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ORIGINAL PAPER

THE IMPACT OF THE RUSSIA-UKRAINE WAR ON THE RESILIENCE OF POLAND'S WHEAT SUPPLY CHAINS – AN ANALYSIS OF CHANGES IN THE CONFIGURATION OF POLAND'S EXPORT MARKET

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JEL Classification: Q13, Q17, L91, F14.

K e y w o r d s: wheat export, supply chain resilience, Russia-Ukraine war, export market reconfiguration, Poland.

A b s t r a c t

This article presents the results of a study on the macroeconomic aspects of the resilience of Poland's wheat export logistics system. The aim of the research is to identify changes in the configuration of Poland's wheat export markets in 2022–2023 in response to disruptions in international supply chains caused by the Russia-Ukraine war. The analysis focuses on the interaction and competition between the global wheat supply networks of Poland and Ukraine during the large-scale disruption of 2022–2023. The statistical analysis covers the period from 2012 to 2025. Qualitative methods – stratification and comparative analysis – confirmed the proposed hypotheses. The study reveals that Poland's wheat export network did not exploit Ukraine's weakened market position during the crisis, but instead expanded into regions where Ukraine had shown weak or no prior export interest. Overall, Poland's wheat export network maintained and strengthened its position in the European and African markets during the 2022–2023 crisis.

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WPŁYW WOJNY ROSYJSKO-UKRAIŃSKIEJ NA REZYLIENTNOŚĆ ŁAŃCUCHÓW DOSTAW PSZENICY POLSKI – ANALIZA ZMIAN W KONFIGURACJI POLSKIEGO RYNKU EKSPORTOWEGO

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Słowa kluczowe: eksport pszenicy, rezylientność łańcuchów dostaw, wojna rosyjsko-ukraińska, rekonfiguracja rynków eksportowych, Polska.

Abstrakt

Artykuł przedstawia wyniki badania makroekonomicznych aspektów rezylientności systemu logistycznego eksportu pszenicy z Polski. Celem badania jest identyfikacja zmian w konfiguracji rynków eksportowych polskiej pszenicy w latach 2022–2023 w odpowiedzi na zakłócenia w międzynarodowych łańcuchach dostaw spowodowane wojną rosyjsko-ukraińską. Analiza koncentruje się na interakcji i konkurencji między globalnymi sieciami dostaw pszenicy z Polski i Ukrainy w okresie zakłóceń na dużą skalę w latach 2022–2023. Analiza statystyczna obejmuje lata 2012–2025. Zastosowanie jakościowych metod badawczych, w szczególności stratyfikacji i analizy porównawczej, umożliwiło sformułowanie wniosków potwierdzających postawione hipotezy. Badanie pokazuje, że polska sieć eksportu pszenicy nie wykorzystała osłabionej pozycji rynkowej Ukrainy podczas kryzysu, lecz rozszerzyła się na regiony, w których Ukraina wcześniej wykazywała słabe lub zerowe zainteresowanie eksportowe. Ogólnie rzecz biorąc, polska sieć eksportowa pszenicy utrzymała i wzmocniła swoją pozycję na rynkach europejskich i afrykańskich w trakcie kryzysu lat 2022–2023.

Introduction

The Russian military invasion of Ukraine has caused large-scale disruptions in the global grain supply network, particularly in the wheat market. The rerouting of grain flows from Ukraine's southern seaports towards its western borders led to a sharp and significant surge in the logistical networks of European Union countries bordering Ukraine, especially Poland, during 2022–2023. This massive disruption in grain supply chains triggered a complex and contradictory response within Poland's logistics system: from negative reactions among hauliers and farmers to positive assessments from traders (Czubak *et al.*, 2024; *Zboże i rzepak z Ukrainy…*, 2023). Despite these challenges, Poland's logistical network demonstrated considerable resilience. However, the consequences of overcoming the 2022–2023 disruption remain under-researched. Existing studies on the logistics dimension of the situation have focused primarily on two areas: the potential for establishing and developing alternative grain supply routes from

Ukraine through Poland (Gołębiewski & Stefańczyk, 2023; Sadłowski & Zając, 2024), and the reasons for, as well as the economic rationale behind, domestic stakeholders' resistance to increased imports of Ukrainian grain (Czubak *et al.*, 2024; Dolińska, 2024; Pasztaleniec & Adamiak, 2024).

