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Entry points of the Russo-Ukrainian war into the EU's food supply chain and potential impacts

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ABSTRACT

The Russo-Ukrainian war led to supply shocks in the EU's Food Supply Chain (FSC), impacting energy, fertilizer, and agricultural trade. By means of seven expert interviews, we assess possible impacts of these shock effects downstream entities within the EU'S FSC. Despite initial concerns about the need to compensate for Ukraine's previous agricultural commodity flows, exports to the EU have actually increased due to the abolition of tariffs and new land routes. However, the sanctions are changing the EU's trade relations in the energy and fertilizer sectors forcing it to find new trading partners. Such shifts in trade are accompanied by rising prices. Also, energy price spikes led to temporarily closure of fertilizer plants, compounding the problem. However, in times of undersupply of named goods, high GDP countries such as the EU states can afford to pay a premium price to fulfil their demand.

***Keywords**: War in Ukraine; Food Supply Chain; Supply Shocks, Energy Crisis; Food Crisis; Supply Chain Disruptions; International Food Trade Network.*

1 Introduction

The supply shocks in the EU triggered by the Russian-Ukrainian war are multi-layered. In response to the conflict, the EU has implemented extensive sanctions against Russia and its ally Belarus, which, among other things, disrupted former trade flows of agrochemicals and fossil fuels. Therefore, the EU's Food Supply Chain (FSC) faces challenges not only due to supply shocks in traded agricultural commodities with Ukraine but also in terms of its own production. Research on the international food trade network (IFTN) primarily investigates how shocks to the agricultural production in one region can spread to other countries through trade and examines factors that either mitigate or amplify these shock effects (Fair et al., 2017; Gephart et al., 2016; Marchand et al., 2016; Otto et al., 2017; Tamea et al., 2016). The Russo-Ukrainian war has already been evaluated using and further developing these research techniques (Laber et al., 2022). However, for a comprehensive analysis of a multi-layered supply disruption, it is essential to extend the perspective beyond the trade flows of agricultural commodities to the entire FSC. This involves understanding how supply shocks enter a FSC, how the different units are affected and how the shocks are passed on along the chain (Dani, 2015; Davis et al., 2021; Manzini & Accorsi, 2013). These fundamental observations are the subject of the present paper. Our primary focus is to analyze the entry points through which the Russo-Ukrainian war impacts the EU's FSC, employing FSC research techniques. In section 2, material and methods are described in detail. Section 3 presents findings from literature and database research, from which a model was derived that formed the guideline for seven in-depth expert interviews. The results of the interviews are then presented and discussed in the light of existing literature and data in section 4.

The research questions are:

RQ 1 Which specific production steps in the EU's food supply chain act as entry points for supply shocks caused by the Russo-Ukrainian war?

RQ 2 How may the different war-induced shocks, such as disruptions in energy supply, agrochemical availability, or agricultural commodity imports, be propagated within the EU's food supply chain?

RQ 3 What adjustments are to be expected from supply chain entities (e.g. new trading partners) and what are possible future market balances?

2 Material and Methods

In order to investigate the impact of Russo-Ukrainian on the EU's FSC, a qualitative research approach with expert interviews was chosen. Between 26.11.2022 and 14.02.2023, seven interviews were conducted with agricultural and food economists (3), researchers from agricultural supply chains (3) and members of the EU Parliament (1). This qualitative research approach was chosen to enable an overview of the potential effects of the Russo-Ukrainian war on the EU's FSC and to gain a comprehensive understanding of the challenges and opportunities emerging from it.

Based on literature and database research, which is explained in more detail in Section 3, we created a model that formed the basis for the interview guide, which was sent to the interviewees in advance. The individual units of the EU's FSC were discussed in the interviews, with the interviewees being encouraged to express themselves freely and in detail. The following topics were discussed for each entity of the EU's FSC in light of the Russo-Ukrainian war: (i) Possible future scenarios, (ii) Influences on trade volumes, (iii) Alternative trade relations, (iv) Effects on output volumes, (v) Interactions with upstream and downstream units.

The interviews were conducted online via video conference and recorded as audio files after consultation. Participation was voluntary. The average duration of the interviews was 40 minutes, while the longest lasted 56 minutes and the shortest 25 minutes. The verbatim transcription of the recorded interviews was carried out manually by the interviewer, with some being translated from German to English. To ensure confidentiality, the interviewees were anonymized and are referred to below as interviewees 1 to 7.

