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War in Ukraine: Impact on global agri-food trade

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Abstract. The conditions and trends of the global agri-food market are elastic to crises and conflicts involving major market players, which threatens food security by blocking sustainable international trade opportunities due to the destruction of production capacity and value chains, as well as supply channels to consumer countries. The purpose of this study was to investigate the specific features and consequences of the impact of the Russian-Ukrainian armed conflict on world agricultural trade and food security at the national and global levels. The scientific conclusions are the result of

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the application of economic and statistical (time series, index, and factor analysis) and dialectical (induction and deduction, analysis, and synthesis) methods of scientific cognition. It was found that the universal features of wars include the ability to influence the global economy, create new geopolitical and economic uncertainty, rapidly increase prices for critical resources (energy), and ensure destabilisation of global value chains. As a result, the disruption of sustainable trade flows caused by military conflicts is an important source of changes in the global economy and the situation of individual countries and regions. It was proved that military operations on the territory of Ukraine led to restrictions in agriculture and forced adaptation of agribusiness to the factors of critical vulnerability. There are trends towards a reduction in production and the breakdown of conventional supply chains for agri-food products due to the destruction of the logistics infrastructure, which, together with a reduction in exports of agricultural products and fertilisers from Russia, has led to a rise in world food prices. As a result, the “price” of the Russian-Ukrainian war for the global economy is being formed, with growing hunger and poverty, as well as the environmental footprint of military operations. The practical significance of the findings of this study lies in the possibility of their application in strategic planning and substantiation of the areas of post-war reconstruction of the national economy in general and its agricultural sector specifically, as well as the restoration and strengthening of Ukraine’s role in global food chains and combating hunger

Keywords: globalisation; international trade; world food market; food market conditions; food security

INTRODUCTION

Globalisation processes, which have been developing rapidly for several decades, despite their many benefits, pose existential risks to the global community. One of these risks is the growing interdependence of countries and the spread of negative trends and phenomena beyond national borders, becoming global. Military conflicts are becoming critical in the context of escalating international tensions in some regions of the world. Russia’s armed aggression against Ukraine has become an indicator of the impact of local events on the stability of the global economic system. Uncertainty, as a primary consequence of the military conflict, provoked a rapid reaction of the global economic community in the context of globalisation, which was indicated by amplified fluctuations in the commodity and financial asset markets. The most vulnerable markets turned out to be energy and food.

The destruction of global food value chains, coupled with rising energy prices, has led to a crisis in the global agricultural market. The crisis was marked by a sharp rise in food prices and demand, temporary shortages of certain goods, intensified speculation, and the reformatting of agricultural value chains by actors and geographic location. The impact of the Russian-Ukrainian war on the global food trade is not only economic, but also socio-humanitarian in nature, with a critical consequence being the exacerbation of poverty, hunger, and global food security.

Despite the economic and social consequences caused by Russia’s military aggression against Ukraine, the global economic system has been substantially affected by the reactions of both governments around the world aimed at mitigating real and potential risks to national economies and food consumers. Irrational demand due to inflationary expectations and consumer deficits, as well as an increased burden on the state budget due to increased spending to support

Ukraine and refugees, have led to an increase in economic nationalism to support the population. Policy of some countries (restrictions on exports of agricultural products and fertilisers, limitation of food imports) has somewhat stabilised the situation at the national level, but has exacerbated the imbalance in global food trade, the price pressure from which is a critical factor for the food security of developing countries. Therewith, the crisis in international food trade is a potential source of new opportunities for some countries, such as expanding their niche in the global market. Their trade expansion policy allows redressing the imbalance of supply and demand, but it takes time and mutual agreement with other influential members of market relations. Considering the magnitude of the effects of global food trade volatility, the problem of identifying the factors of its development and developing mechanisms for mutual coordination of national food trade policies within a sustainable global food security system is becoming increasingly relevant.

The development of international trade is influenced by a multitude of interrelated hyper-, macro-, meso-, and micro-level factors, ranging from growing globalisation, cultural and linguistic differences, tariffs, trade barriers, and agreements to logistics solutions and competitive advantages. This list is subject to permanent additions and reductions because of changes in the global commodity markets and structural transformations in the global economy. Thus, J. Mehtiyev *et al.* (2021) develop the idea of causal links between the dynamics of international trade and indicators of the “financial health” of the global and national economies (inflation, devaluation, exchange rate, price volatility). Among the above factors affecting international trade, war occupies a special place. The principal idea of research on war and its impact on international trade from the perspective of the

historical and evolutionary approach is the assertion that the widespread use of political power and military force leads to the creation of a specific form of the world trading system, which in a basic sense consists of two types of actors – industrial countries and exporters of goods (Krpec & Hodulak, 2019).

G. Zachmann *et al.* (2022) emphasise that modern wars are distinguished by the fact that they are accompanied by profound humanitarian consequences for the world, as they provoke a rise in prices not only for energy resources but also for food. D. Kleimann (2022) noted that fluctuations in global food prices and supply in times of war are largely conditioned by the decisive actions of governments trying to protect their populations. Along with investigating the impact of the war on the global agricultural market and food security, T. Sigaeva *et al.* (2023) addressed the complications of logistics for international trade. Military operations on the territory of Ukraine have led to the blocking of sea-ports, closure of airspace, instability of delivery costs, and vulnerability of logistics systems in the frontline regions, which necessitates the development of new logistics models and strategies. Developing this opinion, Yu. Kushnir *et al.* (2023) emphasise the micro-level context of this impact: difficulties with freight transportation prompted manufacturers and exporters to immediately transform and optimise business processes.

