

## CASE STUDY OF GRAIN EXPORT ROUTS CHANGES FOR UKRAINE IN 2022-2023

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**Abstract.** The military conflict between Russia and Ukraine has caused global problems in the food and agricultural products market. Wheat and corn producers in Ukraine were the first to suffer. Due to hostilities, the ability to sell products using established supply chains was significantly reduced. The decrease in the supply of products on the global market has caused an increase in product prices and also put the food security of the least developed countries at risk. The global nature of the crisis forces us to look for new logistics solutions. One solution to the problem is related to the Black Sea Grain Initiative. As a result of the initiative, Ukraine has significantly increased grain exports to least developed countries such as Bangladesh, Yemen, Ethiopia and Djibouti, but the export gap of wheat compared to 2021 is no more than 50%, which indicates the inadequacy of existing solutions. The Black Sea Grain Initiative has stopped the global rise in food prices. In this context, the possibility of creating a transport corridor for Ukrainian agricultural products through the territory of EU countries is being considered, using the sea routes of the Baltic Sea. At the same time, the article examines changes in the situation on agricultural markets in individual EU countries, taking into account global changes. At this stage, it is obvious that the military conflict has become protracted and long-term. Which requires thinking about the need to reorient the specialization of some Baltic Sea ports to transport agricultural products.

**Keywords:** Black Sea grain initiative, wheat, Russia-Ukraine war, supply chains, market reaction.

### Introduction

On the world market, Ukraine traditionally ranks as one of the largest exporters of agricultural products. This competitive advantage of the country is linked to an optimal climatic balance of temperature and precipitation, high soil fertility, and rational management of available resources.

The grain export potential in Ukraine has been widely discussed in specialized and scientific literature [1]. Certain changes, until recently, have been induced by the COVID-19 pandemic [2]. In conditions of military action, traditional methods of grain export and logistic capabilities are severely limited. This has immediately led to both an overproduction crisis in Ukraine and altered the global food market. The impact of military actions on the export of grain products in Ukraine and the global food market is addressed in various studies. Martins examined the short-term market response of agricultural products to different stages of military actions [3]. Rose et al. investigated the economic impacts of war export disruptions of grain commodities [4]. Specific regional issues are addressed in the works of Urak [5] for the case of Turkey, and by Ayesha and Christo for South Africa [6]. The impact of military actions on global food security is assessed by Ihle [7]. These circumstances underscore the necessity of continuously globally addressing food security, which is an unquestionably significant practical and scientific issue [8-10].

From the authors' point of view, despite the importance of the problem, it remains unresolved. The situation is at a standstill. This study aims to explore alternative solutions for grain exports from Ukraine. As an alternative, the use of intermodal transportation by land from Ukraine to Baltic Sea ports and then by sea to the end consumer is proposed.

The study does not examine changes in grain market prices, as this is a complex issue in itself, encompassing price fluctuations due to military actions as well as global and regional consumption and yield issues. A comprehensive separate study is required to investigate price fluctuations in the market; therefore, this issue was not addressed in this research. It is a study limitation.

### Materials and methods

This section describes the proposed method and the data required for the research. To conduct the study, it is necessary to determine:

- the potential and actual volume of grain exports from Ukraine,

- logistic constraints and opportunities in current conditions for actual and potential routes of product distribution.

The first serious problem in the research process lies in gathering reliable data. According to the State Statistics Service of Ukraine [11], grain exports during the period of 2020-2023 accounted for 19-23% of the total exports, with this indicator fluctuating between 19-20% before the war and rising to 23% in 2023. This underscores the importance of grain exports for the Ukrainian economy. The data from the State Statistics Service of Ukraine is reliable and unquestionable. However, the data from this service is provided in an aggregated format, limiting the ability to conduct a detailed examination of the issue.

An authoritative source of data on the problem under study could be the UN Black Sea Grain Initiative Joint Coordination Centre [12], which tracks grain exports from Ukraine at the international level. Unfortunately, the center tracks data from August 1, 2022, providing insight into the current situation but not allowing for an assessment of export potential.