The choice of wheat exports as the object of study is explained by the strategic importance of this commodity for the Polish economy. In 2024, wheat accounted for 49% of the total volume of grain exports (*Rynek zbóż*, 2025). In the 2022/23 marketing year, wheat ranked second among grain exports from Ukraine to Poland (Tab. 1). "The impact of armed conflicts is significantly greater with regard to staple foods and products essential for food security (much greater in the case of wheat than of sugar)" (Zając & Bogusz, 2024).

Table 1

Grain exports from Ukraine to Poland, in thousand tonnes

Type of grain	2020/21 MY*	2021/22 MY	2022/23 MY
Corn	6.1	1466.2	1184.9
Wheat	3.9	15.9	875.8
Barley	0.0	12.2	50.8

* MY is October – September for corn, July – June for wheat and barley.
Source: own elaboration based on Sobolev (2023a, 2023b, 2024).

Supply chain resilience is defined as the ability "to withstand, adapt, and recover from disruptions to meet customer demand and ensure the target performance" (Aldrighetti *et al.*, 2023). Recovery following disruptions does not restore the supply chain to its previous state, as "the meaning of 'normal' [state] might constantly evolve and be adjusted both inside and outside the supply chain" (Richey *et al.*, 2022). In other words, certain changes are inevitable. Indicators of transformation may include changes in the elements of the supply chain: the structure of the supply network, the configuration of relationships, process and technology flows, and product architecture (Srai *et al.*, 2023). Our study focuses on structural changes in the wheat export supply network. Richey et al. argue that changes occurring under the influence of extreme events lack a stable foundation and do not become the future norm (or standard), whereas structural changes – those affecting the supply chain's configuration – require strategic planning and occur over the long term (Richey *et al.*, 2022). The period of sharply increased wheat inflows from Ukraine into Poland's supply channels lasted for approximately one year, until the official prohibition of wheat imports from Ukraine was imposed at the national level in Poland at the end of April 2023 (Rozporządzenie Ministra Rozwoju i Technologii z dnia 21 kwietnia 2023 r. w sprawie zakazu przywozu z Ukrainy produktów rolnych, 2023) and subsequently

at the EU[1] level on 2 May (Commission Implementing Regulation (EU) 2023/903 of 2 May 2023 introducing preventive measures concerning certain products originating in Ukraine, 2023; Commission Implementing Regulation (EU) 2023/1100 of 5 June 2023 introducing preventive measures concerning certain products originating in Ukraine, 2023). The duration of the system's response to disruption offers a window of opportunity for the implementation of long-term managerial decisions.

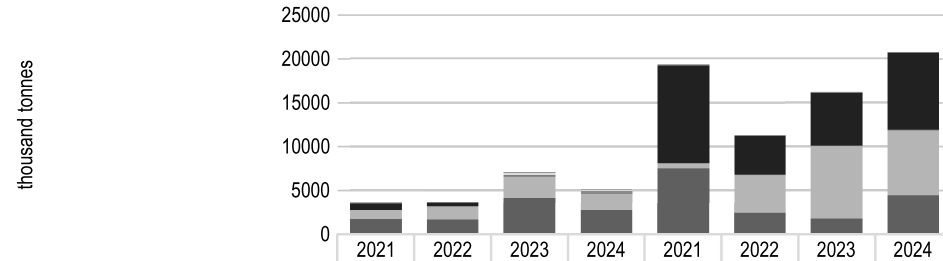
The study by Zając and Bogusz (2024) highlights Poland's entry into new wheat export markets during 2022–2023; however, the authors suggest that the achieved outcomes may be temporary. Therefore, the instances of wheat sales to new markets identified by A. Zając and M. Bogusz cannot be interpreted as a structural reconfiguration of export markets.