Despite the existence of many multidisciplinary studies of the system of international trade relations and its transformations under the influence of armed conflicts, the hybrid nature of the Russian-Ukrainian war and the complexity of its consequences for international trade in general and agri-food products specifically keep this issue relevant and motivate further developments in this area. Considering this, the purpose of this study was to identify the factors and consequences of the impact of the Russian-Ukrainian war on world agricultural trade and food security at the national and global levels. The working hypothesis of the study was the assumption that the volatility of global agricultural trade indicators is the result of the complex impact of changes in the markets for food, fertilisers, and energy resources as a result of the Russian-Ukrainian war, specifically, the destruction of Ukraine's agricultural, export and logistics potential caused by it, and the sanctions pressure on the Russian Federation and Belarus.

MATERIALS AND METHODS

The research methodology was formed according to the objectives and research hypothesis. The following methods were employed in this study: time series (to determine trends in the value of commodity exports from Ukraine in general and agricultural products specifically; to investigate fluctuations in the aggregate price index for food and certain types of agricultural products); index method (to compare changes in the value of agricultural exports from Ukraine and world

exports in general); induction and deduction (to determine indicators of the elasticity of the world agricultural market to fluctuations in export supplies from Ukraine); analysis and synthesis, factor analysis (to identify the factors of volatility of world prices for agricultural products (specifically, grain); graphical and tabular methods (for visual presentation and systematisation of statistical and analytical data, research results). To establish the causal relationship between the processes in the chain “military actions in Ukraine – world food trade – global food security”, the study used indicators that are tested by international organisations to monitor the world food market and food security at the national and global levels:

1) food price index – World Bank (2023) and Food Agriculture Organisation (2023) databases;

2) Global Hunger Index – Global Hunger Index (2023) database;

3) Global Food Security Index (Economist impact, 2022).

The reliability of scientific results is ensured by a step-by-step analysis of: 1) transformations of the production and export potential of the agricultural sector of Ukraine under the influence of military actions; 2) cause-and-effect relationships between the factors of influence and indicators of the development of world food trade with further identification of the key trends; 3) challenges to global food security under the influence of volatility in the world food trade. Consistent application of the methodological tools helped to fulfil the objectives of the study, namely: to assess the economic losses of the agricultural sector of Ukraine's economy and their impact on export potential; to identify manifestations, trends, and principal factors of volatility in world trade in agri-food products; to investigate the level of global food security as a critical result of the impact of the Russian-Ukrainian war on world food trade.

The information basis for the theoretical part of the study included the findings of Ukrainian and foreign economists, expert opinions of the World trade organisation (2024), International Food Policy Research Institute (2023), International monetary fund (2022; 2023), World economic forum (2022), Organisation for economic cooperation and development (Trade and environment working papers, 2017). The empirical study was based on the processing of analytical information from the State Statistics Service of Ukraine (2023) and expert studies of the Kyiv School of Economics (2023) (data on the destruction of agricultural infrastructure, losses of production and export potential of Ukraine), and other information resources from international databases Food Agriculture Organisation (2023), World Bank (2023), Trade map (2023), ResourceTrade.Earth (2023), Economist Intelligence Unit (2024) (data on the global agricultural market conditions, food security at the national and global levels).

RESULTS AND DISCUSSION

For a long time, Ukraine has been actively competing with the United States, Canada, and the EU in the global agricultural market. The annual growth of the agricultural sector was over 5%, while the share of agricultural production in GDP was over 10% and 16% together with processing (Cabinet of Ministers of Ukraine, 2022); the agricultural sector employed over 14% of the population. However, the full-scale armed aggression of the Russian Federation has caused significant civilian casualties, critical destruction, and damage to production facilities and infrastructure, and has also caused enormous economic and natural losses to the agricultural sector: risks of sowing and harvesting due to mined fields and shelling, logistical problems, labour shortages, etc.

According to the Kyiv School of Economics (2023), as of the beginning of the second quarter of 2023, direct losses to agriculture as a result of the war amounted to USD 8.7 billion. Agribusinesses suffered the largest losses due to the destruction of agricultural machinery, the destruction of grain storage facilities, theft, export outside Ukraine, or destruction of finished products. In total, as a result of Russia's armed aggression, over 110,000 units of agricultural machinery were destroyed, including the loss of major tillage equipment (tractors, seeders, harrows) worth more than USD 4.5 billion. Perennial plantations (fruit and berry crops – worth a total of USD 490 million), inputs and farm animals were also considerably damaged, and a significant loss of life was recorded.

