Germany

6.1 Import dependence

Germany, like the rest of the EU, is concerned about the availability of commodities such as maize, wheat, rapeseed and sunflower oil, of which Ukraine is a major global producer, as well as fertilisers, which Russia supplies globally. Yet, the data does not report any significant trade dependence of Germany on Ukrainian and Russian supplies in these product categories. The main supplier of grains for Germany is the EU-27, which provides nearly all imports of wheat and barley and more than 80% of imports of vegetables fats and oils and inorganic fertilisers. Imports of maize and vegetables oils from Ukraine have larger shares than imports of wheat and barley. For instance, in 2021 Ukraine took a 4.97% share in Germany's maize imports and a 7.15% share in Germany's vegetable fat and oil imports.

Figure 13. Annual import dependency, calculated as ratio of imports to exports in selected commodities, %



Source: Authors' calculations using UN COMTRADE data (2022).

Imports of inorganic fertilisers from Russia did not take more than a 6.5% share in Germany's imports of inorganic fertilisers in 2021, which mainly come from the EU-27 (85%) and the rest of the world (9%) (see Table 12. While Germany does not depend directly on Russia's supplies of inorganic fertilisers, it does depend on imports of fertilisers, which are now disrupted globally due to the war. Moreover, restrictions in the supply of potash, which is largely (40%) produced in Belarus and Russia, are creating further shortages, as potash is a crucial component in the production of fertilisers (Government of Canada, 2022). Germany itself is the fourth-largest producer of potash in the world, accounting for 9% of total output, but until recently it remained reliant on imports of mineral fertilisers. As fertilisers are key inputs for all agricultural production, Germany is further increasing its production of potash, but global supply shortages of fertilisers are still pushing up the prices and directly affecting all agricultural produce in Germany.

Table 12. Annual cereal, vegetable oil and fertiliser share in Germany's imports, %

Year	Import partners	Wheat (%)	Barley (%)	Maize (%)	Vegetable fats and oils (%)	(Inorganic) Fertilisers (%)
2019	EU-27	95.78	91.79	69.44	81.38	88.26
2019	Rest of the world	3.25	8.13	1.77	9.73	6.85
2019	Russia	0.22	0	0.70	0.04	4.87
2019	Ukraine	0.76	0.08	28.09	8.84	0.02
2020	EU-27	94.82	96.65	89.48	84.41	85.84
2020	Rest of the world	4.74	3.34	1.68	8.21	8.86
2020	Russia	0.01	0	0.32	0.06	5.21
2020	Ukraine	0.43	0	8.52	7.32	0.10
2021	EU-27	95.20	99.15	93.62	89.92	84.82
2021	Rest of the world	4.53	0.85	1.37	2.88	8.58
2021	Russia	0	0	0.07	0.05	6.50
2021	Ukraine	0.27	0	4.94	7.15	0.10

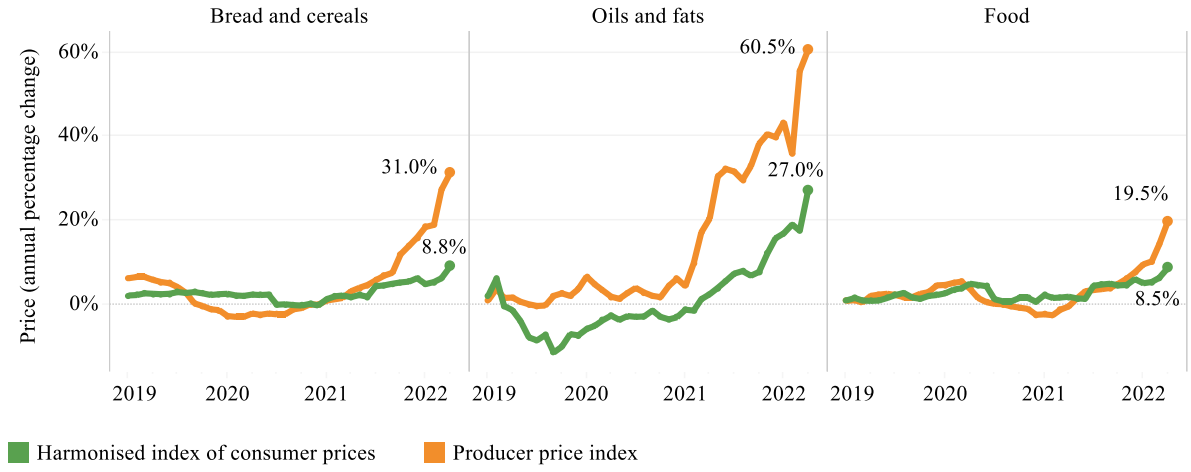
Source: Authors' calculations using UN COMTRADE data (2022).

6.2 Effects on prices

Rising prices, particularly for electricity, fertilisers and animal feed, were already visible before the war and have accelerated even further since the outbreak of the war. Inflation rose to 7.9% in May 2022, reaching its highest level since Germany's reunification, with food prices among the most affected. In April 2022, consumer prices for food were 8.5% higher and producer prices 19.5% higher than the prices observed in April 2021. According to an Allianz estimate, food prices in Germany are anticipated to increase by 10% in 2022, resulting in an additional EUR 250 in costs per consumer for the year (Knight, 2022).

The prices of bread and cereal have also registered growth, particularly from the producer's perspective, as the producer price index was 31% higher in April 2022 compared the same period in 2021. Moreover, price increases in oils and fats are the most considerable. Compared to 2021, in April 2022 consumer prices of oils and fats were 27% higher, and the increase in producer prices surpassed 60% (see Figure 14.

Figure 14. Annual changes in the producer price index and consumer price index in Germany, %



Source: Eurostat, Food price monitoring tool (2022b).

The sharp increase in food prices is taking its toll on the budgets of ordinary citizens, especially the poorest. This mainly refers to around 16% of Germans (more than 13 million people) who are living below the poverty line in 2022. Many of those in need are turning to food banks, such as those run by the organisation 'Die Tafel'. Due to the war in Ukraine, war refugees have joined the unemployed, pensioners with little money, single parents and other food bank clients. Yet the organisations running the food banks are themselves struggling with rising operating costs, which are threatening their operation (Witting, 2022; The Local, 2022a). Food affordability problems existed in Germany even before the current crisis. In 2020, according to data provided by Eurostat, 15.1% of

people could not afford to buy meat, fish or a vegetarian alternative every second day, putting the country at the sixth worst place in the EU (Licskay, 2022)[13].
According to a number of farmers, some European suppliers are taking advantage of the rising prices of fertilisers and, while they have capacity their production, are limiting their production in order to benefit from the spikes in prices (Knight, 2022). In May and June during the grain crop season (Dizard, 2022d), prices peaked and some farmers struggled to purchase a sufficient number of fertilisers to sustain their crop production.

6.3 Regional dependences[14]

For German regions, the negative effects of the COVID-19 pandemic and then the outbreak of the war in Ukraine are aggravated by climate-related problems. In eastern Germany, there was almost no rain at all in March. April was better, but precipitation in the east remained up to 30% below the long-term average. May was also relatively dry. Regions such as Brandenburg and Saxony-Anhalt, as well as parts of Saxony and Mecklenburg-Vorpommern, where soils dried out to a depth of about 1.8 metres, were the most severely affected. Sunflowers are one crop that are predicted to be seriously hit, which is likely to raise concerns about sufficient supplies of sunflower oil (Kamann, 2022; Caddle, 2022).

Data projections across the German regions do not report a high level of dependence on Ukrainian or Russian supplies (see Figures provided for Bavaria, Mecklenburg-Vorpommern, Lower Saxony, Saxony-Anhalt and Schleswig-Holstein). Ukrainian supplies of maize and Russian supplies of inorganic fertilisers are larger than imports of the other product categories, but even these two have quite low values and shares in total imports of Germany across the regions, and they are still quite small in nominal terms (see Figure A 1 – Figure A 5 in Annex I). Little movement is observed in the regional production of cereals (see Figure A 21 - Figure A 25 in Annex I).

More challenging for the German regions is the scarcity of seasonal labour. According to the Ministry of Agriculture, seasonal agricultural workers currently come primarily from the EU Member States, mainly Poland and Romania. As reported by the Association of Agricultural Employers, 65% of seasonal agricultural workers are from Romania, 30% are from Poland and the rest are from other Eastern European nations.
However, some regions have certain dependence on seasonal labour coming from Ukraine. According to a 2021 study by the IG Bauen-Agrar-Umwelt trade union,

[13] https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220225-1#:~:text=In%202020%2C%208.6%25%20of%20the,vegetarian%20equivalent%20every%20second%20day.
[14] This section does not include a sub-section on food poverty, as the relevant data is not available for German regions.

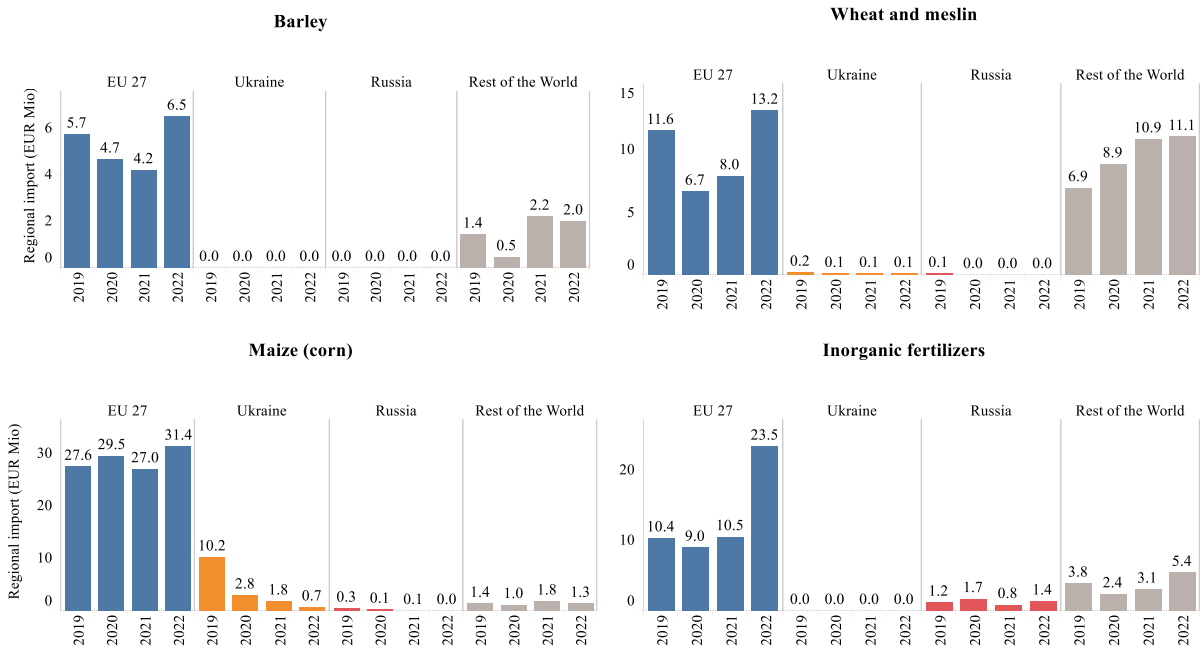
many seasonal workers in regions such as Mecklenburg-Vorpommern and Brandenburg are Ukrainian. According to the Saxony-Anhalt Farmers' Association, the situation in Ukraine makes it difficult to ensure that there are a sufficient number of seasonal workers available. In Lower Saxony, approximately 7 000 Ukrainian students are generally active in berry harvesting (Golder, 2022; Dahm, 2022b).

6.3.1 Bavaria

Bavaria is a good illustration of the trends observed through the data projections across the German regions. As demonstrated by Figure 15, data projections point at Ukraine's supplies of maize and Russia's supplies of inorganic fertilisers, but as in the other regions, the import volumes are rather small. Most imports in these product categories come from the EU-27 and the rest of the world, rather than Ukraine and Russia.

However, there are other issues faced by Bavaria. In 2020, Germany imported 38 320 tonnes of mustard seeds, with Russia accounting for 51.9% of these, Ukraine 27.6% and Canada 10.2%. Then, almost 81 000 tonnes of mustard worth around EUR 167 million were produced, primarily in Bavaria and North Rhine-Westphalia (The Local, 2022b). Given this specialisation, mustard producers are concerned about a lack of imported seeds from Russia and Ukraine, which makes Bavaria and North Rhine-Westphalia vulnerable to the effects of the war on mustard seed supplies.

Figure 15. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Bavaria, Germany, EUR million



Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022a).

Pork production is particularly challenging, since meat prices are continuing to stagnate, partly due to meat producers and retailers importing cheap meat from abroad (Knight, 2022).

6.4 Addressing challenges at national and regional level

To help ease the distortionary effects of the ongoing war in Ukraine, EUR 500 million was secured at EU level to be distributed to farmers, of which Germany received EUR 60 million (European Commission, 2022b). Despite the significant rise in inflation, the government is not going to reduce value added tax (VAT) on food. This proposal was put forward by the Ministry of Agriculture but was rejected by the Ministry of Finance (California18, 2022).

The most important discussion in Germany is whether to make use of exemptions from EU regulations[15] that oblige farmers to keep 4% of their land as 'unproductive' in order to foster more space for wildlife, and this issue is now widely debated. The EU, however, currently allows exemptions to this rule, of which many countries are taking advantage. German authorities are also debating whether to use this exception and roll back on environmental policies in order to boost domestic crop production.

Some farmers and local authorities believe that for the time being, using the land for food would help alleviate grain shortages. As at 2021, Germany's environmentally protected zones, which were off-limits to farming, covered over 1.2 million hectares. The Ministry of Agriculture, on the other hand, believes that allowing the use of pesticides on protected areas would be counterproductive for achieving the green goals set out in the EU's flagship Farm to Fork strategy (European Commission, 2020). Moreover, it points out that only about half of the unused land would be suitable for grain production. A compromise proposal is on the table that would allow fallow lands to be used temporarily to feed animals, while the use of pesticides and cultivation of crops would still be banned on these lands. Due to Germany's federal system, both the federal and state governments would have to agree to ease the constraints (Knight, 2022; Anghel, 2022; Dahm, 2022c).

A strategy to increase the competitiveness of domestic, protein-rich legumes such as peas and broad beans has also been introduced.[16] Changing crop profiles may be a response not only to the crisis caused by the Russian aggression, but also to

[15] EU's Common Agricultural Policy (CAP) - GAEC 8 (European Commission, 2021).
[16] https://time.com/6156901/germany-environmental-rules-crops-russia-war-ukraine/?s=09 .

climate change. For example, the aforementioned drought has had little effect on the harvest of chickpeas, a species more resistant to harsh conditions (Kamann, 2022). In terms of fertiliser availability, Germany is making efforts to increase local production. The country is the fourth-largest producer of potash in the world, accounting for 9% of total output, but until recently it remained reliant on imports of mineral fertilisers. The South Harz in the federal area of Thuringia recently underwent test drilling for more potash mines, and the findings are encouraging. According to the Ministry of Agriculture, Germany will have enough resources to be independent from Belarus imports (Dahm, 2022a). It is worth noting, however, that increased production may provide certainty of supply, but high fertiliser prices will still remain a problem for farmers.

The long-term solution is to shift towards ecological agriculture to strengthen the resilience of the agricultural sector by reducing dependence on pesticides, mineral fertilisers and fossil fuels. To this end, the Ministry has accelerated the launch of programmes that promote renewable energy in agriculture, and has launched a programme to support animal-friendly feeding in organic farming, which is set to be among the areas worst hit by a loss of feed imports from Ukraine (Anghel, 2022). This way, by the year 2030 the government wants to have achieved 30% organic farming in Germany. There is a long way to go though, as in 2020 only 13.5% of German farms operated organically (California18, 2022).

To ensure the necessary supply of seasonal workers, Germany has signed mediation agreements with Georgia (signed in January 2020, in force since 2021)[17] and Moldova (signed in July 2021, in force since 2022)[18]. Workers from these countries are expected to arrive at the harvest later this year. Farmers are also calling for fast-track refugee engagement into the labour market (Dahm, 2022b).

Germany also plans to further reduce biofuel production, as agrofuel consumes 9% of the global grain harvest and 14% of corn and sugar beet production. In Germany, bioethanol derived from wheat, rye or sugar beet accounts for 10% of petrol, while vegetable oil derivatives generated from rapeseed or palm oil account for 7% of diesel (Meza, 2022). To further address drought and climate change issues, a tighter limit on groundwater abstraction has been introduced in Brandenburg and Saxony-Anhalt (Kamann, 2022).