In the context of the logistical disruption and its resolution in 2022–2023, we observe the interaction between two major wheat supply logistics networks: the Polish and the Ukrainian. These networks share certain links within international wheat supply chains but also encompass many independent global wheat supply chains that compete with one another to some extent (Fig. 1). In 2022–2023, we note opposing trends in the volumes of wheat supplied to Africa and Asia, and similar trends in supplies to European countries (particularly EU member states) by both Poland and Ukraine. The overall volume of Ukrainian wheat exports is several times higher than that of Poland. Consequently, it is not possible to assess changes in the configuration of Poland's wheat export markets without accounting for Ukraine's export interests. It is also important to consider the gradual restoration of Ukraine's wheat export network, which has taken place since September 2022 with the partial resumption of maritime transport from Black Sea ports.

Figure 1 illustrates an increase in Poland's wheat exports during 2023–2024. It is important to note that this growth is attributed not only to the significant rise in wheat imports from Ukraine but also to increased wheat production in Poland during 2022–2023 (Tab. 2). Wheat production volumes have been gradually rising and consistently exceed import volumes each year, underscoring the critical role of domestic production in shaping the configuration of export markets. The growth in wheat production serves as a key driver for the expansion of export market structures.

It is also worth noting that domestic consumption levels and wheat stockpiles in 2022–2023 had little influence on export volumes.

[1] The ban on the import of wheat, as well as corn, rapeseed, and sunflower seeds from Ukraine to Poland, does not apply to their transit. The European Commission regulations expired on 15 September 2023. In order to extend the ban on the import of wheat and certain other goods from Ukraine, Rozporządzenie Ministra Rozwoju i Technologii z dnia 15 września 2023 r. w sprawie zakazu przywozu z Ukrainy produktów rolnych (Dz. U. z 2023, poz. 1898) was adopted.



	Poland				Ukraine			
Countries not specified within the framework of extra-Union trade	0.0	0.9	9.6	3.9	0.0	0.0	0.0	0.00
Latin America and the Caribbean	8.1	13.2	12.1	0.0	156.9	0.3	0.0	0.00
Northen America	7.6	0.0	318.4	115.8	0.0	9.3	14.7	0.03
Asia	705.4	342.6	62.7	0.0	11110.1	4389.6	6003.6	8770.4
Other European countries	70.6	34.4	120.8	326.8	57.6	87.8	104.0	105.7
EU countries	1037.7	1547.4	2242.6	1776.6	536.4	4255.3	8236.6	7349.3
Africa	1765.6	1699.4	4206.3	2820.1	7533.9	2480.9	1792.7	4439.3

Fig. 1. Total wheat and meslin export of Poland and Ukraine in 2021-2024 by world regions, in thousand tonnes

Source: own elaboration based on Eurostat database.

Table 2

Selected elements of annual wheat balances of Poland, in thousand tonnes

Wheat balance elements	2017	2018	2019	2020	2021	2022	2023
Opening stock	6 846	8 292	7 091	6 708	4 783	3 890	5 531
Usable production	11 666	9 820	11 012	12 669	12 119	13 445	13 178
Domestic consumption	8 480	9 707	9 813	10 633	9 051	9 151	8 161

Source: own elaboration based on Eurostat database.

The study's objective is to pinpoint shifts in the structure of Polish wheat export markets in 2022–2023, as a consequence of the Russian-Ukrainian war leading to disruption in global supply chains. The research questions are to investigate how Poland's wheat export logistics system has used its potential to increase flows during the period of large-scale disruption in the logistics network and whether it has gone beyond its current configuration in terms of wheat export markets.

Poland and Ukraine share overlapping wheat export markets; therefore, expansion into regions where Ukraine has shown limited export activity appears more attainable for Poland. The stability of the achieved results of the reconfiguration of Poland's wheat export areas in 2022–2023 would be evidenced by the continuation of exports to these markets in 2024 and 2025. It is expected that in sustainable complex supply networks, cooperation will increasingly outweigh

competition, advancing economic, environmental, and social goals (Pathak *et al.*, 2014). We formulate the following interrelated hypotheses:

H1. The expansion of Poland's wheat export market configuration in 2022–2023 took place in regions that had shown the lowest levels of Ukraine's wheat export interest prior to Russia's invasion of Ukraine in 2022.

H2. The expansion of Poland's wheat export market configuration in 2022–2023 did not occur at the expense of Ukraine's export markets.