Assessing the losses incurred by the agricultural sector in the field of animal husbandry (cattle, poultry, pig, aquaculture and fisheries, beekeeping, etc.), experts have found that the amount of such losses from the reduction in the number of cattle and pigs, bee colonies, etc., reaches USD 280 million. In the Kharkiv region,

the cowsheds of the Agromol farm and the production facilities of the leading dairy producer Kharkiv Dairy Plant LLC were destroyed. Over 4 million chickens died at Europe's largest poultry farm in Chornobaivka, Kher-son region (LATIFUNDIST, 2023a). In part of the temporarily occupied Zaporizhzhia region, the premises of a dairy farm and 4 buildings of the pig farm of PJSC Stepnoy Breeding Farm were destroyed, killing more than 6,000 pigs and about 1,000 heifers. Overall, during the war in Ukraine, the number of cattle decreased by 15.6%, or 2.4 million, including cows by 15%, or 1.3 million (LATIFUNDIST, 2023b).

The agricultural business suffered significant losses due to damage, theft, or destruction of goods and means of production. It is difficult to estimate the total number and amount of losses in this category, but the approximate amounts of losses have been established: fertilisers (over USD 68 million), fuel and plant protection products (about USD 28 million), and grain and sunflower seeds (about USD 2 billion) (Kyiv School of Economics, 2023). Most fertilisers for grain crops were used before the war, with high application rates to guarantee yields. However, in 2023, due to the high cost of imported logistics, the fertiliser application rate dropped substantially (15-20%).

The occupation of the southern regions of Ukraine and the mining of agricultural land also caused significant damage to agribusiness (Fig. 1). The area of mined agricultural land is about 471 thsd ha, which, apart from demining, also requires additional cultivation in the form of reclamation and levelling of the surface. To saturate the internal market with agricultural products and adjust prices, agricultural land for growing vegetables is being demined first, followed by grain and legumes, and land for other agricultural needs.

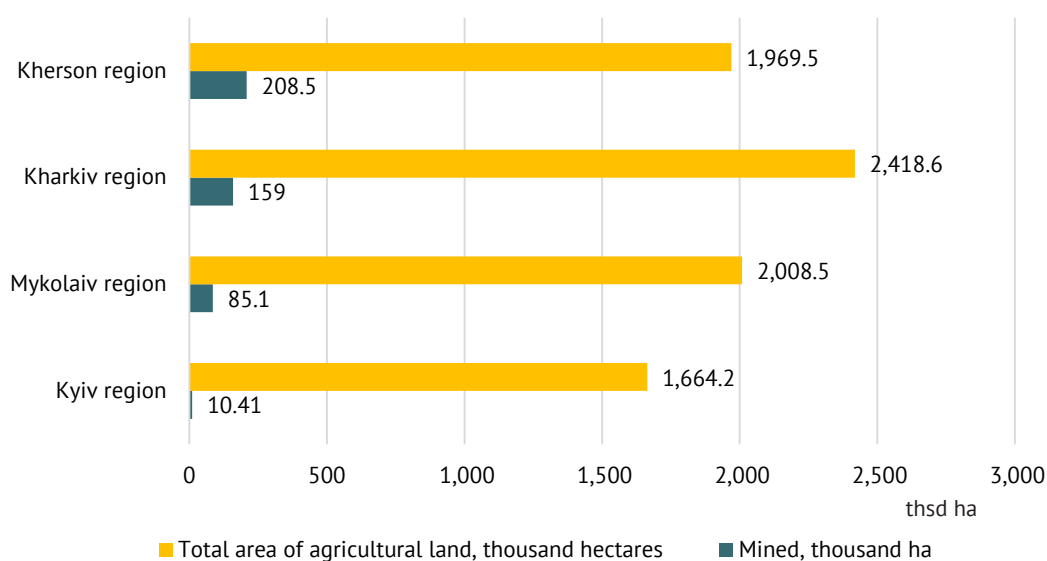


Figure 1. Areas of agricultural land mined as a result of the war, 2023

Source: calculated by the authors of this study according to data from the State Statistics Service of Ukraine (2023)

Apart from direct costs, Ukraine also suffered considerable indirect losses (over USD 30 billion) as a result of the war (Kyiv School of Economics, 2023), which include lower internal prices for export-oriented crops and disruption of export logistics corridors; losses due to reduced crop production; losses from reduced winter crop production; losses from higher prices for inputs and labour; losses from reduced livestock production.

The largest indirect losses – USD 14.3 billion – were recorded in the crop sector, with substantial damage caused by the inability to fully conduct the sowing season in the southern and eastern regions of Ukraine. Thus, the highest level of losses is accounted for by wheat (USD 2.9 billion), sunflower (USD 2.5 billion), and maize (USD 1.7 billion) (Kyiv School of Economics, 2023). As of

the beginning of the second quarter of 2023, the livestock sector recorded losses of USD 1.7 billion due to a decrease in livestock, with production of milk and eggs, beeswax and honey, cattle and pig meat falling. There-with, despite rising feed costs (produced in-house) and the rise in the price of premixes and other components of animal feed rations, producers benefited from low prices for their own grain products, which made livestock production profitable. The warehouse infrastructure has also suffered considerable losses, with facilities total-ling 8 million tonnes of simultaneous storage capacity destroyed or damaged as a result of hostilities. Elevator complexes in 3 southern regions were the most affected (Elevatorist, 2023) (Fig. 2), with losses estimated at over USD 1.3 billion (Kyiv School of Economics, 2023).