[17] Agenda.ge, 2021.
[18] ZDG, 2021.

6.5 Conclusions and recommendations

The analysis shows that, despite an absence of dependence on imports from Ukraine or Russia, EU countries and regions with strong local production such as Germany can still be painfully affected by the war in Ukraine. Germany does not have import dependence on grain supplies from Ukraine or Russia, as its imports mostly come from the EU-27 countries. In terms of fertilisers, Germany is one of the few countries in the EU that produces potash. But the country has import dependence on mineral fertilisers and is vulnerable to the increasing prices of fertilisers. In addition, German regions are affected by energy price increases, shortages in seasonal workers originating from Ukraine, and dry seasons and other climate-related problems.

In the long term, Germany should take further steps towards reducing its dependence on fossil fuels, mineral fertilisers and other external supplies, in order to increase its resilience and sustainable production capacity. Policy measures should be strengthened towards limiting the increase in fertiliser prices in Germany. Strengthening the regional dimension of agricultural policy is needed to increase food security and develop resilient agricultural production capacity. As a federal state, Germany already delegates much of the policy making in agriculture to the regional governments. For example, the second pillar of Germany's CAP Strategic Plan for 2023-2027 concerning rural development has been developed at the regional level. However, the plan was submitted to the European Commission for approval on 21 February 2022, just before Russia's full-scale invasion of Ukraine. Therefore, it is recommended to revise the plan by taking into account the effects at Germany's regional level of the outbreak of the war. This should also include targets on increasing the production of mineral fertilisers and organic farming. Studies show that agricultural-environmental policy is still often a result of political compromises rather than evidence-based investigations in Germany (Baaken, 2022; Pe'Er et al., 2019; Brown et al., 2021). Yet, food security, risk management and building production resilience should be planned and implemented based on actual data reports and scientific studies.

7 Lessons learned and the way forward

Russia's full-scale invasion of Ukraine and related trade restrictions and supply shortages in basic commodities have made it clear that for the EU and its Member States food and energy security are key for resilience. As the EU countries have their own well-developed agricultural production, the availability of grains and food is not in jeopardy in the EU. However, certain EU countries show some trade dependencies on supplies from Ukraine and Russia, while others are also vulnerable to losing export destinations in Eastern Europe, including Ukraine, Russia and Belarus. The effects of the ongoing war on prices are also considerable.

Before the outbreak of the war, Ukraine provided around one third of the EU's maize imports and Russia around one fifth of fertiliser imports in the EU. These trade ties, together with the EU's dependence on Russian energy supplies, make the EU Member States highly vulnerable to Russia's power to affect global energy and fertiliser prices, consequently making all the production processes more costly. Together with Putin's efforts to weaponise food and block Ukrainian ports, this is reflected in increased prices of food and all agricultural produce. This presents a risk for the affordability of basic consumer goods in the EU, particularly among low-income households, and largely disrupts the production capacities of agricultural producers across the EU.

Remaining resilient to the rapidly increasing prices is more challenging as long as Russia continues to block Ukrainian ports, manipulate supplies and prices of fertilisers and – most importantly – provide most of the EU's energy supplies. This once again highlights that the EU should have reduced its energy dependence on Russia a long time ago. The phasing-out of Russia's energy supplies is now happening but, together with other major setbacks in trade and broken delivery chains, this process is now more costly and painful for the EU countries.

The case studies on more vulnerable countries such as Poland and Spain, and more resilient countries, such as Hungary and Germany (please refer to Chapter 2 for more detailed information on the selection criteria) identifies further challenges. For instance, the lack of seasonal workers coming from Ukraine, shortages in Ukraine's commodity supplies for feeding livestock, and the loss of the main destinations for the EU's key export categories. The effects of the ongoing war in Ukraine are aggravated by the systemic problems related to climate change and unsustainable use of natural resources, which risk further distortions of agricultural production in all regions under consideration.

To address these challenges, the study suggests the following policy recommendations that mostly refer to the four analysed countries (Hungary, Germany, Poland and Spain) but could also be considered for all EU Member States:

- Local production of grains in the regions under consideration should be expanded in order to provide sufficient local supplies of food and agricultural produce during such crises. To this end, promoting local production at the regional level is strongly recommended. This particularly refers to Spanish regions with a high dependence on Ukrainian supplies of grains, and Polish regions that rely heavily on vegetable fat and oil imports from Ukraine.

- The production capacity of inorganic fertilisers and their components should be shifted towards production of organic fertilisers to fill the gap in the most affected regions. The reduction in the Russian supplies of non-organic fertilisers could provide much-needed incentives for fertiliser producers to commit to structural changes in their production patterns and to pursue more sustainable long-term strategies.

- Import and export markets should be diversified. The EU should unlock trade potential with like-minded countries to phase out all Russian supplies and address supply shortages in basic commodities.

- The countries covered by this study should move towards smart specialisation to boost resilience at the regional level. This implies that they should identify several competitive advantages beyond their major specialisation in only a couple of products and instead develop production and trade capacities in the mapped product categories. This is highly relevant to the Polish regions, which strongly specialise in only one or two product types (apples and hops) and export to only a few destinations (Ukraine and Russia). Smart specialisation could also be relevant for Spanish regions, particularly Catalonia, which heavily specialises in livestock production and largely depends on imported corn (mostly from Ukraine) for feeding its animals. Diversifying import sources and expanding production capacities in other sectors could strengthen Catalonia's resilience towards external shocks.

- Expanding production capacities should not materialise at the expense of compromising environmental aspects, as climate-related problems are already visible and challenging in the regions under consideration. Ignoring environmental concerns – among others the frequency of dry seasons in Germany and problems related to fresh water supply in Hungary – will only

result in the further distortion of agricultural production. To this end, applying a long-term sustainable approach to agricultural production capacities, moving towards organic farming and adopting environmentally friendly solutions is recommended for all the regions considered in this study.

- The prevention of food waste should be promoted, including by increasing public awareness, and more sustainable use of resources should be encouraged. The newly adopted Spanish Bill on the Prevention of Food Loss and Waste could serve as a good example. Mobilising financial support schemes at national and EU level should continue to ease the pressure of supply shortages and rising prices, particularly on low-income families and small-scale farmers in the EU countries. Financial support should be better tailored to the regions showing high exposure to the devastating effects of the war.
  In this regard, the new Common Agricultural Policy (CAP) 2023-27 is focused on strengthening resilience on the production side, supporting a fair income for farmers (European Commission, 2021). But given the fact that the new CAP was developed before the start of the war, the policy does not focus on countering the consequences of supply shortages and rising prices for both producers and consumers. The war created new 'uncertainty factors' and exceptional and temporary derogation from the CAP were requested by several EU Member States. Meanwhile, the largest EU support measures have been mobilised outside the CAP. Policy interventions should also be designed to consider the needs of low-income families, who were already struggling with food affordability before the outbreak of the war, and who are now among the most affected by price increases on basic consumer goods and agricultural produce.

- When designing policy interventions, having a strong regional dimension could be an effective tool for addressing challenges at the local level. Germany, as a federal state, could provide a good example of designing and implementing strong regional policies. Engaging regional authorities with a diverse group of regional stakeholders, as was done in Poland, could also serve as a good example of establishing collaboration between the public and private sectors, farmers and businesses at the local level. This is a forward-looking approach not only to diversifying and expanding local production, but also to promoting employment and entrepreneurship at the regional level.

- Pursuing protectionist policies by introducing price caps and export controls, as Hungary is currently doing, does not provide sustainable and valid solutions to inflation and supply shortages. Policy tools should instead

promote solidarity across the EU and put forward more long-term and sustainable solutions beyond short-sighted quick fixes, which fail to address systemic economic challenges.

- While designing policy interventions, more long-term and sustainable solutions should be considered for building resilience at the regional level:
    - In line with the Farm to Fork Strategy, the considered regions should shift towards relying on affordable and environmentally friendly solutions for increasing the resilience of the food system during such a large-scale crisis. Among others, this should include an expansion of the local production of grains and organic farming, the wider use of organic fertilisers and limiting input dependences on external supplies. On the other hand, the Farm to Fork Strategy should streamline its regional dimensions by considering the needs and interests of a diverse groups of local stakeholders to better reflect the challenges of food systems at the regional level.

    - There is a need to more actively promote changes in lifestyle and consumption to enable the more sustainable use of agricultural crops. In 2019 in the EU, 62 % of all grain crops were used to feed animals, 12 % were used in industry and as biofuels, and only the remaining 23 % were used directly to feed people (Greenpeace 2020). Therefore, policies should aim to reduce the grains needed to sustain livestock and instead devote more of the existing farmland to feeding people. At the same time, measures for reducing food waste should be introduced, both by consumers and by producers at every stage of the food supply chain. A long-term solution could be shifting to a more plant-based diet and reducing meat, fat and sugar consumption. New, more efficient and less resource-intensive food sources, such as insects, should also be considered for achieving these goals.

    - Global grain trading is largely concentrated across a few companies, the so-called ABCD group, which already have significant leverage on world grain prices. Export controls create extra room for speculation that further boosts price volatility. For this reason, back in 2006-2008, agricultural export restrictions raised world prices on wheat and maize by 19 % and 10 % respectively (Anania 2013). Therefore, there is a need to strengthen the monitoring of export controls under the WTO Agreement on Agriculture (AoA). The EU should also more carefully consider derogations from Articles 34 and 35 of the Treaty on the Functioning of the EU (TFEU) which prohibit imports and export restrictions among the EU countries.

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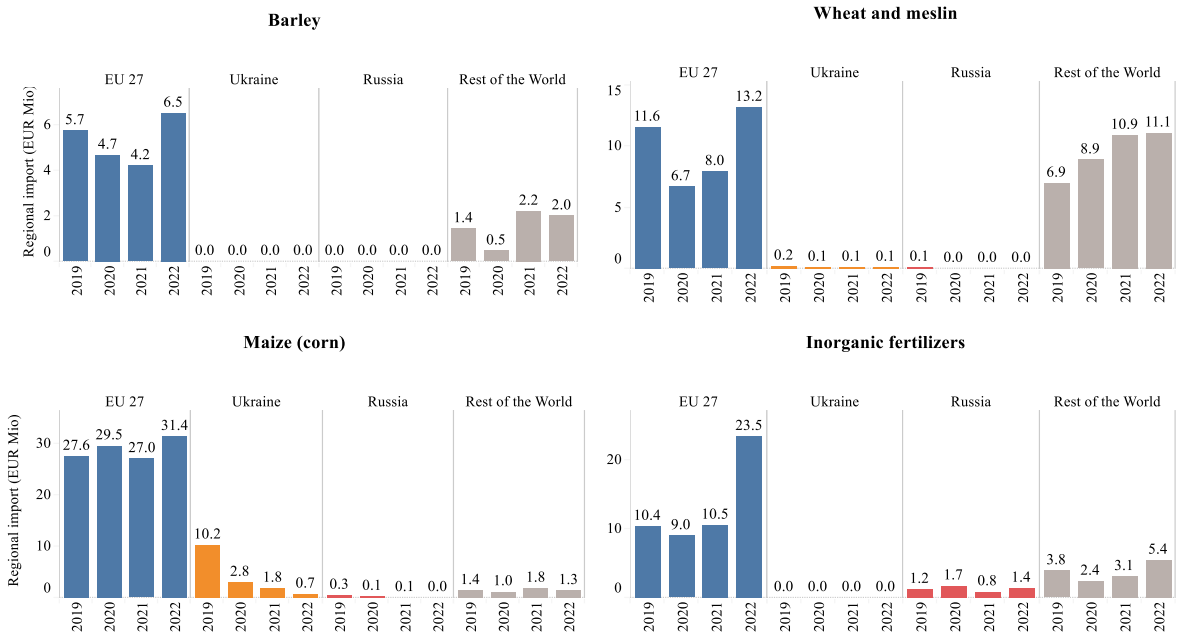
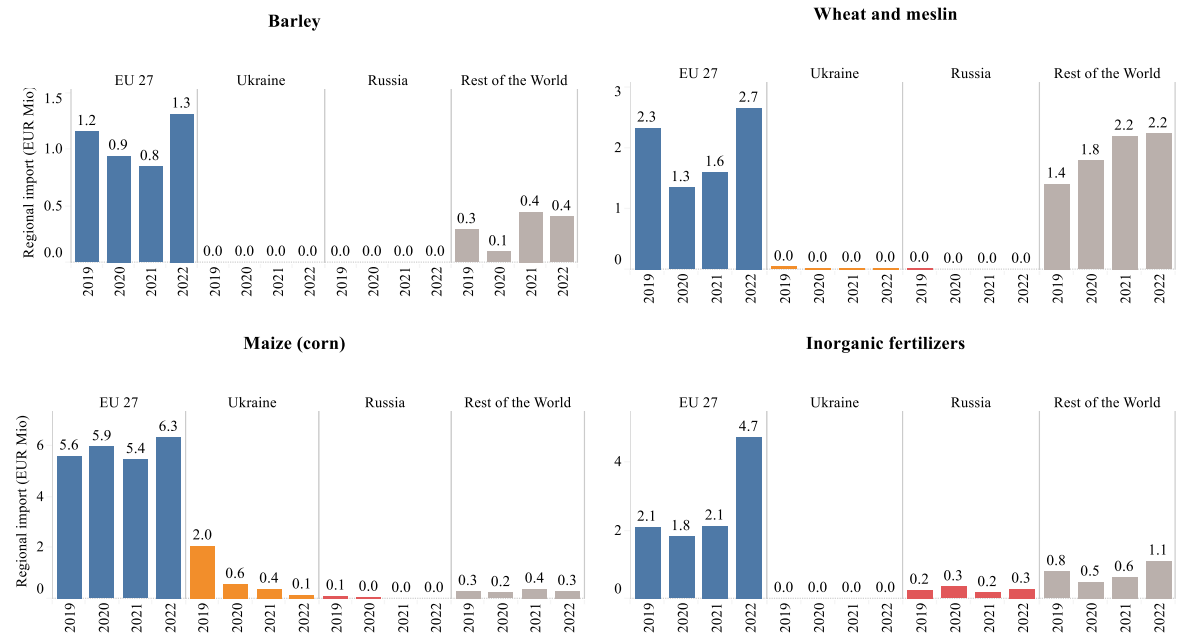
Annex I

Figure A 1. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Bavaria, Germany, EUR million



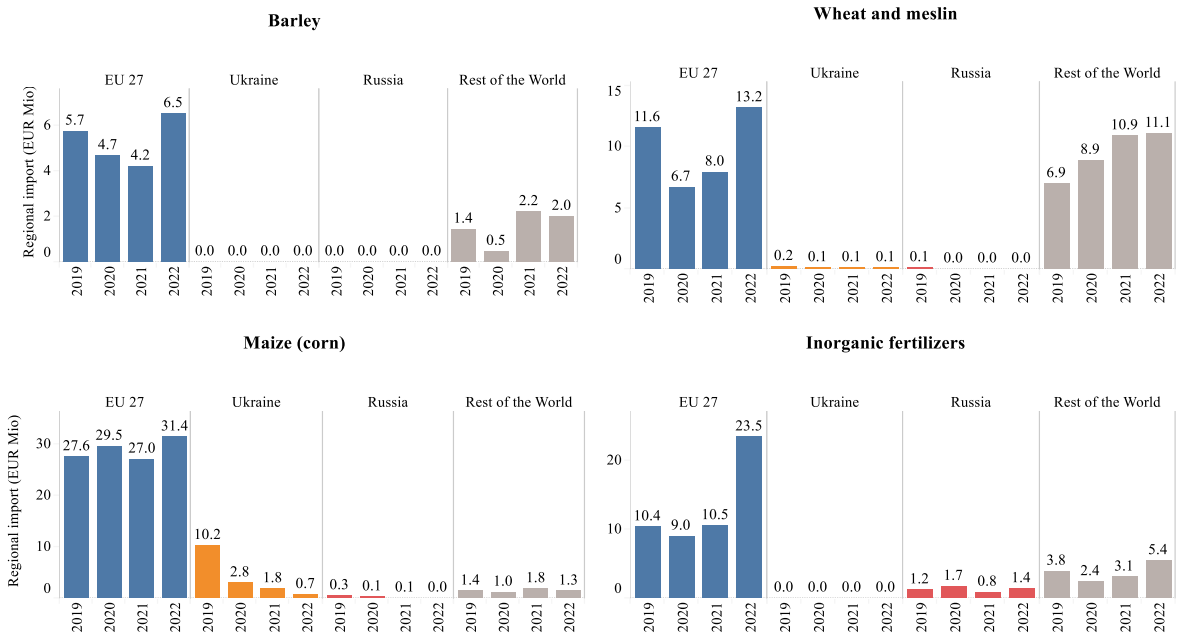
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 2. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Mecklenburg-Vorpommern, Germany, EUR million



