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TRADE AND LOGISTICS BETWEEN THE EU AND UKRAINE IN THE WARTIME PERIOD

The work analyzes the transformational processes in Ukraine's foreign trade with EU countries, as well as the interaction models between the national logistics infrastructure and international logistics corridors under the conditions of Russia's military aggression against Ukraine. The development of a virtually new logistics structure for the export and import of goods, including those from third countries, became necessary. Ukraine continued to reform its transport sector during the war in accordance with its commitments under the Association Agreement with the EU. Further liberalization of trade relations between the EU and Ukraine amid the aggression contributed to maintaining and increasing exports to EU member states. Two years into the Russia-Ukraine war, Ukrainian exports to the EU were slightly below pre-war levels. However, thanks to international aid, Ukraine was able to increase its imports from the EU by more than one-third. In the pre-war period, Ukraine primarily used road, sea, and rail transport for its exports to the EU, while EU exports to Ukraine were 80% carried by road transport. During the war, the share of sea transport in Ukrainian exports decreased from 38% to 29%, which was offset by increasing shares of road and rail transport. Additionally, there was a smaller increase in the importance of rail transport for Ukrainian imports, rising from 5.7% to 9.3%, compensating for the declining shares of sea and air transport. Regression analysis showed that pre-war dominant modes of transport, logistics performance in trade partners, and their changes during the war did not significantly affect Ukraine's trade dynamics with them in 2023 compared to 2021, after controlling for other factors. Thus, logistics for trade with the EU proved to be relatively resilient, considering the low contribution of the most affected air transport to overall trade flows, the partial restoration of sea routes after their initial collapse in 2022, further bilateral trade liberalization, international aid, and sectoral integration

in transport. Rather than logistical factors, the dispersion of trade dynamics with EU member states can be more effectively explained by factors related to the value chain effect and dynamic overlapping demand effect. Specifically, Ukraine increased its exports to EU countries that were more successful in expanding their extra-EU exports. Ukraine also increased its imports primarily from member states with a relatively low development level compared to the EU average, while decreasing imports from the richest economies.

Keywords: foreign trade, trade partners, trade liberalization, logistic, Russia-Ukraine war, commodity markets, free trade area, EU member states

JEL classification: ***F14, F15, F51, C4, L91, L92***

У роботі проаналізовано трансформаційні процеси зовнішньої торгівлі України з країнами-членами ЄС, а також моделі взаємодії національної логістичної інфраструктури з міжнародними логістичними коридорами в умовах військової агресії росії проти України. Необхідним стає створення нової логістичної експортно-імпортної структури для торгівлі товарами, у тому числі з третіми країнами. Україна продовжувала реформувати транспортний сектор під час війни відповідно до зобов'язань за Угодою про асоціацію з ЄС. Подальша лібералізація торговельних відносин ЄС з Україною в умовах агресії сприяла збереженню та збільшенню експорту в ЄС. Через 2 роки після початку російсько-української війни український експорт до ЄС був трохи нижчим за довоєнний період. Але завдяки міжнародній допомозі Україна змогла збільшити імпорт з ЄС більш ніж на 1/3. У довоєнний період Україна використовувала переважно автомобільний, морський та залізничний транспорт для свого експорту до ЄС, тоді як 80% експорту з ЄС в Україну здійснювався автомобільним транспортом. За роки війни частка морського транспорту в українському експорті зменшилася з 38 до 29%, що було компенсовано збільшенням частки автомобільного та залізничного транспорту. Також спостерігалося збільшення ваги залізничного транспорту для українського імпорту з 5,7 до 9,3% як компенсація зменшення частки морського та повітряного транспорту. Регресійний аналіз показав, що домінуючі види транспорту, індекс ефективності логістики в країнах партнерах та їх зміни під час війни не мали статистично значущого впливу на динаміку торгівлі України з ними в 2023 р. у порівнянні з 2021 р. після урахування впливу контрольних факторів. Таким чином, логістика для торгівлі з ЄС виявилася відносно стійкою з урахуванням малої частки авіатранспорту у поставках (саме на цей вид транспорту найбільше вплинула війна), частковим відновленням морських шляхів після їх початкового колапсу в 2022 р., подальшої лібералізації взаємної торгівлі, міжнародній допомозі та секторальній інтеграції в транспортній галузі. Замість логістичних факторів, дисперсія торговельної динаміки з країнами-членами ЄС може пояснюватися іншими факторами, що пов'язані з ефектом ланцюгів вартості та динамічним ефектом перехресного попиту. Зокрема, Україна збільшила свій експорт в країни ЄС, які більш вдало змогли збільшити власний експорт за межі ЄС. Україна також збільшила імпорт переважно з країн-членів з відносно меншим рівнем розвитку у порівнянні із середнім по ЄС і зменшила імпорт з багатших країн.

Ключові слова: зовнішня торгівля, торговельні партнери, лібералізація торгівлі, логістика, російсько-українська війна, товарні ринки, зона вільної торгівлі, країни ЄС

JEL classification: ***C4, F14, F15, F51, L91, L92***

Introduction

International trade is a complex process that involves an extensive network of suppliers, manufacturers, distributors, and consumers. A significant body of research has been dedicated to scientifically justifying the importance of international trade for the economic development of national economies, with contributions from both classical economic theory and contemporary studies. Participation in international trade accelerates economic growth by generating positive externalities through specialization, efficient resource allocation, the enhancement of production technologies, and increased competitiveness of national goods and services in global markets, driven by economies of scale [1].

Success in both national and international competition depends on the competitive advantages leveraged by international trade entities when executing their economic

activities. A systematic analysis of all business spheres and the interdependencies among international trade entities can help uncover the reasons behind these competitive advantages and their potential. One of the most crucial operations in the value chain is logistics, which is closely tied to customer service and, consequently, can impact a company's competitive advantages. In general, logistics ensures that products are delivered to the right place and at the right time, in the required quantity and quality, at a competitive price, thus guaranteeing the availability of goods and information to consumers [2].