The interpretation of the resulting texts was based on techniques described by Mayring (2015). A summarizing form of analysis with deductive category formation was chosen, with the units of the EU's FSC serving as the basis for category formation.

3 Entry points into the EU's FSC for supply shocks triggered by the Russo-Ukrainian war

In Figure 1, we present our literature findings and outline potential entry points of the Russo-Ukrainian war into the EU's FSC. It is based on the analytical framework presented by Davis et al. (2021). FSC-research mostly starts at farm level and excludes entities prior to crop production (Aday & Aday, 2020; Dani, 2015; Davis et al., 2021). However, to research the impact of the Russo-Ukrainian war on the EU's FSC, it is necessary to consider how the availability and production of agricultural inputs may be affected. For this reason, we have introduced two additional units – Energy and Agricultural Inputs – positioned at the forefront of the chain. We found three entry points in the EU's FSC for supply shocks induced by the Russo-Ukrainian war: the energy sector, the import of agricultural inputs and imported crops. While shocks to agricultural input and commodity trade enter the FSC at certain units, from where they are passed on, a shock to energy trade may affect every unit of the FSC directly. In the following, each unit of the chain is explained in more detail.

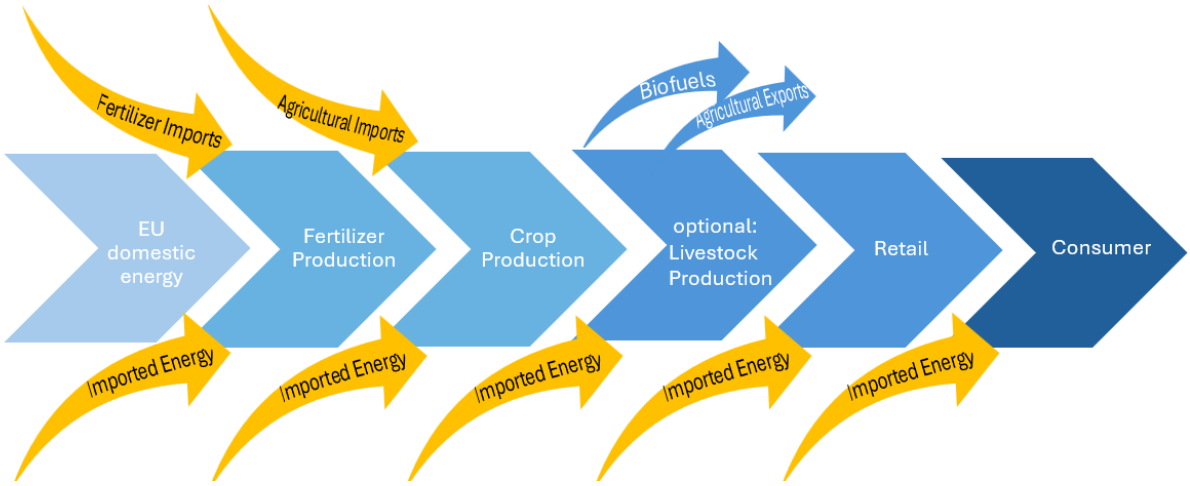

Figure 1*:* the EU's Food Supply Chain (FSC). While blue colors represent inner EU production flows, orange arrows entering the chain highlight (former) imports from either Russia or Ukraine. These former trade relations may act as entry points, from where supply shocks evoked by the Russo-Ukrainian war are then propagated to other units of EU's FSC (Davis et al., 2021).

3.1 Energy imports from Russia

Eurostat data was used to examine EU energy imports from Russia in 2020 (Eurostat, 2022). The mix of the energy used in the EU is presented in Figure 2. More than two thirds of its gross available energy are accounted for by fossil energy sources. The EU can only produce 42% of its energy needs and is therefore a net importer of energy. 43% of these energy imports come from Russia, which is a total of 24.4% of the gross available energy as can be seen in Figure 3. These energy imports from Russia are exclusively fossil, and accounted for 41% of gas and 37% of oil consumption in 2020, as shown in figure 4 and figure 5.