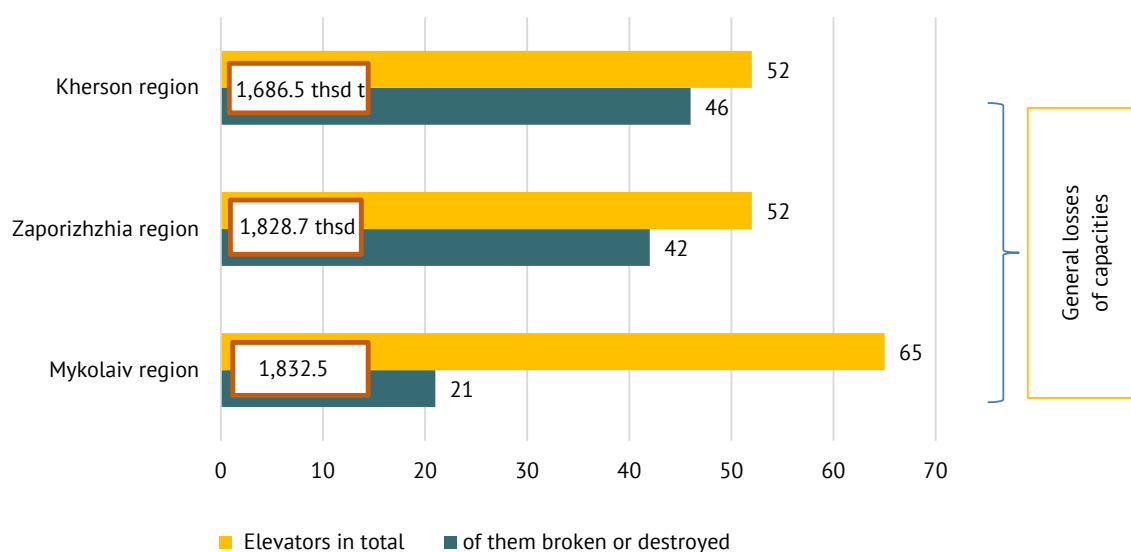


Figure 2. Number of lost warehouse infrastructure (granaries) as a result of the war, 2023

Source: calculated by the authors of this study according to data from the State Statistics Service of Ukraine (2023)

The following agricultural companies lost the most grain storage facilities as a result of the Russian military aggression and temporary occupation: OptimusAgro Trade (lost 50% of capacities, 16 out of 27 elevators are in operation), TESSLAGROUP (7 elevators are under occupation, 2 are de-occupied, of which 1 was destroyed by shelling), Bunge Ukraine (over 30% of capacities have been lost, 3 elevators are currently operating), NIBULON LLC (25% of capacities have been lost), State Food and Grain Corporation of Ukraine (control over 9 elevators has been lost) (Elevatorist, 2023).

Considering the overall losses in agriculture, economic and trade decline during the full-scale military invasion of Russia, Ukraine did not lose its foreign trade potential, and increased its export and import performance. This result was mainly achieved due to temporary trade liberalisation and a forced change in the institutional “rules of the game” in the market. To support agricultural producers as much as possible, the government temporarily suspended a range of import duties in the first months of the war, imposed restrictions on critical

imports, simplified registration procedures for the import of agricultural machinery, and expanded credit support and grant programmes for agricultural producers. The export capacity of the state and international business activity of Ukrainian exporters were considerably strengthened by the EU’s launch of logistics “solidarity routes”, the development of customs infrastructure, and temporary measures to eliminate anti-dumping duties and tariff quotas for Ukrainian products and goods.

Over the past decade, Ukraine’s economy has stabilised its growth rate as a result of systemic reforms and optimisation of its sectoral structure, as well as steadfast adherence to the course of integration into the European economic space. As a result of consolidated efforts by the state to promote economic interests in the international community and by private business to produce high-quality products, Ukraine has gradually increased its export potential, strengthening its position in the global market for goods and services. Agricultural products became the country’s defining export item with a share of around 40%. Steady demand

for food products ensured that the agricultural sector was able to maintain exports even during the crisis (in 2021, the value of exports exceeded the pre-crisis level after the COVID-19 pandemic by more than 25%). The Russian-Ukrainian war became a critical factor in

preserving the country's agricultural export potential. The destruction of production facilities and the disruption of logistics routes for the sale of products and the supply of fertilisers and seeds led to a sharp decline in exports (Fig. 3).