Today, geopolitical changes have become the main challenges to the stability of trade relations, particularly in the context of organizing effective logistics for the supply of goods and services. Over the past three years, most logistical challenges have stemmed from military conflicts and political instability, including the war in Ukraine, the conflict between Israel and Hamas, and the crisis in the Red Sea. Attacks on container ships in the Red Sea have disrupted navigation through the Suez Canal, which handles up to 15% of international trade. The forced rerouting has led to a 40% increase in transportation costs. The war in Ukraine has similarly disrupted supply chains for goods, affecting not only its own exports but also those of other countries. Supply chain problems triggered by geopolitical factors create additional challenges for international companies, as logistics costs and contract execution times rise.

Literature review

International trade is one of the key factors influencing the global competitiveness of countries and companies. For this reason, many countries focus on implementing effective logistics to foster economic growth through increased participation in international trade, as competitiveness in global and regional markets depends on the ability to manage logistics processes in the modern business environment. It should also be noted that logistics services are a key element of the modern international trading system, as the importance of international competitiveness grows with the intensification of globalization and the fragmentation of production processes. Efficient management of logistics ensures the stability of trade flows and reduces logistics costs between countries [4].

The impact of Russian aggression against Ukraine on the global economy as a whole, and international trade in particular, has been the focus of many researchers. For example, the study by Mahlstein et al. (2022) analyzes the war's impact on the economic growth of various countries in the context of implementing economic sanctions against Russia. The research results revealed that the economies of Ukraine's allies were unevenly affected by the sanctions, with real GDP losses ranging from 0.1% to 1.6% [5]. Using the geopolitical conflict risk index, Fang Y. and Shao Z. demonstrated the negative impact of Russian aggression on economic growth and global commodity markets, particularly due to the reduction in exports of goods from Ukraine and Russia [6].

Ukraine is one of the world's leading producers and exporters of many food commodities, particularly wheat, corn, and oilseeds. Therefore, global food supply chains have faced significant disruptions due to Russia's war against Ukraine. The study by Aizenman et al. (2023) analyzes the consequences of Russia's invasion of Ukraine on global agricultural and energy markets. The authors found that the war led to an increase in prices in the wheat (2%), corn (1%), and European natural gas (7.5%) markets [7]. In a study of grain and oilseed trade, Ahn et al. (2023) found that imports of these commodities from Ukraine were 78.2% lower during the period from February to July 2022. The researchers argue that the Ukraine–Russia war had significant trade impacts on the directly involved countries, but only limited effects on global grain and oilseed markets [8].

The works by Walter et al. (2023) and Yakymenko et al. (2024) analyze the impact of the war on global food security in the context of reduced agricultural exports from Ukraine [9,10]. The authors highlight that the occupation and destruction of key maritime

routes by Russia have made it impossible to export a significant volume of Ukrainian products to European and other regional markets.

Trends in Ukrainian agricultural exports to the EU during the full-scale aggression are analyzed in the studies by Shnyrkov et al. (2023), Leshchenko (2023), and Ostashko (2023) [11,12,13.].

In the context of war, understanding the efficiency of international logistics is crucial for increasing the export volume of Ukrainian products. In this regard, it is essential to examine the interaction between national and international logistics corridors to implement a real and effective trade and transport facilitation policy—not only in the short term but also for the future.

Analyzing the pathways and challenges of Ukraine's European integration aspirations, Shnyrkov and Chugaev (2023) note that the development of Ukraine's foreign trade – particularly with the EU – largely depends on the reconstruction of the country's destroyed export infrastructure and the creation of a new logistics system for the export and import of goods, especially in trade with third countries [11, p.60].

Research conducted by the Razumkov Center indicates that the development of the logistics sector is one of the key priorities for both the recovery of the Ukrainian economy and the promotion of Ukraine in European markets for goods and services within the framework of European integration processes [14, p. 32]. This involves the implementation of two complementary tasks:

1. Accumulating internal and external resources to rebuild the destroyed logistics infrastructure based on European standards.

2. Simultaneously integrating Ukraine's logistics system into the European one through the implementation of EU directives and technical regulations, modernization of technical equipment, and liberalization of the transport services market, which will significantly expand Ukraine's transit potential.

The aim of this article is to analyze the trends in Ukraine's foreign trade relations with EU countries during 2022–2023 in the context of changes in logistics corridors resulting from Russia's military aggression against Ukraine.

Conceptual base of the research

The EU became Ukraine's largest trading partner even before Russia's full-scale military aggression. The shift began ten years ago as a result of trade wars, the annexation of Crimea, and the onset of the war in Donbas, when Ukrainian producers began reorienting their exports from CIS countries to the European market. Ukraine's access to the EU market was significantly liberalized in 2016 through the Association Agreement and the establishment of a Free Trade Area. The full-scale Russian-Ukrainian war has had a negative impact on Ukraine's socio-economic development overall, and on the dynamics of foreign trade in particular. The country's GDP was $199.77 billion in 2021, but dropped to $161.99 billion in 2022 and recovered slightly to $178.76 billion in 2023. As of the end of 2023, estimates by the Ukrainian government and the World Bank indicated that the country's total reconstruction needs had already reached $486 billion, with 15% allocated for the restoration of transportation infrastructure [15]. The total volume of foreign trade fell by 37.18% in 2022 but saw a slight increase of 4.15% in 2023, while exports decreased significantly by 23.44% and 4.15%, respectively [16]. The restoration of the national economy's resilience and foreign trade in 2023–2024 is taking place largely through economic cooperation with the European Union, with a key factor being the restoration, protection, and development of transportation infrastructure between Ukraine and the EU.

