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THE TRANSPORT OF UKRAINIAN GRAIN THROUGH POLAND AND THE DOMESTIC GRAIN MARKET

The aim of this paper is to identify the potential of the Ukrainian grain transport route through Poland, and to predict the effects of using this route for the domestic grain market. Analytical methods are used in the research, including SWOT analysis and variant analysis. It is found that, even with a certain organizational and investment effort, the route through Poland may be, at most, a significant supplement to other export routes. The available transport, reloading, and storage reserves are small when set against the scale of needs related to the replacement of traditional export routes through Ukrainian ports on the Black Sea and the Sea of Azov. Conclusions are also formulated about the impact of Ukrainian grain transport on the domestic grain market in various scenario options (direct transit, indirect transit, and “penetration” of goods into the Polish market).

Keywords: food security, grain exports, grain market, grain production, grain transport.

1. INTRODUCTION

The military operations in Ukraine strongly reduced the volume of grain production in this country and the volume of its exports abroad (Oxford Analytica, 2022; Nasir, Nugroho, Lakner, 2022). Looting of agricultural equipment and harvest as well as deliberate arson of crops by the occupiers have a negative impact on Ukraine's production and export capabilities. The destruction of the storage and transport infrastructure, blockades of ports and laying mines make exports of Ukrainian grain much more difficult or even impossible (Kurzeja, 2022).

Ukraine is a potentate in grain production, therefore, the problem of Ukrainian grain deficit is growing in the global economy, and Ukraine is painfully affected by the decline in foreign exchange revenues from the export of this raw material. The war in Ukraine disrupted international trade in agricultural products and strengthened the upward trend in

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global food prices with negative consequences for food security in many countries (FAO, 2022). The crisis caused by the disruption of supply continuity covered, among others, countries of North Africa and the Middle East (Tárik, 2022; M. Dykha, V. Dykha, 2022). In order to mitigate the effects of the crisis, alternative ways of exporting Ukrainian grain are sought, including those via Polish seaports.

The aim of the study is to identify the potential of the Ukrainian grain transport route through Poland, including the analysis of the possibility of using various modes of transport for transit of the Ukrainian grain through Poland, and to foresee the consequences of using this route for the domestic grain market. Analytical methods were used in the research, e.g. SWOT analysis and scenario analysis, supplemented with the presentation of results in tabular form. An infographic was used for the graphical visualization of the data and the information.

2. RUSSIA'S INVASION OF UKRAINE AND GRAIN PRODUCTION AND EXPORT

The largest contribution to the production of three types of grain, which account for almost 100% of Ukraine's grain exports (i.e. corn, wheat and barley), is made by oblasts where intensive warfare has been or is being carried out (Dylewski, 2022). It is estimated that the decrease in cereal production, in 2022, compared to the previous year, was from several to several dozen percent, depending on the type of cereal. The data published by the European Commission (2022) in September 2022 show that the harvest of the three most important types of cereals amounted to 65 million tonnes, including 32.0 million tonnes of maize (a decrease of 24%), 26.2 million tonnes of wheat (a decrease of 18%) and 6.8 million tonnes of barley (a decrease of 28%). Predictions of a decline in export vary quite significantly. The strongest, reaching 80%, is expected to be a drop in barley export. The decrease in the volume of grain export will result from a decrease in their production and a deterioration in the efficiency of logistics channels as a result of warfare (Zolotnytska, Kowalczyk, 2022).

The main corn growing regions are Northern and Central Ukraine. Chernihiv, Vinnytsia, Poltava, Khmelnytsky, Sumy and Cherkasy oblasts are of the greatest importance. Wheat production is concentrated, in particular, in the Odessa region and in the belt of oblasts north of Crimea (Kharkiv, Dnipropetrovsk, Zaporizhia and Kherson). The same is true for barley, for which a very large share in national production is also attributed to the Mykolaiv Oblast (International Grains Council, 2022). The five largest Ukrainian river ports essential for grain transport are: Dnepropetrovsk, Zaporozhye, Nikopol, Kherson and Mykolaiv (Cherevko, Kolodiichuk, 2017). So far, grains from the main growing regions, as well as other oblasts, have been exported mostly by sea from ports in the Black Sea and the Sea of Azov (Jagtap et al., 2022). Up to 5 million tons of cereals were transported in this way every month. Ukrainian grain is price-competitive on the world markets (A. Dibrova, L. Dibrova, M Dibrova, 2018; Dylewski, 2022).