Information from the Ukrainian Grain Association [13], Ministry of Agrarian Policy and Food of Ukraine [14], and State Customs Service of Ukraine [15] were considered as data sources for the study. The association's data potentially possesses a moderate level of reliability. The ministry's and association's data have links to the Customs Service. Therefore, the Customs Service was chosen as the main data source for the study. The service publishes reports based on filled declarations, making it publications as the primary data source for other services and government agencies. This data holds the highest degree of reliability. It is worth noting that this study is the first built on Customs Service data. The authors express skepticism towards previous studies based on secondary data, for example, based on data from the UN Food and Agriculture Organization [1;3]. The difference in data sources leads to discrepancies in conclusions compared to earlier studies. From the authors' perspective, this study directly points out previously unnoticed aspects of the problem. The novelty of the article is associated with both the analysis of the situation and the utilization of non-standard source of data. This source enables the timely monitoring of the situation. The article was formulated in February 2024, i.e. a month after the completion of the calendar year, when complete data for 2023 became available. Statistical authorities rarely publish data so promptly.

The data on the main groups of grain exports from Ukraine are presented in Table 1.

Table 1

**Grain exports from Ukraine, 2019-2023, mil. USD (authors' summary based on [15])**

<b>Grain</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>
Corn	5220	4877	5893	5940	4966
Wheat	3660	3595	5075	2677	2941
Barley	710	877	1275	447	362
Wheat flour	93	59	36	24	42
Other	155	156	213	168	153
<b>Total</b>	<b>9839</b>	<b>9565</b>	<b>12492</b>	<b>9255</b>	<b>8464</b>

From Table 1, it can be seen that corn and wheat exports constitute the main part (over 90%) of grain exports from Ukraine. These results confirm previous research findings. Considering the high significance of these two grain groups, only corn and wheat are further examined in the study, which is a reasonable limitation.

Objectively and neutrally considering the available data, it should be noted that in the pre-war year of 2021, Ukraine significantly increased grain exports by 30%. Given the nature of agricultural production, data for individual years may be largely influenced by natural factors. Basing the analysis solely on data from 2021 would not be appropriate. The average level of exports for the three pre-war years is close to the 2019 results. Undoubtedly, grain exports have decreased by 3-32% in wartime conditions.

In relation to the research objectives, to determine the transportation routes for grain exports, it is necessary to investigate the geographical structure of exports, as done in Table 2.

Table 2 presents the main export countries for the primary grain groups in Ukraine. The data reveal significant differences in the changes in exports of the two grain groups: corn and wheat.

Table 2  
Structure of grain exports from Ukraine, 2019-2023, mil. USD (authors based on [15])

Corn						Wheat					
Country code	2019	2020	2021	2022	2023	Country code	2019	2020	2021	2022	2023
CN	703	1382	1873	1055	1081	EG	665	611	858	242	122
ES	654	460	583	657	683	ID	537	543	732	0	0
RO	0	1	0	821	573	TR	207	208	446	476	447
EG	618	508	523	294	292	RO	0	0	0	332	417
NL	614	506	539	332	499	BG	419	295	0	4	0
IT	240	116	204	323	264	ES	48	71	34	228	679
Other	2391	1903	2171	2458	1574	Other	1784	1868	3004	1396	1276
Total	5220	4877	5893	5940	4966	Total	3660	3595	5075	2677	2941

Regarding the corn group, in the first year of the war, Ukraine increased export volumes, and in the second year, the decrease in exports did not exceed the levels of 2020. It would not be objective to ignore the increase in corn exports in the first year of the war. Corn exports stabilized due to supplies to Romania, evidently for subsequent re-export.

The situation with wheat exports is not as straightforward. The decline in exports is directly linked to the loss of major markets such as Indonesia and, partially, Egypt. Increasing exports to Romania and Spain only partially compensated for these losses.

Comparing the data from the State Customs Service of Ukraine [15] with the data from the UN Black Sea Grain Initiative Joint Coordination Centre [12], it confirms the main direction of grain exports to China, as well as Spain's second-leading position. The detailed geographical structure of grain exports within the Black Sea Grain Initiative is shown in Fig. 1.