The development of transportation trade infrastructure between Ukraine and EU countries during the war in 2022-23 was influenced by several factors.

First, due to the Russian occupation of the Azov Sea ports, the partial blockade of Black Sea ports, the effective disruption of trade with Central Asian countries through Russian and Belarusian territories, and the capture and destruction of rolling stock, roads, railways, and critical nodes of

Ukraine's transportation infrastructure, the development of an entirely new logistics structure for the export and import of goods – including with third countries – became necessary. At the onset of Russia's military aggression, Ukraine lost access to its Black Sea logistics infrastructure and was forced to rely on more expensive land-based logistics corridors for product delivery. This logistics restructuring during the war was guided by the EU Action Plan of May 12, 2022, titled "Solidarity Lanes." From May 2022 to April 2024, Ukraine exported approximately 136 million tons of goods via the Solidarity Lanes, including 70 million tons of grain, oilseeds, and related products to both EU member states and third countries. During this period, more than €2 billion were mobilized to support the initiative through contributions from the European Commission, the European Investment Bank, the European Bank for Reconstruction and Development, and the World Bank. The Agreement on Freight Transport by Road between Ukraine and the EU also played a key role in developing transportation infrastructure for mutual trade in 2022–2023.

Second, Ukraine continued to reform its transport sector during the war, in line with its commitments under the Association Agreement with the EU. Although, as of August 2024, Ukraine's progress in fulfilling the Agreement's transport obligations stood at only 56% [17], during 2022-2023, a number of laws and regulations were adopted that facilitated the integration of Ukraine's transport and logistics infrastructure into the European system. For example, in 2023 alone, more than 20 large-scale measures were implemented across the road, rail, maritime, aviation, and port sectors, all of which supported trade with EU countries [18].

Third, the further liberalization of trade relations between the EU and Ukraine, in the context of ongoing aggression, played a crucial role in maintaining and increasing exports to EU member states. The Special Regulation of the European Parliament and Council of the EU, effective June 4, 2022, temporarily suspended most tariff and quantitative restrictions on imports from Ukraine for one year, effectively establishing an internal EU market regime with certain provisions for Ukrainian goods. This initiative was extended for another year in early June 2023. Specifically, the Regulation included the suspension of import duties on industrial products, the application of the entry price system for fruits and vegetables, the elimination of all tariff quotas for agricultural products, the removal of anti-dumping duties on Ukrainian imports, and the suspension of global safeguard measures on Ukrainian goods. This liberalization was conditional and operated under certain terms. If the relevant conditions were not met, the European Commission could implement corrective measures. It is important to note that unilateral decisions by some Eastern European countries to ban the import of significant amounts of Ukrainian agricultural products in April 2023 directly contradicted the "single principles" of the EU customs union and its internal market. Such decisions, after appropriate investigation, should be made exclusively at the EU level. Given the logistical challenges faced by Ukrainian producers and exporters, the provision of these trade preferences enabled national producers and exporters to quickly reorient their markets and partially integrate into new value-added chains. According to the State Customs Service of Ukraine, in the first two months of 2024, Ukrainian exports to the EU accounted for 57% of total exports (with imports slightly less than half). Ukraine is the EU's 16th largest trading partner, accounting for 1.2% of the total EU goods trade in 2023. The total value of trade in goods between the EU and Ukraine reached 61.9 billion euros in 2023, more than doubling since the implementation of the DCFTA in 2016.

Methodology

The main dependent variables are the growth of Ukrainian merchandise exports to an EU member state (ExpU) and the growth of Ukrainian merchandise imports from the EU member state (ImpU) in 2023 compared to the pre-war base year of 2021 (measured in %). Potential independent variables related to logistics include:

- ExpW – share of Ukrainian merchandise exports to the EU member state carried by sea and inland water transport in 2021 (%);
- ImpW – share of Ukrainian imports from the EU member state carried by sea and inland water transport in 2021 (%);
- ExpRa – share of Ukrainian exports to the EU member state carried by rail transport in 2021 (%);
- ImpRa – share of Ukrainian imports from the EU member state carried by rail transport in 2021 (%);
- ExpRo – share of Ukrainian exports to the EU member state carried by road transport in 2021 (%);
- ImpRo – share of Ukrainian imports from the EU member state carried by road transport in 2021 (%);
- ExpA – share of Ukrainian exports to the EU member state carried by air transport in 2021 (%);
- ImpA – share of Ukrainian imports from the EU member state carried by air transport in 2021 (%) [19];
- LPI – Logistics Performance Index in 2022 [20].

Several other trade factors are considered as control variables:

- Trade – bilateral merchandise exports and imports between Ukraine and the EU member state in the base year (2021), € billion;
- ExpE – growth of the extra-EU merchandise exports of the EU member state in 2021-2023 (a proxy of export capacities growth), %;
- ImpE – growth of the extra-EU merchandise imports of the EU member state in 2021-2023 (a proxy of market demand growth), %;
- Dist – distance between Ukraine and the EU member state (capitals), thousand km [21];
- GDPpc – GDP per capita in the EU member state according to the exchange rate method in 2022, $ thousand [20].

We also calculated our own indicators as additional potential factors or dependent variables:

- ExpL – logistical reorientation of Ukrainian exports, defined as the total of absolute changes in the shares of various modes of transport used for exports in 2023 compared to 2021, measured in percentage points (pp);
- ImpL – logistical reorientation of Ukrainian imports, calculated using a similar method, measured in percentage points (pp);
- LPIch – change in the Logistics Performance Index in 2022 compared to 2018.

Correlation analysis (Pearson and Spearman correlations) is used to identify the factors to be included in the regression analysis. A robustness check is performed by excluding outliers.

