

MARKET ANALYSIS

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Temporary Shifts in Agricultural Export Logistics: The Case of Hungarian Maize Imports During the Russia-Ukraine Conflict

This paper examines the impact of the Russia-Ukraine armed conflict on agricultural trade, focusing specifically on the surge in maize exports from Ukraine to Hungary during the marketing year 2022/23. The conflict has significantly disrupted maritime trade routes, particularly affecting export logistics of Ukraine. The study analyses shifts in trade patterns and market dynamics associated with these disruptions, emphasising that these changes appear temporary and do not pose a continuous threat to grain markets of EU member states neighbouring Ukraine. The findings underscore the importance of safe and adaptive logistics in maintaining market stability amidst geopolitical tensions.

Keywords: Russia-Ukraine conflict, maize trade, export routes, logistics

JEL classifications: Q17, Q18

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Introduction

Owing to its natural conditions, direct connection to the Black Sea, and the expansion of field crop cultivation on its fertile steppes, Ukraine has become a significant player in the global markets for grains, oilseeds, and their derivatives over the past two decades. In the calendar year 2021, preceding the full-scale Russian armed invasion, Ukraine exported 20 million tonnes of wheat, representing approximately 10% global market share. This wheat was primarily shipped to North African and Middle Eastern countries, as well as the South Asian region. In 2021, Ukraine was the fourth-largest maize exporter, with 24.7 million tonnes (12% global market share), following the United States, Brazil, and Argentina. It was also the third-largest exporter of rapeseed, with 2.7 million tonnes (20% global market share), following Canada and Australia, and the leading sunflower oil exporter with 5.1 million tonnes (43% global market share) (Tovstopyat, 2022).

Due to its geographical proximity and competitive pricing derived from low maritime transport costs, Ukraine has become an important trading partner for the European Union (EU), particularly for its Mediterranean member states and the Netherlands, especially (but not exclusively) for maize, sunflower oil, sunflower meal, and rapeseed. Based on data from Eurostat – COMEXT, Belgium and Germany also played significant roles in rapeseed imports, with a temporary shift of focus to more easily and cost-effectively accessible buyers in Romania and Poland during the 2022/23 EU crop marketing year (July-June, MY).

In MY 2021/22, even before the war, Ukraine exported substantial volumes of maize (about 30% of its total exports), sunflower oil (37%), sunflower meal (24%), and rapeseed (67%) to the EU. Following the outbreak of the war, Ukraine's exports of wheat and maize to the EU significantly increased during MY 2022/23 and 2023/24, to 35-45% and 55-63% of its total exports of these crops, respectively.

Additionally, owing to the temporary shutdown of oilseed crushing capacities because of the war (Duke and Beaman,

2022; APK-Inform, 2022a), Ukraine was forced to sell a significant 1.85 million tonnes of sunflower seeds on the international market in the 2022/23 season (September-August). Of this, 61% found buyers in the EU, while prior to the war, Russia and Moldova were the leading suppliers of sunflower seeds to the EU, but in substantially smaller volumes, amounting to a few hundred thousand tonnes per season.

From May to mid-September 2023, through Commission Implementing Regulation (EU) 2023/903, the European Commission replaced, at least temporarily, national import bans, first introduced by Poland in mid-April and subsequently mirrored by Hungary, Slovakia and Bulgaria, by restricting the imports of wheat, maize, sunflower, and rapeseed from Ukraine into Poland, Slovakia, Romania, Bulgaria, and Hungary, only allowing grain meant for transit to enter those member states neighbouring Ukraine. However, this measure and the national import bans did not drastically affect the dynamics of EU imports of any of the specified commodities from Ukraine, which followed their seasonal patterns, except for maize (Figure 1). As trade data shows, the import of Ukrainian maize halved after the measure took effect and did not return to previous levels until the 2023 crop harvest and export shipments began.