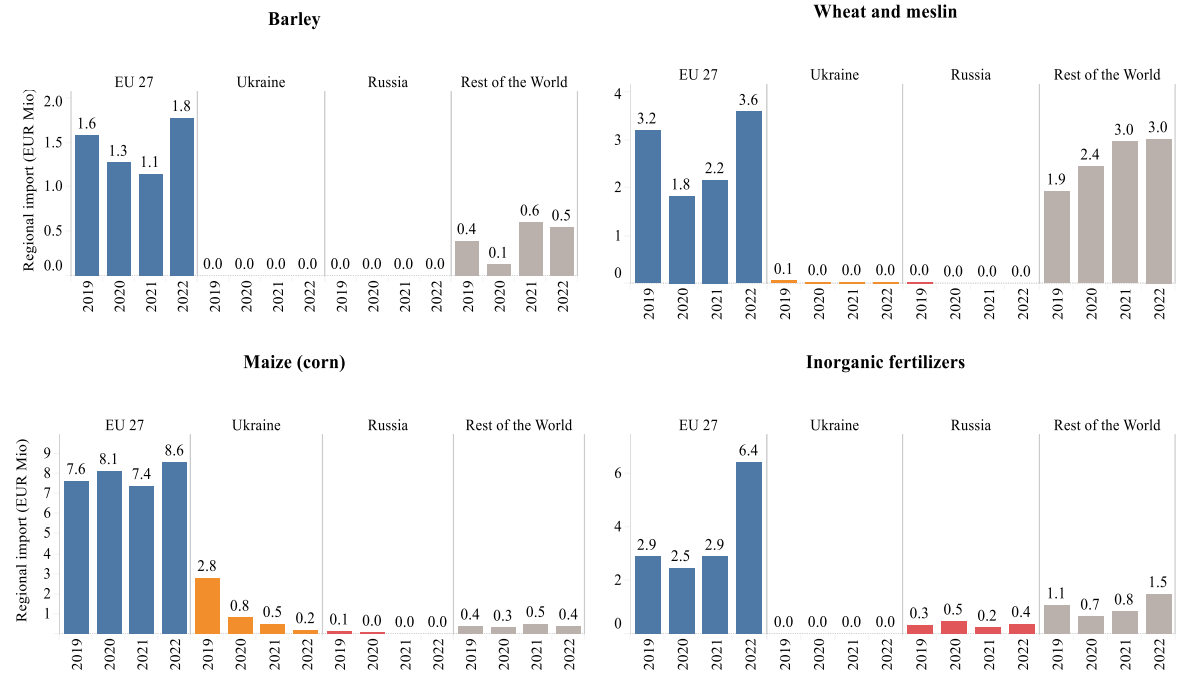
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 3. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Lower Saxony, Germany, EUR million



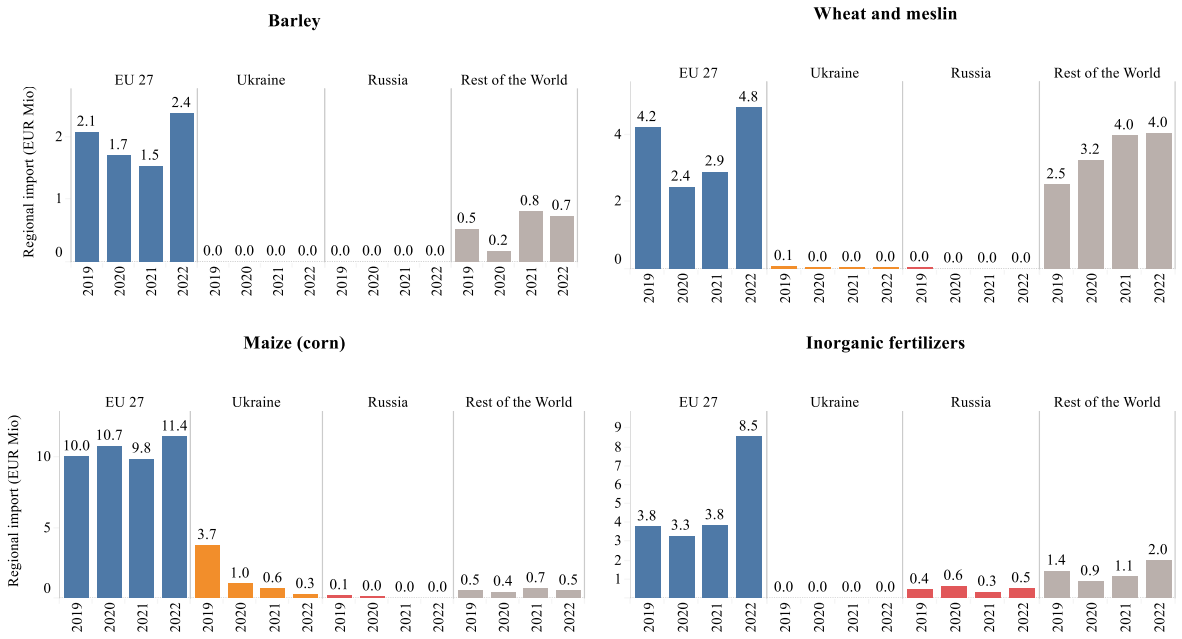
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 4. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Saxony-Anhalt, Germany, EUR million



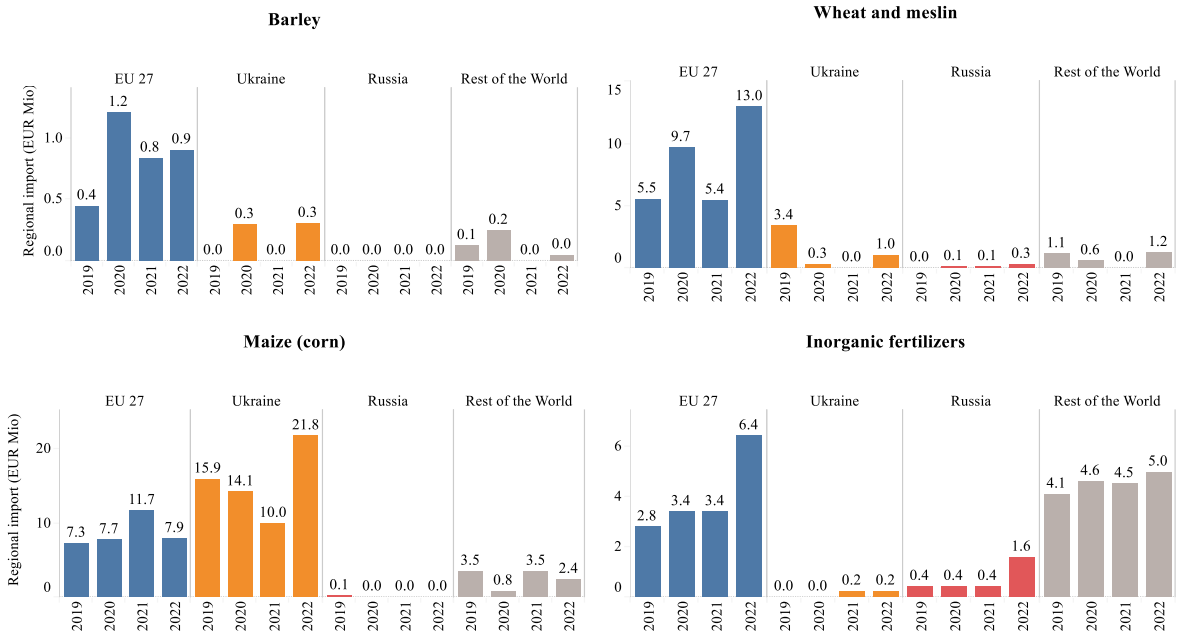
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 5. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Schleswig-Holstein, Germany, EUR million



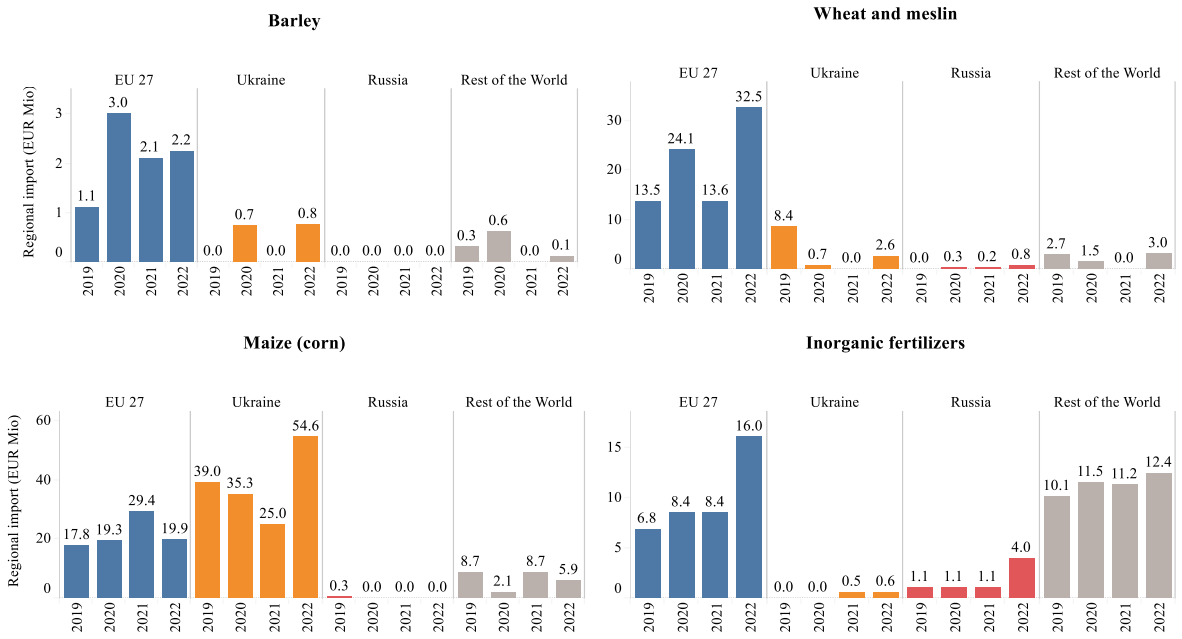
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 6. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Galicia, Spain, EUR million



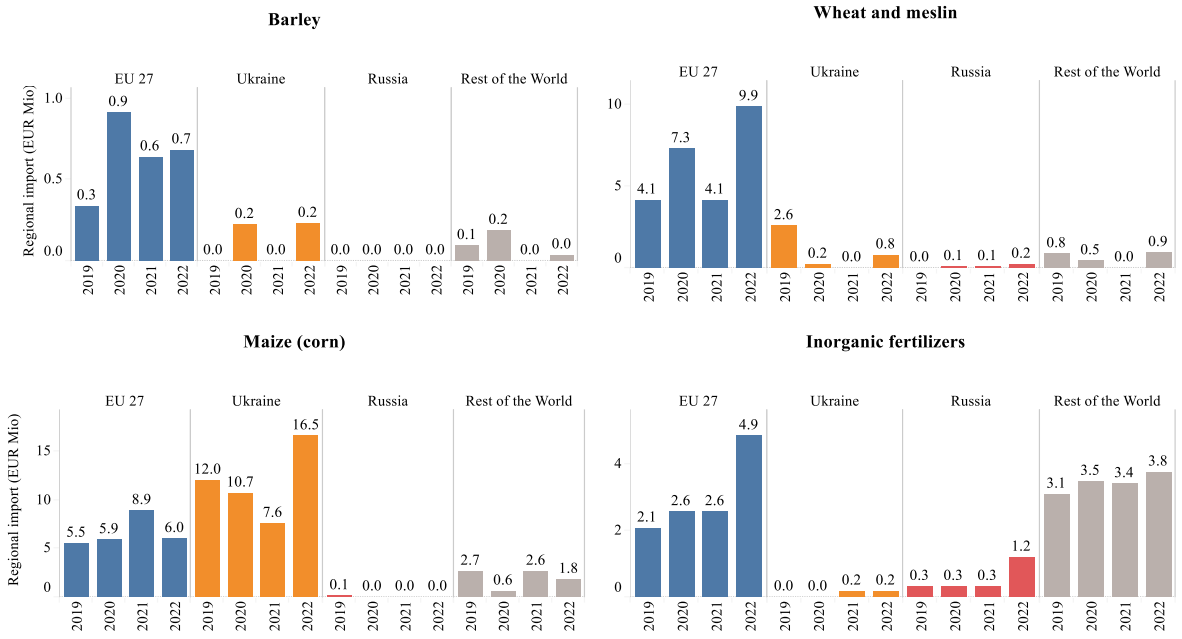
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 7. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Madrid, Spain, EUR million



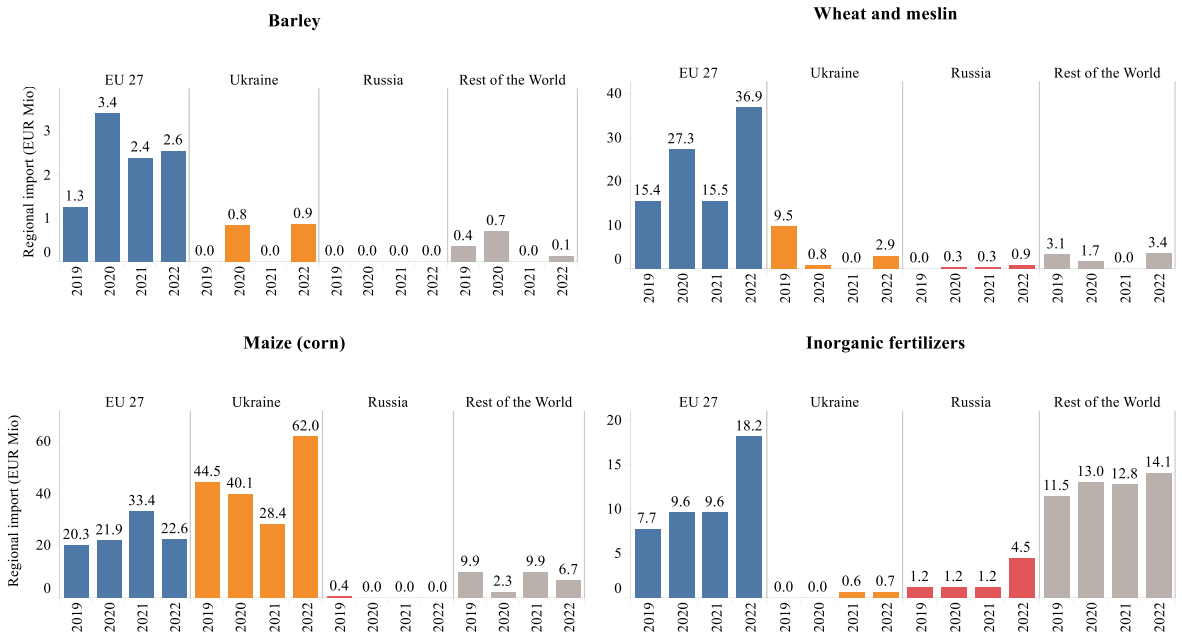
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 8. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Castile-La Mancha, Spain, EUR million