Results

Table 1 contains the main indicators relevant to trade between Ukraine and EU countries. In 2023, the fastest growth in Ukrainian exports, compared to the pre-war base year, occurred with Cyprus, Slovenia, and Croatia. The fastest growth in imports came from Romania, Greece, and Slovakia. Although Ukraine's total exports to the EU decreased by 5%, the importance of the EU as a market for Ukrainian goods increased due to security and logistical barriers affecting trade with other countries during the war. Major export decreases were observed with Ireland, Italy, and the Netherlands, while significant import decreases occurred from Ireland, Cyprus, and Malta. Originally, Ukraine's main trade partners were Poland, Germany, Italy, Hungary, and the Netherlands. The total import of Ukrainian goods from the EU increased by 38%, partially due to financing within aid initiatives.

As for extra-EU trade, the fastest growth in exports occurred in Slovenia, Cyprus, and Slovakia (indicating export capacity growth), while exports decreased in Estonia. The fastest growth in imports was observed in Cyprus, Slovenia, and Ireland (reflecting market demand growth), while imports fell in Estonia, Latvia, and Luxembourg. On average, extra-EU trade of the EU grew by 18%. The negative factor of distance can act as a barrier for Ukrainian trade, particularly with countries like Portugal, Spain, and Ireland. However, this can be offset by a higher share of exported goods carried

Table 1

Growth of trade between Ukraine and the EU countries and its potential factors

EU country	ExpU	ImpU	Trade	ExpE	ImpE	Dist	GDPpc	LPI	LPIch
Austria	-23.1	-5.7	1.53	19.8	16.4	1.39	52	4	-0.03
Belgium	-17.0	-16.7	1.44	11.1	16.4	1.97	50	4	-0.04
Bulgaria	16.6	107.4	1.24	37.3	28.4	0.88	14	3.2	0.17
Cyprus	373.9	-45.6	0.03	50.3	79.7	1.56	31	3.2	0.05
Czechia	-11.4	46.6	2.56	17.2	23.8	1.23	28	3.3	-0.38
Germany	1.4	26.0	7.63	12.9	8.2	1.55	48	4.1	-0.1
Denmark	5.5	-5.1	0.58	6.9	29.2	1.67	67	4.1	0.11
Estonia	-32.4	42.7	0.25	-20.8	-43.7	1.18	28	3.6	0.29
Spain	84.8	7.6	2.21	18.1	20.1	2.99	29	3.9	0.07
Finland	-4.9	-34.1	0.30	8.9	2.8	1.71	51	4.2	0.23
France	-33.8	-5.8	1.94	19.5	25.2	2.26	41	3.9	0.06
Greece	53.3	145.1	0.54	18.4	29.2	1.37	21	3.7	0.5
Croatia	126.6	56.6	0.10	25.2	29.5	1.32	18	3.3	0.2
Hungary	-28.1	2.9	4.91	20.2	27.1	0.92	18	3.2	-0.22
Ireland	-79.4	-54.1	0.16	12.3	34.9	2.80	104	3.6	0.09
Italy	-48.0	-16.9	5.40	23.2	22.2	1.63	34	3.7	-0.04
Lithuania	11.1	-6.4	1.76	6.2	12.8	0.90	25	3.4	0.38
Luxembourg	9.9	-35.9	0.03	19.6	-6.3	1.86	126	3.6	-0.03
Latvia	32.2	103.9	0.48	18.5	-13.5	1.00	22	3.5	0.69
Malta	-15.5	-39.6	0.01	11.6	19.0	2.04	34		
The Netherlands	-37.4	8.3	3.82	20.0	21.5	1.88	56	4.1	0.08
Poland	3.8	81.8	10.46	24.3	14.2	0.91	18	3.6	0.06
Portugal	21.9	83.8	0.33	27.6	22.0	3.31	24	3.4	-0.24
Romania	11.0	261.6	2.01	28.6	20.1	0.62	16	3.2	0.08
Sweden	19.7	10.4	0.57	11.3	9.4	1.79	56	4	-0.05
Slovenia	235.3	-1.1	0.37	77.5	58.3	1.31	29	3.3	-0.01
Slovakia	14.6	127.2	1.70	43.7	12.9	0.92	21	3.3	0.27

via relatively inexpensive sea transport. According to the theory of comparative advantage, trade with wealthier economies such as Luxembourg, Ireland, and Denmark may tend to be inter-industry. Following the theory of overlapping demand, a smaller income per capita difference between Bulgaria, Romania, Croatia, Hungary, and Ukraine may promote intra-industry trade. The best logistical systems were estimated in Finland, Germany, the Netherlands, and Denmark.

Table 2 shows the pre-war use of various modes of transport in bilateral trade with Ukraine. In Ukrainian exports, 37.5% of goods (by value) were carried by road transport, 37.4% by sea transport, 18.6% by rail transport, 3.3% by fixed mechanisms (such as pipelines and power lines), 2.2% by inland water transport, 0.5% by air transport, 0.4% by unknown transport, 0.2% by post, and 0.02% by self-propulsion. In imports, the shares were 79.6% for road transport, 5.2% for sea transport, 5.7% for rail transport, 4.0% for fixed mechanisms, 0.1% for inland water transport, 3.5% for air transport, 0.01% for unknown transport, 0.1% for post, and 1.8% for self-propulsion. The difference can be partially explained by the nature of exported goods, as Ukraine exports more raw materials than the EU. Table 3 shows the shares of transport modes in 2023 and the logistical reorientation compared to 2021.