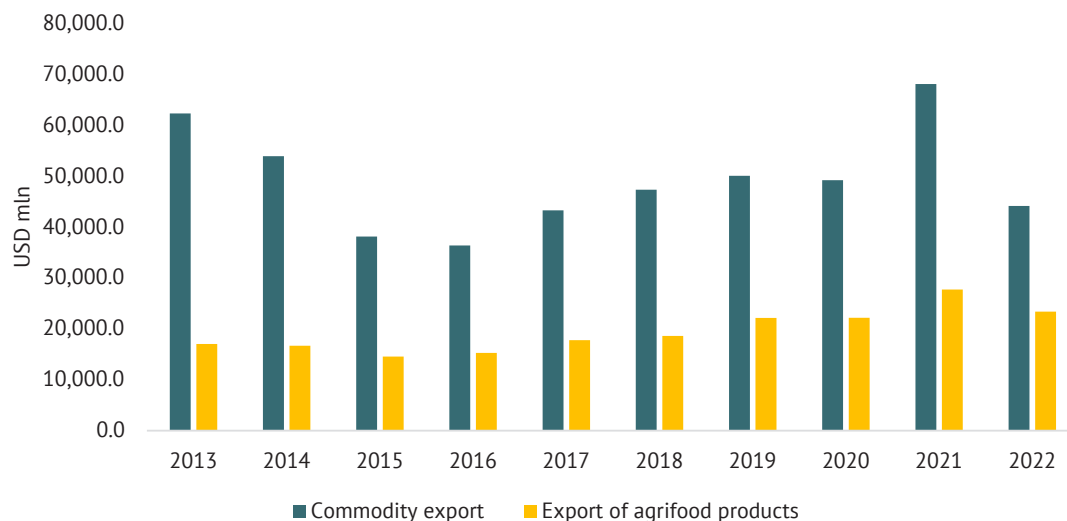


Figure 3. Dynamics of the value of Ukraine's exports, USD million

Source: calculated by the authors of this study according to data from the State Statistics Service of Ukraine (2023)

In 2022, the value of merchandise exports in general and agricultural products specifically decreased by 35.2% and 15.6%, respectively. The key factor behind this trend was the closure of the principal sales channel through the Black Sea ports. At the same time, alternative routes through the land corridors of Poland, Romania, Slovakia, and Hungary were not institutionally agreed upon and insufficiently tested for large-scale exports.

The Russian-Ukrainian war has transcended national boundaries and become a critical factor for the global commodity market, specifically its agricultural and energy segments. The indicators of food market

development turned out to be the most elastic, as both countries of the military conflict are significant food exporters (in 2020, Ukraine's share of the world market for maize was 13.1%, barley – 11.8%, wheat – 8.3%, and vegetable fats – 6.6%) (World Bank, 2022). The rise in food prices was a complementary result of national trends of declining production and the destruction of logistics infrastructure and chains in Ukraine, as well as a reduction in exports of agricultural products and fertilisers from Russia. Therewith, the volatility of world prices, rather than capacity, became a manifestation of the elasticity of the world food market to changes in export flows from Ukraine (Table 1).

Table 1. Agricultural export value index, 2022

Product type	Export value index, 2022 to 2021	
	Ukraine	World as a whole
Wheat	0.53	1.17
Barley	0.35	0.91
Maize	1.02	1.21
Sunflower oil	0.86	1.22

Source: developed by the authors of this study based on data from Trade Map (2023)

Specifically, the deficit in the wheat market was offset by the release and sale of stocks from India and China. In response to the threat to food security, Argentina, Brazil, and the United States have considerably increased their maize plantings. The problem of shortages of certain types of products was solved by countries with a prominent level of development by finding alternative sources of supply. At the same

time, underdeveloped countries were more vulnerable due to the lack of their own reserves and alternative regional suppliers. The problem was most acute in the countries that were the primary importers of Ukrainian grain – Lebanon, Moldova, Qatar, Pakistan, Egypt, and Turkey. The principal indicator of the elasticity of the global agricultural market to fluctuations in exports from Ukraine was the price. The largest increase in

food prices was recorded from February to June 2022, when it reached its maximum of 59% (Fig. 4). This was conditioned by the highest level of uncertainty about

the duration and consequences of the Russian-Ukrainian war. A considerable number of contracts expired or were suspended due to force majeure.

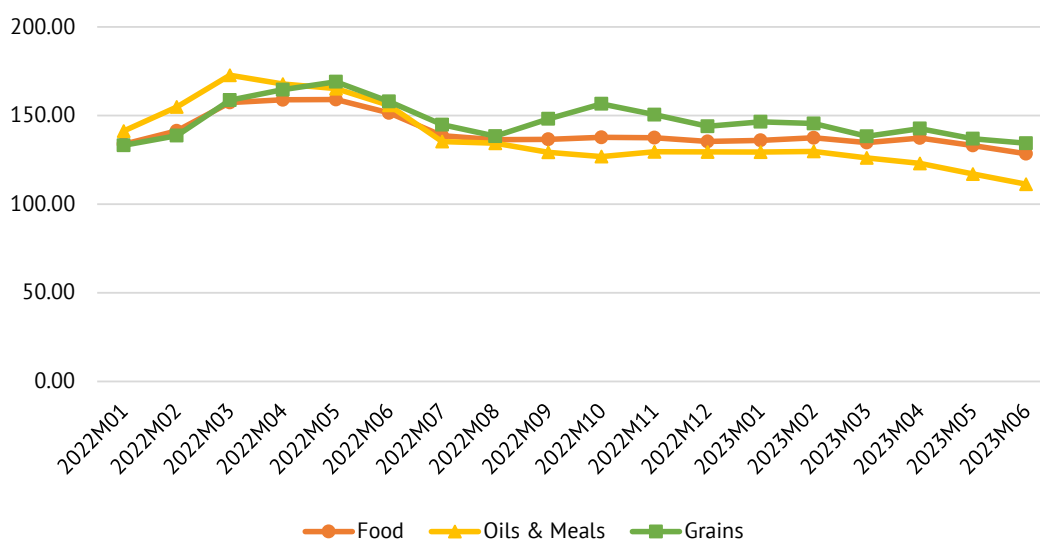


Figure 4. World Bank Commodity Price Index

Source: developed by the authors of this study based on World Bank data (2023)

