

MAKAROVA Tetiana <https://orcid.org/0000-0002-1599-0751>

PhD (Economics), Associate Professor
of the Department of International
Management
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine
t.makarova@knute.edu.ua

STRUCTURAL TRANSFORMATIONS OF UKRAINIAN EXPORTS

The article examines the structural transformation of Ukraine's exports under the impact of the full-scale war of 2022, which triggered an unprecedented shock to the country's trade system. The relevance of the study stems from the profound shifts in logistical, institutional, and production conditions that reshaped external trade flows and generated a critical dependence on the European Union market. The research is based on the hypothesis that the war caused not temporary fluctuations but a deep and irreversible structural reconfiguration of Ukraine's export model, reflected in changes in geographical orientation, commodity composition, and market concentration. The methodological framework includes: comparative analysis of export dynamics in 2010–2024; calculation of the Herfindahl-Hirschman Index (HHI) to assess geographic concentration; graphical modeling of long-term trends; identification of factors influencing the war on the export of goods from Ukraine. The statistical database was compiled based on data from the State Statistics Service of Ukraine, the European Commission, UN Comtrade, analytical reports from international organizations (Oxfam, Deloitte, PricewaterhouseCoopers, Brookings Institution, Statista), and author calculations. The results substantiate the proposed hypothesis. The share of exports directed to the EU increased from 24% in 2010 to over 60–66% in 2022–2024, while exports to Asia and Africa contracted sharply due to the blockade of Black Sea ports. The commodity structure shifted from metallurgy to agriculture. Export concentration reached record levels ($HHI \approx 0.48$ in 2023). The study identifies key adaptive mechanisms, including the expansion of Danube

МАКАРОВА Тетяна <https://orcid.org/0000-0002-1599-0751>

к. е. н., доцент кафедри міжнародного
менеджменту
Державного торговельно-економічного
університету
вул. Кіото, 19, м. Київ, 02156, Україна
t.makarova@knute.edu.ua

СТРУКТУРНІ ТРАНСФОРМАЦІЇ ЕКСПОРТУ УКРАЇНИ

Проаналізовано структурну трансформацію українського експорту, зумовлену повномасштабною війною 2022 р., що стало безпрецедентним шоком для торговельної системи України. Актуальність дослідження викликана різкою зміною логістичних, інституційних і виробничих умов, що визначили нову конфігурацію зовнішньоторговельних потоків та сформували критичну залежність від ринків Європейського Союзу. Внесено гіпотезу, що війна спричинила не короткострокові коливання, а глибоку та незворотну структурну перебудову експорту, яка проявляється у зміні його географічної орієнтації, товарної структури та рівня ринкової концентрації. Методологія дослідження включає: порівняльний аналіз динаміки експорту у 2010–2024 рр.; розрахунок індексу географічної концентрації Herfindahl-Hirschman Index (HHI); графічне моделювання довгострокових трендів; ідентифікацію факторів впливу війни на експорт товарів з України. Статистичну базу сформовано на основі даних Державної служби статистики України, Єврокомісії, UN Comtrade, аналітичних звітів міжнародних організацій (Oxfam, Deloitte, PricewaterhouseCoopers, Brookings Institution, Statista) та авторських розрахунків. Отримані результати підтверджують гіпотезу дослідження. Встановлено, що частка експорту до ЄС зросла з 24% у 2010 р. до понад 60–66% у 2022–2024 рр., тоді як обсяги експорту до Азії та Африки різко скоротилися через блокаду морських портів. Товарна структура зазнала зсуву від металургії до аграрної продукції; рівень географічної концентрації експорту досяг рекордних значень ($HHI \approx 0.48$ у 2023 р.).



logistics routes, deepening integration with the EU, and digitalization of customs procedures. The findings confirm that Ukraine's export sector is undergoing a systemic and irreversible transformation that will shape the trajectory of post-war recovery and long-term integration into European and global markets.

Keywords: Ukraine's exports, export structure, EU, logistics, war, geographical concentration, Herfindahl–Hirschman Index, foreign trade.

JEL Classification: F14, F15, F51.

Виявлено ключові адаптивні механізми – розвиток дунайських маршрутів, поглиблення інтеграції з ЄС, цифровізація митних процедур. Дослідження підтверджує, що експорт України перебуває у фазі системної трансформації, яка визначатиме траєкторію післявоєнної відбудови та інтеграції в європейські ринки.

Ключові слова: експорт України, структура експорту, ЄС, логістика, війна, географічна концентрація, *Herfindahl–Hirschman Index*, зовнішня торгівля.

Introduction

Structural transformations in exports are an integral component of long-term economic development and macroeconomic resilience in a globalised economy. Many countries face the need to adapt their production structures and foreign trade sectors to changes in technological paradigms, intensifying global competition, shifts in demand in world markets, and growing geoeconomic and geopolitical risks. The drivers of such transformations are diverse, ranging from technological innovation and the green transition to crises, pandemics, and armed conflicts, all of which affect national specialisation patterns in different ways.

For Ukraine, the issue of structural changes in exports has become particularly acute. In 2010–2024, foreign trade development was influenced by a number of major external shocks, including global economic crises, the COVID-19 pandemic, and the full-scale military invasion of the Russian Federation in 2022. The war became a catalyst for profound structural shifts, causing the destruction of production capacity, the blockade of port infrastructure, the disruption of traditional logistics chains, and a sharp decline in investment activity. As a result, these processes not only transformed export volumes but also significantly altered their commodity and geographical structure.

The problem is that contemporary structural transformations in Ukraine's exports are not merely situational but also long-term in nature, shaping new parameters of the country's economic model. The strengthening of agrarian and resource-based specialisation, the narrowing of production diversification, the increasing concentration of export markets, limited access to maritime logistics, and greater dependence on EU institutional and trade support create a complex set of systemic risks. This highlights the need for a comprehensive scientific analysis of structural shifts in Ukraine's exports, the identification of their causes and consequences, and the development of approaches to enhancing the resilience and adaptability of the foreign trade system amid prolonged instability.