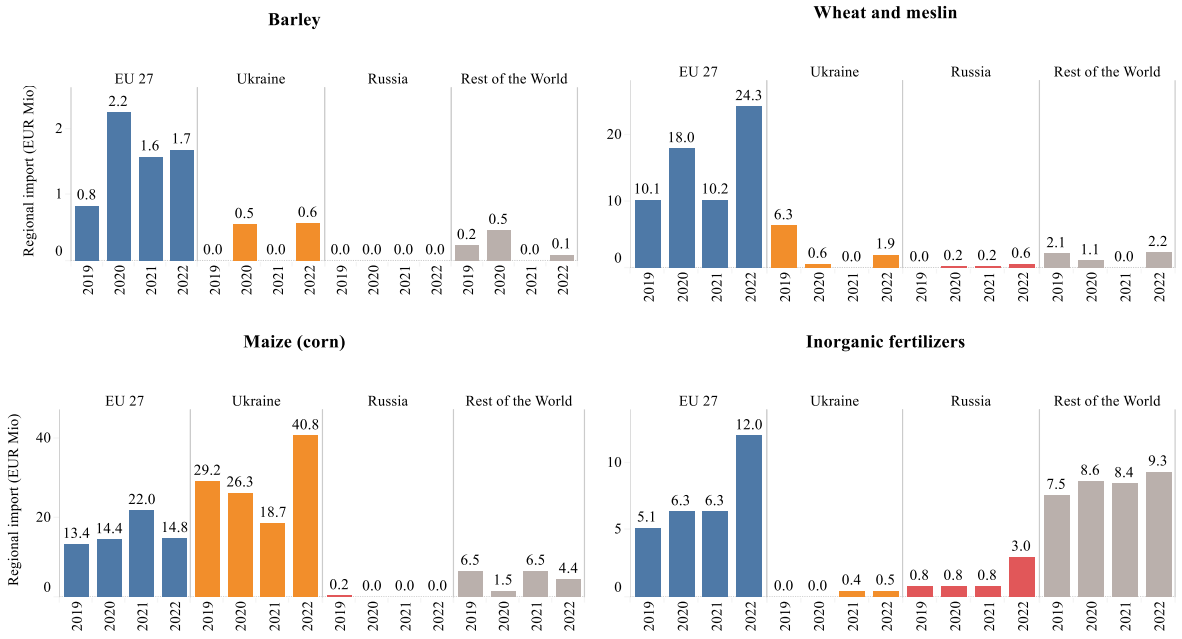
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 9. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Catalonia, Spain, EUR million



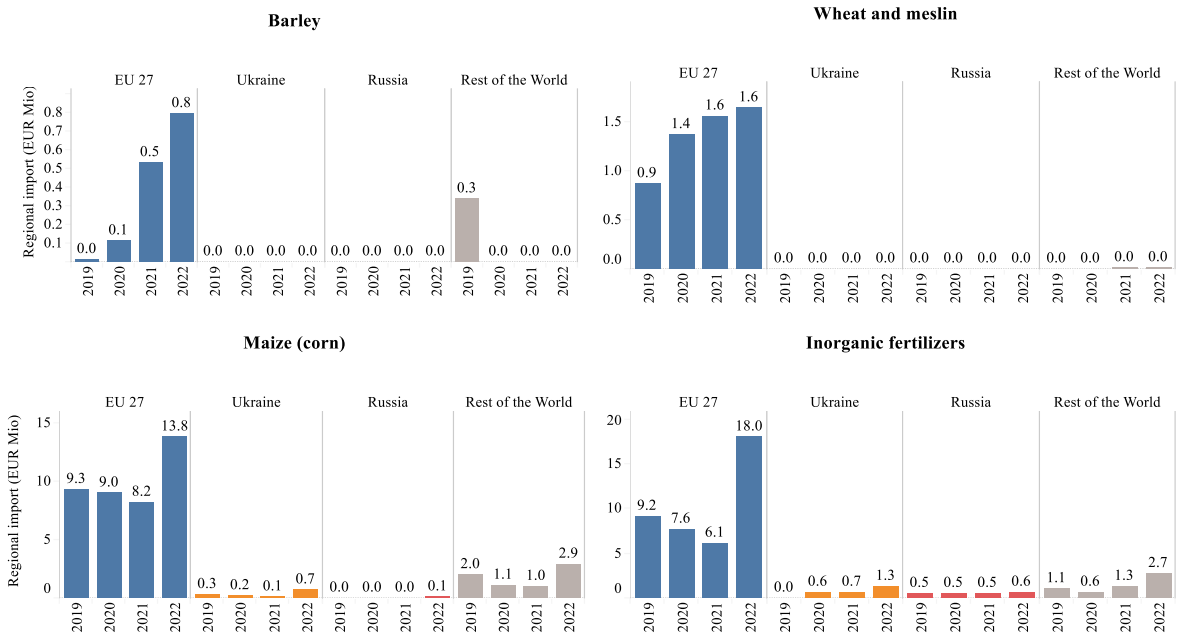
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 10. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Valencia, Spain, EUR million



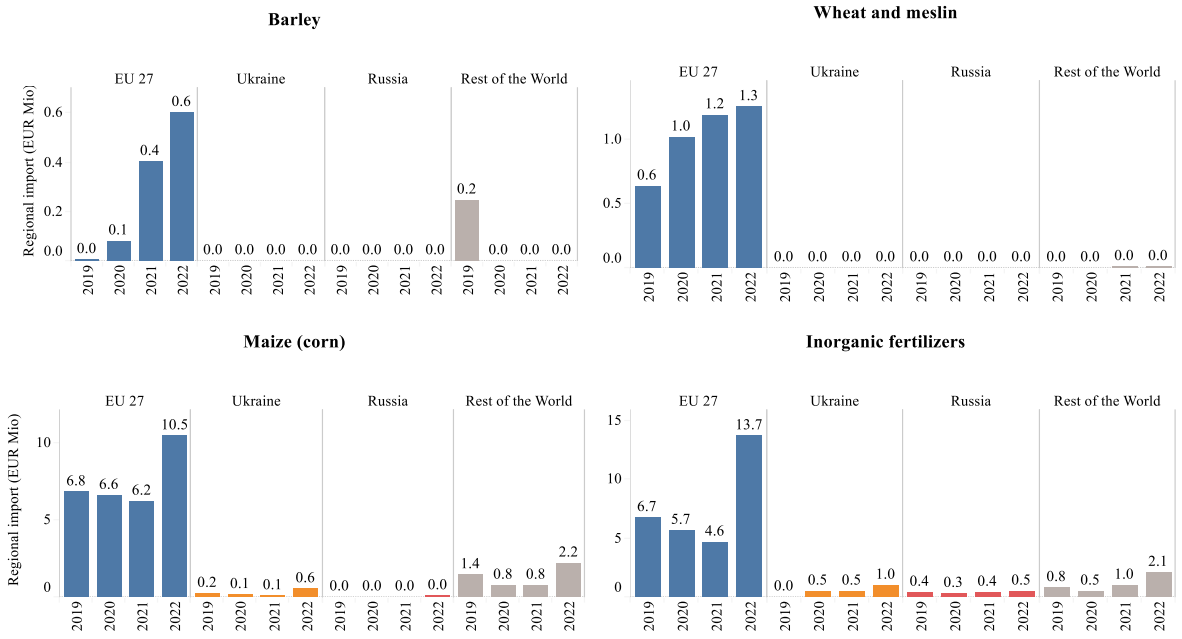
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 11. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Budapest, Hungary, EUR million



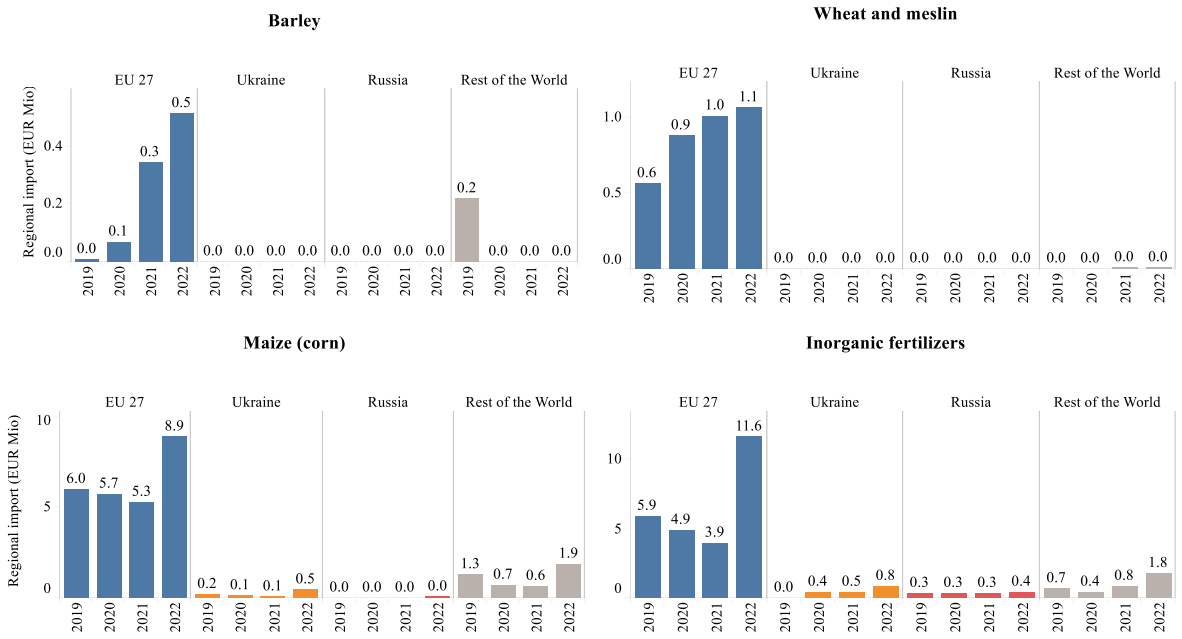
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 12. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Pest, Hungary, EUR million



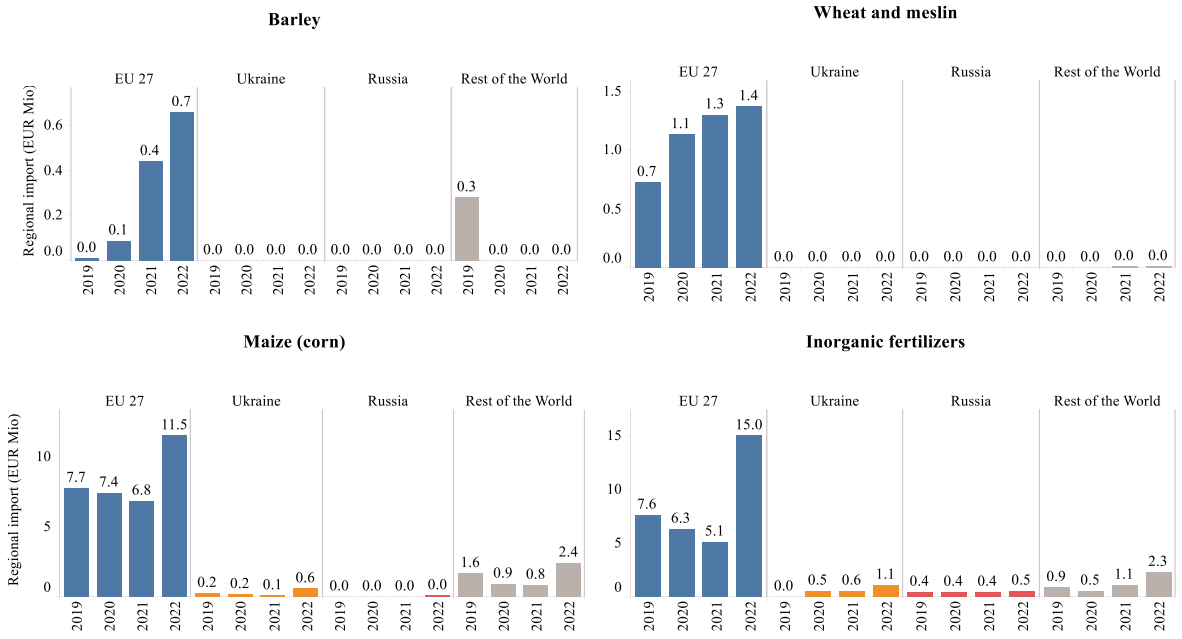
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

A 13. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Észak-Magyarország, Hungary, EUR million



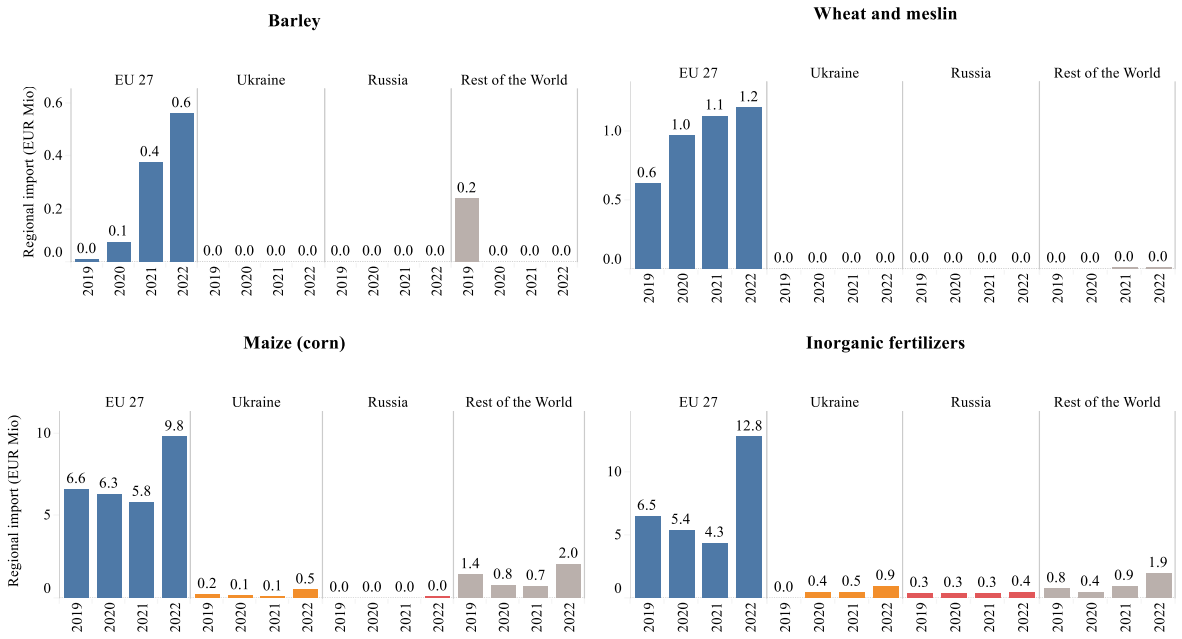
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 14. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Észak-Alföld, Hungary, EUR million



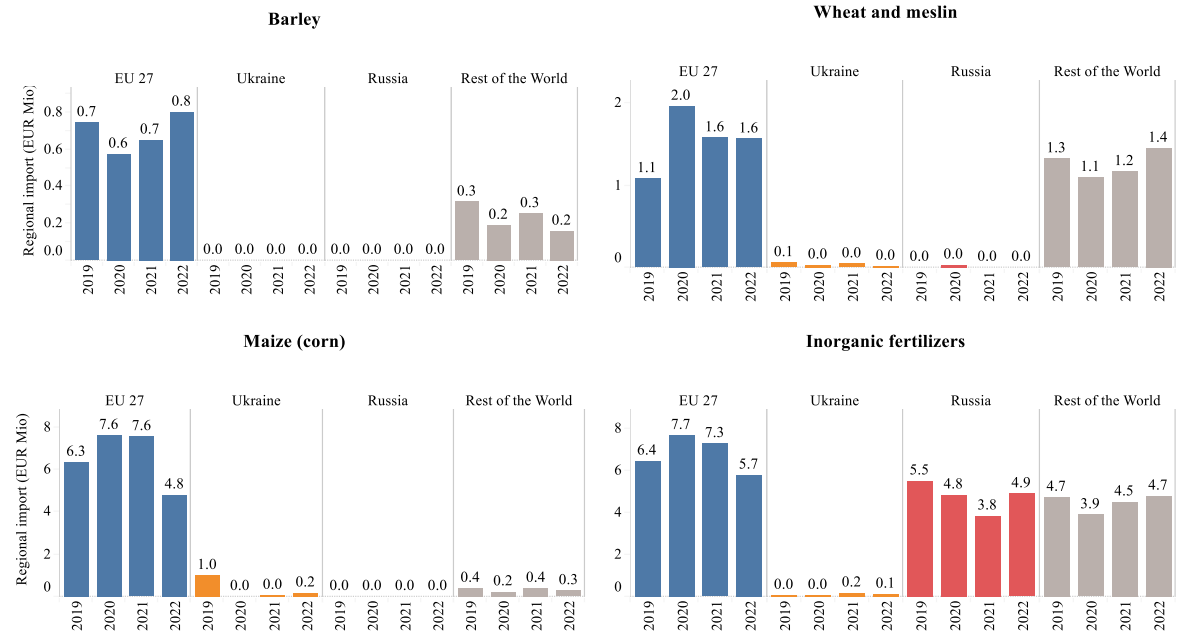
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 15. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Dél-Alföld, Hungary, EUR million