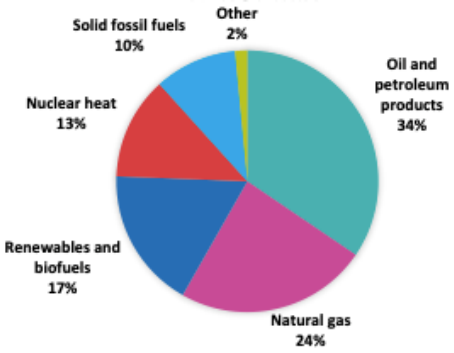

Figure 2*:* EU Energy Mix 2020, (Eurostat, 2022)

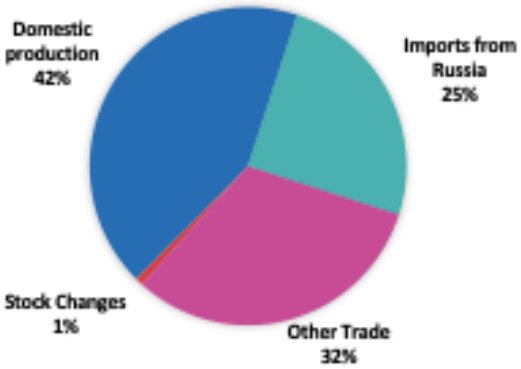

Figure 3: Gross available energy in the EU and its sources in 2020 (Eurostat, 2022)

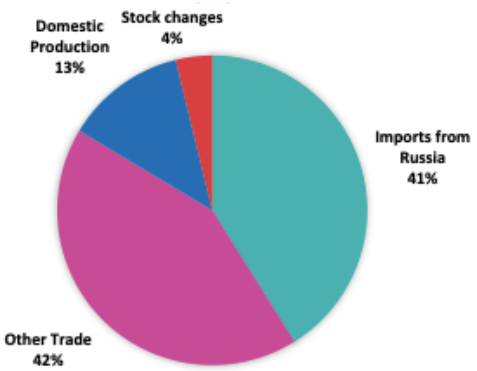

Figure 4*:* Sources of gas available in the in EU in 2020 (Eurostat, 2022)

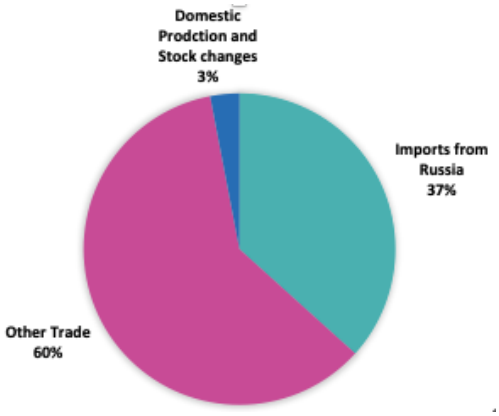

Figure 5*:* Sources of oil available in the in EU in 2020 (Eurostat, 2022)

3.2 Fertilizer imports and production

Agricultural inputs produced in the EU and those imported are compiled in the second unit of the EU's FSC. Both of these streams are sensitive to impacts of war in Ukraine. Prior to the war, imported gas from Russia made up for 90% of the EU's fertilizer industry's variable production costs (Fertilizers Europe, 2022). With gas prices in Europe being ten times higher than in America and Asia due to the war, producers in Europe became unable to compete in the domestic and global markets and started to curtail production throughout 2022 (Fertilizers Europe, 2022). This effected nitrogen fertilizer production in particular. With 16% of the total global fertilizer exports in 2021 (Caprile, 2022), Russia was the biggest supplier of nitrogen fertilizers, the second biggest supplier of potassic fertilizers and third biggest supplier of phosphorus fertilizers in the global market (FAO, 2022c). 59% of the EU's potassium fertilizer imports come from Belarus and Russia and 31% of the EU's nitrogen fertilizer imports come from Russia alone (Caprile, 2022; European Commission, 2022b). As UN Comtrade data shows, the

trade direction of fertilizers was one sided and imports from Russia to the EU were opposed by almost no exports (UN Comtrade, 2022). The biggest importing EU countries of nitrogen and potassium fertilizers are listed in *Table 1* and *Table 2*.