The aim of this article is to assess the transformations in Ukraine's exports in 2010–2024, driven by a combination of technological, institutional,

logistical, and geopolitical factors, as well as by the specific manifestations of these processes under conditions of full-scale war. Particular attention is paid to identifying changes in the commodity and geographical structure of exports, the level of export market concentration, and the role of war-related and logistical shocks in shaping the current dynamics of Ukraine's exports.

To achieve this aim, the following objectives have been set: to analyse the stages of development of Ukraine's exports in 2010–2024 and identify the key patterns in their dynamics; to systematise structural shifts in the commodity and geographical structure of exports; to assess the level and dynamics of export concentration using the Herfindahl-Hirschman Index; to identify the impact of the main institutional, logistical, production, and security factors associated with the war on export processes; and to synthesise the findings of the analysis in order to develop an analytical model of transformations in Ukraine's exports under conditions of high uncertainty.

The study is based on the hypothesis that the full-scale war constituted a major exogenous shock that significantly intensified and accelerated the existing trends in structural changes in Ukraine's exports, particularly in terms of commodity specialisation and geographical orientation. At the same time, the structural shifts observed in 2022–2024 may be either temporary or potentially more persistent in nature, which requires empirical verification.

A significant contribution to the study of transformations in Ukraine's foreign trade has been made by Ukrainian scholars who have analysed both long-term trends in export development and the impact of crises and war-related factors on export dynamics and geographical structure. In particular, Mazaraki and Melnyk (2025) examined the influence of institutional and logistical factors on the formation of Ukraine's current export model. The authors emphasise that hostilities have significantly accelerated the reorientation of trade flows, brought the issue of adapting customs and transport infrastructure to the forefront, and increased the dependence of exports on European markets.

The geoeconomic transformations of the global economy in the twenty-first century were examined by Herasymenko (2020), with a focus on the interaction between globalisation, regionalisation, and economic resilience. The author argues that contemporary geoeconomic development is characterised by a combination of dynamic changes and structural stability, creating new challenges for national economies.

Halutskykh and Koshkarova (2022) investigated the evolution of Ukraine's foreign trade model amid global instability and European integration processes. The authors focus on the gradual increase in the role of the European Union as a key trading partner while also highlighting the risks associated with excessive concentration of export flows. Their analysis of structural changes in exports by commodity group and regional destination is particularly valuable, as it makes it possible to identify vulnerable segments of Ukraine's foreign trade.

Boichyk (2023) analyses the role of market infrastructure in ensuring the stability and adaptability of Ukraine's business sector under martial law, emphasising the importance of its functional components in supporting small and medium-sized enterprises during periods of crisis-driven transformation.

The impact of armed conflicts, logistical shocks, and institutional changes on international trade has been addressed in the works of foreign researchers. Their focus is on the transformation of trade flows, increasing regional concentration, and the adaptive mechanisms employed by economies under crisis conditions. In particular, Gnangnon (2020) examines the impact of international trade cooperation and multilateral trade liberalisation mechanisms on reducing the magnitude of exogenous economic shocks in developing countries. The author demonstrates that participation in global trade institutions, particularly within the framework of the WTO and the "Aid for Trade" programme, helps mitigate the adverse effects of external shocks on trade flows and reduces their magnitude.

The reports by the OECD (2024) and the World Bank (2024) examine structural shifts in Ukraine's foreign trade since 2022, focusing on logistical constraints, the blockade of maritime routes, and the reorientation of exports towards European overland corridors. These studies confirm that war acts as a catalyst for long-term changes in the trade model rather than merely constituting a temporary shock.

Analytical materials published by Deloitte (2024) and PricewaterhouseCoopers (2024) focus on the transformation of global supply chains and the growing importance of trade regionalisation. The authors emphasise that countries facing war-related risks are compelled to rapidly adapt their export logistics and place greater emphasis on integration with nearby stable markets. Research by the Bruegel Institute (2024) and Statista (2024) further contributes to the academic debate by providing empirical assessments of trade flow concentration and changes in the commodity structure of exports amid geopolitical instability. Their findings are consistent with the results of this article regarding the increasing geographical concentration of exports and the heightened systemic risks to export resilience.

The information base comprises statistical data from the State Statistics Service of Ukraine, the State Customs Service of Ukraine, the European Commission, and UN Comtrade, as well as analytical reports by international organisations (Oxfam, Deloitte, PricewaterhouseCoopers, the Brookings Institution, Statista). The data were processed by constructing time series, calculating concentration indicators, conducting structural analysis, and performing factor decomposition. The limitations of the study are attributable to the partial lack of complete data for certain commodity groups after 2022, uneven access to logistics statistics, and methodological differences between international statistical systems.

Structurally, the article consists of four sections. The first examines the stages and dynamics of Ukraine's export development in 2010-2024. The second section presents a periodisation of the key changes in Ukraine's merchandise exports. The third section analyses the level of export concentration and identifies the key structural shifts. The fourth section identifies the main groups of factors – institutional, logistical, energy-related, financial, security-related, social and labour-related, environmental, and production-structural – that determine the transformation of foreign trade flows, based on an assessment of the factors through which the war has affected Ukraine's merchandise exports.

The study is expected to identify the key mechanisms through which structural transformations affect the dynamics and resilience of Ukrainian exports, clarify the role of war-related, logistical, institutional, and market factors in shaping the current export model, and determine long-term trends in changes in commodity and geographical specialisation. The findings are intended to provide a basis for developing practical recommendations aimed at enhancing the competitiveness of Ukrainian exports, reducing the risks associated with excessive market concentration, establishing effective mechanisms for adapting to external shocks, and strengthening Ukraine's integration into global trade chains. They may also be used to improve state trade policy, strategic planning, and the development of support instruments for export-oriented sectors of the economy amid prolonged external challenges.