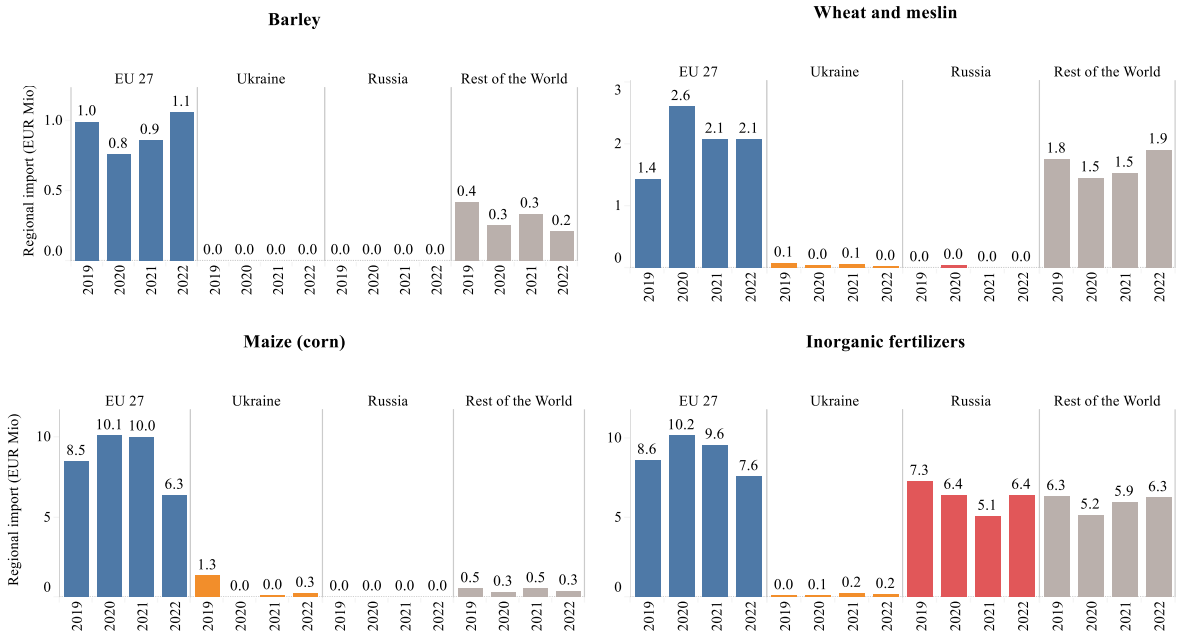
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 16. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Małopolskie, Poland, EUR million



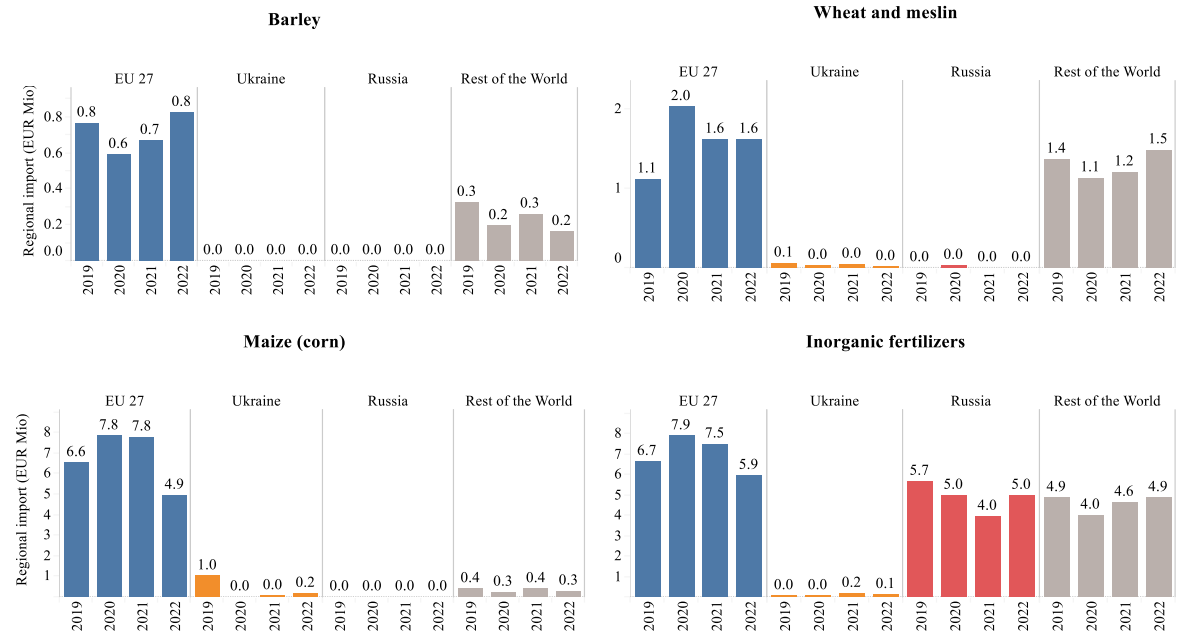
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 17. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Śląskie, Poland,
EUR million



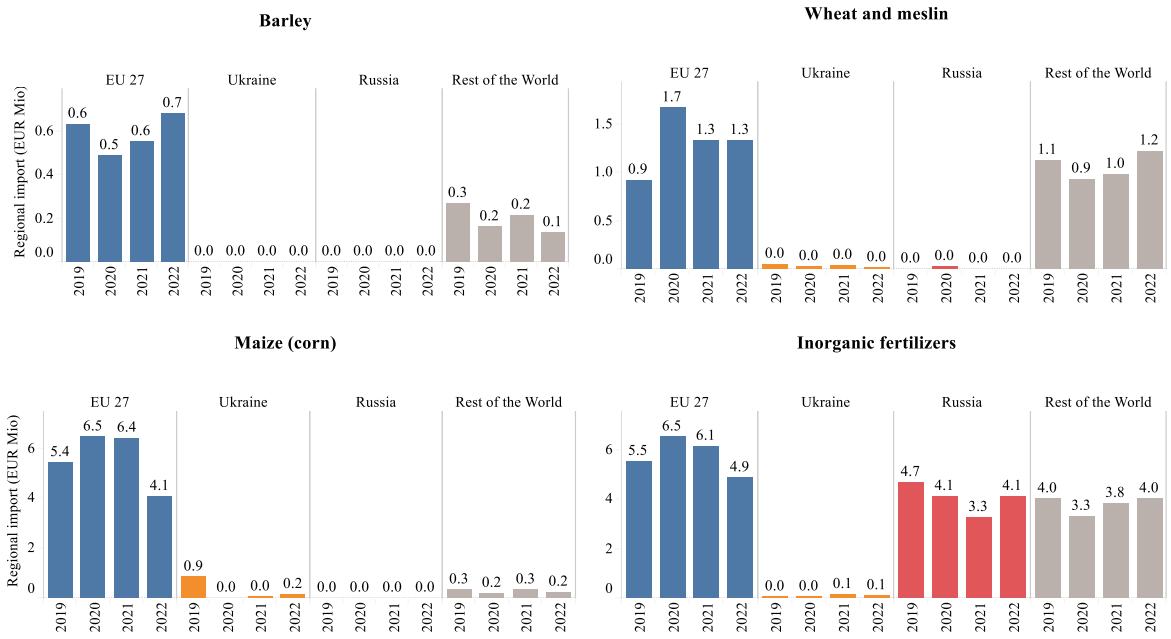
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 18. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Wielkopolskie, Poland, EUR million



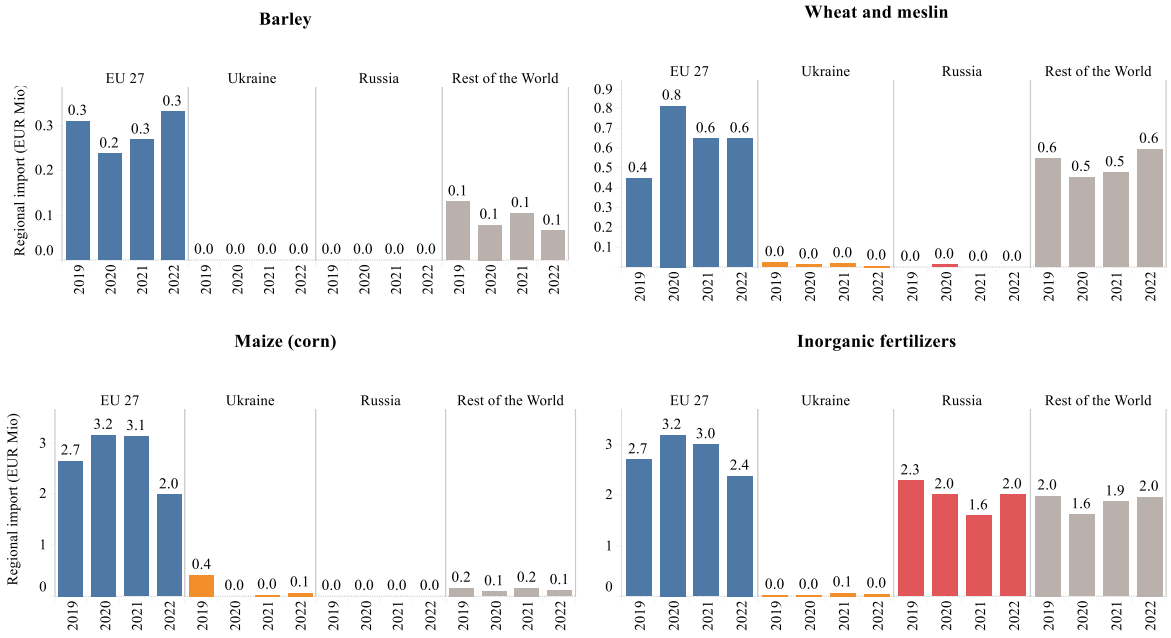
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 19. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Dolnośląskie, Poland, EUR million



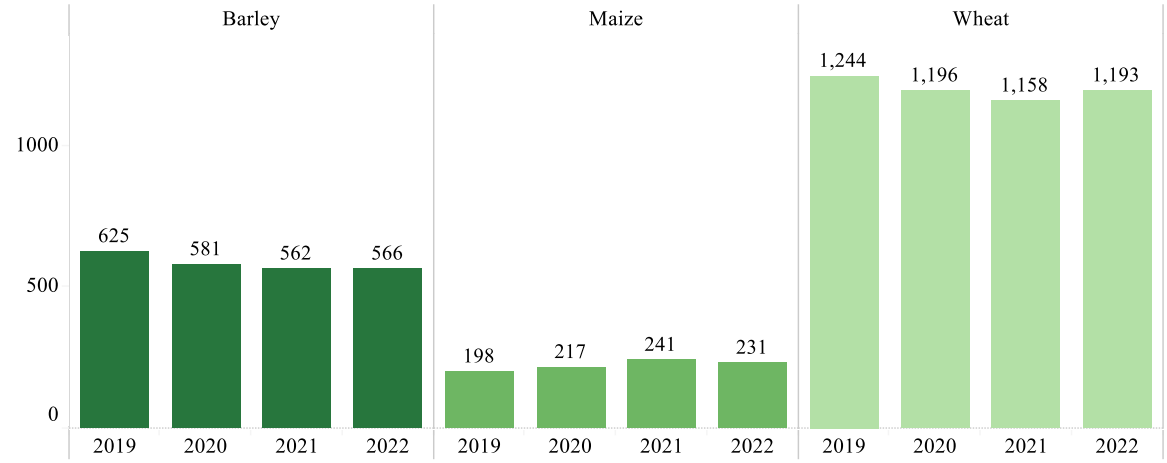
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 20. Regional imports from EU-27, Ukraine, Russia and the rest of the world in Warmińsko-Mazurskie, Poland, EUR million



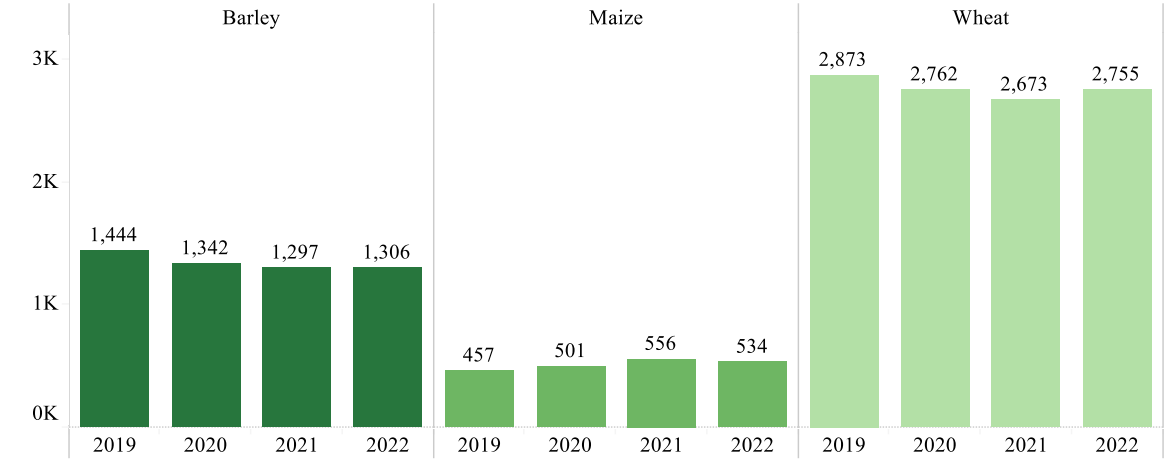
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022).

Figure A 21. Cereal gross production by crop type in Bavaria, Germany, 1 000 tonnes



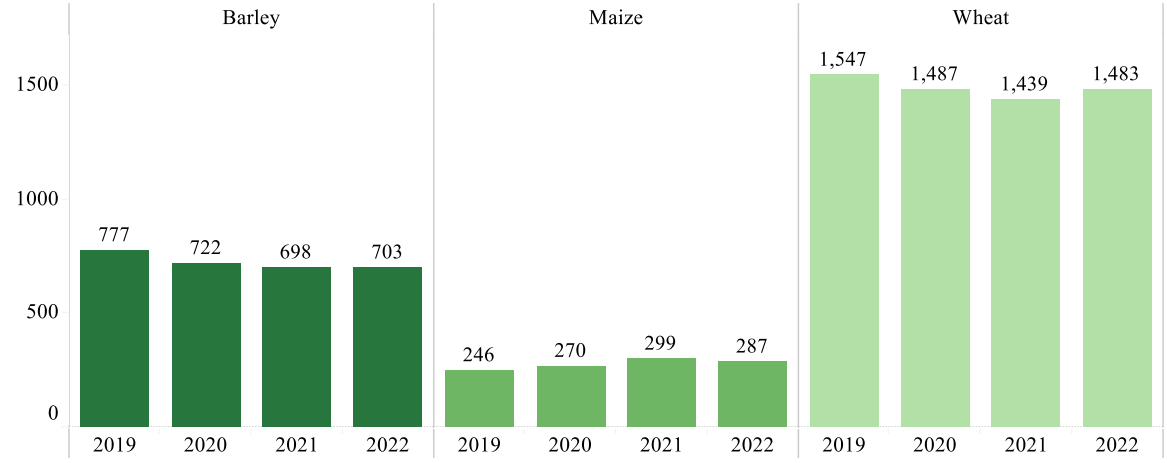
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 22. Cereal gross production by crop type in Mecklenburg-Vorpommern, Germany, 1 000 tonnes