Table 1.
Biggest importers of Russian nitrogen fertilizer in the EU in 2020 (UN Comtrade, 2022)

Country	Imports of Russian nitrogen fertilizer in tons	Percentage of total nitrogen fertilizer Imports	Russia's rank of N-suppliers
Finland	911 k	94%	1st
Estonia	901 k	88%	1st
Lithuania	260 k	52.7%	1st
Latvia	235 k	44%	1st
Romania	164 k	16%	3rd
France	137 k	3%	10th
Poland	66 k	6.5%	3rd
Netherlands	62 k	6.3%	5th
Sweden	54 k	8%	3rd
Ireland	50 k	9%	4th

Table 2.
Biggest importers of Russian potassium fertilizer in the EU in 2020 (UN Comtrade, 2022)

Country	Imports of Russian potassium fertilizer in tons	Percentage of total potassium fertilizer imports	Russia's rank of potassium suppliers
Estonia	760 k	99%	1st
Finland	423 k	86%	1st
Poland	209 k	31%	2nd
Belgium	176 k	16%	3rd
Lithuania	61 k	90%	1st
Italy	57 k	29%	2nd
Romania	54 k	46%	2nd
Netherlands	37 k	8.4%	4th
Hungary	26 k	47%	1st
Croatia	25 k	70%	1st

3.3 Agricultural Commodity Imports and Crop Production

Imported agricultural commodities are entering the EU's FSC at the EU's own crop production in the third unit of the chain. Based on FAO data we found that maize, sunflower oil and rapeseed are the main agricultural commodities exported from Ukraine to the EU (FAO, 2022b). Although Russia is a major agricultural producer, its exports to EU markets are marginal. Ukraine however, was the EU's most important external supplier for maize in 2020: a third of the maize produced in Ukraine, namely 9.6 million tons, was exported to the EU, where it accounted for 25% of the total maize imports and 11.8% of the total consumption. The largest importing nations of Ukrainian maize in the EU are shown in

Table 3. In addition, Ukraine has almost doubled its production of sunflower oil in the last decade, starting from 3 million tons in 2010 and reaching nearly 6 million tons in 2019. While Ukraine exported 6.8 million tons in 2020, Russia's exports are about half that amount.

Table **4** shows the main importing EU nations of Ukrainian sunflower oil. Although only 28% of sunflower oil produced in Ukraine was traded to EU markets, this volume accounted for 38% of the EU's consumption of sunflower oil.

3.4 Product Conversion and Export

The subsequent link in the EU's FSC delineates potential applications for agricultural commodities, encompassing product conversion into livestock, biofuels, and agricultural exports.

Livestock production: Given that 76% of maize consumption in the EU is allocated for feed, shocks in maize trade could impact the livestock sector (FEFAC, 2021; Laber et al., 2022; Lakner et al., 2022). Therefore, potential effects on animal husbandry were discussed in our interviews.

Table 3.
EU nations with the highest imports of Ukrainian maize in 2020 (FAO, 2022b)

Nation	Ukrainian maize imported in tons	Share of maize imports from Ukraine in the total import volume	Ukraine's rank of maize suppliers
Netherlands	3 mil.	50%	1st
Spain	2.7 mil.	33.7%	1st
Portugal	732 k	38%	2nd, after Brazil
Italy	770 k	12%	3rd, after Hungary and Slovenia
Belgium	419 k	22%	3rd after France and Netherlands
Ireland	415 k	31%	1st

Table 4.
EU nations with the highest imports of Ukrainian sunflower oil in 2020 (FAO, 2022b)

Nation	Ukrainian sunflower oil imported in tons	share of sunflower oil imports from Ukraine in the total import volume	Ukraine's rank of sunflower oil suppliers
Netherlands	679 k	76%	1st
Spain	431 k	71%	1st
Italy	346 k	58%	1st
France	154 k	52%	1st
Poland	140 k	64%	1st

Biofuels: To address greenhouse gas emissions in the transportation sector, EU member states blend fossil fuels with biofuels (EPure, 2020). Approximately 44% of bioethanol is produced from corn and 25% is derived from wheat, while nearly half of the biodiesel feedstock is obtained from rapeseed oil (European Commission, 2021). Lakner et al. (2022) recommended suspending the blending of biofuels to mitigate supply shocks in the IFTN caused by the Russo-Ukrainian war.