Research methodology

The research questions were formulated on the basis of a literature review. The study was conducted using statistical data and qualitative analytical methods, in particular stratification and the method of comparison. The issue under investigation concerns the impact of the situation in Ukraine on developments in Poland within the shared branches of the global wheat supply network. Therefore, to analyse Poland's export flows, a comparative approach using Ukrainian data was applied. It was found that the export and import statistics for Ukrainian wheat differ in volume between the Eurostat and State Customs Service of Ukraine databases. As a result, only Eurostat data were used for the analysis of wheat exports and imports from both Poland and Ukraine. The only exception concerns Ukrainian wheat exports in 2015 and 2016, where data from the State Statistics Service of Ukraine were used due to the absence of corresponding entries in the Eurostat database.

Wheat classification follows Harmonized System (HS) codes, while the classification of geographical regions is based on the United Nations "Standard Country or Area Codes for Statistical Use (M49)".

To assess the novelty of Poland's wheat export destinations, overlapping zones with Ukraine's export markets were analysed for the decade preceding the Russia-Ukraine war (2012–2021) – a sufficiently long period to establish market patterns. The analysis was limited to export directions where Poland was active in 2022–2023, as only these routes were subject to potential reconfiguration.

Based on this data, six clusters of Poland's wheat export markets were identified (Tab. 3), grouped by the intensity of exporter activity. To measure this, the indicator "Number of non-export years during 2012–2022" was applied.

Table 3

Groups and stratification criterion of selected areas of wheat export interests of Poland and Ukraine in 2012–2021

Groups of wheat export markets	Number of non-export years during 2012–2022	Countries
Group 1 – Area (markets) of intersection of wheat export interests of Poland and Ukraine	0 – 4 years for Poland and Ukraine	*Africa*: Algeria, Kenya, Morocco, Tanzania, South Africa, Mozambique, Nigeria. *EU countries*: Austria, Italy, France, Germany, Lithuania, Netherlands, Spain. *Other European countries*: Belarus, United Kingdom.
Group 2 – Area (markets) of sporadic wheat export interests of Poland and Ukraine	5 – 10 years for Poland and Ukraine	*Africa*: Burundi, Congo (Democratic Republic of), Congo, Ghana, Gambia, Guinea, Malawi, Namibia, Rwanda, Senegal, Zimbabwe. *EU countries*: Bulgaria, Estonia, Hungary. *Asia*: Kazakhstan.
Group 3 – Area (markets) of wheat export interests of Poland (outside the wheat export interests of Ukraine)	0 – 9 years for Poland 10 years for Ukraine	*EU countries*: Luxemburg, Belgium, Finland, Latvia, Sweden, Slovakia. *Other European countries*: Iceland. *Latin America and the Caribbean*: Haiti. *Countries and territories not specified within the framework of extra-Union trade.*
Group 4 – Area (markets) of unequal wheat export interests of Poland and Ukraine	x	x
Subgroup 4A – Area (markets) of predominant wheat export interests of Poland	0 – 4 years for Poland 5 – 9 years for Ukraine	*EU countries*: Czechia, Denmark, Ireland, Portugal, Romania, Slovenia. *Other European countries*: Norway, RF (Russia). *Asia*: Saudi Arabia. *North America*: Canada, USA.
Subgroup 4B – Area (markets) of predominant wheat export interests of Ukraine	5 – 9 years for Poland 0 – 4 years for Ukraine	*Africa*: Mauritania. *EU country*: Greece. *Other European countries*: Moldova, Switzerland. *Asia*: Israel.
Group 5 – Area (markets) outside the wheat export interests of Poland	x	x
Group 5A – Area (markets) outside the wheat export interests of Poland and inside the wheat export interests of Ukraine	10 years for Poland 0 – 9 years for Ukraine	*Africa*: Angola, Burkina Faso, Benin, Côte d'Ivoire (Ivory Coast), Cameroon, Madagascar, Mali, Gabon.
Group 5B – Area (markets) outside the wheat export interests of Poland and Ukraine	10 years for Poland and Ukraine	*Africa*: Cabo Verde, Liberia, Togo.

Source: own elaboration.