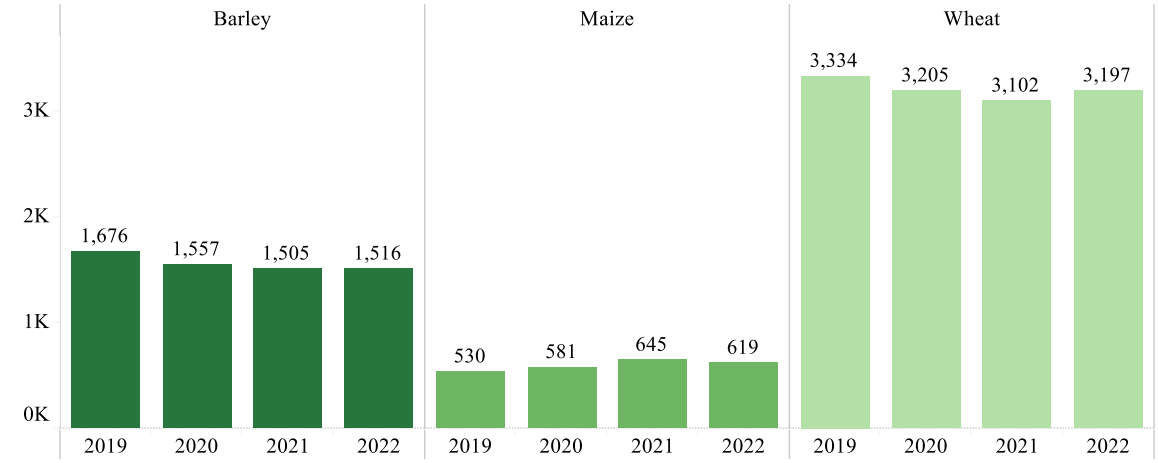
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 23. Cereal gross production by crop type in Lower Saxony, Germany, 1 000 tonnes



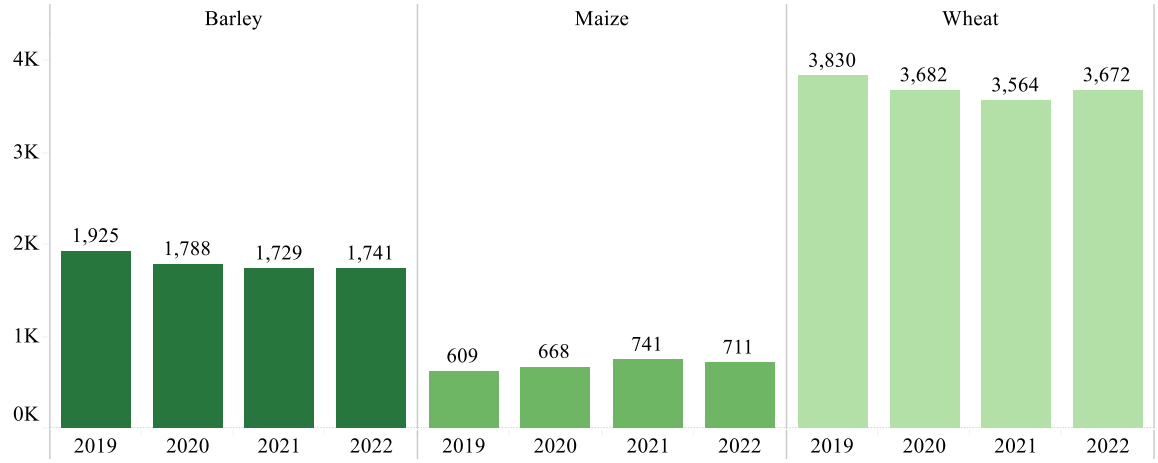
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 24. Cereal gross production by crop type in Saxony-Anhalt, Germany, 1 000 tonnes



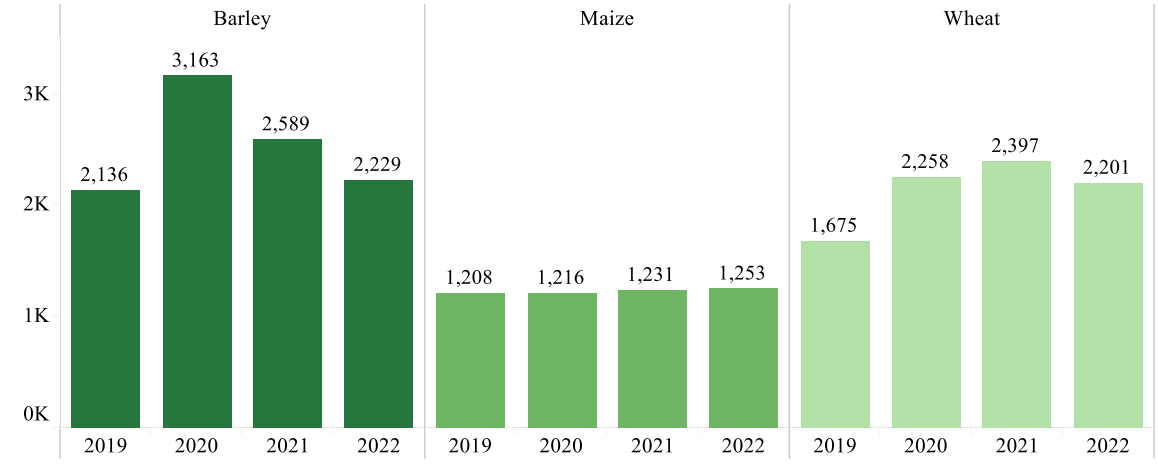
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 25. Cereal gross production by crop type in Schleswig-Holstein, Germany, 1 000 tonnes



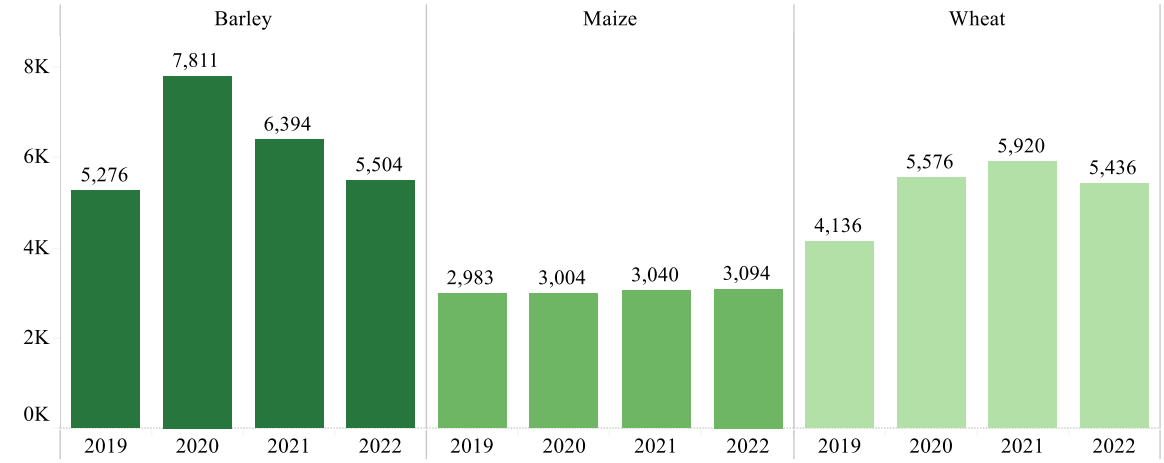
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 26. Cereal gross production by crop type in Galicia, Spain, 1 000 tonnes



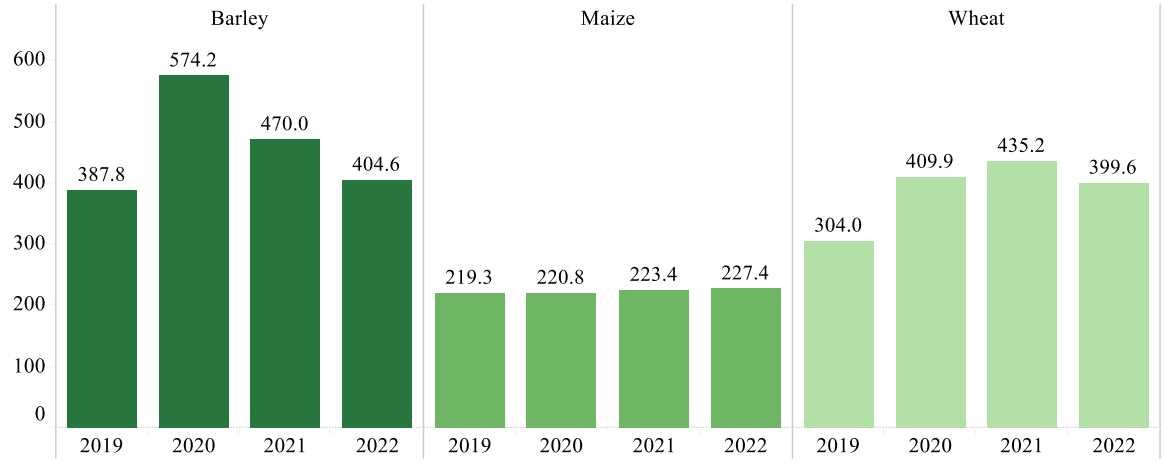
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 27. Cereal gross production by crop type in Madrid, Spain, 1 000 tonnes



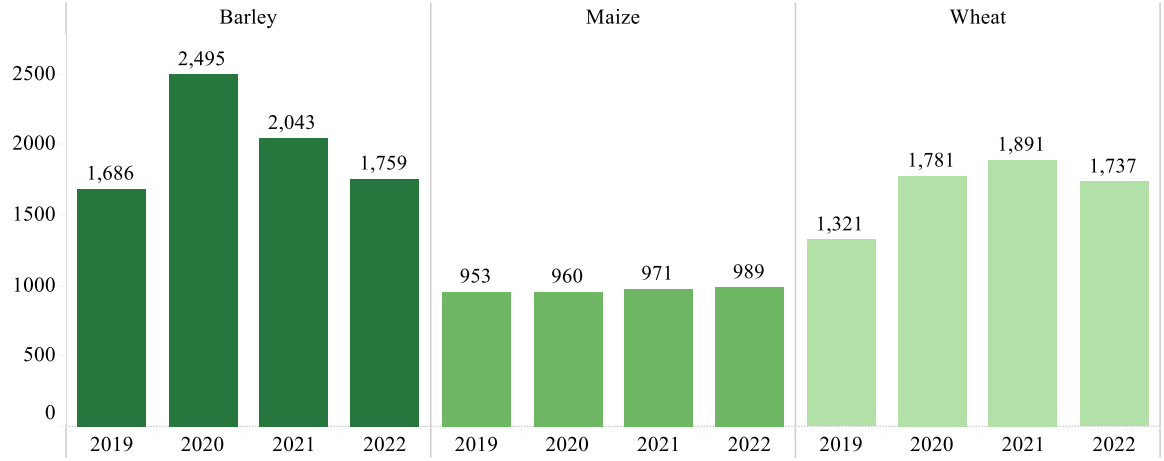
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 28. Cereal gross production by crop type in Castile-La Mancha, Spain, 1 000 tonnes



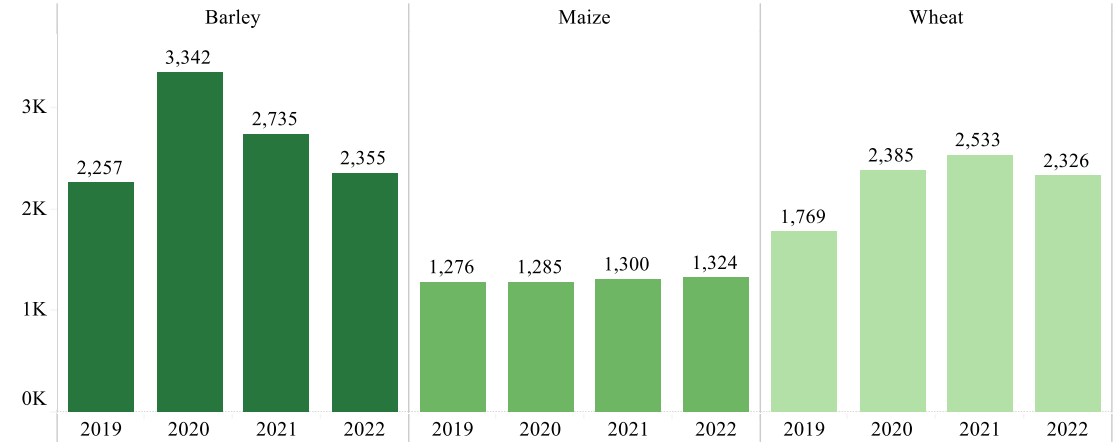
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 29. Cereal gross production by crop type in Catalonia, Spain, 1 000 tonnes



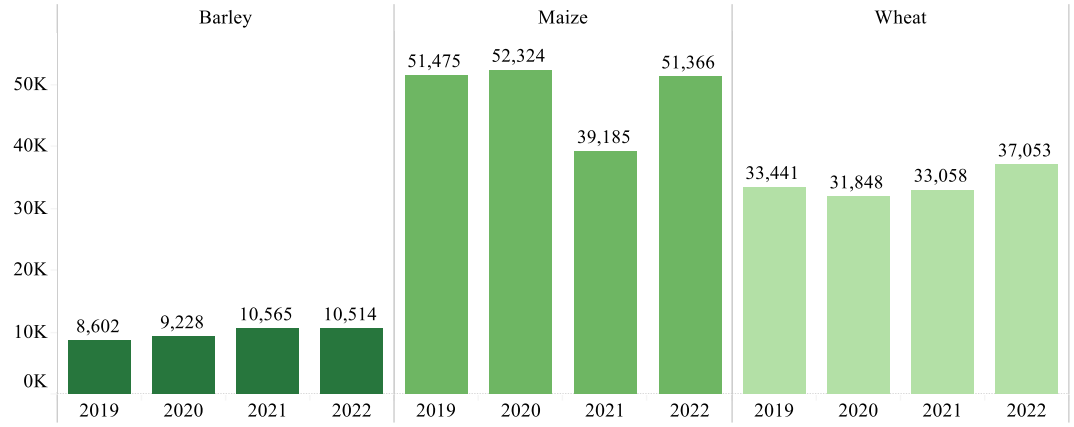
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 30. Cereal gross production by crop type in Valencia, Spain, 1 000 tonnes



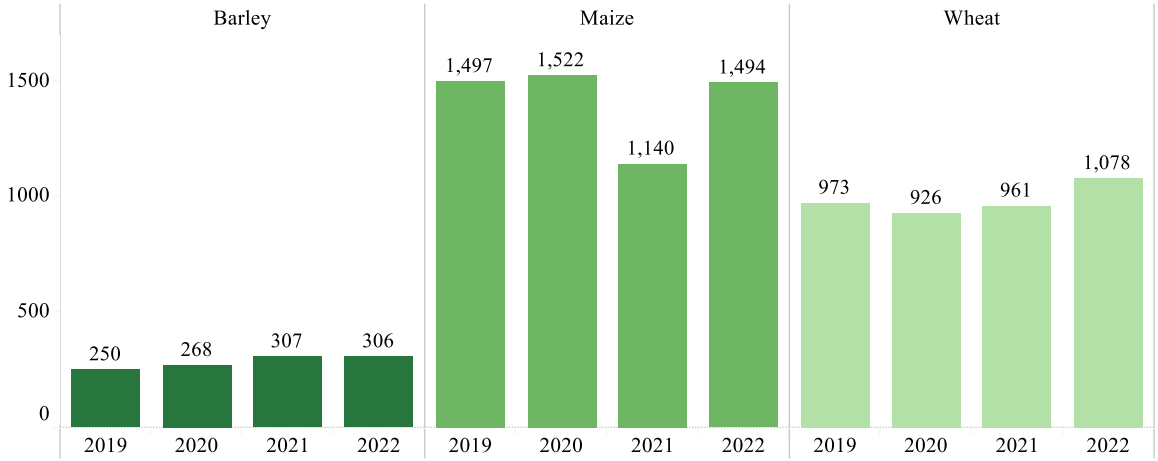
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 31. Cereal gross production by crop type in Budapest, Hungary, 1 000 tonnes



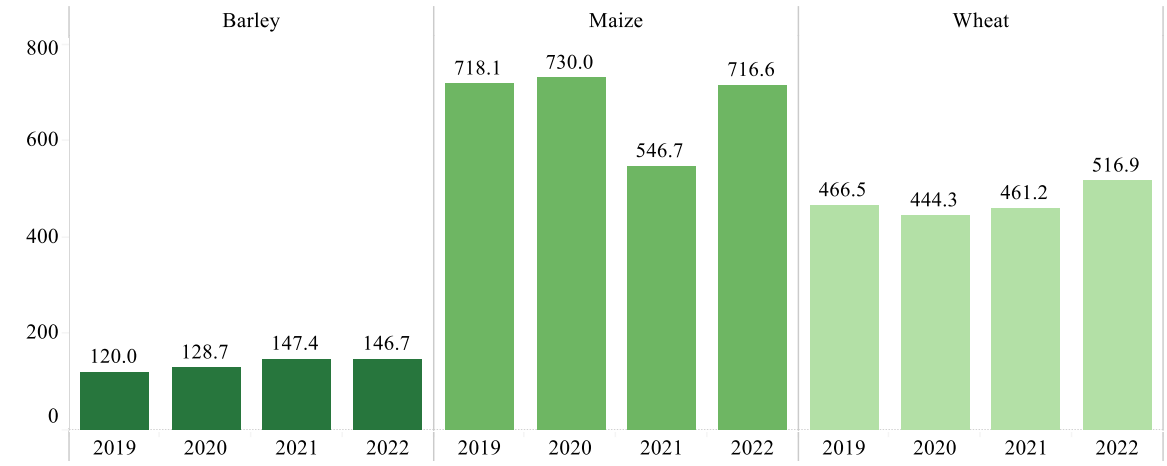
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 32. Cereal gross production by crop type in Pest, Hungary, 1 000 tonnes