Exports: The disruptions in the international food trade network have led numerous importing nations on different continents to explore alternative suppliers. In June 2022, the quantity of EU cereal exports to sub-Saharan Africa surpassed the three-year average by 80% (European Commission, 2022c).

The findings presented in this section and the model derived from them, shown in Figure 1, formed the basis for a questionnaire for seven expert interviews. The results of these interviews are presented and discussed in section 4.

4 Results and Discussion

The effects of a crisis such as the Russo-Ukrainian war on the FSC cannot be viewed in isolation from other crises. All interviewees agreed that the effects of the COVID-19 pandemic, the climate crisis, crop failures, social changes, and conventional dynamic processes in the economy form a complex overall picture, the changes of which can hardly be attributed to individual factors. Also, they agreed that at the time of the interviews, the supply shocks that had been experienced throughout the EU's FSC due to the Russo-Ukrainian war were already leveling off. Interviewees 1 and 4 both further emphasized that new variations of crises, such as the COVID-19 pandemic or the Russo-Ukrainian war, first led to price peaks and would then occur in a weaker form in a subsequent phase. Interviewee 5 came to a similar conclusion and illustrated it with *"It's a shock going through a system, it will find stability again."* Nevertheless, interviewees 1, 4 and 5 said that households in the EU might spend one to two percentage points more of their household budget on food in the future than they did a few years ago. Respondent 5 explained that even if inflation was compensated for by wage adjustments, it was still highest in the food sector, which would have an impact on the distribution of household expenditure. Table 5 shows the key results of the interviews. In the following, they are discussed in more detail in the light of literature and database research.

Table 5.
Key results from qualitative expert interviews. Roman numerals indicate differing opinions.

Chain Link	Observation	Assessment of Consequences	
Energy and Fertilizer imports	Trade flows shift; new trade relations develop and compensate for former trade relations	Russia sells cheaper to new partners; EU buys more expensive from new partners	
	Total traded volumes hardly change	Supply in the EU is secure; Developing countries may struggle with price increases (LNG)	
Fertilizer Production in the EU	Production becomes unviable due to high energy costs	Production stopped…	(I)…for long term; industry will move to energy abounded countries
			(II)…temporarily and is already being picked up again
			(III)… and industry will partially move away
Agricultural Imports from Ukraine	Supply chain disruptions caused by the war lead only to small impacts on EU markets	In the EU cultivation of some crops may be increased to compensate losses	
	Imports have actually increased in some regions	Commodity prices fall in countries bordering Ukraine	
Crop Production in the EU	Correlation between output and input prices is constant to date; output and input prices influence each other	From an economic perspective, EU farmers should not reduce production due to high input prices	
	Cultivation partially shifts to extensive crops and less volatile crops	Soybean cultivation increases; rapeseed may disappear from EU crop rotations	
Livestock Production the EU	Rising commodity prices multiply at animal production level due to feed conversion rations	(I) Prices for animal products may rise more dramatically than for plant products	Due to effective calorie conversion: chicken will gain market shares
			Cattle fed on grass are less affected than cattle fed on concentrates.
	Other factors, such as national regulations in the animal farming sector, have much greater influence on the production output	(II) the EU livestock sector will not be affected greatly	
Biofuels	A suspension of the blending obligation is a suitable tool for lowering oilseed and grain prices	(I)…as a temporary measure	
		(II)…the blending obligation should be abolished altogether	
Agricultural exports from the EU	No significant shifts in exports can be observed		
Retail	(I) Food retailers pass on price increases	(I)…immediately	
		(II)…with some delay from a couple of weeks to months	
	(II) Food retailers avoid passing on price increases to a certain degree by lowering their own margins and using their market power to enforce lower prices on upstream units		