Notably, the 14.9 million tonnes of maize (including processed products) delivered to the EU during MY 2022/23, is not unprecedented. In MY 2018/19, 14.7 million tonnes of maize were imported (with the United Kingdom excluded) from Ukraine, accounting for 49% of the country's total exports then. According to market analyst Stratégie Grains, production and old crop carry-in stocks of maize in the EU totalled 68.9 million tonnes in the 2018/19 season (October-September) compared to 60.3 million tonnes in the 2022/23 season. This places the claims of maize from Ukraine "flooding" the EU in MY 2022/23 (see e.g. Bickert, 2023) in a different perspective. Traditionally, the largest buyers of Ukrainian maize have been Spain and the Netherlands, with their combined share exceeding 50% both before and during the war in 2022 and 2023.

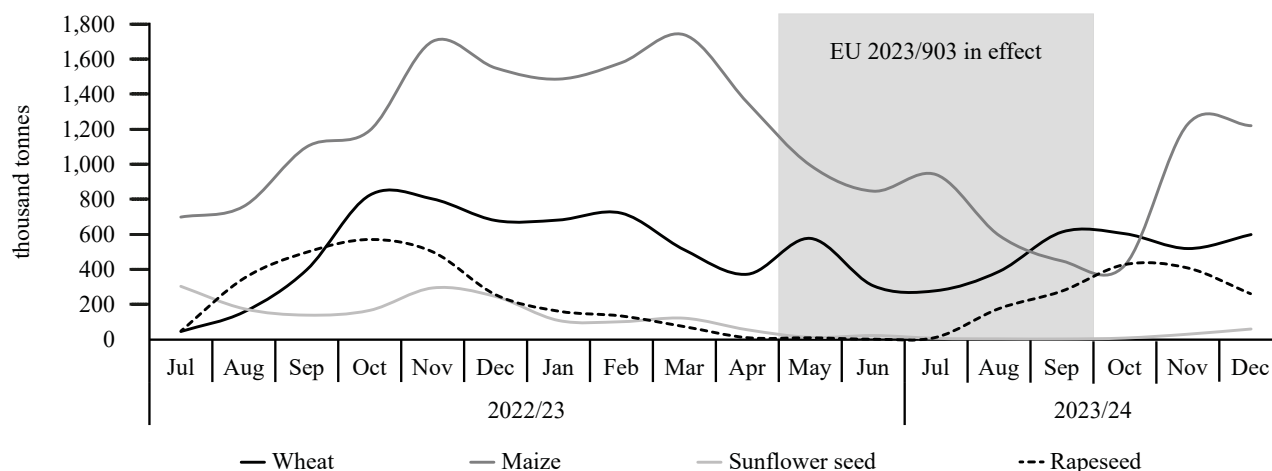


Figure 1: The EU’s monthly imports of wheat (excluding durum wheat, but including flour and groats), maize (including processed products), sunflower seed, and rapeseed from Ukraine in MY 2022/23 and in the first half of MY 2023/24.