According to analysts, this was the biggest jump in agricultural prices since 1974 and 2008. The high amplitude of price growth is conditioned by the volatility of the global agricultural market, which has not yet recovered from the 2019 crisis caused by the COVID-19 pandemic. For comparison, at the end of 2020, the aggregate food price index reached 107.3; in 2021, the index ranged within 115-127; in 2022, it was within 133-159 (World Bank, 2022). Prices rose for all commodities, with Ukraine and the Russian Federation playing a significant role in supplying them. However, prices for vegetable fats stabilised at a faster pace than grain. Specifically, in March 2022, the fat price index reached 172.8, with a downward trend since July 2022, when the index stopped at 111.3. At the same time, the aggregate grain price index did not fall below 133 in 2022-2023, reaching a peak of 169 in May 2022.

These trends are driven by the fact that the deficit in the global sunflower oil market was quickly compensated by other types of vegetable fats, such as palm, soybean, and other oils. At the same time, the high and steady demand for grain on the world market cannot be quickly met by other substitute commodities. The high volatility of global grain prices is the result of a range of factors:

1. Fertiliser shortages and rising prices. the Russian Federation and Belarus accounted for about 30% of global fertiliser exports. Although Russia's fertiliser exports are not subject to Western sanctions, supplies have been reduced due to disruptions in logistics, insurance, and banking. Carriers, insurers, and financial institutions have raised prices for their services due to reputational risks. Another factor was China's imposition of restrictions on fertiliser exports to stabilise

prices in the internal market. Taken together, this led to sharp price fluctuations for minerals. The rise in mineral fertiliser prices started in mid-2021, peaking in April 2022 (the global price index was 293.7). Between October 2021 and November 2022, the price index did not fall below 200 (World Bank, 2022).

2. Decreased grain yields due to reduced use of fertilisers by farmers in the EU and deteriorating weather conditions in Argentina, Brazil, and the US.

3. Increased energy prices, which led to higher fertiliser production costs, and higher prices for all parts of the food value chain, including storage, processing, delivery, and sales.

4. Sharp increase in the number of forward and futures transactions in agricultural markets, which are inherently speculative. This was the result of prolonged and acute uncertainty about the outcome and duration of the Russian-Ukrainian war and stimulated a rise in agricultural commodity prices. In February 2022, grain futures prices on the Chicago Mercantile Exchange rose by 50%. The share of non-commercial traders (speculators) holding long positions in durum wheat and maize increased to 50% in early 2022 (United Nations conference on trade and development, 2022). In general, futures and forward contracts are classic exchange instruments that have a positive impact on commodity liquidity. However, excessive use of long-term instruments leads to distortions in the price situation. To minimise this effect, some countries, including the EU, introduced controls on financial speculation in commodity futures contracts after the 2008 financial crisis. However, such state regulation measures have not been practised since then.

To compensate for the food shortage and avoid sharp price fluctuations, in 2022, some EU countries began to impose restrictions on exports and imports of agricultural products and increase regional imports, which had a short-term effect on the national market but increased the impact on global price fluctuations. In these conditions, an effective method of diversifying price risks is for countries to build up stocks of agricultural raw materials and increase plantings of a wide range of crops, which will ensure long-term market stability.

Russia's aggressive intervention and armed actions on the territory of Ukraine, following the logic of the war's destructive impact, were not limited to the national economy, but also caused a shock to global food markets and updated the world's food price indices (Food Agriculture Organisation, 2023). The situation with food security in the world has also deteriorated considerably: according to international organisations, the number of people suffering from hunger during the war has increased to 349 million people (compared to ~200 million people recorded during the COVID-19 pandemic) (International Monetary Fund, 2023). The reason for this is not only the reduction in food exports from Ukraine, but also the entire range of factors that logically follow from the growing role of the Black Sea region in ensuring global food security, on the one hand, and changes in market rules under sanctions pressure, on the other hand (Glauber & Debucquet, 2023). This includes restrictions on the supply of not only Russian agri-food products, but also energy, fertilisers from Belarus, etc., which has a complex impact on food production and availability.

Even though Ukraine was among the leaders in the global grain market in the pre-war period (USD 10.9 billion with a 7.2% increase in the value of this export item in 2015-2020) and oilseeds (USD 9.3 billion in 2020, which is 9.1% more than in 2015 (ResourceTrade.Earth, 2023), the reduction in its export opportunities has affected the availability of a wider range of food products. It is noted that the cost of a food basket in East Africa increased by 55% in the first year of the war in Ukraine (World food programme, 2022a). The impact of the Russian-Ukrainian war has been most pronounced in food-insecure countries:

- against the backdrop of a general decline in the Global Hunger Index (GHI) (from 28.0 in 2000 to 18.2 in 2022), countries with moderate, severe, or alarming levels of hunger have higher GHI scores in 2022 than in 2014;

- 44 countries are once again in the group of countries with alarming levels of hunger;

- 46 countries will not be able to achieve low levels of hunger by 2030 (Global Hunger Index, 2023).