4.1 Energy imports

The interviewees agreed upon the shifts in energy trade that would evolve due to the sanctions: Russia would look for new buyers and would focus on expanding its trade relations with China and India. India was now buying Russian oil and would no longer be dependent on the Middle East. Interviewee 5 observed that the Middle East would now look for new markets, with Europe serving as a substitute. These assessments could be partially verified by trade data: While overall trade gains between Russia and India have skyrocketed by 250%, the 25% increase in Sino-Russian trade is only just above the long-term average annual growth (Lipsky & Graham, 2023). Indian imports of Russian crude oil have experienced a remarkable surge, escalating from 2% before the war to 20% in 2022 and 40% of its total crude oil imports in 2023 (Jackish, 2023). The increase in Russian oil in India and China was at the expense of oil from Arab regions, just as interviewee 5 noted (Tagesschau, 2023). The energy surplus on the Indian markets opens up opportunities for transit trade, which enables India to capitalize on the current crisis, as interviewee 5 noted: As India's refining capacity exceeds its own demand and refined crude oil is no longer considered Russian, diesel, petrol and paraffin of Russian origin legally end up on EU markets (Jackish, 2023). However, the authors were unable to verify such a transit trade for fertilizer products as proposed by interviewees 1 and 5. Interviewee 3's observation about the EU's strong bargaining power and its ability to afford rising prices of LNG (from the USA and the Middle East) at the expense of low GDP LNG importers, such as Bangladesh, is consistent with previous research findings on the IFTN. IFTN research has consistently shown that affluent countries have the capability to pay premium prices for food during crises, experiencing less impact compared to nations with lower GDP (Distefano et al., 2018; Puma et al., 2015). It may be of interest to further investigate whether other research findings on the IFTN are also applicable to energy trade.

4.2 Fertilizer Imports

Interviewees 1, 4 and 7 agreed that Russia was dependent on foreign currency income and therefore it would neither reduce its energy nor fertilizer production and exports, however, it may be looking for new sales markets. Just like with gas, new trade relations would emerge here.

The authors were unable to verify that the price of Russian potash exports had fallen due to trade deflection, as assumed by interviewees 2 and 4. However, as interviewee 4, 6 and 7 assumed, Canada had increased their production and export capacities of potassium and Morocco of phosphor fertilizes in response to the increased world market prices (Kee et al., 2023). Sanctions hardly ever applied against fertilizers directly, however Russian export bans did, but only for the first three months of the war. International fertilizer markets were primarily shaken by uncertainties and resulting overreactions. These did lead to historic price peaks, however, since there was never a severe and long-lasting deficiency, supply and demand levelled these price peaks off again, just like interviewee 1 and 7 had suggested they would: in March 2023, after the interviews had taken place, fertilizer prices were back to before war levels (Hebebrand & Glauber, 2023; Kee et al., 2023). As interviewee 1 noted, there was never a real supply shock in terms of volumes on the world market - apart from a temporary drop in European nitrogen fertilizer production. To phrase it like interviewee 5: the shock that went through the system lasted for about one year. Once trade data is available, an in-depth analysis of changes in fertilizer trade patterns caused by the Russo-Ukrainian war could be an interesting topic for further research.

4.3 Fertilizer Production in the EU

As the current energy crisis is primarily a gas crisis, manufacturers of basic chemicals – such as nitrogen fertilizer– are among the most affected industries (Bialek et al., 2023). For that reason, a possible migration of the European fertilizer industry was extensively discussed in the interviews. The scientific verification of the migration of energy-intensive industries to countries with abundant energy is a well-established fact (Gerlagh & Mathys, 2011). However, the extent to which and how quickly the fertilizer industry will react to an energy crisis, which is looming in Europe in particular, will depend on several factors. Long-term investments made with the construction of fertilizer plants and their immobility, lead to delays in a possible relocation to countries with cheaper energy. Relocation may occur if a long-term trend of high energy prices emerges, but not after a short-term shock. Interviewee 4 repeatedly emphasized the importance of the differentiation between such short-term shocks and long-term events. At the time of the interviews, energy prices in Europe were expected to stabilize again, but to remain above precrisis levels (Bialek et al., 2023). From a strategic point of view, closing all fertilizer production plants permanently, like interviewee 3 suggested, might have been an "*overreaction"*, as interviewee 1 phrased it several times. Interviewee 4 and 7 stated that plants were being put back into operation already at the time of the interview. However, the findings of Bialek et al. (2023) support the opinion of interviewee 3 and indicate that the basic chemicals industry, among others, is likely to be one of the most affected by factory relocations. Interviewee 5 emphasized that regardless of energy price developments, a partial relocation of the fertilizer industry is to be expected in order to reduce its vulnerability to supply shocks and economic and political instability through geographic diversification, which is a common approach of risk mitigation (Lee & Chung,

2007). Whether companies will actually further diversify geographically as a result of the Russo-Ukrainian war may be the subject of future research.