1. Dynamics and stages of Ukraine's export development in 2010–2024

The war has constituted an unprecedented shock to Ukraine's trading system. Before 2022, foreign trade accounted for more than 40% of GDP, and Ukrainian exports were deeply integrated into international markets. Dependence on Black Sea ports, a high share of raw materials in exports, and infrastructural vulnerability created conditions in which hostilities immediately disrupted supply chains (World Bank, 2024).

In 2022, Ukrainian ports, through which more than 60% of exports passed, were blockaded. The destruction of industrial facilities, logistical constraints, congestion along rail and road corridors, and the loss of market share in the Middle East and Asia all created a critical need to assess the resilience of the export system and its ability to adapt (OECD, 2025).

The dynamics of Ukrainian exports in 2010–2024 (Table 1) demonstrate a succession of profound structural transformations caused by both external economic factors and a series of crisis shocks. These include the annexation of Crimea in 2014, the armed conflict in Donbas, the COVID-19 pandemic, and Russia's full-scale invasion in 2022.

Table 1

Volume of Merchandise Exports from Ukraine in 2010–2024*, USD million

Year	Total	CIS countries	Other countries of the world	Europe	EU countries (27)	Asia	Africa	America	Australia and Oceania
2010	51405.2	18740.6	32664.6	13829.6	12411.9	13715.4	3018.7	2000.0	28.4
2011	68394.2	26177.0	42217.2	18442.4	17378.0	17737.8	3344.2	2552.3	29.8
2012	68830.4	25318.6	43511.8	17424.0	16410.8	17681.1	5638.2	2607.7	50.9
2013	63320.7	22077.3	41243.4	17064.2	16048.4	16813.0	5094.7	2163.6	40.1
2014	53901.7	14882.3	39019.4	17122.1	16413.7	15350.9	5098.2	1372.2	23.5
2015	38127.1	7806.1	30321.0	13248.3	12647.3	12378.9	3803.3	785.6	13.6
2016	36361.7	6031.5	30330.2	13790.1	13178.5	11796.3	3865.1	735.2	18.3
2017	43264.7	6916.4	36348.3	17901.9	17053.4	12967.3	4047.7	1207.9	71.9
2018	47335.0	7025.2	40309.8	20606.0	19572.8	13754.1	4127.0	1620.0	48.6
2019	50054.6	–	–	26739.5	20122.7	16646.1	4971.5	1467.9	59.0
2020	49191.8	–	–	23736.1	17938.1	19699.0	4048.0	1548.9	67.1
2021	68072.3	–	–	34213.6	26793.0	24762.1	5626.8	3258.5	73.9
2022	44135.6	–	–	30271.7	27890.7	10467.7	2129.8	1190.6	29.0
2023	37584.3	–	–	25455.0	24715.9	8051.0	1678.1	760.1	21.5
2024	41733.3	–	–	26665.7	24829.8	10837.2	2943.2	1241.7	23.9

**Since 2019, the columns "CIS countries" and "Other countries of the world" have not been completed. For 2014–2024, the data are presented excluding the territories temporarily occupied by the Russian Federation and parts of the territories where hostilities are being (or have been) conducted.*

Source: State Statistics Service of Ukraine (2024).

The analysis of the data indicates that Ukraine's export system has undergone several stages: a period of growth (2010–2013), a transformation and crisis phase (2014–2016), recovery (2017–2021), and a new large-scale shock followed by adaptive changes (2022–2024) (Ministry of Economy of Ukraine, 2023).

In 2010–2012, Ukrainian exports grew steadily, from USD 51.4 billion to USD 68.8 billion, which was associated with strong global demand for metallurgical and agro-industrial products. However, in 2013, exports declined to USD 63.3 billion, reflecting the first signs of macroeconomic instability.

The outbreak of the armed conflict in eastern Ukraine in 2014 led to the sharpest decline in exports up to that point, with exports falling to USD 38.1 billion in 2015. This significant downturn was caused by the loss of industrial capacity in Donbas, the severing of cooperative ties with the Russian Federation, the reorientation of trade flows, and the devaluation of the hryvnia.

In 2017–2021, Ukrainian exports entered a phase of stabilisation and moderate growth, reaching USD 68 billion in 2021. This period was characterised by deeper integration with the European Union, the growing role of the agricultural sector, and the gradual recovery of metallurgical production.

Russia's full-scale invasion in 2022 once again caused a sharp decline in exports, to USD 44.1 billion, representing a 35% decrease compared with 2021. The main causes were the blockade of Black Sea ports, the destruction of logistics and industrial infrastructure, and restrictions on maritime routes,

which had traditionally accounted for more than 70% of Ukrainian exports. The decline continued in 2023, when exports amounted to USD 37.6 billion. However, 2024 showed signs of a partial recovery, with exports reaching USD 41.7 billion, indicating the emergence of new adaptive mechanisms.

In 2010–2013, the CIS countries accounted for 33–37% of Ukrainian exports, indicating a strong dependence on the Russian market. After 2014, the share of this destination declined rapidly, and from 2019, official statistics ceased to identify the CIS as a separate category due to the effective loss of this market. Thus, over the decade, Ukraine's geoeconomic orientation underwent a complete transformation.

The EU became the main market for Ukrainian products. While the EU accounted for 24% of exports in 2010, its share had risen to more than 39% by 2021. In 2022–2024, following the blockade of maritime routes, the EU's importance increased further: 63% in 2022, 66% in 2023, and approximately 60% in 2024. This was driven by the introduction of EU "trade visa-free arrangements", access to European logistics infrastructure, and the diversification of export routes through overland corridors (European Commission, 2023).

Until 2021, Asia was one of Ukraine's key trading destinations, accounting for USD 16–18 billion in exports annually. However, in 2022–2023, export volumes fell by more than half. The main reason was the inability to maintain stable maritime shipments of grain and metals due to the destruction of Black Sea infrastructure and the risks to maritime navigation.

Exports to Africa and the Americas also declined, but less sharply, owing to the continued availability of certain logistics routes.