Source: own compilation based on Eurostat – COMEXT

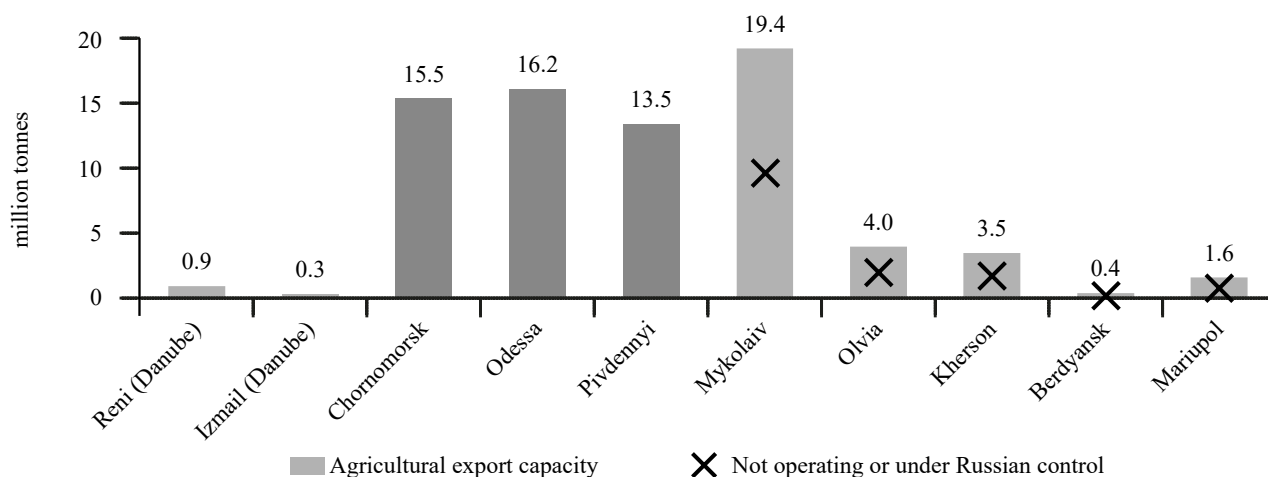


Figure 2: Agricultural export capacity of Ukraine’s major ports in 2021

Source: own compilation based on Tovstopyat (2022)

In contrast to maize, the volume of Ukrainian wheat entering the EU during the wartime is exceptional. The 6.1 million tonnes imported in MY 2022/23 (excluding durum wheat, but including wheat flour and groats, expressed in wheat equivalent) is about ten times the average of the three seasons before the war and more than double the average of all imports from third-countries. In MY 2023/24, Ukrainian wheat exports to the EU have continued at a similar pace. Ukrainian exporters were mostly displaced from African and Asian markets, while Middle Eastern countries remained stable buyers, according to the agricultural business association UCAB (cited by Reuters, 2023). During the first nine months of MY 2023/24, nearly 75% of Ukrainian wheat exports to the EU were shipped to Spain (primarily for feed due to droughts in the country in 2022 and 2023), with Italy and Greece also being significant buyers. Romania and Poland took substantial volumes of wheat for re-export during MY 2022/23.

It should be noted that the increase in exports of maize, sunflower oil, sunflower meal, and the comparatively smaller volume of rapeseed meal to the EU is largely attributable to a

normal market-driven process that began long before the war rather than as a consequence of the conflict.

The role of maritime transport in Ukraine’s agricultural exports

The Black Sea provides a strategic route to global markets, allowing access to Europe, the Middle East, and Africa. Its proximity to these regions reduces transportation costs and transit times compared to other routes. Therefore, the continuous, undisturbed operation of its Black Sea ports is essential for Ukraine. These ports are connected by robust rail and road networks, facilitating the efficient transport of agricultural goods from the interior of the country.

In the calendar year 2021, Ukraine exported a total of 50.8 million tonnes of grains, of which approximately 90% passed through its Black Sea ports. Of this volume, 35% exited the country via Mykolaiv (see Figure 2), which has been closed since the war began. Transport to the Black Sea

ports was facilitated by rail (64%), road (27%), and rivers (9%) (Nycz-Wojtan, 2023). In 2022, 16.3 million tonnes of grains were exported via sea routes, with 15.9 million tonnes shipped through the United Nations-administered Black Sea Grain Initiative (BSGI) corridor, operational from 22 July 2022 through 17 July 2023, according to the Ministry of Agriculture in Ukraine. During the BSGI period, Ukraine's Black Sea ports loaded 16.9 million tonnes of maize, 8.9 million tonnes of wheat, 1.3 million tonnes of barley, 1 million tonnes of rapeseed, 0.8 million tonnes of soybeans, 1.9 million tonnes of sunflower meal, and 1.7 million tonnes of sunflower oil for export (UN, 2024).

In August 2023, after Russia's withdrawal from the BSGI in July 2023, Ukraine established a protected maritime corridor to the Bosphorus to secure shipments from the Greater Odessa Ports (Odessa, Chornomorsk, and Yuzhny/Pivdennyi) through the coastal waters of three NATO countries: Romania, Bulgaria, and Turkey. By January 2024, the Greater Odessa Ports, capable of handling bulk carriers of Handy-size (up to 50,000 deadweight tonnage) and above, had exported a total of 6.8 million tonnes of goods, with agricultural products accounting for nearly 4.8 million tonnes. In March 2024, a total of 7.7 million tonnes of goods were exported, of which 5.2 million tonnes were agricultural products, as reported by the Ukrainian Sea Ports Authority (USPA). The traffic through the Greater Odessa ports had far exceeded pre-war levels.