4.4 Agricultural Imports from Ukraine

When developing the questionnaire for the interviews, during the first months of the war, the authors assumed that the EU's amount of imported agricultural commodities from Ukraine would decrease due to reduced acreage and collapse of infrastructure, as the European Parliament warned at the time (Wax, 2022). The model of Laber et al. (2022) also assumed complete export stops of Ukraine. Therefore, respondents were asked to give their opinion on how resilient the EU is in finding new trading partners to compensate for these import losses. However, during the interviews only two respondents pointed out, that a different trend was emerging at the time: due to new trading routes, avoiding shipping via the war-affected Black Sea, the EU's import volumes of agricultural commodities from Ukraine had actually increased. Cereal imports increased by 57%, resulting in oversupply, dwindling prices for grain farmers and saturated logistical chains in Poland, Romania, and Bulgaria (European Commission, 2023). Although these increases in imports are most likely the result of the abolition of tariffs and the high prices paid on EU markets, as interviewee 7 suggested, it is also in line with previous research on international commodity trade crises: During the five sharpest declines in global wheat exports, rich countries actually increased their imports compared to previous years (Distefano et al., 2018). For the hypothetical loss of all Ukrainian agricultural exports, all respondents answered, the EU could compensate these losses by intensifying trade with other countries. These assumptions are in line with the results of previous research for shock transmission through the IFTN, finding that high-income countries, such as the EU Member States, suffer less from trade shocks triggered by export declines (Distefano et al., 2018; Puma et al., 2015). Such trade shocks to the IFTN, have mainly negative effects on import volumes of developing countries.

4.5 Crop Production in the EU

Respondents 1 and 4 agreed that the relationship between input and output prices had not changed and that lower fertilizer use by farmers would therefore be a poor business decision. A study that examined the escalation in fertilizer prices in 2008 also concluded, that fertilizer price increases had been offset by higher farm revenues (Huang et al., 2009). Nonetheless, it should be noted that Huang et al. pointed out, that this conclusion may not be universally applicable to all instances of fertilizer price increases. Interviewee 7 stated that even those farmers who purchased fertilizers at the worst possible time, in the peak season in August 2022, could make a profit, due to the high commodity prices. This is in line with the agricultural report of the European Commission, stating that fertilizer price increases could be passed on along the supply chain, subsequently leading to an increase in food prices (European Commission, 2023). Fertilizers Europe (2022) however, noted a massive decline in fertilizer application in the EU in 2022, with a decreased consumption of 11% for nitrogen, 16% for phosphorus and 15% for potassium fertilizers. This may partly be due to the shift towards increased soy production, which interviewee 1 identified. A trend that had also been seen in the US in 2008 (Huang et al., 2009). However, the extent to which the reduction in fertilizer usage, the unfavorable weather conditions and the shift towards alternative crops contributed to the 9.2 % decline in grain production in the EU in 2022 (European Commission, 2023) may be the subject of further research.

4.6 Livestock Production in the EU

Most interviewees agreed that a shift in feed prices resulting from the increase in commodity prices would lead to a decline in livestock production, although different assumptions were made for different animal species and production systems. Lawrence et al. (2008) showed, that rising feed prices, due to the introduction of biofuels in the US in 2000s, lead to a downsizing of the animal industry, accompanied by rising end consumer prices. Laber et al. (2022) used their model to calculate – among other things – the effects of a hypothetical complete elimination of Ukrainian export goods on the animal production systems of other countries. Their results showed that such a scenario would lead to a decline in production of 12.9% for pork and 17.2 % for poultry meat and eggs in Southern Europe. However, the actual influence of the Ukrainian war on this entity of the EU's FSC has proven to be very complex. As outlined above, some European regions actually suffered an oversupply of Ukrainian agricultural commodities, while at the same time, inflation and world market food prices rose to a record high. Eurostat (2023) recorded a decline in production of 5.1% for pigs, 2.4% for bovine and 1.5% for poultry in 2022 compared to the previous year which is, however, within the range of annual fluctuations. As Laber et al. (2022) pointed out, the effects of shifts in the availability of Ukrainian commodities may take years to be evident via all direct and indirect transmission channels. Interviewee 7 didn't agree with the observation, that animal production in the EU might decline due to the consequences of the war in Ukraine. Other factors, such as national regulations, had a much greater impact on the development of livestock production than feed prices.