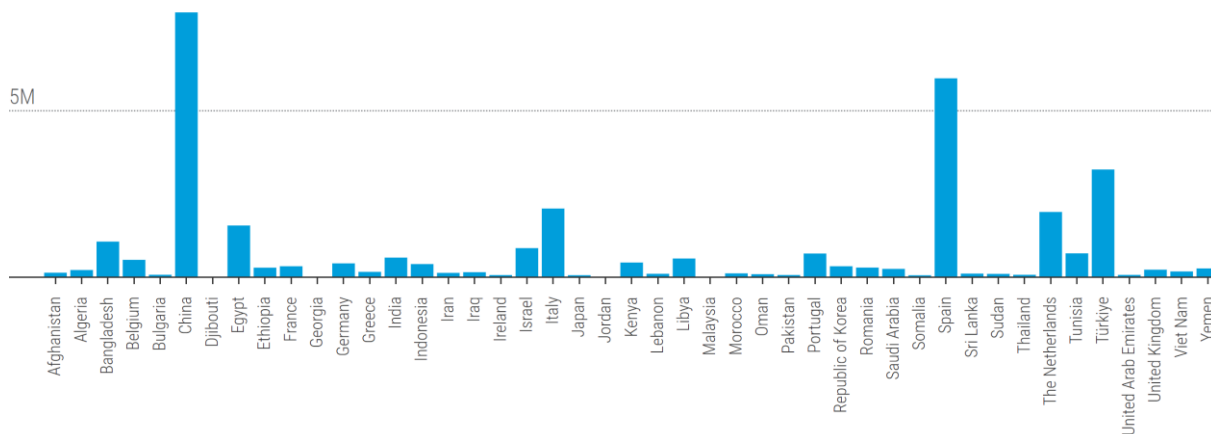


Fig. 1. Cargo destinations in Black Sea Grain Initiative, metric tonnes [12]

It is worth emphasizing that the data from the UN Black Sea Grain Initiative Joint Coordination Centre, shown in Fig. 1, reflect freight shipments only within the framework of the Initiative. In contrast, the data from the State Customs Service of Ukraine depict the complete picture. This is clearly seen in the case of Egypt and Romania. Grain exports to Egypt are carried out within the Initiative, while exports to Romania, among others, utilize alternative transportation routes. Data on exports to Romania are not reflected in the Grain Initiative data.

Thus, the available materials show the potential and actual volume of grain exports from Ukraine and demonstrate the importance, feasibility, and necessity of diversifying transportation corridors.

According to the Ukrainian Grain Association [13], 74.4% of grain exports are conducted through ports, i.e. maritime transport; the role of railway transportation in grain exports is 17.6%, road transportation is around 7%, and river transportation is approximately 1%. Therefore, at this stage, maritime transport plays a predominant role in grain exports from Ukraine. Changes in the volume of transportation in the Black Sea area for January 2022 and 2024 are compared in Fig. 2 and Fig. 3.

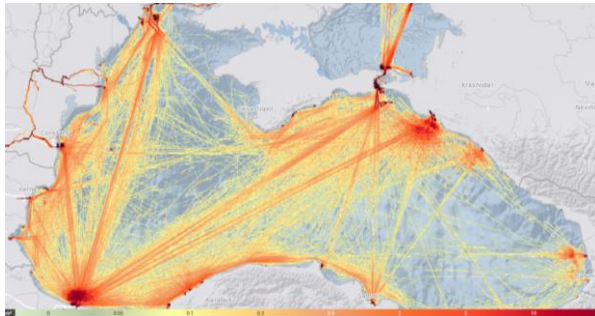


Fig. 2. Cargo vessel traffic density in Black Sea in January 2022 [16]