With the temporary closure of Ukrainian Black Sea ports from March through July 2022, the role of Ukrainian ports along the river Danube (Reni, Izmail, and the smaller Ust-Dunaisk) in the export of agricultural products became increasingly important. The maximum combined monthly export loading of Ukrainian Danube ports was 550 thousand tonnes in August 2021. In 2023, 23 new berths were established in Reni and the more developed Izmail, with plans for an additional 15 berths in 2024. As a result of these expansions and developments, the combined export loading of these ports approached 2.8 million tonnes in August 2023, an all-time record, with agricultural products accounting for about 85%. According to USPA data, Ukrainian Danube ports handled over 13 thousand ships and loaded a total of 29 million tonnes of cargo in 2023, roughly twice the volume of 2022 and six times that of 2021 (Centre for Transport Strategies, 2024). Of this, 14.1 million tonnes were grains. Reni, the largest grain-loading port, is currently capable of serving 22 seagoing ships and 40 barges simultaneously. For comparison, in 2021, Ust-Dunaisk's annual nominal capacity was around 1 million tonnes, Reni's around 7 million tonnes, and Izmail's around 8.5 million tonnes, with actual loadings of 67.5 thousand tonnes, 1.37 million tonnes, and 4.07 million tonnes (mostly iron ore and coal), respectively, based on data from the Association of Seaports Ukraine. By early 2024, up to 1.2 million tonnes of agricultural products were loaded monthly at Ukraine's Danube ports.

The intensified protests in Poland in autumn 2023, continuing into early 2024, against the import of Ukrainian agricultural products and the repeated border closures have strongly incentivised the further development of Ukrainian Danube ports. This development will allow for the circumvention of Polish road and rail transit, making cost-effective

access possible for Ukraine to countries along the Danube-Rhine-Main waterway (Safronova and Krasnolutska, 2024). In the future, the role of river shipping in Ukraine's agricultural exports to the European Union is expected to grow.

With the temporary closure of Ukrainian Black Sea ports, the role of the Romanian port of Constanța, which is situated on the western coast of the Black Sea, is connected with the river Danube, and is now the largest grain export hub on the European continent, has also become more significant for the export of agricultural products via the Black Sea. According to data from the Port of Constanța, of the 24 million tonnes of grains and 3.5 million tonnes of oilseeds handled in 2022, the transit from Ukraine accounted for 6.9 million tonnes and 1.8 million tonnes, respectively. In 2023, grain handling increased to 36.2 million tonnes and oilseed handling to 9.3 million tonnes, with Ukrainian transit accounting for 15.3 million tonnes and 5.4 million tonnes, respectively.

The economic rationale of Ukraine's maize export to Hungary

Hungary, a land-locked EU member state neighbouring Ukraine, is one of the EU's major exporters of maize, with an average annual net export of around 3.1 million tonnes during the 2018-2020 period. In MY 2022/23, Hungary imported 1.56 million tonnes of maize (including processed products) from Ukraine, an unprecedented increase compared to the typical annual volume of 10-20 thousand tonnes. Of this, 509 thousand tonnes arrived in autumn 2022, while 895 thousand tonnes were imported in the first half of MY 2022/23. In the following, we will explore the background of this sharp rise in maize imports from Ukraine through a specific example.

Information on logistics transport costs for Ukraine is difficult to obtain and not frequently and readily available. Therefore, a specific time period was selected for investigation. The average Ukraine FOB (Free on Board¹) price for grain maize for November delivery was around USD 255 per tonne (for loads over 30 thousand tonnes) at the Greater Odessa Ports during the last week of October 2022, USD 20 per tonne less than the average FOB price in Romania (Port of Constanța) (Hammersmith, 2022). The difference primarily reflects additional costs associated with shipping grains through the BSGI corridor, including sea freight and risk insurance, which ranged between USD 20-25 per tonne at that time, according to Miroshnicenko (cited by Grain Trade, 2022).