4.7 Biofuels

Right from the beginning of the war, there were calls to suspend the mandatory blending of biofuels in order to lower prices for feed grain and oilseeds (Lakner et al., 2022). While all interviewees agreed that this would be an easily applied

and well-suited method to dampen the demand curve, there were controversies on how long such a suspension would be appropriate: interviewee 1 suggested a maximum of 6 months, while 4 and 5 favored suspending biofuels all together. The discussion about controversial climate effects, higher prices, higher price volatilities and additional pressure on the availability of land for food cultivation is as old as biofuels themselves (Anderson et al., 2008; Bessou et al., 2011; Lawrence et al., 2008; López Cabrera & Schulz, 2016) and will not be discussed further at this point. In their study written at the beginning of the war, Lakner et al. (2022) considered a suspension of the blending obligation for biofuels as an effective measure to gain additional grain for the tense situation in global food supply. However, like most of the participants in the discourse, they did not consider the oversupply of Ukrainian commodities in some EU countries that would result from alternative transportation routes bypassing the Black Sea. Whether a suspension of biofuel blending could further increase a grain oversupply on local EU markets and what consequences this could have for grain farmers is a subject of debate. However, another effect of a biofuel suspension might be, that fossil fuels may become cheaper, since biofuel blending is a fuel price increasing measure, as interviewee 1 and 3 pointed out.

4.8 Agricultural exports from the EU

In the midst of the historic price peaks on the global grain market in summer 2022, EU wheat exports to sub-Saharan Africa rose by up to 80% (European Commission, 2022c). However, all interviewees stated that these were only short-term effects that would normalize again and that no long-term changes in export volumes and partners were to be expected.

4.9 Retail

Respondents 3, 4 and 5 assumed that price increases were passed on by retailers to the consumer, due to well-functioning markets. However, interviewee 1 disagreed and believed that retailers did buffer some prices increases, using their concentrated market power. This assertion is consistent with previous studies that concluded that retailers could use their market power to limit the pass-through of shocks coming from upstream units of the FSC and force price shocks back up the chain rather than down to the consumer (Assefa et al., 2017). Alexandri (2011) found that retailers use their market power to dampen common price volatility of agricultural products throughout the year, however, they would pass on big price increases in times of crisis. Their findings were also in line with interviewee 3's statement that such price increases are generally passed on quite quickly, while price relaxations do not always find their way to the consumer. However, interviewee 7 was the only one to emphasize once again what the authors had already demonstrated in Figure 1. Namely, that the increasing costs in the EU's FSC could only be partially attributed to price pass-through from upstream units. Instead, the rising energy and labor costs would impact every entity. However, it is difficult to attribute all these observable changes in the EU's FSC and food markets to the Russo-Ukrainian war alone, since other crisis such as COVID-19 pandemic and climate change have already led to highly volatile international product and raw material prices (Mykhailova et al., 2023).

5 Conclusion

This article analyzed entry points of the Russo-Ukrainian war into the EU's FSC. It was found that the chain entities energy, fertilizer imports and agricultural imports comprise potential entry points. The most severe supply shock resulting from the war affected the energy sector, leading to price rises along the entire chain. However, the EU's wealth enabled it to compensate these trade losses by finding new trading partners for both energy and fertilizers. Noteworthy, is the possible intensification of energy imports from the Middle East and the USA, along with the exploration of alternative sources for fertilizers, such as Canada for potassium fertilizers and Morocco for phosphorus fertilizers. Nitrogen fertilizer may be produced anywhere in the world, preferably where energy is abundant. A partial, but not complete, relocation of the European fertilizer industry may be expected. Contrary to initial fears, imports of agricultural commodities from Ukraine have not decreased, but have increased. The EU's own agricultural output, however, may only be affected if input prices stay high in the long term, while output prices decline, which is unlikely. Nevertheless, food prices for consumers have risen and could remain high, which may result in a lasting rise in the proportion of household expenditure allocated to food.

Declaration

The authors declare no conflict of interest. The entire article is the intellectual property of the authors. AI software was used for formulations and translations into English.

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