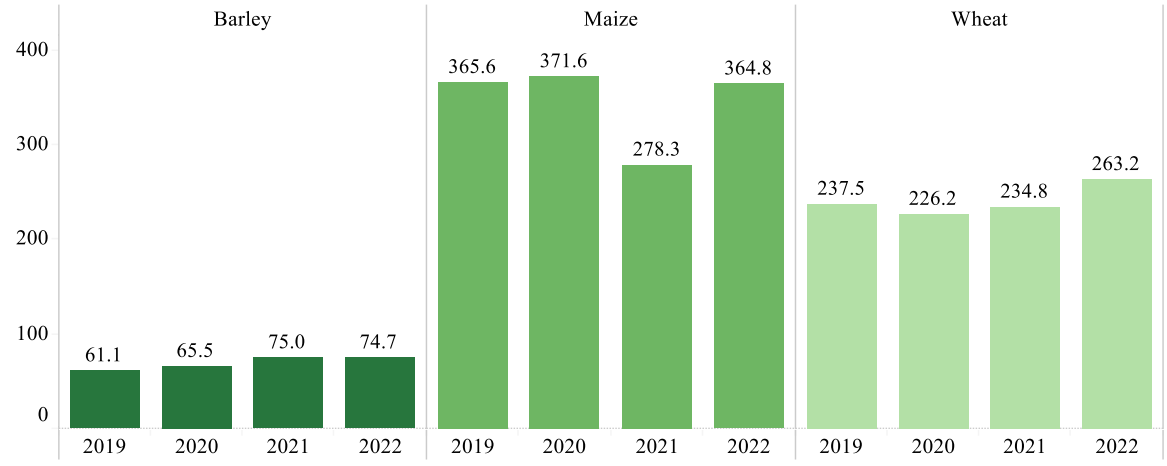
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 33. Cereal gross production by crop type in Észak-Magyarország, Hungary, 1 000 tonnes



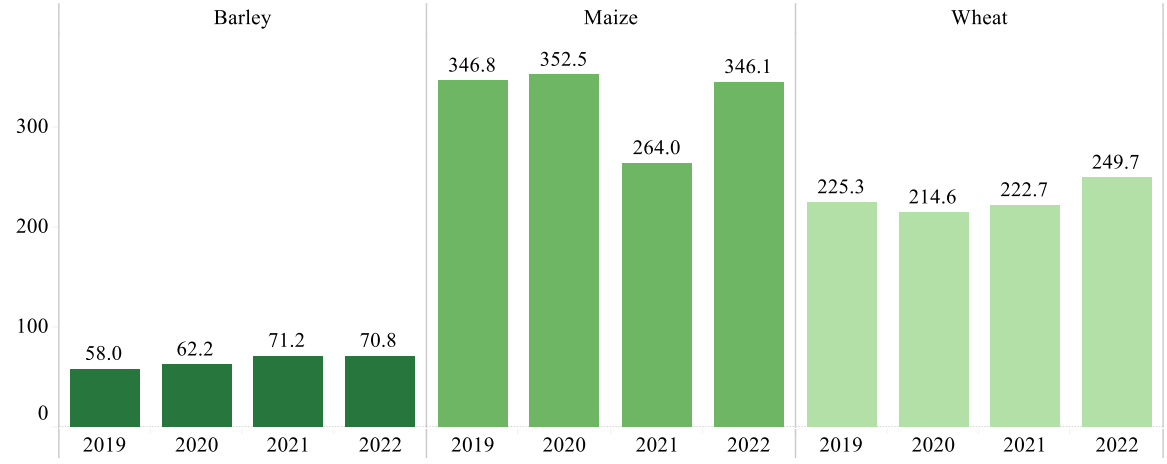
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 34. Cereal gross production by crop type in Észak-Alföld, Hungary, 1 000 tonnes



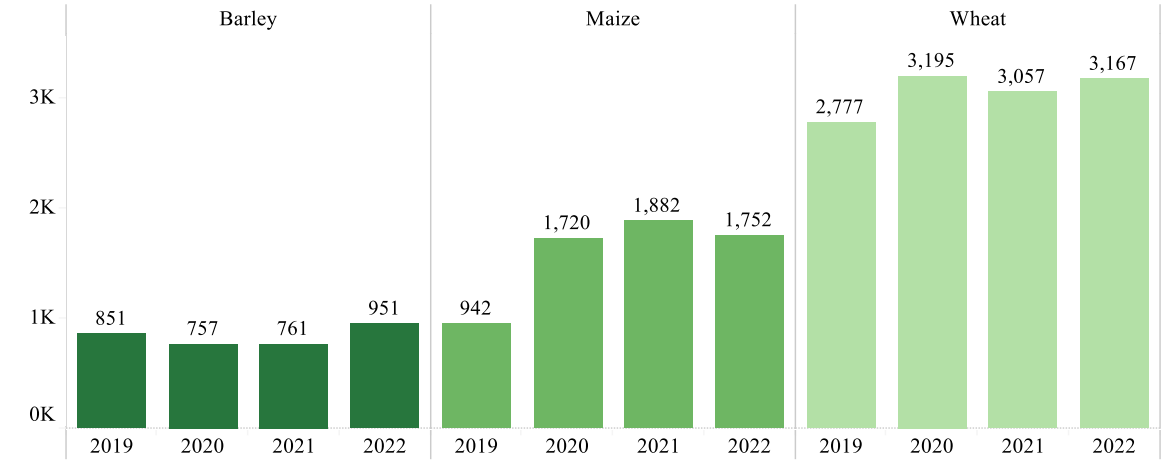
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 35. Cereal gross production by crop type in Dél-Alföld, Hungary, 1 000 tonnes



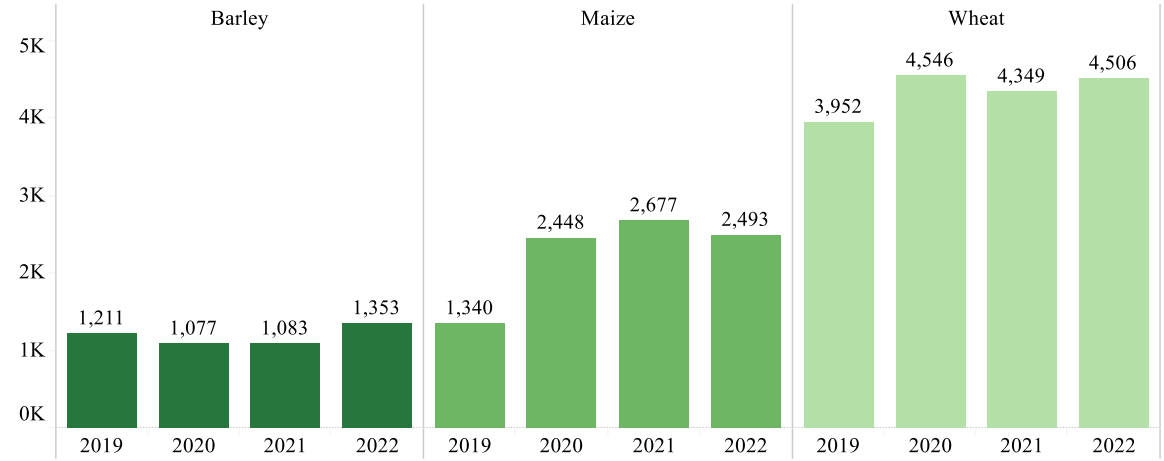
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 36. Cereal gross production by crop type in Małopolskie, Poland, 1 000 tonnes



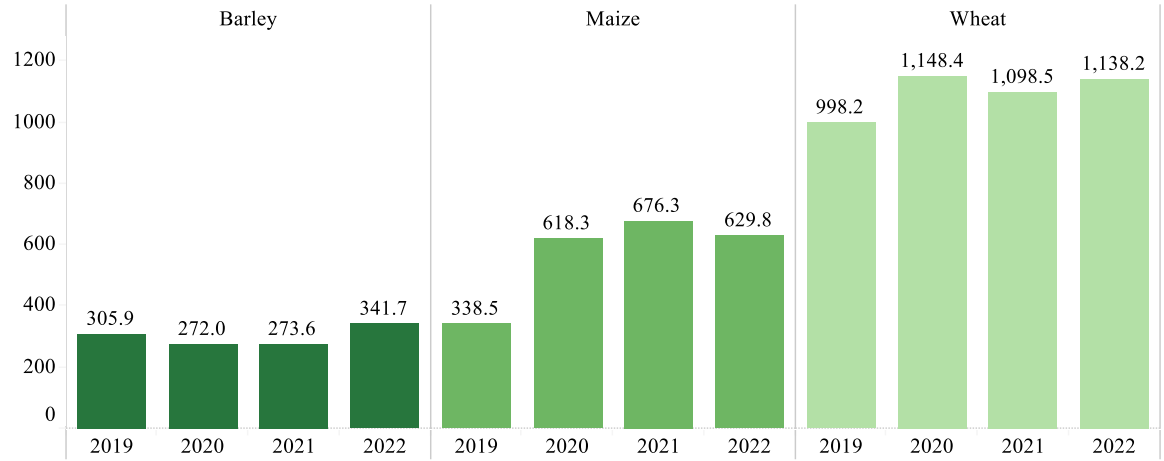
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 37. Cereal gross production by crop type in Śląskie, Poland, 1 000 tonnes



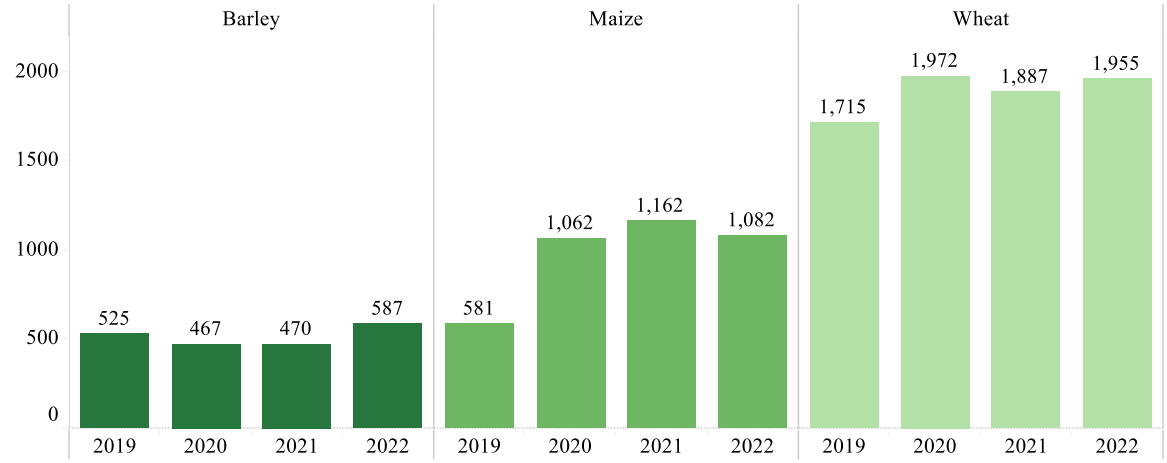
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 38. Cereal gross production by crop type in Wielkopolskie, Poland, 1 000 tonnes



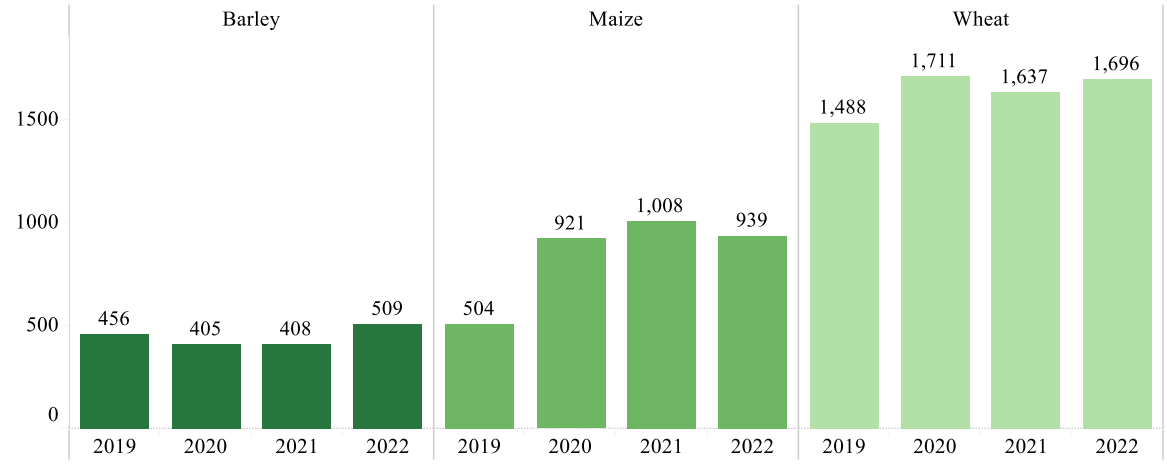
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 39. Cereal gross production by crop type in Dolnośląskie, Poland, 1 000 tonnes



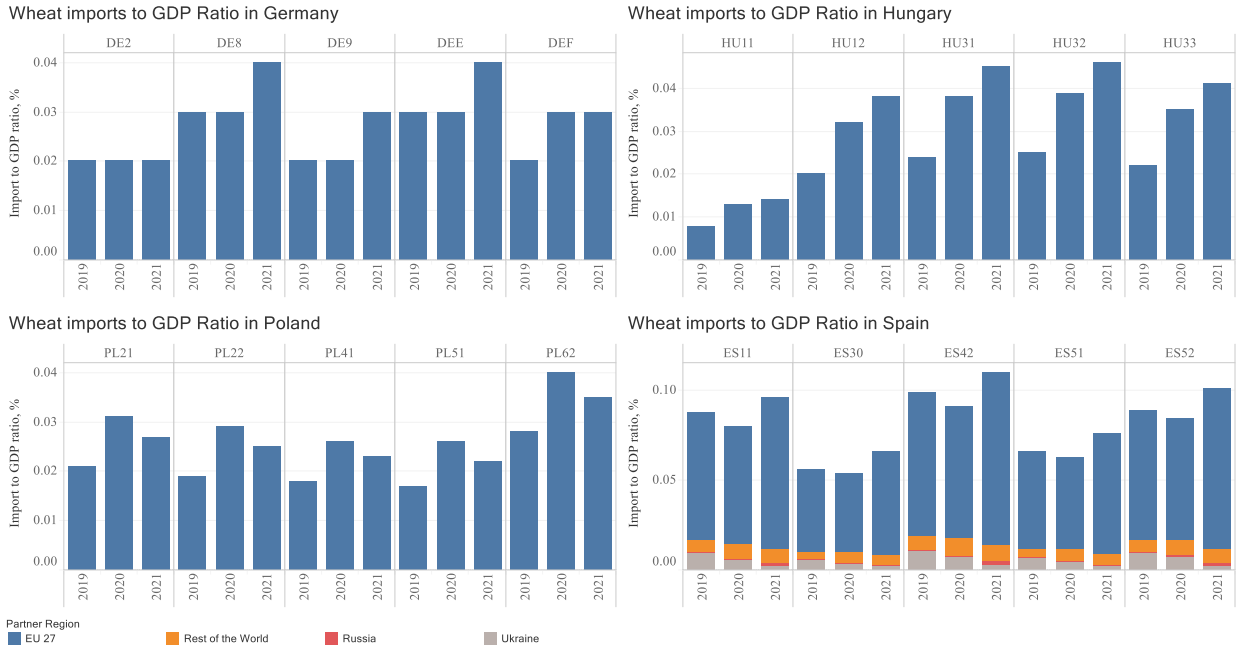
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 40. Cereal gross production by crop type in Warmińsko-Mazurskie, Poland, 1 000 tonnes