The wartime shock of 2022 caused the most radical changes in the structure and geographical distribution of Ukrainian exports in the entire history of Ukraine's independence. In this regard, several fundamental structural transformations can be identified:

- a reorientation of exports towards the EU market, which became the dominant export destination; for the first time throughout the period of independence, the EU's share exceeded two-thirds of total exports;
- a decline in the role of maritime logistics and an increase in the importance of overland corridors through Poland, Romania, and Slovakia;
- a collapse in exports of metals and ores, which had traditionally been major export commodities, as a result of the destruction of steelworks in Mariupol and the blockade of the Sea of Azov;
- an increase in the share of agricultural exports as the most mobile and adaptable segment of foreign trade;
- the development of new adaptive mechanisms, including the digitalisation of customs procedures, the expansion of the Danube logistics corridor, and the use of alternative routes through the Balkans.

The data for 2010–2024 indicate that Ukrainian exports are undergoing an irreversible structural transformation. The loss of the Russian market did not lead to the catastrophic destruction of export potential; on the contrary, rapid integration into the European economic area and the diversification of trade flows took place.

At the same time, the war has created a number of critical risks, including dependence on EU logistics corridors, the vulnerability of maritime infrastructure, a shift in the commodity structure towards raw-material specialisation, and a decline in exports of high-tech products.

2. Periodisation of key changes in Ukraine's exports

The analysis of changes in Ukraine's exports (*Table 2*) indicates that, over the period under study, Ukrainian exports underwent three structural transformations: from a raw-material-oriented model dominated by the CIS to a Europe-oriented model and then to an adaptive wartime model.

Table 2

Periodisation of Key Changes in Ukraine's Merchandise Exports in 2010–2024

Year	Export volume, USD billion	Key changes	Main characteristics
Growth and Relative Stability in 2010–2013			
2010	51.4	Beginning of growth	Recovery following the global financial crisis; strong external demand for Ukrainian steel and grain
2011	68.4	Record growth (+33%)	Peak prices for metals and agricultural products; active trade with the CIS and Asia
2012	68.8	Stabilisation	Favourable market conditions continued; exports of iron ore and ferroalloys increased
2013	63.3	Beginning of decline	Political instability; declining global demand for metallurgical products
Deep Crisis and a Sharp Shift in Trade Geography in 2014–2016			
2014	53.9	Decline in exports to the CIS	Severance of economic ties with the Russian Federation; political sanctions; temporary occupation of Crimea
2015	38.1	Largest decline (–29%) in the country's history	Loss of Donbas industrial regions; hryvnia devaluation; contraction in industrial production
2016	36.3	Stabilisation at a low level	Initial steps towards reorientation to the EU; reduced dependence on the CIS
Recovery, Diversification and Integration with the EU in 2017–2021			
2017	43.3	Export recovery	The EU–Ukraine Association Agreement began to produce results; the agricultural sector expanded
2018	47.3	Sustained growth	Ukraine strengthened its presence in EU markets; the metallurgical sector stabilised
2019	50.0	The EU became the main trading partner	The EU became the main trading partner
2020	49.1	Moderate decline	COVID-19 affected logistics; the agricultural sector ensured export resilience
2021	68.0	Highest level since 2012	High global prices for agricultural products and iron ore; growth in exports to Asia and the EU
The Wartime Shock and the New Export Model in 2022–2024			
2022	44.1	Sharp decline (–35%)	Full-scale invasion; blockade of the Black Sea; destruction of the metallurgical industry; restricted logistics routes
2023	37.6	Lowest level in 20 years	Prolonged blockade of ports; instability of the grain corridor; energy attacks by the Russian Federation
2024	41.7	Partial recovery	Increased use of the Danube route; expansion of the EU's "customs visa-free regime"; stabilisation of agricultural exports

Source: compiled by the author using data from the State Statistics Service of Ukraine (2024).

The reorientation towards EU markets is the most significant change of the decade: in 2010, the EU accounted for 24% of exports, whereas in

2023–2024, its share exceeded 60–66%. The war in 2022 was the most powerful shock, compared with which even the crisis of 2014–2016 appears less extensive. Logistical factors became decisive: changes in routes, the use of Danube ports, overland corridors, and the optimisation of border crossing points. The export structure shifted from metals towards agricultural products. Despite the severe crisis, Ukrainian exports demonstrated adaptability, confirming their potential for rapid recovery after the end of the war. These transformations directly affected the level of geographical concentration of exports, which is examined below.

3. Geographical concentration of Ukraine's exports and changes under the influence of the war

To gain a deeper understanding of structural transformations in Ukraine's foreign trade, a graphical analysis of key trends across the main regions – the European Union (EU), Asia, Africa, the Americas, Australia and Oceania – was conducted for 2010–2024 (*Figure 1*). The visualisation makes it possible to clearly trace both long-term trends and sharp changes caused by wartime and economic shocks.

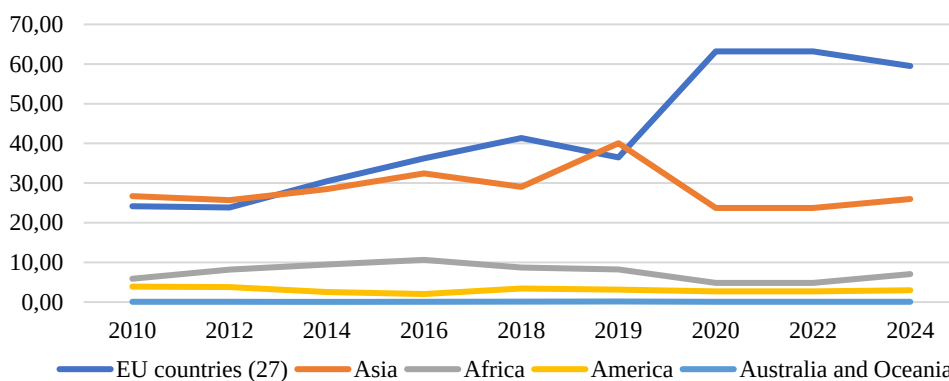


Figure 1. Geographical structure of Ukraine's merchandise exports, 2010–2024, %

Source: author's calculations based on data from the State Statistics Service of Ukraine (2024).