Research results

Stratification made it possible to distinguish between those zones within Poland's wheat export configuration that were part of the established market structure prior to the 2022–2023 crisis (groups 1–4), and those that entered Poland's wheat export configuration during 2022–2023 (group 5). The market groups that were already part of Poland's wheat export zones before the 2022–2023 crisis could only undergo configuration changes in the direction of contraction during the period of crisis resolution and recovery (2022–2025). The total volumes of Poland's wheat exports by market group are presented in Table 4.

Table 4

Wheat export from Poland to selected areas (markets) in 2012–2025, in thousand tonnes

Group number*	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Jan–May 2025
1	779	1155	2005	2168	2242	1745	800	900	2437	2716	2446	4963	3007	576
2	1	9	67	36	69	91	48	22	42	10	170	439	661	355
3	20	8	19	21	53	58	6	19	29	14	79	78	126	28
4.A	258	353	934	648	1459	506	840	773	1805	855	266	540	309	48
4.B	0.01	0.03	0	86	5	33	13	41	31	0	272	89	60	0
5.A	0	0	0	0	0	0	0	0	0	0	354	781	759	288
5.B	0	0	0	0	0	0	0	0	0	0	52	82	122	27

*Group and subgroup numbers are given according to the data in Table 3.
Source: own elaboration based on Eurostat database.

Groups 1, 2, and 5B are characterised by balanced export interest of varying intensity from both Poland and Ukraine: regular interest (group 1), irregular interest (group 2), and zero interest (group 5B). In addition, groups 1 and 2 are the most numerous, comprising 16 and 15 countries respectively.

Group 1 shows the highest Poland-Ukraine competition. Although Poland increased wheat exports to this zone in 2022–2023, its overall configuration contracted. It failed to capitalise on its positions in Algeria and Kenya (Tab. 5), while a rise in exports to the UK did not alter the zonal configuration.

Poland effectively leveraged its potential and strengthened its position in wheat supply chains, particularly in deliveries to Africa, within groups 2 and 5B, where competition with Ukraine prior to 2022 had been relatively low or entirely absent. In 2024, wheat exports from Poland to African markets within group 2 amounted to 655 thousand tonnes, and in January–May 2025 totalled 355 thousand tonnes – 65.5 and 35.5 times higher, respectively, than exports to this region in 2021. In 2025, Poland also continued to export wheat

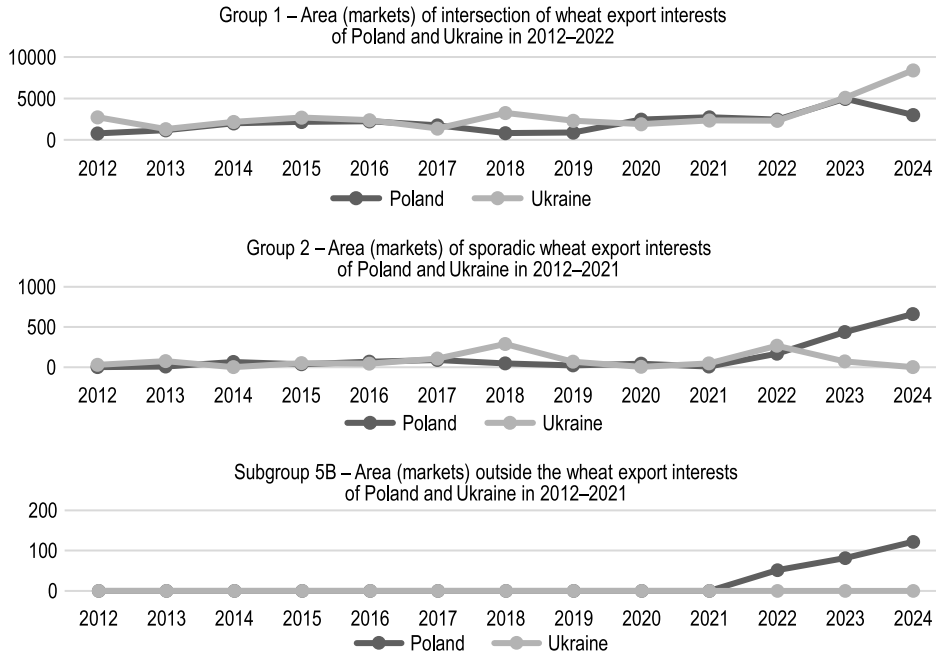


Fig. 2. Wheat export from Poland and Ukraine to countries of group 1, 2, and 5B in 2012–2024, in thousand tonnes

Source: own elaboration based on Eurostat database and State Customs Service of Ukraine (for 2015 and 2016).