Due to the destruction, blockades or occupation of Ukrainian ports, as well as the deployment of anti-landing mines in the Black Sea, the existing export channels have been blocked. Therefore, grain is being exported via alternative routes, these are in particular:

- route through the Romanian Black Sea port of Constanta,
- route through Polish Baltic ports,
- route through Belarus and the ports of the Baltic States (in particular, the Lithuanian Klaipeda).

The importance of alternative routes depends, among others, on the continuity of agreements on unblocking Ukrainian grain exports through Black Sea ports (Matuszak, 2022).

3. CHARACTERISTICS AND POTENTIAL OF THE ROUTE THROUGH POLAND

Land transport of Ukrainian grain to Polish Baltic ports is carried out in two stages: to the Polish-Ukrainian border and from the border to the ports. In land transport on the territory of Ukraine, railways definitely dominate. In the case of rail transport, due to the different track gauge in Ukraine than in Poland, it is necessary to reload from broad-gauge wagons to standard-gauge ones or to use variable-gauge trolleys at the border. Polish seaports are very far from traditional Ukrainian grain transport routes. Compared to the route from Odessa or Czarnomorsk, the route running through Poland is characterized by a much longer land section, and – taking into account the geographical location of recipients of Ukrainian grain – also a sea section is often many times longer.

Grain is an important cargo handled by PKP Cargo S.A. and other railway carriers. According to the Railway Transport Office (Urząd Transportu Kolejowego, 2022, after Farmer.pl), in the second quarter of 2022, the transport of this raw material amounted to over 1 million tons, i.e. 600,000 tons more than in the first quarter, which has been a record result since the publication of quarterly data broken down by commodity groups.

In 2020, in this respect a record-breaking year, the main Polish seaports (Gdańsk, Gdynia and Szczecin-Świnoujście) handled 8.8 million tonnes of cereals and feeds, with the Port of Gdynia having 62% of the share (4 million tonnes). Transshipment in this cargo group at the Port of Szczecin-Świnoujście and at the Port of Gdańsk amounted to 1.9 million tonnes (21%) and 1.5 million tonnes (17%), respectively (Ziajka, Rozmarynowska-Mrozek, 2021). The average monthly transshipment amounted to 734 thousand tons. In 2021, the total transshipment of cereals and fodder in these ports amounted to 8.2 million tonnes (Ziajka, Rozmarynowska-Mrozek, 2022). The monthly average was therefore 680,000. In turn, transshipment of an additional 1.5 million tons of Ukrainian grain monthly, as declared by government representatives (Solska, 2022), would mean an increase in the transshipment volume of Polish Baltic ports in the grain and feed group by more than twice the monthly average from the record year 2020.

In view of the need for the transit of Ukrainian grain from the border to Polish seaports, the following main problems of the rail transport in Poland should be pointed out:

- despite the implementation of very significant investments co-financed by the European Union (Rabe, 2019; Massel, 2021), the problem of decades of neglected investments in most railway lines (except for some main lines, mainly between metropolitan cities) and means of transport (locomotives and wagons) is still not resolved,
- insufficient design facilities (except for the Railway Institute, which is relatively active in this field (Barcikowska, 2019), industry institutes and design offices were mostly liquidated during the system transformation due to the decision-makers' belief that there were no development prospects for this branch of transport),
- low railway construction potential (execution of only restitution works and small infrastructural investments without assistance of foreign specialist companies),
- problems with ensuring satisfactory quality of passenger transport (despite the priority of passenger traffic over freight traffic).

No less significant is the fact that hard coal is given a transport priority. After the embargo on coal imports from Russia was imposed in April 2022 (Ustawa..., 2022), alternative foreign suppliers were hastily sought. An abrupt increase in imports in order to compensate for the resulting deficit before the heating season caused difficulties with the successive delivery of this fuel to end users due to the inefficiency of the transport system. These conditions significantly reduced the possibilities for releasing the additional potential of railways transport to handle large streams of grain cargo.

Ukrainian grain can reach the Baltic ports by rail having been reloaded from the wide gauge to the standard gauge European network. The replacement of bogies of wagons crossing borders concerns mainly passenger traffic. On the Polish-Ukrainian border, the key “dry” border port is Żurawica-Medyka. Another important transport point is Sławków in Upper Silesia, which is the final station of the so-called Hrubieszów broad-gauge line, previously used for mass transport of iron ore and hard coal to Upper Silesia iron and steel works, as well as sulphur and chemical products. Recently, the Hrubieszów line has been poorly utilised. In the case of transport on this line, no transshipment of goods at the border is carried out. Trains cross the border in Gródek-Uściąg. The war in Ukraine intensified transport to Sławków to a few couples of trains a day. However, directing streams of millions grain tons to Sławków for further transit to seaports and importers from Western Europe would require the construction of a large, modern transshipment terminal.