At the end of October 2022, CPT (Carriage Paid To²) prices for maize delivered by rail to Odessa port ranged between USD 185-205 per tonne (APK-Inform, 2022b). The difference from the FOB price typically covers insurance costs until loading onto ships, transshipment (fobbing) expenses such as unloading from rails and possible storage

¹ The seller is responsible for arranging and paying for transportation to the ship and is also responsible for loading the goods onto the ship (<https://www.customsupport.com/insights/incoterms-explained-free-board-fob>).

² The seller is responsible for the costs until the goods are delivered to the place of destination, but the risks are transferred to the buyer when the goods are loaded and handed to the selected carrier (<https://www.eurosender.com/en/incoterms/cpt-vs-dap>).

in terminal silos, as well as the exporter's margin. In this case, the difference ranged between USD 50-70 per tonne. The cost of fobbing reportedly increased by USD 15-20 per tonne compared to pre-war times, attributed to the inefficient organization within the BSGI corridor, with an average cost of USD 25 per tonne during the corridor's operation (Kharchenko, 2024).

Miroshnicenko (cited by Grain Trade, 2022), plus Häberli and Kostetsky (2023), suggest that demurrage (the fee paid by the charterer to the ship owner for delays in loading) was also passed upstream, ultimately to farmers, embedding some risks into the FOB price, which is not typical. Data published by Häberli and Kostetsky (2023) indicates that the average demurrage in October 2022 was USD 26 per tonne, including both inbound and outbound demurrage. Russian inspector-related delays reportedly caused detention periods up to 60 days on average: 8-12 days outbound and 40-50 days inbound. Therefore, fobbing and demurrage combined amounted to USD 51 per tonne.

Based on data published by Rail.insider (2023), the cost of transporting 1 tonne of maize by rail in Ukraine to the Greater Odessa Ports using 94 m³ and 116-120 m³ private grain hoppers averaged UAH 1,038.5 or USD 28.1 in October 2022 (with an average exchange rate of USD 1 = UAH 36.90). This estimate excludes the freight forwarder's commission, fees for locking and sealing, loading and unloading operations, and other additional charges at departure and destination stations. It compares to the USD 26.9 per tonne average railway transport cost (including solely the delivery cost to the railway station and the rental cost of a grain hopper) calculated by Salin (2023) for the entire fourth quarter of 2022 from Central Ukraine to Odessa port over an average distance of 341 miles (549 km).

Salin (2023) estimates the average rail distance to Odessa port as 343 miles (552 km) from Western Ukraine, 521 miles (838 km) from Eastern Ukraine, and 341 miles (549 km) from Central Ukraine, averaging 402 miles (647 km) for all of Ukraine. Based on this data, the average cost of railway transport in October 2022 is assumed to be USD 0.0700 per mile or USD 0.0435 per kilometre. The 647 km average distance closely aligns with the distance from Kyiv, centre of Ukraine, to Chop in Zakarpattia Province by train (641 km), near the international railway border crossing to Zahony, Hungary. It is reasonable to assume that the average cost of railway transport in Ukraine to Chop is approximately equivalent to the average cost of railway transport to Odessa port, i.e., USD 28.1 per tonne in October 2022.

According to APK-Inform (2022b), DAP (Delivery at Place³) prices for maize ranged between USD 270-300 per tonne in Hungarian cities and USD 225-250 per tonne when delivered for export to Chop by rail within Ukraine at the end of October 2022. The difference between these two parities covers the costs of transshipment or bogie changes, customs, transport to the final destination in Hungary, and the importer's margin.

By deducting the USD 28.1 per tonne rail transport cost from the Chop DAP prices and the Odessa CPT prices, the average DAP price for maize received at interior Ukrainian

railway stations for export to Hungary was USD 196.9-221.9 per tonne at the end of October 2022. In contrast, the average DAP price received at interior Ukrainian railway stations for maize exported through the Greater Odessa Ports was USD 156.9-176.9 per tonne at the same time. This clearly highlights the economic advantage of exporting maize via rail to Hungary during that period.

For comparison, a year later, during the last week of October 2023, the average FOB price for maize for November delivery was around USD 185 per tonne (for loads over 30 thousand tonnes) at the Greater Odessa Ports, USD 25 per tonne less than the average FOB price at the port of Constanța (Hammersmith, 2023). The difference again primarily reflects insurance costs, which remained significant due to frequent attacks against port facilities by the Russian military after Russia exiting the BSGI.