Based on the data in *Figure 1*, it is worth noting that the EU has consistently remained Ukraine's leading export destination throughout the entire period. In 2010–2014, the EU's share fluctuated within the range of 24–30%, without any sharp increases. After 2014, when the war began and part of Donbas's industrial capacity was lost, the EU's share increased moderately, reaching a peak in 2018 (over 41%). After 2021, a sharp increase is observed, reaching 63%, which was driven by the reorientation of exports under the conditions of Russia's invasion in 2022. Due to the blockade of ports and changes in logistics, the EU effectively became almost the only gateway for Ukrainian goods to foreign markets. In 2023–2024, the EU's share declined slightly to 59.5%, but remained dominant. Thus, in 2022–2024, the EU effectively served as the "gateway" for Ukrainian exports, demonstrating critical dependence on European infrastructure and markets (United Nations, 2026; World Bank, 2024; OECD, 2025).

The Asian market maintained a high and stable share of Ukraine's export structure throughout 2010–2021. Moderate growth was observed in 2010–2015, while its peak was recorded in 2015–2018. In 2022, Asia's share in the geographical structure of Ukraine's merchandise exports declined, coinciding with the destruction of logistics infrastructure and restrictions on maritime transport. However, a partial recovery in supplies took place in 2023–2024. Thus, Asia remains a strategic market for Ukraine, although its share is heavily dependent on maritime infrastructure, which was partially blockaded in 2022–2023 (Center for Economic Strategy, 2023).

The share of Ukrainian exports to Africa increased almost twofold between 2010 and 2017, peaking in 2016–2017, as exports to African agricultural markets developed actively. After 2018, a gradual decline became apparent, particularly in 2022. In 2024, its share increased again. Thus, Africa can be characterised as a sensitive market that responds to logistical and security challenges, with the steepest decline associated with the period of port blockades.

The share of exports to the countries of the Americas remained below 4% throughout the period under study, reaching its peak in 2018. In 2021–2024, the figures stabilised at 2.7–3%. Consequently, the American market is not a key destination for Ukrainian exports; geographical distance and the commodity structure of exports limit its growth (Center for Economic Strategy, 2023).

The share of Australia and Oceania was close to zero in all the years under study. This region plays no structural role in Ukraine's overall exports (M. I. Dolishniy Institute of Regional Research of the National Academy of Sciences of Ukraine, 2022).

Therefore, the analysis of the geographical structure of Ukraine's exports illustrates its profound transformation, particularly after 2022. The EU has become the main and strategically critical market, while exports to Asia and Africa have been most severely affected by logistical constraints. In the long term, restoring the balance between the EU and Asia may indicate Ukraine's gradual return to a diversified pattern of trade relations.

Table 3

Herfindahl–Hirschman Index (HHI) for Ukraine's merchandise exports in 2010–2024

Level of concentration	Year	HHI
Low concentration (HHI: 0.13–0.14)	2010	0.134
	2011	0.136
	2012	0.131
	2013	0.142
Transition to moderate concentration (HHI: 0.18–0.26)	2014	0.183
	2015	0.226
	2016	0.248
	2017	0.255
	2018	0.264
Consistently moderate concentration (HHI: 0.28–0.30)	2019	0.283
	2020	0.301
	2021	0.296
	2022	0.459
Sharp increase in concentration, high level (HHI: 0.46–0.48)	2023	0.481
	2024	0.427

Source: author's calculations based on data from the State Statistics Service of Ukraine (2024).

The analysis of the data in *Table 3* indicates a clear long-term trend towards increasing geographical concentration of Ukraine's exports, pointing to a gradual narrowing of market diversification.

In 2010–2013, Ukraine's merchandise exports exhibited a low level of concentration. Until 2013, Ukrainian exports were relatively evenly distributed among the main markets – the EU, Asia, and, to some extent, the CIS countries (which were not included in this HHI calculation but nevertheless influenced the overall picture). The index remained within the low-concentration range, indicating a sufficient degree of diversification across trade destinations (World Trade Organization, 2023; Bruegel Institute, 2024).

During 2014–2018, Ukraine's merchandise exports transitioned towards moderate concentration. With the outbreak of the war and the decline in exports to the CIS, the structure shifted towards the EU and Asia, leading to a gradual increase in the HHI. The severance of production chains with the Russian Federation and the reorientation towards Western markets increased dependence on several key regions, reducing geographical balance.

In 2019–2021, Ukraine's merchandise exports exhibited a consistently moderate level of concentration. This period was characterised by relative macro-financial stability, but exports became more focused on the EU and Asia. The growth of agricultural exports to the EU strengthened dependence on one dominant market.

In 2022–2023, a sharp increase in the concentration of Ukraine's merchandise exports was recorded. Russia's full-scale invasion led to the blockade of seaports, the destruction of logistics routes, a decline in exports to Asia and Africa, and a sharp increase in the EU's share (to 63–66% of exports). This resulted in a record increase in the HHI to almost 0.50, corresponding to a high level of market concentration.

In 2024, the concentration of Ukraine's merchandise exports declined slightly, but the indicator remained high. The partial recovery of exports to Asia and Africa via Danube ports and alternative routes led to a moderate reduction in concentration; however, dependence on the EU remained above pre-crisis levels.

4. Identification of factors influencing Ukraine's merchandise exports during the war

The analysis conducted makes it possible to systematically assess the multidimensional impact of the full-scale war on the functioning of Ukraine's export sector and identify the key groups of factors determining the transformation of foreign trade flows in 2022–2025. The generalised results presented in *Figure 2* demonstrate that these changes are complex in nature, encompassing institutional, logistical, production and technological, financial, geoeconomic, regulatory, social and labour-related, and security dimensions.