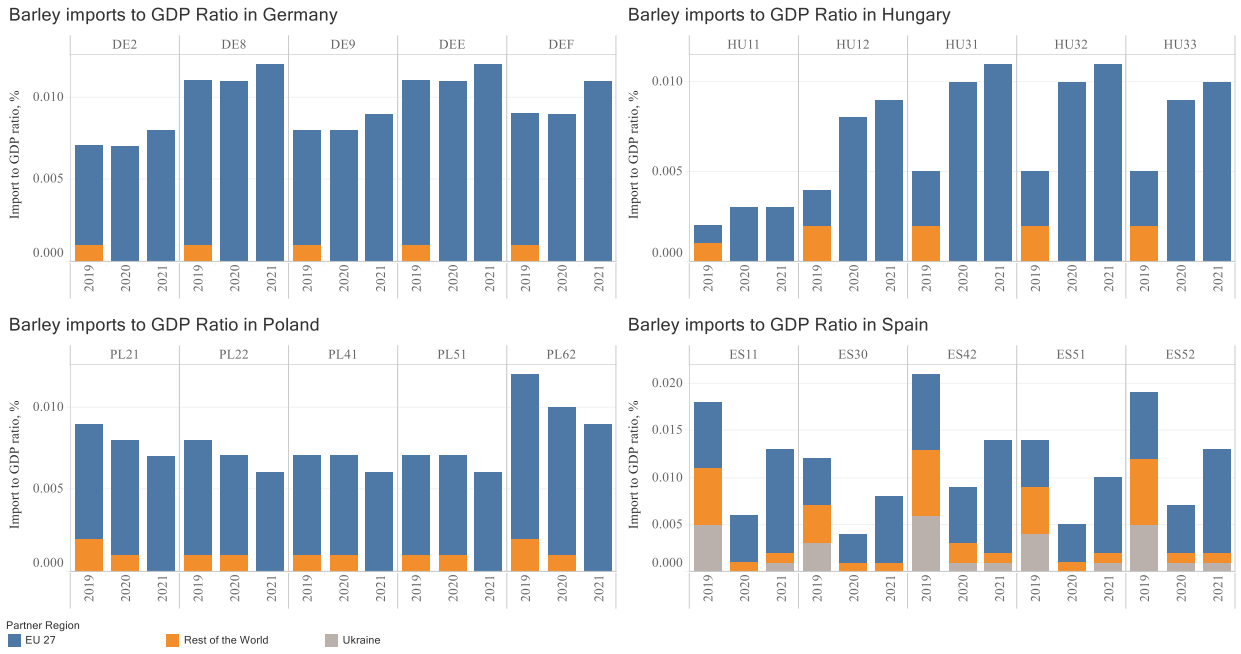
Source: Authors' calculations using agri-food data (EC 2022d) and Eurostat (2022).

Figure A 41. Annual ratio of wheat imports to GDP, %



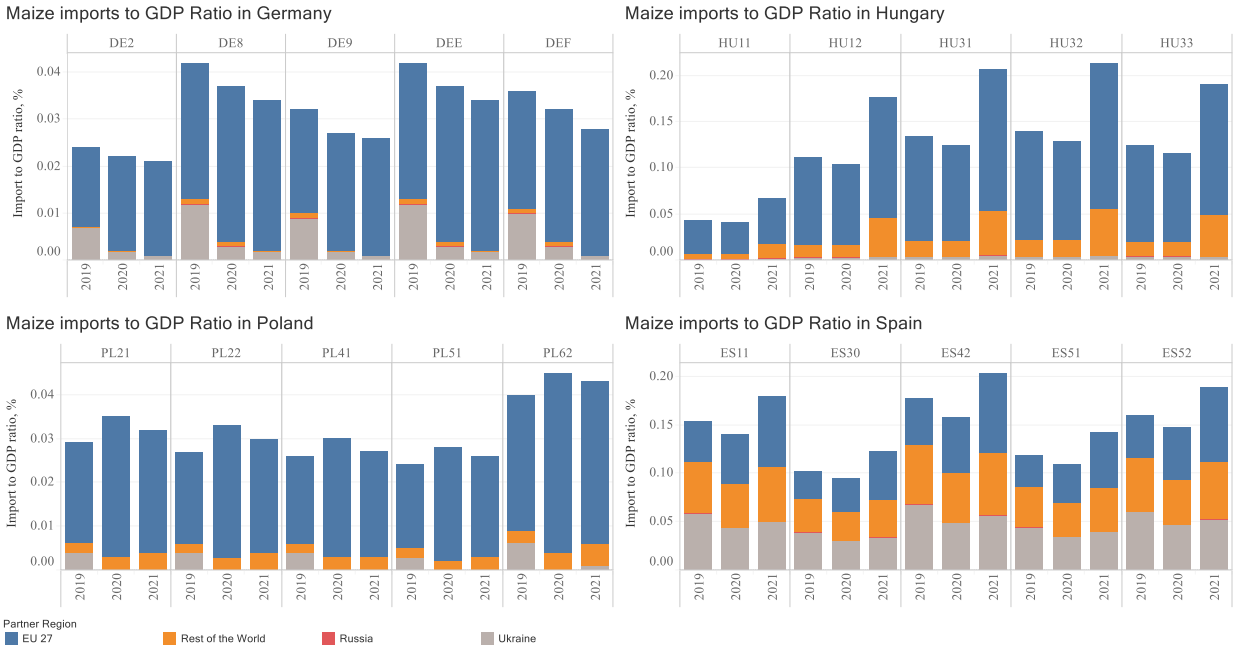
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022c).

Figure A 42. Annual ratio of barley imports to GDP, %



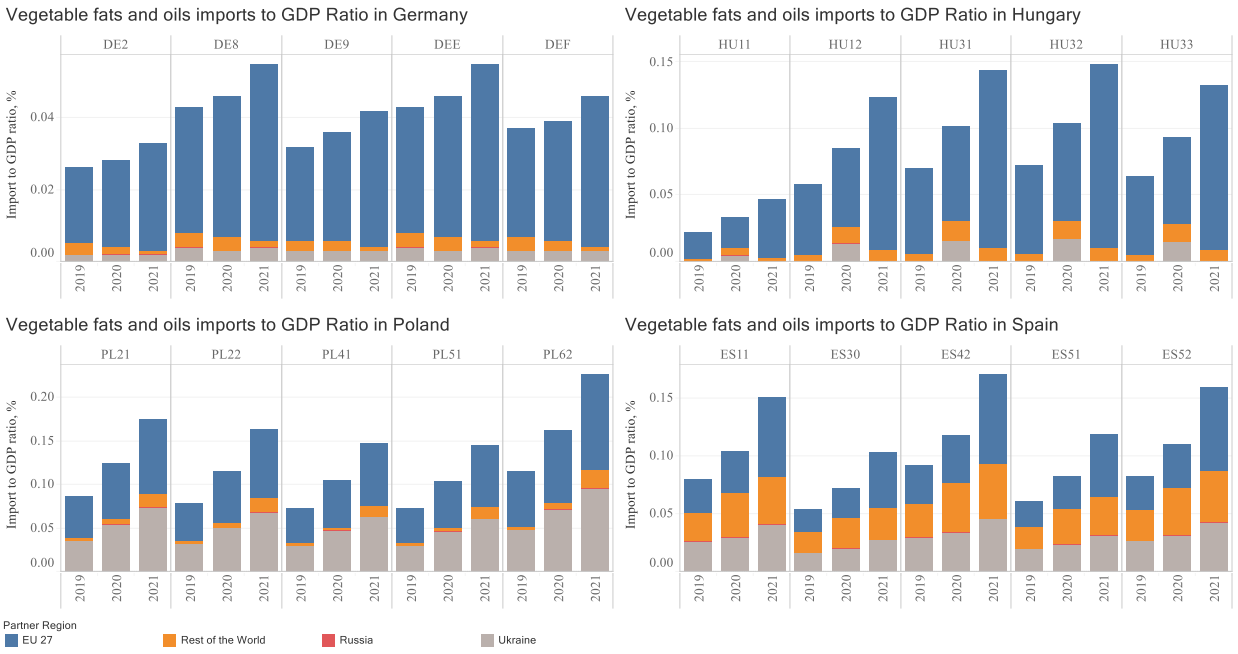
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022c).

Figure A 43. Annual ratio of maize imports to GDP, %



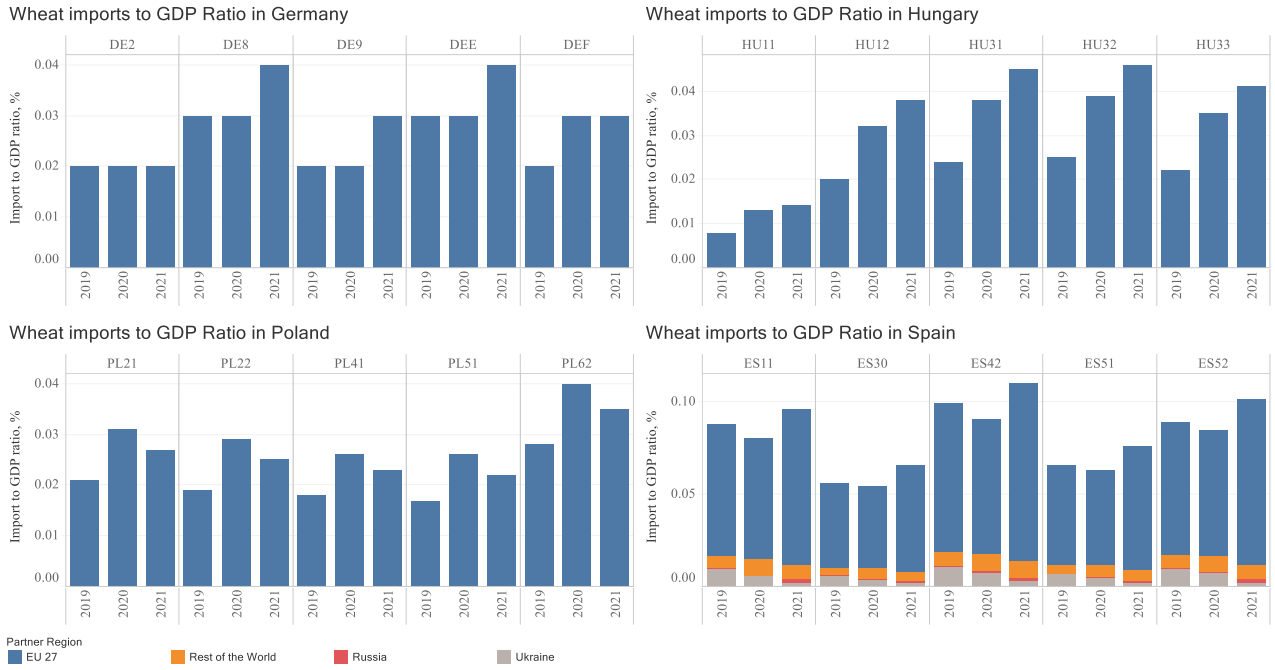
Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022c).

Figure A 44. Annual ratio of vegetable oil imports to GDP, %



Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022c).

Figure A 45. Annual ratio of wheat imports to GDP, %



Source: Authors' calculations using UN COMTRADE data (2022) and Eurostat (2022c).

Table A 1. Top cereal and vegetable oil exporters in the world, export share as %

Year	Reporter	Barley (%)	Reporter	Maize (%)	Reporter	Wheat (%)	Reporter	Vegetable oils (%)
2019	France	22.1	US	22.5	Russia	15.9	Ukraine	13.4
2019	Russia	11.2	Brazil	20.4	US	15.5	Spain	11.4
2019	Australia	10.6	Argentina	16.7	Canada	13.3	Argentina	11.1
2019	Ukraine	10.4	Ukraine	14.6	France	10.8	Russia	9.0
2019	Argentina	8.6	Romania	3.9	Ukraine	9.1	Canada	7.9
2020	France	18.5	US	26.1	Russia	17.7	Ukraine	14.5
2020	Australia	12.3	Argentina	16.5	Canada	14.1	Argentina	10.8
2020	Russia	12.2	Brazil	15.9	US	14.1	Spain	10.2
2020	Ukraine	11.9	Ukraine	13.3	France	10.1	Russia	9.0
2020	Canada	8.1	France	4.7	Ukraine	8.0	Canada	7.5
2021	Australia	22.1	US	39.4	US	16.2	Ukraine	14.8
2021	France	18.2	Argentina	17.3	Australia	15.8	Argentina	12.6
2021	Ukraine	12.9	Ukraine	12.1	Canada	14.7	Spain	11.1
2021	Canada	10.1	Brazil	8.6	Ukraine	10.5	Canada	9.7
2021	Germany	8.0	Romania	4.0	France	10.1	Brazil	4.9

Source: Authors' calculations using UN COMTRADE data (2022).

Table A 2. Top fertiliser exporters in the world, export share as %

Year	Reporter	Inorganic fertilisers (%)	Reporter	Organic fertilisers (%)
2019	Russia	15.7	China	9.2
2019	China	13.3	US	7.8
2019	Canada	10.4	India	5.7
2019	US	7.6	Turkey	5.3
2019	Belarus	6.1	Germany	4.6
2020	Russia	14.1	China	10.6
2020	China	13.2	US	7.7
2020	Canada	10.3	India	6.1
2020	US	7.3	Turkey	5.3
2020	Morocco	6.8	Germany	5.0
2021	China	24.4	China	13.5
2021	Canada	14.0	US	9.6
2021	US	8.5	India	7.2
2021	Germany	5.7	Turkey	6.8
2021	Netherlands	5.7	Netherlands	6.0

Source: Authors' calculations using UN COMTRADE data (2022).

Table A 3. Organic crop production, by crop

Year	Member State	Wheat		Barley		Maize	
		1 000 tonnes	Growth rate	1 000 tonnes	Growth rate	1 000 tonnes	Growth rate
2019	Hungary	54.2		6.0		22.9	
2019	Poland	27.8		5.4		17.0	
2019	Spain	63.4		122.9		8.0	
2020	Hungary	55.5	2.4	4.4	-26.7	21.3	-7.0
2020	Poland	41.0	47.5	5.9	9.3	26.3	54.7
2020	Spain	67.4	6.3	131.8	7.2	6.3	-21.3

Source: Eurostat (2022).
Note: Data for Germany is not available.

Table A 4. Food security indicators: prevalence of food insecurity in the total population in the EU, annual estimates

Year	Member State	Prevalence of food insecurity (%)		Number of food-insecure people (million)	
		moderate to severe	severe	moderate to severe	severe
2020	Europe	56.2	1.4	7.5	10.5
2021	Europe	58.3	1.9	7.8	14.4
2020	Eastern Europe	30.0	1.4	10.2	4.1
2021	Eastern Europe	30.8	1.7	10.5	4.9
2020	Northern Europe	4.4	1.2	4.1	1.3
2021	Northern Europe	4.7	1.8	4.4	1.9
2020	Southern Europe	14.1	2.3	9.2	3.6
2021	Southern Europe	13.1	2.8	8.6	4.3
2020	Western Europe	7.7	0.8	3.9	1.6
2021	Western Europe	9.7	1.7	4.9	3.3

Source: FAO (2022).
Note: Food insecurity: A situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life (FAO 2022). Prevalence of food insecurity is calculated as the percentage of people in the population who live in households classified as severely (or moderately to severely) food insecure.

Table A 5. Food security indicators: prevalence of food insecurity in the total population in the Member States, three-year average

Year	Member State	Prevalence of food insecurity (%)		Number of food-insecure people (million)	
		moderate to severe	severe	moderate to severe	severe
2018-2020	Germany	3.4	0.7	2.9	0.6
2019-2021	Germany	3.5	1.1	2.9	0.9
2018-2020	Hungary	8.6	1.4	0.8	0.1
2019-2021	Hungary	10.6	2.1	1.0	0.2
2018-2020	Poland	5.8		2.2	0.2
2019-2021	Poland	7.4	0.9	2.8	0.4
2018-2020	Spain	8.8	1.8	4.1	0.9
2019-2021	Spain	8.6	2.0	4.0	0.9

Source: FAO 2022.
Note: Food insecurity: A situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life (FAO 2022). Prevalence of food insecurity is calculated as the percentage of people in the population who live in households classified as severely (or moderately to severely) food insecure.

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