Although Ukraine resumed operations of the Greater Odessa Ports by October 2023 through the new "humanitarian corridor" established in August 2023, it was not until November, that insurance brokers Marsh and Lloyd's, in collaboration with Ukrainian state banks, launched a marine war insurance programme specifically for grain shipments, aimed at reducing the cost of claims for damage to ships and crew transporting grain through this new Black Sea corridor. The insurance programme cut war insurance premiums back by more than half (Cohn, 2024). For comparison, by the end of March 2024, the gap between Romanian and Ukrainian FOB prices for maize for April delivery narrowed to USD 12 per tonne (Hammersmith, 2024).

In the last week of October 2023, CPT bid prices for maize in Odessa ranged between USD 122-128 per tonne, according to data from APK-Inform's database (<https://www.apk-inform.com/en/prices>) (A bid price represents the highest price a buyer is willing to pay, typically lower than the actual selling price). The difference between the FOB and CPT bid prices in Odessa varied from USD 57 to USD 63 per tonne.

During the 2023/24 season, grain fobbing costs at the Greater Odessa Ports ranged between USD 20-24 per tonne (Kharchenko, 2024), indicating potential significant demurrage due to factors such as missile attacks, suspension of cargo operations during air raid warnings, unavailability of pilotage at night, etc. Data on demurrage at Ukrainian sea ports was not readily available for this period.

Based on data published by Rail.insider (2023), the cost of transporting 1 tonne of maize by rail in Ukraine to the Greater Odessa Ports using 94 m³ and 116-120 m³ private grain hoppers averaged UAH 696 or USD 26.5 in October 2023 (with an average exchange rate of USD 1 = UAH 36.52), excluding the fees and charges mentioned above. Consequently, the average DAP price for maize received at interior Ukrainian railway stations is estimated to range between at least USD 95.5-101.5 per tonne.

For October 2022, DAP maize prices for Hungarian cities were not readily available. Therefore, data from the Hungarian Market Price Information System (MPIS, operated by the Institute of Agricultural Economics, Budapest, Hungary, accessible at <https://www.aki.gov.hu/piaci-arinformacios-rendszer/>) is used to indicate year-on-year changes in price levels. In the 43rd week of 2023 (end of October), the

³ The seller is responsible for the costs and risks until the goods are delivered to the place of destination (<https://www.eurosender.com/en/incoterms/cpt-vs-dap>).