Institutional	Logistical
"Customs visa-free regime" with the EU	Expansion of the capacity of Danube ports (Reni, Izmail, Kiliia)
Simplification of Ukrainian goods' access to the EU	Growing role of the Romanian port of Constanța
Liberalisation of road transport	Changes in rail logistics routes through Poland, Slovakia, and Hungary
Changes in certification rules and technical regulations	Implementation of the "Grain Corridor" without the participation of the Russian Federation (2023–2024)
Expansion of duty-free trade arrangements and preferential quotas	Rising costs of land transportation and customs clearance
Energy and Infrastructure	Financial and Currency-Related
Destruction of major metallurgical plants (Azovstal, Illich Iron and Steel Works)	Hryvnia volatility and the impact of foreign exchange interventions by the National Bank of Ukraine
Impact of attacks on the energy system on industrial production	Rising production costs due to inflationary shocks
Power supply disruptions and rising energy costs for enterprises	Shortages of working capital and higher borrowing costs
Damage to transport and warehousing infrastructure	Government compensation and lending programmes, 5–7–9% loans, and support for business relocation
Institutional and Security-Related	Social and Labour-Related
Military risks to trade routes	Labour migration and demographic losses
Blockade and restrictions affecting seaports	Shortages of skilled workers in industrial sectors
Rising costs of insuring cargo, vessels, and transport operations	Mobilisation processes and reduced workforce availability
Capacity constraints at EU border crossings (transport operators' protests and suspension of operations at border crossing points)	Social adaptation of enterprises that have relocated their production facilities
Territorial losses of production capacity	
Environmental and Climate-Related	Legal and Regulatory
Land degradation and territorial pollution resulting from military operations	Harmonisation of Ukrainian legislation with EU law
Higher costs of environmental certification of products for EU markets	Changes in the conditions of access to the EU market within the framework of pre-accession integration
More stringent environmental standards in international trade (CBAM)	New requirements for supply chain transparency (Due Diligence)
Marketing and Communications-Related	Production and Structural
Changes in the positioning of Ukrainian products in global markets	Changes in the structure of the economy towards the agricultural and food sectors
Growing importance of the "Made in Ukraine" brand in EU countries	Declining share of metallurgy and mechanical engineering in exports
Development of trade representative offices and participation in international exhibitions	Development of small and medium-sized enterprises as a driver of exports during wartime

Figure 2. Factors Influencing Ukraine's Merchandise Exports during the War

Source: compiled by the author.

Institutional factors have been a fundamental driver of the reorientation of Ukrainian exports towards European Union markets. The introduction of the "customs visa-free regime", the liberalisation of road transport, the harmonisation of technical regulations, and the simplification of access for products to the EU internal market have significantly accelerated

Ukraine's integration into European supply chains. These measures have not only compensated for the loss of access to traditional Asian and post-Soviet markets but have also created an institutional foundation for long-term trade and economic integration.

Logistical factors have determined critical constraints while simultaneously acting as a stimulus for structural changes in exports. The blockade of major Black Sea ports has led to the reorientation of trade flows towards Danube ports (Reni, Izmail, Kiliia), intensified cooperation with the port of Constanța, and increased rail freight volumes through Central European countries. At the same time, the establishment of an alternative "Grain Corridor" in 2023–2024 without the participation of the Russian Federation opened up new routes for exporting agricultural products, although these remain more expensive and less predictable than pre-war maritime transport.

Energy and infrastructure factors have also been significant, causing a substantial decline in the export potential of certain sectors. Extensive destruction of metallurgical plants in eastern Ukraine (in particular, Azovstal and Illich Iron and Steel Works), along with regular attacks on the energy system, has led to lower production and higher production costs. This has directly affected the structure of exports, increasing the share of agricultural products while reducing the share of the metallurgical segment and high-value-added goods.

Financial and currency-related factors, among which exchange rate fluctuations, inflationary shocks, higher borrowing costs, and limited working capital for enterprises have been decisive, have also had a significant impact on the economy and trade. At the same time, government business support instruments (in particular, the "5–7–9%" programme) have partially mitigated these risks, helping to maintain export activity among small and medium-sized enterprises.

The group of *institutional and security-related factors* is also important, encompassing the direct impact of military risks on logistics chains, higher cargo insurance costs, and reduced predictability of trade operations. Port closures, periodic blockades at the EU border, and risks to transport infrastructure significantly constrain the physical capacity to increase exports.

Social and labour-related, environmental and climate-related, marketing, and production and structural factors provide a deeper understanding of how the war is transforming not only export volumes but also the very operating logic of export-oriented sectors. In particular, the relocation of enterprises is stimulating the modernisation of production lines; emigration and mobilisation are changing labour availability; EU environmental standards are making access to the European market more challenging for products; and the growing importance of the "Made in Ukraine" brand is shaping a new marketing strategy for product promotion.

Thus, the structure of factors demonstrates that the war has created a synergistic impact of different groups of factors, which simultaneously constrain export opportunities and open up new pathways for Ukraine's integration into global markets. Taken together, these factors are shaping a

new configuration of Ukraine's foreign trade policy, determining its strategic adaptation under conditions of high turbulence and increased risks.

The results obtained indicate a profound transformation of the geographical and commodity structure of Ukraine's exports under wartime conditions; however, their interpretation requires broader contextual understanding. The changes identified should not be viewed solely as a loss of export potential or a simplification of the structure of foreign trade; rather, they reflect a change in the forms, channels, and spatial organisation of Ukraine's participation in global markets.

The decline in the share of metallurgical products in merchandise exports, which at first glance may be interpreted as a loss of Ukraine's position in the global steel market, has a more complex nature. The destruction of production facilities in Mariupol and the blockade of the Sea of Azov have indeed led to a sharp reduction in the physical volume of metal exports. At the same time, these processes have been accompanied by increased investment activity by Ukrainian metallurgical companies abroad, particularly through asset acquisitions, participation in joint ventures, and integration into production chains in EU and Middle Eastern countries. Thus, part of the export potential of the metallurgical business is being transformed from a commodity-based presence into an investment and corporate presence, making it more difficult to interpret the decline in exports directly as a definitive loss of competitive positions.