In general, Jordan, Israel, Lebanon, and Yemen are the most vulnerable to the effects of the war on their food security, having imported a key share of agri-food products from Ukraine (4.6%, 3.7%, 15.0%, and 5.2%, respectively) and Russia (5.3%, 1.5%, 5.2%, and 5.8%, respectively) in the pre-war period, including cereals from the two countries in total – 26.0%, 12.0%, 47%, and 24% each (ResourceTrade.Earth, 2023). In terms of changes in global food security indicators, the Russian-Ukrainian hybrid war has had a greater impact on local food availability than on the overall picture of food security in the world as a whole (Fig. 5).

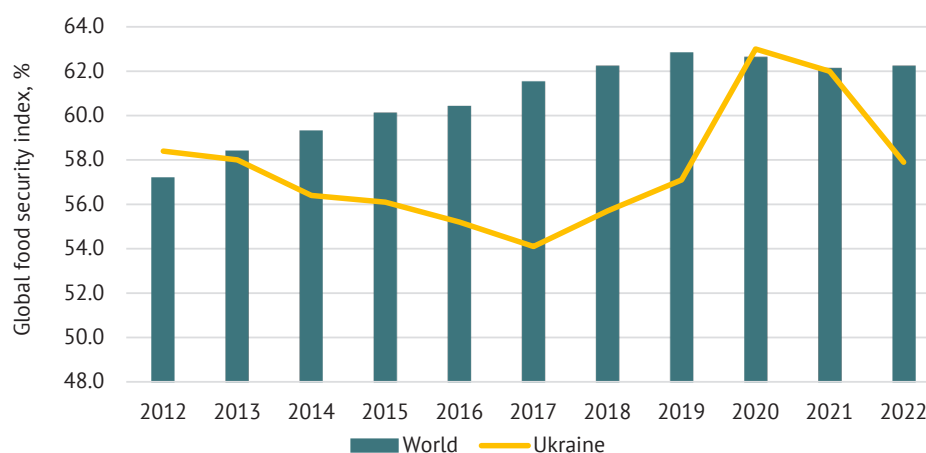


Figure 5. Trends in food security: global and national profiles

Source: developed by the authors of this study based on Economist Impact data (2022)

For Ukraine, in 2022, food security indicators plummeted to their lowest level since 2020, with the food security index falling to 58.4, which is only $\frac{3}{4}$ of the European average (74.8) (Economist impact, 2022). Despite the existing endogenous potential to produce enough food to meet the needs of 400 million people,

about 45% of the population of Ukraine, according to the United Nations World Food Programme, is concerned about the problem of sufficient food, and every fifth resident is forced to reduce the frequency of meals or portion size, and to give up meat consumption in favour of children (World food programme, 2022c).

In the current context of geopolitical and security transformations in the architecture of the global economy, conflicts have been identified as a key driver of food insecurity due to their comprehensive impact on the food supply system – from agricultural production and processing, transportation, and supply of inputs, to marketing and consumption, financing, and supply chain infrastructure (Economist impact, 2022). At the same time, M. Chepeliev *et al.* (2023) shows the differential impact of war on different countries of the world. Thus, high-income countries (as a group) are much less negatively affected than most low- and middle-income countries. While direct shocks to agriculture have a negative impact on high-income economies, rising energy prices benefit energy-exporting countries in this group (the United States, Qatar, Saudi Arabia, Norway, Australia, Canada, Kuwait, and the United Arab Emirates), leading to an increase in purchasing power and calorie consumption by consumers.

The study of the impact of the war in Ukraine also shows changes in the positions of players in global markets. S. Jagtap *et al.* (2022) note that the international market demonstrates the significance of goods exported from Ukraine – wheat, maize, sunflower seeds, and oil. With the supply of these products shrinking and demand for them constantly rising, buyers in European countries are looking for alternative suppliers, which opens new opportunities for such important global producers of these products as Argentina, Australia, Brazil, Canada, China, India, Mexico, and the United States.

The war in Ukraine has triggered a so-called “three-dimensional” crisis – food, energy, and financial – that has a devastating impact on the most vulnerable people, economies, and countries (World Food Programme, 2022b). Exacerbated by the adverse effects of the COVID-19 pandemic, it has led to the largest increase in the number of people suffering from poverty and hunger since the Second World War (1.7 million people). Considering the high concentration of the global grain market, where Ukraine and Russia’s share of wheat and barley exports together accounted for more than 30%, 36 countries – the most import-dependent and food-vulnerable ones – experienced problems with grain supplies. The overall impact of the Russian-Ukrainian war, including the destruction of the food supply system, has resulted in hunger and malnutrition for 222 million people in 53 countries (Lin *et al.*, 2023). In contrast, EU countries with a high level of food self-sufficiency and, at the same time, dependence on imports of specific goods (e.g., sunflower oil, seafood, etc.) face the problem of their prompt substitution. Furthermore, as the war continues, the dependence of EU agri-food production on imports of key inputs such as energy, feed, and animal nutrition supplements, and fertilisers has become more pronounced (European Parliamentary Research Service, 2022).