However, the importance of transport modes varied significantly by country, considering differences in distance, availability of land, sea or river connections, and infrastructure. The highest share of

Table 2

Means of transportation for goods traded between Ukraine and the EU countries in the base year (2021), % of exports or imports value

EU country	ExpW	ExpRa	ExpRo	ExpA	ImpW	ImpRa	ImpRo	ImpA
Austria	38.0	27.5	34.2	0.3	0.4	2.6	92.0	4.6
Belgium	78.2	0.2	21.4	0.3	8.5	0.1	80.4	10.9
Bulgaria	73.1	0.1	26.5	0.2	54.2	0.0	44.6	1.1
Cyprus	97.3	0.0	0.0	2.5	82.4	0.0	0.0	17.6
Czechia	0.0	66.7	33.2	0.1	0.5	7.6	86.1	5.4
Germany	14.1	2.1	81.8	1.9	0.8	0.1	89.0	6.2
Denmark	6.2	0.0	93.0	0.8	8.3	0.0	86.8	3.8
Estonia	0.0	23.5	71.1	0.8	0.6	5.7	89.8	3.8
Spain	92.7	0.0	6.9	0.3	37.6	0.0	59.6	2.8
Finland	16.2	0.1	81.4	1.1	2.2	0.4	94.9	2.5
France	61.4	0.0	30.6	0.7	2.0	1.7	86.5	7.7
Greece	73.3	0.0	26.3	0.4	73.8	0.0	23.6	2.6
Croatia	0.0	0.0	97.9	1.8	0.4	0.0	97.7	1.8
Hungary	0.2	9.6	55.1	0.1	0.4	0.7	67.8	0.3
Ireland	91.6	0.0	4.9	3.5	53.9	0.0	34.1	11.9
Italy	86.9	0.0	12.8	0.3	10.4	0.3	85.9	3.4
Lithuania	0.0	30.6	68.9	0.4	0.0	65.2	30.2	1.2
Luxembourg	2.1	0.0	96.9	0.9	3.3	0.0	81.8	14.9
Latvia	0.0	20.7	62.5	0.2	0.0	12.5	82.5	0.7
Malta	86.6	0.0	0.0	13.1	6.4	0.0	0.0	93.6
The Netherlands	85.3	0.0	12.7	0.3	3.5	0.0	84.8	11.0
Poland	0.3	51.8	46.6	0.1	0.1	6.4	88.9	0.4
Portugal	94.1	0.0	4.8	1.0	29.1	0.0	64.8	4.8
Romania	26.2	15.8	57.4	0.1	3.5	0.7	93.4	0.5
Sweden	4.5	0.0	76.5	18.8	39.8	12.5	44.8	2.8
Slovenia	11.1	9.3	77.3	0.4	0.1	0.0	96.1	2.5
Slovakia	0.2	60.6	32.0	0.1	1.0	10.4	68.4	0.7

Table 3

Means of transportation for goods traded between Ukraine and the EU countries in the base year (2023), % of exports or imports value

EU country	ExpW	ExpRa	ExpRo	ExpA	ImpW	ImpRa	ImpRo	ImpA	ExpL	ImpL
Austria	20.9	28.3	50.5	0.1	0.6	4.1	92.9	2.0	34.5	5.3
Belgium	77.7	0.9	21.2	0.2	7.2	0.6	89.1	3.1	6.2	18.4
Bulgaria	63.9	4.2	31.8	0.1	11.4	3.8	84.5	0.2	41.1	94.8
Cyprus	99.3	0.0	0.0	0.6	90.6	0.0	0.0	9.4	4.1	16.4
Czechia	0.0	54.5	45.3	0.1	0.2	6.7	89.6	3.2	24.4	7.0
Germany	3.7	19.4	75.9	0.9	1.2	9.5	84.3	3.3	35.8	20.1
Denmark	5.2	0.0	83.0	0.2	1.3	0.0	96.5	1.2	23.1	19.7
Estonia	0.0	4.3	95.2	0.2	0.5	0.0	99.1	0.3	48.4	18.7
Spain	94.2	0.0	4.3	0.1	11.3	0.0	79.8	8.8	5.7	52.5
Finland	20.9	27.6	49.2	0.7	2.3	0.0	96.7	0.9	23.9	10.0

End of the table 3

EU country	ExpW	ExpRa	ExpRo	ExpA	ImpW	ImpRa	ImpRo	ImpA	ExpL	ImpL
France	45.4	0.0	53.1	0.4	2.2	2.0	87.9	3.9	65.1	3.9
Greece	74.9	0.0	24.9	0.3	84.9	0.0	14.3	0.1	45.1	7.6
Croatia	0.7	25.9	72.6	0.2	0.8	12.6	81.7	0.7	3.2	23.8
Hungary	0.6	36.2	60.4	0.2	0.1	0.3	51.1	0.1	54.4	34.2
Ireland	62.4	0.0	29.5	5.9	42.8	0.0	45.0	12.1	65.0	35.5
Italy	72.7	1.6	25.6	0.1	3.0	0.7	91.3	5.0	58.3	22.2
Lithuania	0.0	2.4	96.0	1.5	0.0	13.0	84.1	0.1	28.7	14.7
Luxembourg	0.1	0.0	99.0	0.7	1.4	0.0	90.5	8.1	56.3	107.8
Latvia	0.0	0.0	99.6	0.0	0.0	0.3	92.9	0.0	4.5	17.2
Malta	95.7	0.0	0.0	2.9	27.1	0.0	0.0	72.9	74.3	33.0
The Netherlands	49.5	5.2	32.9	0.2	1.1	0.5	92.7	4.3	20.3	41.5
Poland	2.5	48.0	48.5	0.0	0.1	15.5	80.7	0.1	71.8	18.0
Portugal	90.4	3.3	6.0	0.1	2.5	0.0	97.2	0.3	8.3	19.2
Romania	8.3	23.1	68.5	0.1	3.5	16.8	69.7	0.2	9.2	64.7
Sweden	4.1	0.0	81.5	14.1	21.0	33.5	43.4	1.4	45.4	57.0
Slovenia	0.1	62.9	36.9	0.1	0.1	3.7	96.1	0.1	10.3	43.4
Slovakia	0.3	64.5	35.2	0.0	0.8	10.4	70.0	0.2	107.1	7.5