A similar pattern can be observed in the agricultural sector, which became a key driver of export adaptation in 2022–2024. The increasing share of agricultural products in exports reflects their relative mobility, the speed with which logistics can be reconfigured, and their lower capital intensity compared with industrial sectors. However, this specialisation entails significant structural risks. The high concentration of agricultural exports in the EU market intensifies competition with European producers, which is already manifesting itself in trade disputes, temporary restrictions, and tighter regulatory barriers. In this context, the increase in the geographical concentration of exports, as recorded by the *Herfindahl–Hirschman Index*, is not merely an indicator of adaptation but also a signal of heightened vulnerability to the political and regulatory decisions of a key trading partner.

The identified concentration of exports towards the European market also reflects a deeper contradiction between the strategic need for sectoral and technological modernisation of exports and the severe geospatial constraints imposed by the war. On the one hand, integration with the EU encourages higher standards of quality, environmental sustainability, and production traceability, which are prerequisites for the transition to higher-value-added exports. On the other hand, logistical dependence on overland corridors, high transportation costs, and limited infrastructure capacity constrain the development of precisely those sectors that require complex production and transport chains.

The results of the analysis confirm that structural changes in Ukraine's exports are shaped by the influence of interconnected factors that often have

contradictory effects. EU institutional support and trade liberalisation compensate for some of the losses but simultaneously increase dependence on external rules and market conditions. Logistical innovations (the Danube corridor and alternative routes) expand export opportunities but cannot fully replace the pre-war maritime model. Production and structural changes promote the development of small and medium-sized enterprises but do not compensate for the loss of major industrial exporters in the short term.

Thus, the quantitative changes recorded in 2022–2024 should be viewed not as a completed model of a new export specialisation but as an intermediate outcome of adaptation to an exogenous wartime shock. The further evolution of the structure of Ukraine's exports will depend on the duration of the war, the restoration of maritime logistics, the pace of industrial reconstruction, and the ability of government policy to reconcile the requirements of European integration with the need to preserve the multi-vector nature of foreign trade. It is precisely in this context that the findings of the study open up scope for further academic debate and the development of strategic decisions, which are summarised in the article's conclusions.

Conclusions

A comprehensive analysis of the dynamics and structure of Ukraine's exports in 2010–2024 demonstrates that the country has undergone several successive stages of structural transformation: from a raw-material-oriented model dominated by CIS markets to a Europe-oriented system and, since 2022, to an adaptive export model shaped by the conditions of the full-scale war. The wartime shock has acted as a catalyst not only for a sharp decline in export volumes but also for profound changes in the geographical, commodity, and logistical configuration of exports.

The geographical reorientation of exports towards European Union markets represents the most extensive structural change throughout the entire period of Ukraine's independence: the EU's share increased from 24% in 2010 to over 60–66% in 2022–2024. This concentration was a forced response to the blockade of Black Sea ports and restrictions on maritime logistics, transforming the EU into a key geospatial "access hub" for Ukrainian exports to global markets. At the same time, the decline in exports to Asia and Africa demonstrated the critical dependence of Ukraine's multi-vector trade model on the uninterrupted functioning of maritime infrastructure.

Calculations of the Herfindahl–Hirschman Index confirm a sharp increase in the geographical concentration of exports in 2022–2023, reaching a high level ($\text{HHI} \approx 0.46\text{--}0.48$), which indicates a narrowing of market diversification and the emergence of new systemic risks. Although a partial decline in concentration was recorded in 2024, its level remains substantially higher than pre-war values, limiting the resilience of the export system to future external shocks.

The identification of factors influencing Ukraine's merchandise exports during the war has shown that the current model of Ukrainian exports

is shaped by the simultaneous influence of institutional, logistical, production and structural, energy, financial, and security-related factors. On the one hand, EU institutional support, trade liberalisation, and the digitalisation of customs procedures have created conditions for rapid adaptation. On the other hand, the geospatial constraints imposed by the war, the destruction of industrial capacity, and the high cost of alternative logistics constrain the structural modernisation of exports and reinforce their agricultural and raw-material orientation.

Ukrainian exports are undergoing a profound structural transformation, the key characteristic of which is the acute contradiction between the strategic need for technological and sectoral modernisation and the forced adaptation to the severe geospatial and security constraints imposed by the war.

Prospects for further research include in-depth modelling of scenarios for the post-war transformation of Ukraine's export structure, assessing the impact of logistical diversification on reducing geographical concentration, and developing export policy instruments aimed at strengthening sectoral modernisation and expanding sales markets.