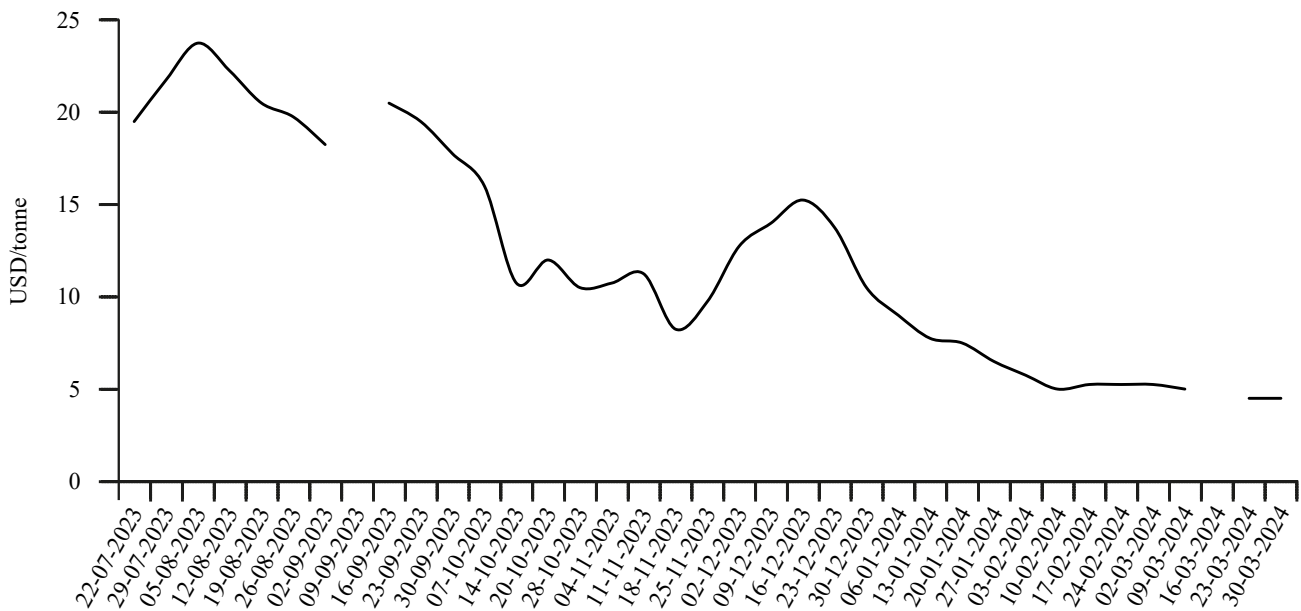


Figure 3: 4-week moving average of the difference in dry bulk sea freight costs (30 thousand tonnes) in Ukrainian and Russian ports to Alexandria (Egypt) from July 2023 (termination of the BSGI) to March 2024.

Note: The gaps indicate the dates when weekly reports were not published

Source: own compilation based on data from Hammersmith (2024)

net producer (farm gate) price for maize averaged USD 156 per tonne (with an average exchange rate of USD 1 = HUF 361.9). DAP prices for maize for export at stations on the western Ukrainian border, including Chop, ranged between EUR 110-120 (Spike Brokers, 2023), or USD 116.5-127.1 (with an average exchange rate of USD 1 = EUR 0.9441) per tonne at that time.

Assuming, as before, that the average cost of railway transport within Ukraine to its western border (i.e., to Chop) is approximately equivalent to the average cost of railway transport to the Odessa port, deducting the USD 26.5 per tonne rail transport cost from these DAP prices estimates USD 90.0-100.6 DAP for maize at interior Ukrainian railway stations for export to Hungary.

This brief analysis suggests a notable reduction in the economic incentive for Ukraine to export maize to neighbouring Hungary by the last quarter of 2023, coupled with a heightened financial attractiveness of exporting through sea-ports. Importantly, this shift does not suggest that exporting from regions closer to the border became unfeasible. However, for most of the maize exports, utilising the new maritime corridor emerged as the preferred choice, substantially mitigating market pressures on countries such as Hungary, or Slovakia, and Poland.

Hungary introduced an import ban on various agricultural products, including grains, from Ukraine, on 19 April 2023, through Governmental Decree 130/2023 (IV. 18.). This ban remained in effect as of June 2024, permitting only the transit of these goods. However, changing market and logistics conditions, as demonstrated above, raise questions about the necessity of maintaining the import ban through 2023 and beyond. The difference in sea freight costs from ports in Ukraine compared to ports in Russia, for which data were available, to the same destination steadily declined

since December 2023 (see Figure 3). This improved the competitiveness of maritime transport and further diminished the appeal of land exports of grains, including maize, to neighbouring EU countries such as Hungary, or even Romania. In Romania, grain exports transiting through the Port of Constanța declined by 35.1% year-on-year to 2.16 million tonnes in the first quarter of 2024 (Hellenic Shipping News, 2024), reflecting the narrowing of the gap between Ukrainian and Romanian FOB prices. For most grains in Ukraine, the optimal export route has become through the ports of Greater Odessa.

Discussion and Conclusions

The market penetration of Ukrainian maize in Hungary in the autumn of 2022 can be explained partly by the drastic increase in the costs associated with exports through the Black Sea ports and partly by the extremely high physical market price level in Hungary. During this period, the MPIS average net producer price of maize in Hungary was more than EUR 20 per tonne higher compared to the MATIF front-month average, whereas the basis (physical market price minus futures price) averaged around EUR -40 per tonne during the 2018-2020 period (see Figure 4), which is typical for Hungary, as a net maize exporting country.