road transport was for exports to Croatia, Luxembourg, Denmark, and imports from Croatia, Slovenia, Finland, Romania, and Austria. The highest share of sea transport was for exports to Cyprus, Portugal, Spain, and Ireland (island or remote economies), and imports from Cyprus, Greece, Ireland, and Bulgaria. The highest share of rail transport was for exports to Czechia, Slovakia, Poland, and imports from Lithuania, as well as Latvia and Sweden. The highest share of fixed mechanisms was for exports and imports with Hungary and Slovakia. The highest share of inland water transport was for exports to Austria and Bulgaria (countries along the Danube River), with no significant use of this mode for imports from the EU. The highest share of air transport was for exports to Sweden and Malta, and imports from Malta, as well as Cyprus, Ireland, and the Benelux countries. The highest share of unknown transport was for exports to France and Estonia. The highest share of postal transport was for exports and imports with Latvia. The highest share of self-propulsion was for imports from Poland, Lithuania, and Germany.

In 2023, fewer goods were exported from Ukraine to the EU via sea transport (-8.6 pp) and fixed mechanisms (-3 pp) compared to 2021, while more goods were exported via road (+6.5 pp) and rail transport (+4.6 pp). Specifically, Ukraine increased exports of oil to the EU via fixed mechanisms from 0 to 74 million euros, but decreased exports of natural gas from 645 to 35 million euros, and electricity from 158 to 42 million euros. The main reorientations occurred in exports to Slovenia (from road and sea to rail), Latvia (from rail and post to road), the Netherlands (from sea to road and unknown), Finland (from road to rail), Hungary (from fixed mechanisms to rail), Lithuania (from rail to road), and Ireland (from sea to road). In 2023, fewer goods were imported to Ukraine from the EU via sea and air transport (-1.9 and -1.9 pp, respectively), while more goods were imported via rail transport (+3.6 pp) and fixed mechanisms (+0.5 pp). Specifically, Ukraine increased imports of oil from the

EU through fixed mechanisms from 0 to 359 million euros, natural gas from 906 to 1,064 million euros, and electricity from 163 to 260 million euros. The main reorientations occurred in imports from Lithuania (from rail to road), Bulgaria (from sea to road), Portugal (from sea to road), and Spain (from sea to road).

Since the majority of the indicators are not normally distributed, Spearman correlations are more informative (see Table 4). The EU-Ukraine trade growth does not significantly correlate with the size of pre-war bilateral trade during the war. Ukrainian exports grew more to countries with increasing overall export capacities (participation in value chains effect) and lower GDP per capita (overlapping demand effect). Ukrainian imports grew from countries with lower GDP per capita (overlapping demand effect), geographical proximity, a low initial share of imports by air (logistical ease effect), and higher logistical reorientation of imports (logistical flexibility effect). Surprisingly, logistical performance in trade partners was negatively associated with their bilateral trade growth with Ukraine. Nevertheless, logistical improvements (mainly before the war) were slightly positively associated with faster growth of such trade, although the effect was insignificant.

Higher logistical reorientation of Ukraine's exports occurred in countries where road transport originally dominated compared to water transport. Higher logistical reorientation of Ukraine's imports was observed in countries with faster-growing imports (demand effect), a greater reliance on rail transport, a lower reliance on road transport, poorer logistics performance, and lower income per capita.

Table 5 contains the results of regression analysis on trade factors. Models 1-2 demonstrate the value chain effect, where an additional 1% increase in a member state's extra-EU exports stimulated a 3% increase in Ukrainian exports to that country. However, the overlapping demand effect was

Table 4

Correlation between dependent variables and potential factors

	Pearson r				Spearman r			
	ExpU	ImpU	ExpL	ImpL	ExpU	ImpU	ExpL	ImpL
ExpU	1.00	-0.04	-0.01	-0.03	1.00	0.38*	-0.26	0.35*
ImpU	-0.04	1.00	-0.05	0.30	0.38*	1.00	-0.00	0.40**
Trade	-0.26	0.10	-0.07	-0.10	-0.31	0.30	0.06	-0.01
ExpE	0.66**	0.15	0.18	-0.05	0.37*	0.33*	-0.03	-0.01
ImpE	0.63**	-0.15	-0.00	-0.03	0.16	-0.09	0.01	-0.02
Dist	-0.08	-0.45**	-0.27	-0.08	-0.21	-0.54**	-0.28	-0.16
GDPpc	-0.25	-0.55**	-0.10	-0.33*	-0.41**	-0.71**	-0.07	-0.47**
LPI	-0.38*	-0.41**	-0.12	-0.38*	-0.39**	-0.33	-0.08	-0.34*
LPIch	0.06	0.29	0.21	0.19	0.21	0.23	0.27	0.22
ExpW	0.08	-0.19	-0.27	0.09	-0.07	-0.33*	-0.34*	-0.00
ExpRa	-0.13	0.33*	-0.05	-0.08	-0.14	0.35*	0.29	-0.14
ExpRo	0.01	0.06	0.32	-0.06	0.16	0.15	0.32*	-0.11
ExpA	-0.02	-0.24	-0.21	0.10	0.06	-0.51**	-0.08	0.06
ImpW	0.42**	0.00	-0.39**	0.20	0.06	-0.15	-0.54**	0.20
ImpRa	-0.07	-0.02	0.13	0.55**	-0.19	0.23	0.25	-0.08
ImpRo	-0.27	0.18	0.35*	-0.41**	-0.14	0.18	0.44**	-0.48**
ImpA	-0.03	-0.33*	-0.17	-0.01	-0.31	-0.62**	-0.30	-0.35*
ExpL	-0.01	-0.05	1.00	-0.03	-0.26	-0.00	1.00	-0.06
ImpL	-0.03	0.30	-0.03	1.00	0.35*	0.40**	-0.06	1.00