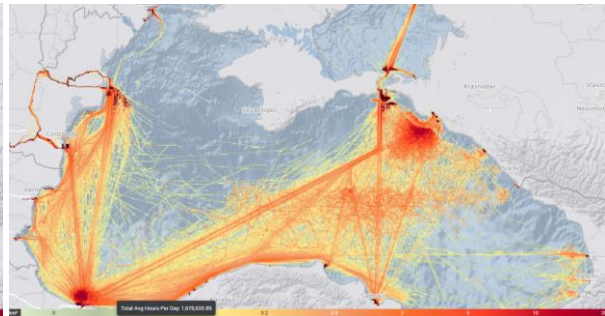


Fig. 3. Cargo vessel traffic density in Black Sea in January 2024 [16]

Fig. 2 and Fig. 3 show that as a result of the war, Ukrainian ports ceased operations. Freight shipments from the main ports in the Odessa and Nikolaiv regions shifted to Romanian ports. Shipping along the Crimean coast came to a complete halt, and Ukraine lost access to the Sea of Azov. The role of Turkish ports in the region increased.

Thus, based on the available data, it is shown that by modifying transportation routes, it is possible to fully replace direct maritime shipments with intermodal ones.

## Results and discussion

During the research, the authors arrived at the following findings:

Despite the severe military situation and the loss of part of its territory, Ukraine succeeded in preserving and even increasing its corn exports in 2022. This finding often contradicts other studies [17] that consider all grain exports through the lens of wheat exports, which, according to the authors, is not acceptable.

The increase in exports presented in this article may be attributed both to the increase in exports due to rising prices and to the increase in the physical volume of exports. The authors examine this issue in detail during the development of the article. Long-term contract prices on the global corn market in 2023 were lower than in 2021 [20]. Therefore, prices do not play a dominant role in preserving exports in Ukraine. However, the short-term price increase may have influenced export volumes in 2022.

The loss of wheat export volumes is undeniable. However, the reasons for the decline in wheat exports are subject to discussion. Why Ukraine demonstrates growth in exports in one grain group, it experiences a decline in another? To answer this question, the situation needs to be evaluated considering the global wheat market. Bloomberg News published an opinion stating that Ukraine's loss of wheat export markets is due to the increase in exports from Russia [18]. The analysis of the wheat export structure from Ukraine, presented in Table 2, indirectly confirms this opinion. Unlike Ukraine, the main part of Russia's grain exports is wheat, up to 83%, with corn accounting for no more than 2%. Ukraine's loss of exports to Egypt is undoubtedly linked to competition with Russia. The Russian Federal State Statistics Service published information about a 40% increase in wheat harvest in 2022 [19]. As a result, Russia faced a wheat overproduction crisis and was forced to lower export prices, leading to a sustained decline in global wheat prices [20].

It is worth noting that the policy and attitudes towards this crisis situation vary among different EU countries. Spain actively increases its imports of Ukrainian grain. There are certain disagreements between Poland and Ukraine regarding grain supplies to the domestic market. The reasons for this lie in Ukraine's use of road transport to expand exports through Poland and Poland's lack of understanding of global trends resulting from wheat overproduction in Russia. Reacting to the crisis situation, Latvia banned transit of Russian grain through its ports. Latvia's actions are aimed at reducing the volumes of Russian wheat both in the EU market and in global markets.

Increasing grain exports via road transport to Poland is a forced and highly ineffective measure. Transit through Poland by rail, followed by shipping by sea, appears to be a promising solution. Although this solution has some technical complexities, given the different rail gauges, this drawback could potentially be addressed by transiting grain through the Baltic States ports. However, this route is complicated by the need to transit grain through Belarus. Despite existing contradictions, the routes for exporting Ukrainian grain through Baltic Sea ports may emerge as leading positions in the event of further escalation in the Black Sea region.

### Conclusions

1. Despite the severe military situation and the loss of part of its territory, Ukraine succeeded to increase its corn exports in 2022. The decline in wheat export volumes is attributed to the growth of global competition.
2. Export routes for agricultural products underwent significant changes. Direct exports from Ukrainian ports on the Black Sea, except for the Black Sea Grain Initiative, have ceased entirely. Ukraine has largely succeeded in diversifying the export routes for agricultural products.
3. In terms of facilitating the transit of Ukrainian agricultural products, the capabilities of Baltic Sea ports have not been fully utilized.

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