REFERENCES / СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ

Boichyk, V. Ye. (2023). The impact of market infrastructure on entrepreneurial activity in Ukraine under wartime conditions. <i>Journal of Strategic Economic Research</i> , 5(16), 9–16. https://doi.org/10.30857/2786-5398.2023.5.1	Бойчик, В. Є. (2023). Вплив ринкової інфраструктури на підприємницьку діяльність в Україні в умовах війни. <i>Журнал стратегічних економічних досліджень</i> , 5(16), 9–16. https://doi.org/10.30857/2786-5398.2023.5.1
Bruegel Institute. (2024). <i>Paris Report 2: Europe's Economic Security</i> . (Eds.: Pisani-Ferry, J., Weder di Mauro, B., Zettelmeyer, J.). CEPR Press, Paris & London. https://cepr.org/publications/books-and-reports/paris-report-2-europes-economic-security	
Center for Economic Strategy. (2023). <i>The Impact of the 2022 War on Ukrainian Exports: Analytical Report</i> . Kyiv: CES. https://ces.org.ua/wp-content/uploads/2024/01/ukrainian-economy-in-war-times-2023-1.pdf	
Deloitte. (2024). <i>Restructuring the supply base: Prioritizing a resilient, yet efficient supply chain</i> . https://www.deloitte.com/us/en/insights/industry/manufacturing-industrial-products/global-supply-chain-resilience-amid-disruptions.html	
European Commission. (2023). <i>EU–Ukraine Trade Relations: Annual Actavity Report 2023</i> . Brussels: European Commission. https://commission.europa.eu/document/download/d745abed-3ca7-408d-9821-b7ac2e85b096_en?filename=TRADE_AAR_2023_final.pdf	
Galutskykh, O. O., & Koshkariova, I. V. (2022). Structural transformations of Ukraine's foreign trade under conditions of global instability. <i>Foreign Trade: Economics, Finance, Law</i> , (3), 45–59. https://journals.knute.edu.ua/foreign-trade/article/view/2234/2128	Галуцьких, О. О., & Кошкарьова, І. В. (2022). Структурні трансформації зовнішньої торгівлі України в умовах глобальної нестабільності. <i>Зовнішня торгівля: економіка, фінанси, право</i> , (3), 45–59. https://journals.knute.edu.ua/foreign-trade/article/view/2234/2128
Gnangnon, S. K. (2020). International trade cooperation and exogenous economic shocks in developing countries. <i>The International Trade Journal</i> , 35(2), 133–158. https://doi.org/10.1177/0976747920945188	
Herasymenko, A. M. (2020). Geo-economic transformations in the 21st century: Dialectics of dynamics and sustainability. <i>Bulletin of Kyiv National University of Trade and Economics</i> , 4(132), 5–19. http://visnik.knute.edu.ua/files/2020/04/03.pdf	Герасименко, А. М. (2020). Геоекономічні трансформації у ХХІ ст.: діалектика динаміки та сталості. <i>Вісник Київського національного торговельно-економічного університету</i> , 4(132), 5–19. http://visnik.knute.edu.ua/files/2020/04/03.pdf

Institute of Regional Research named after M. I. Dolishnyi of the National Academy of Sciences of Ukraine. (2022). <i>Development of the Areas of Influence of International Transport Corridors: Analysis of Problems and Prospects</i> (Scientific and Analytical Brief). https://ird.gov.ua/irdp/e20220401.pdf	Інститут регіональних досліджень імені М. І. Долішнього НАН України. (2022). <i>Розвиток зон впливу міжнародних транспортних коридорів: Аналіз проблем та перспектив</i> (науково-аналітична записка). https://ird.gov.ua/irdp/e20220401.pdf
Mazaraki, A. A., & Melnyk, T. M. (2025). Institutional and logistical factors in the formation of the modern export model of Ukraine. <i>Foreign Trade: Economics, Finance, Law</i> , (1), 3–24. https://journals.knute.edu.ua/foreign-trade/article/view/2234/2128	Мазаракі, А. А., & Мельник, Т. М. (2025). Інституційні та логістичні чинники формування сучасної моделі експорту України. <i>Зовнішня торгівля: економіка, фінанси, право</i> , (1), 3–24. https://journals.knute.edu.ua/foreign-trade/article/view/2234/2128
Ministry of Economy of Ukraine. (2023). Infographic on the overall results of Ukraine's exports of goods and services in 2022. Kyiv: Ministry of Economy of Ukraine. https://me.gov.ua/view/76108863-4141-4040-80db-96ac042d1ba1	Міністерство економіки України. (2023). <i>Інфографіка щодо загальних підсумків експорту товарів і послуг України у 2022 році</i> . Київ: Мінекономіки. https://me.gov.ua/view/76108863-4141-4040-80db-96ac042d1ba1
OECD. (2025). <i>OECD economic surveys: Ukraine 2025</i> . Organisation for Economic Co-operation and Development. https://www.oecd.org/en/publications/oecd-economic-surveys-ukraine-2025_940cee85-en.html	
PricewaterhouseCoopers. (2024). <i>Reinventing supply chains 2030</i> . https://www.pwc.com/gx/en/services/consulting/digital-operations/reinventing-supply-chains-2030.html	
State Statistics Service of Ukraine. (2024). <i>Foreign trade of Ukraine in 2010–2024: Statistical data</i> . State Statistics Service of Ukraine. https://www.ukrstat.gov.ua/	Державна служба статистики України. (2024). <i>Зовнішня торгівля України у 2010–2024 рр.: статистичні дані</i> . Київ: ДССУ. https://www.ukrstat.gov.ua/
Statista. (2024). <i>Ukraine: Trade revenue by country</i> . https://www.statista.com/statistics/1297572/ukraine-trade-revenue-by-country/	
United Nations. (2026). <i>UN Comtrade database: International trade statistics</i> . https://comtrade.un.org/	
World Bank. (2024). <i>Ukraine trade, logistics, and connectivity under wartime conditions</i> . World Bank Group. https://documents1.worldbank.org/curated/en/099061124011599512/txt/P180318180f46106919c5a133c75be0e5a7.txt	
World Trade Organization. (2023). <i>Trade Policy Review: Ukraine 2023</i> . Geneva: World Trade Organization. https://www.wto.org/english/tratop_e/tpr_e/s441_e.pdf	Світова організація торгівлі. (2023). <i>Огляд торговельної політики: Україна, 2023</i> . Женева: Світова організація торгівлі. https://www.wto.org/english/tratop_e/tpr_e/s441_e.pdf

Conflict of interest. The author certifies that she doesn't have financial or non-financial interest in the subject matter or materials discussed in this manuscript; the authors have no association with state bodies, any organizations or commercial entities having a financial interest in or financial conflict with the subject matter or research presented in the manuscript. Given that the author is affiliated with the institution that publishes this journal, which may cause potential conflict or suspicion of bias and therefore the final decision to publish this article (including the reviewers and editors) is made by the members of the Editorial Board who are not the employees of this institution.

The author received no direct funding for this study.

Makarova, T. (2026). Structural Transformations of Ukrainian Exports. *Scientia fructuosa*, 5(169), 42–58. [http://doi.org/10.31617/1.2026\(169\)03](http://doi.org/10.31617/1.2026(169)03)

Received by the editorial office 15.12.2025.

Accepted for printing 05.05.2026.

Accepted for printing 09.09.2026.

Published online 21.10.2026.