Note: ** significant at $p<0.05$, * at $p<0.1$.

not supported due to the insignificance of the regression coefficient for GDP per capita. Nevertheless, the overlapping demand effect is present in Ukraine's imports. These grew faster from EU member states with relatively low income per capita, while there was no substantial change, or even a decrease, in imports from relatively medium- and high-income EU member states. In other words, the relationship was nonlinear (inverse). Other dynamic effects for imports turned out to be insignificant. After controlling for these factors, logistical structure and performance factors in trade partners had an insignificant effect on the growth of their trade with Ukraine. This can be explained by the moderate correlation between logistics performance and other factors: distance (0.40), income per capita (0.45), and export capacity growth (-0.49) in the EU member states. Despite low multicollinearity, there is still a possibility that their effects may overlap.

Table 6 contains the results of the regression analysis of logistics reorientation factors. Logistical reorientation of Ukrainian exports was higher when water transport was less important for imports, although this is difficult to explain. However, when Cyprus is excluded, the coefficient becomes

Table 5

Regression analysis of trade during the war

	ExpU	ExpU	ImpU	ImpU
b_0	-48.4** (21.8)	-36.1*** (14.8)	-76.0*** (22.1)	-60.1*** (18.2)
b_{ExpE}	3.51*** (0,80)	2,42*** (0,58)		
$b_{1/GDPpc}$			3127*** (582)	2484*** (495)
b_{GDPpc}				
b_{ExpRo}				
R^2	0,43***	0,42 ***	0,54 ***	0,51 ***
N	27	26, Cyprus	27	26, Romania

Note for tables 5 and 6: *** significant at p<0.01, ** at p<0.05, * at p<0.1. Standard errors are in brackets. Bottom row contains countries which are excluded outliers according to standardized residuals or standardized variable values.

Table 6

Regression analysis of logistical changes during the war

	ExpL	ExpL	ExpL	ImpL	ImpL	ImpL	ImpL	ImpL
b_0	42.6** (5.9)	39.0*** (5.2)	42.4*** (6.1)	44.1*** (10.1)	36.5*** (8.5)	44.6*** (9.3)	55.4*** (11.5)	55.3*** (12.1)
b_{ImpW}	-0.44** (0,20)	-0.37* (0,18)	-0.42 (0.25)					
b_{ImpU}				0.136** (0.53)	0.096** (0.045)	0.166*** (0.050)	0.126 (0.081)	
b_{ImpRa}				0.962*** (0.300)	1.07*** (0.25)	-0.958 (0.890)		
b_{ImpRo}				-0.326** (0.133)	-0.235** (0.112)	-0.289** (0.123)	-0.424** (0.156)	-0.361** (0.162)
R^2	0,15 **	0,15 *	0.11	0,52 ***	0,59 ***	0.40***	0.28**	0.17**
N	27	26, Slovenia	26, Cyprus	27	26, Bulgaria	26, Lithuania	26, Romania	27

insignificant. Logistical reorientation of Ukrainian imports was higher when the importance of road transport for imports was lower, and the importance of rail transport and import growth was higher. However, the coefficients are sensitive to outliers.

Further analysis could focus on the sectoral aspects of trade, as various modes of transport may only be partially substitutable for certain types of products. New data in subsequent years may also help assess the robustness of the results.

Conclusion

Two years following the outbreak of the Russia-Ukraine war, Ukrainian exports to the EU were slightly below pre-war levels. However, thanks to international aid, Ukraine was able to increase its imports from the EU by more than one-third. Before the war, Ukraine primarily used road, sea, and rail transport for its exports to the EU, while 80% of EU exports to Ukraine were carried by road transport. The importance of transport modes, however, varied significantly across EU member states. During the war, the share of sea transport in Ukrainian exports decreased from 38% to 29%, which was offset by increasing shares of road and rail transport. Exports (mainly of natural gas) from Ukraine via fixed mechanisms (pipelines) nearly disappeared and were not compensated by other modes of transport. There was also a smaller increase in the importance of rail transport for Ukrainian imports, from 5.7% to 9.3%, as a compensation for the decreasing shares of sea and air transport.

Correlation analysis suggested that several potential logistical factors could explain the trends in bilateral trade between the EU and Ukraine. However, the regression analysis was able to confirm only the effect of some control variables. Ukraine increased its exports to EU countries that were more successful in boosting their own extra-EU exports (value chain effect). Ukraine increased its imports primarily from member states with relatively low development levels compared to the EU average and decreased imports from the wealthiest economies (dynamic overlapping demand effect). However, the pre-war dominant modes of transport, logistics performance of trade partners, and their changes during the war did not significantly affect trade dynamics after controlling for the control variables. This may be explained by the relative resilience of westward logistics (serving trade with the EU) compared to southward logistical routes (trade with developing economies), which were more affected by military actions. Additionally, the lower contribution of the most affected air transport to overall trade flows and the partial restoration of sea routes in 2023 after their initial collapse in 2022 may have mitigated the impact.

As for the regression analysis of logistics trends, countries that relied less on road transport for delivering goods to Ukraine, under growing demand for their goods, tended to switch their mode of transport the most (usually to road or rail transport), although this conclusion is sensitive to outliers. No robust factors for the logistical reorientation of Ukrainian exports were found within the analyzed two-year wartime period.

References

1. Marelli, E., Marcello, S. (2011). China and India: Openness, trade, and effects on economic growth. The European Journal of Comparative Economics, Vol.8, Issue 1. p.129-154.