Table 5

Wheat export from Poland and Ukraine to Algeria and Kenya (group 1) in 2022–2025, in thousand tonnes

Exporters	Importers	2022	2023	2024	Jan–May 2025
Poland	Algeria	0	32	0	0
	Kenya	105	0	0	0
	United Kingdom	6	64	234	0.1
Ukraine	Algeria	488	32	1349	844
	Kenya	78	156	0	0
	United Kingdom	4	11	71	0

Source: own elaboration based on Eurostat database.

to Kazakhstan (group 2) as well as to Liberia and Togo (group 5B). Consequently, the inclusion of Liberia and Togo expanded the configuration of Poland's wheat export markets.

Groups 3, 4, and 5A are characterised by asymmetrical export interest between Poland and Ukraine. Groups 3 and 4A are dominated by Poland's

export interests (Fig. 3), whereas groups 4B and 5A are primarily shaped by Ukraine's export focus (Fig. 4).

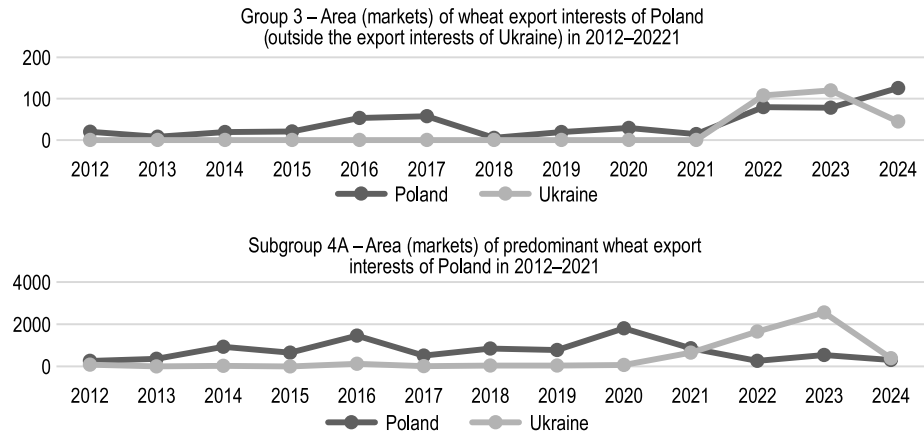
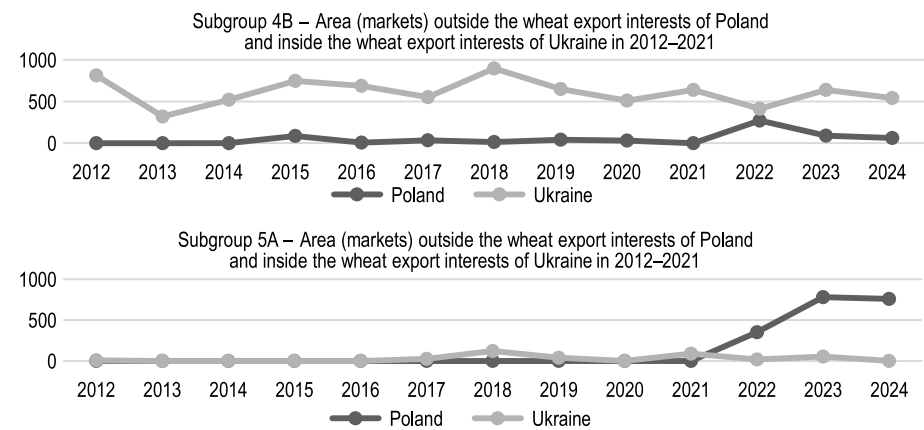


Fig. 3. Wheat export from Poland and Ukraine to countries of group 3 and 4A in 2012–2024, in thousand tonnes

Source: own elaboration based on Eurostat database and State Customs Service of Ukraine (for 2015 and 2016).