The transport of Ukrainian grain to Polish seaports by main railway lines is possible on a larger scale only in relations with the port of Gdynia, the port complex of Gdańsk (mainly to the Northern Port) and to the port of Świnoujście. The port in Szczecin is incapable of handling larger bulk carriers and, in terms of geography of Ukrainian grain trade, it may be a European port at best. The port in Kołobrzeg may be used to transport relatively small batches of goods over short distances – to Scandinavian countries and to German ports. The use of the port in Elbląg, which has been most successful in transshipment in recent years thanks to the handling of hard coal imports from Kaliningrad, is not possible, as this port does not have appropriate transshipment equipment or a deepened fairway through the Vistula Lagoon, and the parameters of the cutting of the Vistula Spit do not meet the requirements of the sea merchant shipping.

The underdevelopment of the railway and port infrastructure, the shortage of specialists at border crossings, transshipment terminals and ports, as well as the insufficient capacity of railway routes (long stretches with no passing loops are the bottlenecks) impede the efficient transport of Ukrainian grain. Freight trains are held up for days at border crossings (16 days on average in May 2022) and in Polish ports (Polski Instytut Ekonomiczny, 2022). Nevertheless, rail transport might transport 0.5–0.6 million tons of Ukrainian grain per month from the Polish-Ukrainian border to Polish seaports, provided that certain conditions are met, and in particular:

- giving priority to these transports,
- 24-hour operation of state services (border, phytosanitary) handling the transit of Ukrainian grain,
- adequate remuneration of employees of railway transport and seaports as well as of the state services involved,
- cooperation with domestic and foreign private entities on market, mercantile terms, rationalizing the undertaking.

An increase in the volume of rail transport of Ukrainian grain to Polish seaports would be boosted not only by setting up a Polish-Ukrainian logistics company, but also by agreeing on a list of infrastructural investments to be realized with the EU financial assistance for cross-border projects (Bezpartochnyi, Britchenko, 2022).

Private car carriers in Poland have a modern truck fleet, and thanks to infrastructural investments co-financed by the European Union (Banak et al., 2014; Brdulak et al., 2017), they work on a road network with systematically improving technical parameters. Polish road transport of cargo is able to handle as much as $\frac{1}{4}$ of international transport of this transport branch in Europe. Nevertheless, road transport may only be complementary in handling a large stream of Ukrainian grain from the border to Polish seaports (not to mention ports of Western Europe) Observing the transport of Ukrainian grain by road transport, it can be noted that:

- truck trips scattered across Poland and further across Western Europe are predominant,
- high freight rates make foreign carriers more active, especially Romanian ones;
- a significant increase in truck traffic was a consequence of the abolition in mid-July 2022 of the requirement to obtain a permit to enter the European Union,
- the situation at all border car terminals is very difficult (the waiting time for trucks to enter Poland is up to 6 days; elementary sanitary facilities for drivers stuck in traffic jams are not always provided; unreliability of the border IT system on the Ukrainian side).

Road border crossings are poorly equipped and – apart from the Korczowa-Krakowiec terminal – they lack sufficient manoeuvring space for large road trains. The X-ray machine and scales are usually not located in one line, so drivers have to make difficult manoeuvres in the crowded area. Truck scales are not automated, which means laborious manual handling.

A wider inclusion of road transport in the transit of Ukrainian grain through the territory of Poland requires, above all, clearing the border crossings on the territory of both countries. The capacity of Polish road border crossings with Ukraine may be increased through organizational and management changes as well as infrastructural investments. In this context, a desirable action, though in another area, would be the abolition of restrictions on weekend truck traffic.

A simplified diagram of the Ukrainian grain transit route through Poland is shown in Fig. 1. It takes into account the structure of Ukrainian grain exports and the transport conditions indicated above. The thickness of the arrows in the diagram reflects the proportions of the size of the streams of goods that could possibly ensure the effective use of the transport system for the carriage of Ukrainian grain.