2. *Richards, G., Grinsted, S. (2016). The logistics and supply chain toolkit: Over 100 Tools and Guides for Supply Chain, Transport, Warehousing and Inventory Management. Second edition. London: Kogan Page. 400 p.*

3. *Global Economic Consequences of the War in Ukraine: Sanctions, Supply Chains, and Sustainability. (2022). Ed. by Garicano, L., Rohner, D., Weder, B. SERP PRESS. 217 p.*

4. Cheung, K.F., Bell, M.G., Pan, J.J., Perera, S. (2020). An eigenvector centrality analysis of world container shipping network connectivity. *Transportation Research Part E: Logistics and Transportation Review. Vol.140, p.101991.*

5. *Mahlstein, K., McDaniel, Ch., Schropp, S., & Tsigas, M. (2022). Estimating the economic effects of sanctions on Russia: An Allied trade embargo. The World Economy, 45(11), 3344-3383.*

6. Fang, Y., & Shao, Z. (2022). The Russia-Ukraine conflict and volatility risk of commodity markets. *Finance Research Letters, 50*, p.103-113.

7. Aizenman, J., Lindahl, R. Stenvall, D., Uddin, G. (2023). Geopolitical Shocks and Commodity Market Dynamics: New Evidence from the Russian-Ukraine Conflict. NBER Working Paper No. w31950, SSRN: https://ssrn.com/abstract=4660277.

8. *Ahn, S., Kim, D., & Steinbach, S. (2023). The impact of the Russian invasion of Ukraine on grain and oilseed trade. Agribusiness, 39(1), p.291-299.*

9. Walter, F., et al. (2023). How the war in Ukraine affects food security. Foods 12(21): 39-96. https://doi.org/10.3390/foods12213996.

10. Yakymenko, Y., Melnyk, O., Yurchyshyn, V. (2024). International Support to Ukraine for Provision of the Global Food Security. https://razumkov.org.ua/images/2024/06/10/T7it_tf1_pb03.pdf.

11. Shnyrkov, O., Chugaiev, O. (2023). Economic integration of Ukraine: context of the Russian-Ukraine War. Journal of European Economy. Vol. 22. No 1 (84). 2023, p.48-69. [in Ukrainian].

12. Leshchenko, K. (2023). Current challenges of agricultural trade liberalisation between Ukraine and the EU. Ekonomika APK.. 30(3). P. 10-17. https://doi.org/10.32317/2221-1055.202303010.

13. Ostashko, T. (2023). Grain export of Ukraine in the conditions of war . *Economy of Ukraine*, Vol. 66(8), p. 28–46. [in Ukrainian]. https://doi.org/10.15407/economyukr.2023.08.028.

14. Ukraine on the Way To the EU: Realities And Prospects. (2022). National Security and Defence Journal. №1-2, 2022, 131 p. [in Ukrainian].

15. Government and World Bank present RDNA3: Ukraine's reconstruction needs already amount to nearly USD 486 billion [in Ukrainian]. https://www.kmu.gov.ua/news/uriad-i-svitovyi-bank-predstavyly-rdna3-potreby-na-vidbudovu-ukrainy-skladaiut-vzhe-maizhe-486-miliardiv-dolariv.

16. State Customs Service of Ukraine. https://bi.customs.gov.ua/uk/trade/

17. Pulse of the Agreement. https://pulse.kmu.gov.ua/

18. Real sector development priorities in the conditions of war and post-war reconstruction economy of Ukraine / https://niss.gov.ua/sites/default/files/2024-02/ad_realsektor-2023.pdf. [in Ukrainian].

19. Eurostat Extra-EU trade since 2000 by mode of transport, by HS2-4-6. https://ec.europa.eu/eurostat/databrowser/view/ds-058213__custom_11836185/default/table?lang=en. (2024, June 14).

20. World Bank World Development Indicators. https://databank.worldbank.org/source/world-development-indicators#. (2023, October 26).

21. Distance calculator Distance calculator. https://www.distance.to/ (2023, October 15).

TRADE AND LOGISTICS BETWEEN THE EU AND UKRAINE IN THE WARTIME PERIOD

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The work analyzes the transformational processes in Ukraine's foreign trade with EU countries, as well as the interaction models between the national logistics infrastructure and international logistics corridors under the conditions of Russia's military aggression against Ukraine. The development of a virtually new logistics structure for the export and import of goods, including those from third countries, became necessary. Ukraine continued to reform its transport sector during the war in accordance with its commitments under the Association Agreement with the EU. Further liberalization of trade relations between the EU and Ukraine amid the aggression contributed to maintaining and increasing exports to EU member states. Two years into the Russia-Ukraine war, Ukrainian exports to the EU were slightly below pre-war levels. However, thanks to international aid, Ukraine was able to increase its imports from the EU by more than one-third. In the pre-war period, Ukraine primarily used road, sea, and rail transport for its exports to the EU, while EU exports to Ukraine were 80% carried by road transport. During the war, the share of sea transport in Ukrainian exports decreased from 38% to 29%, which was offset by increasing shares of road and rail transport. Additionally, there was a smaller increase in the importance of rail transport for Ukrainian imports, rising from 5.7% to 9.3%, compensating for the declining shares of sea and air transport. Regression analysis showed that pre-war dominant modes of transport, logistics performance in trade partners, and their changes during the war did not significantly affect Ukraine's trade dynamics with them in 2023 compared to 2021, after controlling for other factors. Thus, logistics for trade with the EU proved to be relatively resilient, considering the low contribution of the most affected air transport to overall trade flows, the partial restoration of sea routes after their initial collapse in 2022, further bilateral trade liberalization, international aid, and sectoral integration in transport. Rather than logistical factors, the dispersion of trade dynamics with EU member states can be more effectively explained by factors related to the value chain effect and dynamic overlapping demand effect. Specifically, Ukraine increased its exports to EU countries that were more successful in expanding their extra-EU exports. Ukraine also increased its imports primarily from member states with a relatively low development level compared to the EU average, while decreasing imports from the richest economies.

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