In group 4B, where Poland holds weaker positions than Ukraine, exports rose in 2022–2023 due to shipments to Mauritania and Israel but ceased entirely by 2025.

Fig. 4. Wheat export from Poland and Ukraine to countries of group 4B and 5A in 2012–2024, in thousand tonnes

Source: own elaboration based on Eurostat database and State Customs Service of Ukraine (for 2015 and 2016).

Poland successfully utilised and consolidated its position in the markets of group 3, where the majority of exports are directed towards EU countries and Iceland. As of 2025, the main area of competition between Poland and Ukraine in wheat supply is the Belgian market. However, in January–May

2025, Poland's wheat export volume to group 3 markets significantly exceeded that of Ukraine – 28.3 thousand tonnes compared to just 0.3 thousand tonnes, respectively.

Changes in the configuration of Poland's wheat export markets are occurring as a result of logistical shifts in the Asian direction, influenced by the geopolitical factors of the Russia-Ukraine war. During the period 2022–2025, wheat deliveries to Saudi Arabia (group 4A) fell to zero (Tab. 6).

Table 6

Wheat export from Poland to countries of subgroup 4A in 2021–2025, in thousand tonnes

Importers	2021	2022	2023	2024	Jan–May 2025
EU*+Norway	140.77	151.33	158.91	192.73	47.56
North America	7.55	0.00	318.35	115.77	0.0004
Saudi Arabia	705.30	114.77	62.70	0.00	0.00
Russia	0.88	0.02	0.04	0.00	0.28

*EU countries in subgroup 4A: Czechia, Denmark, Ireland, Portugal, Romania, Slovenia.
Source: own elaboration based on Eurostat database.

Saudi Arabia was Poland's key Asian wheat importer during 2011–2021. Its share of Poland's total wheat exports to Asian countries ranged from 81% (in 2013) to 100% (in 2011, 2012, 2018, and 2021), and from 7% (in 2011) to 39% (in 2018) of Poland's total wheat exports. In addition to the decline in wheat exports to Asia, the volume of wheat exports from Poland to Russia also decreased during 2022–2025, though it did not come to a complete halt.

In 2022–2023, Poland made very effective use of Ukraine's limited activity in the markets of group 5A. In January–May 2025, wheat exports from Poland to countries in this group – namely Angola, Burkina Faso, Benin, Cameroon, and Gabon – amounted to 288.2 thousand tonnes, indicating the consolidation of Poland's position in these new markets. There is further potential for continued shipments to other countries within group 5A, including Côte d'Ivoire, Madagascar, and Mali.

Conclusions

The study confirmed that in 2022–2023, Poland's wheat export markets underwent notable reconfiguration due to disruptions caused by the Russia--Ukraine war. These changes included both losses and gains, demonstrating the resilience of Poland's wheat supply system.

The most significant loss was the cessation of exports to Saudi Arabia, previously Poland's key market in Asia. Poland failed to maintain its position

in Algeria and Kenya – markets characterised by high competition with Ukraine. It also did not strengthen its role in regions where Ukraine had a dominant presence. By 2025, Poland's presence there remained marginal.

Despite geopolitical tensions, Russia and Belarus remained among Poland's export destinations. However, the largest expansion was observed in African markets, which have historically been less attractive to Ukraine. Poland's expansion into new destinations during the peak crisis period confirmed the first hypothesis about entering regions where competition with Ukraine was relatively low or completely absent until 2022.

While Poland entered numerous new markets, long-term consolidation occurred only in a few – such as Angola, Burkina Faso, Benin, Cameroon, Gabon, Liberia, and Togo. This supports the second hypothesis: the expansion followed a complementary, not substitutional, trajectory relative to Ukraine's export activity.

Changes in export geography were structural, not just quantitative: with the loss of some markets, the gain of others, and redefined trade volumes. A marked shift occurred from Asia to Africa, influenced by geopolitical and logistical factors.

These findings provide a basis for future studies on the relationship between market reconfiguration and the operational logistics of Poland's wheat exports, particularly regarding infrastructure and long-term route viability.

Translated by the Author

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