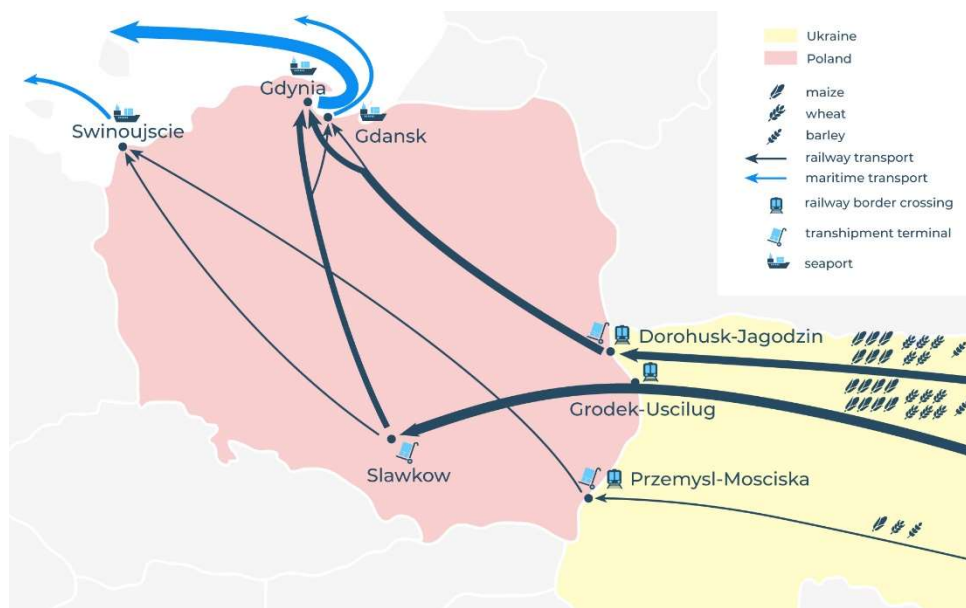


Fig. 1. Schematic diagram of Ukrainian grain transit through Poland

Source: Own study.

4. SWOT ANALYSIS OF THE DEVELOPMENT OF THE TRANSIT ROUTE THROUGH POLAND AND IMPACT ON THE DOMESTIC GRAIN MARKET

The SWOT analysis, including strengths and weaknesses as well as opportunities and threats for the development of the Ukrainian grain transit route to Polish Baltic ports from the point of view of Poland, is presented in Table 1. The effects on the domestic grain market will depend on how the proportions of individual scenarios described in Table 2 are distributed.

As for the impact on the Polish grain market, it is particularly important to know to what extent such a large increase in the volume of transported goods will increase transport prices and reloading services, thus increasing transport costs of Polish grain, and consequently, reducing its competitiveness on international markets. This will depend on the extent to which the companies providing these services will respond to an increase in demand with increasing supply, and to what extent – with increasing prices. This, in turn, depends on the extent to which the transport and transshipment potential is used, and on the ratio of increased demand to unused potential. If Polish grain was to compete for transport under the conditions of full use of “production capacity”, then its price on international markets is likely to be higher.

Another issue is the question of how much Ukrainian grain will be covered by indirect transit, i.e. temporarily stored in Poland. This issue would only be irrelevant if additional, new warehouses were built for these needs. If the existing storage infrastructure is used, the question arises as to how long the Ukrainian grain transported through Poland will be stored in the country. Indirect transit, absorbing warehouses built for domestic production, to some extent hinders the efficient organization of purchase and export of Polish grain.

On the other hand, indirect transit makes it possible to regulate the degree of loading of means of transport and reloading terminals with Ukrainian grain.

Table 1. SWOT analysis of the Ukrainian grain export route through Poland

Strengths	Weaknesses
<ul style="list-style-type: none"> • increasing the degree of utilization of the transport potential of Polish railways • increasing the level of utilization of the reloading capacity of Polish ports • advantage over the route to the ports of the Baltic states as it is independent of Belarus 	<ul style="list-style-type: none"> • low competitiveness with the traditional route (transport to existing recipients via a round-about route) • very limited competitiveness with other alternative routes (especially in relation to the route leading through Romania) • significant extension of delivery time • technical barriers to rail transport due to different track widths, which would require costly and time-consuming investments to bring them down • absorption of storage space for indirect transit • increased truck traffic on Polish roads
Opportunities	Threats
<ul style="list-style-type: none"> • increasing the profitability of Polish logistics, forwarding and transport companies involved in the transit of Ukrainian grain • increase in the international importance of Poland due to active participation in mitigating the effects of the global food crisis caused by the war in Ukraine • the possibility of using the route to transport other goods, including those needed to rebuild Ukraine after the war • the potential for developing trade with Ukraine due to the integration of transport infrastructure, railway infrastructure in particular (announced construction of a standard-gauge network in Ukraine) • an opportunity to expand the border, railway, port and warehouse infrastructure with the use of external financing (American or EU) 	<ul style="list-style-type: none"> • the risk of deterioration of the situation of Polish grain producers as a result of “leakage” of Ukrainian grain onto the Polish market • the risk of only temporary usability of the hastily developed infrastructure • possible increase in the cost of transporting goods due to the rapid, unprecedented increase in the volume of cargo transport • possible increase in the cost of reloading services • possible increase in the cost of storage services for indirect transit

Source: Own study.