This clearly indicated that Hungary had become a net importer of maize due to the 2022 drought affecting spring-sown crops, resulting in a significant 63% drop in maize production compared to the average of the previous five years. Additionally, farmers held back their produce, partly due to the rapid depreciation of the Hungarian national currency, the forint. The unusual price constellation provided a lifeline for Ukrainian grain exporters, who were otherwise forced sellers.

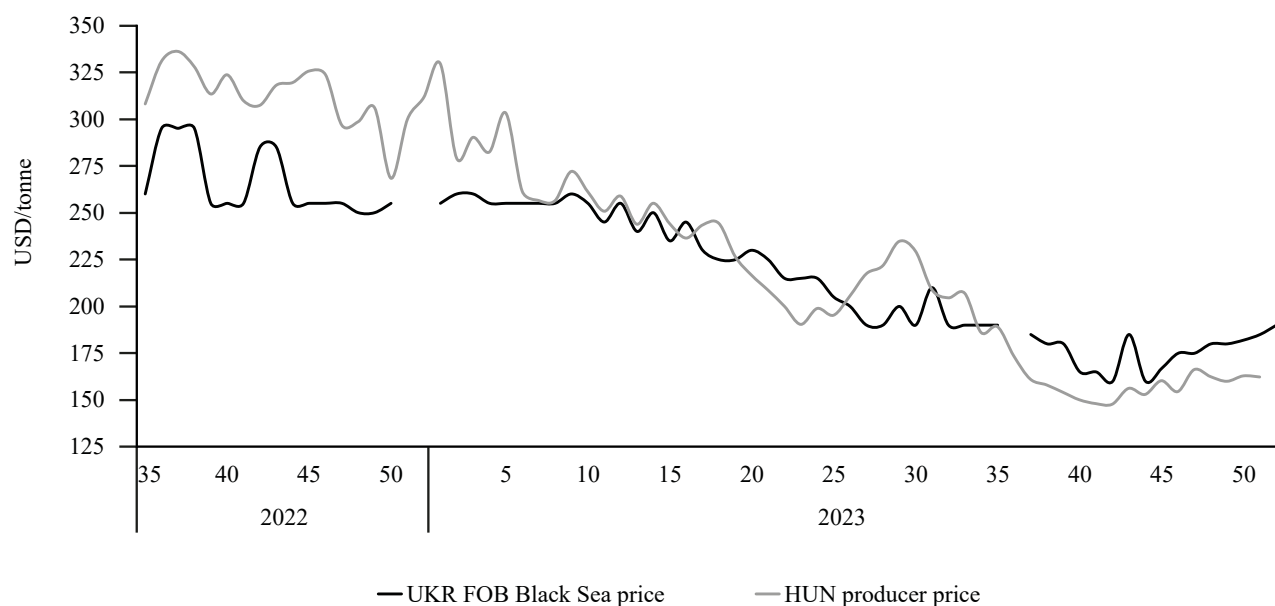


Figure 4: Comparison of Ukrainian Black Sea FOB maize prices for nearby shipments and Hungarian producer prices for maize from week 35 of 2022 to the end of 2023.

Source: own compilation based on data from Hammersmith (2024) and MPIS

The appearance of Ukrainian sellers was also advantageous for domestic maize processors, such as compound feed producers and starch and ethanol plants, seeking feedstock. At the same time, arable farmers, as well as investors who had not previously been involved in agricultural production, processing, or agricultural commodity trading, also tried to profit from the market anomaly and bought Ukrainian maize in hopes of further price increases. However, lacking experience, many of them were unaware, among other things, that export restriction (Government Decree 83/2022 (III. 5.) on the notification procedure and measures related to the export of agricultural products of strategic importance in terms of feed and food supply security) effective from 6 March 2022 to 20 January 2023 had long deterred EU importers from the Hungarian grain market, resulting in sluggish demand from foreign buyers.

In conclusion, the shifts observed in trade patterns, influenced by factors such as conflict-related disruptions and evolving market dynamics, appear to be temporary and do not represent a continuous threat to grain markets in EU member states neighbouring Ukraine. These shifts underscore the importance of safe, flexible, and resilient logistics for maintaining market stability amidst geopolitical tensions.

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