Table 2. Potential effects of developing the Ukrainian grain export route

Scenario	Impact on cereal prices on the domestic market			Who gains?	Who loses?
	direction of impact	impact force	cause		
Direct transit	Increase, especially in the price of grain transported to more distant processing plants or dedicated to exports.	Rather moderate, proportional to the scale of the transit.	Increase in transport and handling costs.	Forwarding, transport and reloading companies (increase in demand for services).	To a limited extent, domestic producers and exporters of cereals.
Indirect transit	Increase, especially in the price of grain transported to more distant processing plants or intended for exports	Rather moderate, proportional to the scale of the transit.	Increase in transport, handling and storage costs.	Forwarding, transport, reloading and storage companies (increase in demand for services).	To a limited extent, domestic producers and exporters of cereals.
“Leakage” of goods onto the Polish market	Decrease.	Potentially very large.	Increase in the quantity offered.	Processing enterprises (cheaper raw material supply), consumers (lower food prices).	Domestic grain producers.

Source: Own study.

At the same time, one may assume that intermediaries will seek to “pass” higher costs (transport, handling and storage) onto grain producers (by lowering purchase prices) in order to be able to offer grain on foreign markets at the current price without lowering their margins.

Indirect transit is also associated with a greater risk of “penetration” of goods into the Polish market. The “leakage” of Ukrainian grain onto the Polish market means that, at least in part, it is not grain transit through Poland, but rather its export to Poland, which has been facilitated since June 4, 2022 due to the introduction of measures of temporary trade-liberalization (until June 5, 2023) between the European Union and Ukraine (Regulation (EU) 2022/870).

Ukraine's grain export in terms of volume is over 1.5 times greater than the total grain production in Poland. Transit of 1.5 million t of cereals per month would mean an annual transport volume of 18 million t, which is 65% of the average annual volume of cereal production in Poland in the period 2016-2020. Therefore, the “penetration” of even a relatively small part of the planned transit volume has a very large potential to affect

grain prices on the domestic market. An increase in the quantity offered for a given level of demand results in a decrease in prices.

5. CONCLUSIONS

Poland's participation in the flows of redirected grain streams in the new geopolitical situation requires an appropriate qualitative adaptation of the branch of the Polish transport system. In the current situation, there are real opportunities to transport approx. 0.6 million tons of Ukrainian grain per month by rail to the Baltic ports, and further on by ships. This, however, requires considerable organizational effort and some investments. Geographically, these transport routes are much more expensive compared to transport from Ukrainian seaports on the Black Sea and the Sea of Azov and may be taken into account when the political situation worsens. Additionally, it is possible to export about 0.2 million tons of Ukrainian grain per month by road transport (with scattered European truck trips), provided the service of trucks at the Polish-Ukrainian border crossings is improved.

The available transport, reloading and storage reserves are small when set against the scale of needs for the replacement of traditional export routes leading through Ukrainian ports. Taking into account the accumulated problems resulting from months of delays in the export of Ukrainian grain, it can be concluded that the route through Poland may at most be a significant supplement to other alternative export routes.

The impact of Ukrainian grain transit through Poland on the domestic grain market is due to the fact that the transport of this commodity requires the involvement of infrastructure for transport, reloading and storage. The strength of this influence is proportional to the transit volume. If the transit of Ukrainian grain were to be carried out with no effect on Polish foreign trade in grains, its quantitative limits would be determined by the unused railway transport capacity (possibly supported by road transport) and the unused potential for transshipment of bulk materials in Polish ports. Indirect transit absorbs storage space in Poland, and means hindering the efficient purchase and export of Polish grain. Including the increased costs of transport, handling and storage in the price of cereals reduces its competitiveness on the world markets, which may result in a decrease in the export volume of Polish cereals. Another issue is the risk of the penetration of Ukrainian grain into the Polish market. This process is facilitated by the characteristics of the goods (homogeneity) and circumstances (handling, unloading, storage). The potential of grain inflow for prices reduction on the domestic market (even taking into account the very strong decline in production due to the war and looting by Russians) is very large – particularly, in the case of corn, wheat and barley.

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