The crisis of globalisation and the emergence of its post-industrial paradigm, combined with social

centrism, have affected the understanding of the factors influencing international trade. These ideas have been echoed in studies that distinguish among other factors a category related to human well-being (Guo, 2023). In this context, the relationship between international trade and climate change has also been rethought – the traditional notion that the scale of international trade operations leads to an increase in the ecological footprint and an aggravation of the climate issue (Trade and environment working papers, 2017; Yamaguchi, 2021) has been replaced by arguments in favour of the opposite. Specifically, the impact of climate change on trade is substantiated both in a negative sense – through the destruction of infrastructure (due to extreme weather events such as tornadoes, tropical cyclones, convective storms, floods, etc, forest fires, etc.) and reduced factor productivity (due to impacts on labour productivity and biological effects such as insect infestations or the spread of viruses), and in a positive sense – through the opening of new supply chains (global warming may facilitate the opening of new routes for maritime transport) (Martínez-Martínez *et al.*, 2023).

Recent research contributes to expanding the scope of factors influencing international trade, strengthening the geopolitical (specifically, the growing control of global supply chains by Asian countries) (Elion, 2022) and technological aspects of the impact on international trade (the continued growth of logistics costs). They also focus on global challenges (such as the pandemic, the war in Eastern Europe, etc.). Research is being actively conducted to investigate the interests and capabilities of international trade stakeholders as a separate driving force for its development. Specifically, some researchers argue that trade communities strengthen their power in international trade by stabilising resource flows (Huang *et al.*, 2017) and improving their international position through cooperation with other countries (Dong *et al.*, 2018). Despite the differences between individual wars in terms of their duration, scale, causes of outbreak, and methods of settlement, they all have a common feature – the ability to influence the global economy, creating new geopolitical and economic uncertainty, skyrocketing energy prices, and disrupting global value chains. Under these conditions, disruption of sustainable trade flows caused by military conflicts is an important source of changes in the global economy and the situation of individual countries and entire regions. These violations are understood as a side effect of achieving concrete political and military goals that are achieved militarily (Krpec & Hodulak, 2019).

Price shocks and supply fluctuations in the global food trade are exacerbated by active measures taken by governments (from guaranteed price ceilings for consumers to export restrictions) to protect their populations. Despite the emotional component and variability of such policies, their effect is the same – while

protecting the interests of the population of some countries, they have a detrimental impact on all others, exacerbating agricultural trade deficits, and creating pressure for higher prices (Kleimann, 2022).

Considering Russia's unprecedented armed aggression against Ukraine, it has become an object of study for many researchers and is in the focus of attention of many international organisations and institutions. Thus, the World Bank has identified five of the most vulnerable areas of international trade and investment attraction for which the war in Ukraine has caused radical changes: the commodity market, logistics networks, supply chains, foreign direct investment, and other specific sectors (Ruta, 2023). The World Trade Organisation (WTO) notes that the conflict in Ukraine will affect global trade in commercial services, especially those related to the transport sector, such as container shipping and passenger air travel. Experts of the World Economic Forum primarily note that the war in Ukraine is causing food and fuel crises (World economic forum, 2022). In this context, some researchers note that the war and, as a result, the surge in prices for basic goods will make it difficult for policymakers in some countries to strike a delicate balance between curbing inflation and supporting the economy and its recovery from the pandemic (International Monetary Fund, 2022). In this regard, armed conflict, together with climate change and poverty, are factors that combine to create endemic and pervasive risks to global food security, a new reality with rising food prices and the expectation of problems with securing sufficient food.

CONCLUSIONS

The invasion of Russia provoked the largest civilian casualties in the history of Ukraine's independence, temporary occupation of territories and restrictions on agriculture, destruction of infrastructure, a decline in GDP and trade turnover (over 30%), which slowed economic development. The total losses of the agricultural sector of the economy amounted to USD 40 billion. Ukraine has suffered considerable losses due to the temporary occupation of territories and hostilities on agricultural land; over 2,600 agricultural businesses suffered critical losses during the military invasion of Russia, with sown areas decreasing by 1.9 million hectares. More than 500 thsd t of grain were exported from Ukraine to Russia, and over 20% of livestock and poultry were lost due to shelling.

Agribusinesses are forced to build an adaptive system of functioning that will help to mitigate the determinants of the critical level of vulnerability. These include the need to demine agricultural land; restore the destroyed warehouse infrastructure; establish import logistics for seeds, feed, and fertilisers, and veterinary products; increase agricultural export potential and provide food to the population of frontline areas and combat zones. The revitalisation of Ukraine's

agricultural sector in the post-war period should be aimed at implementing a highly efficient export policy to support the trade balance and contribute to the country's macroeconomic stability.

The agricultural market has proven to be more resilient to fluctuations in external factors than other sectors of the global market. Its resilience is manifested in the ability to recover more quickly (in 2022, global exports of wheat, maize, and sunflower oil increased by an average of 20% compared to 2021). An indicator of elasticity is the price, the amplitude of which varies by commodity item and is higher for cereals (the aggregate price index for cereals in 2022-2023 did not fall below 133) compared to oilseeds (in 2022, the price index for vegetable fats was 111.3). Solving the problem of maintaining equilibrium in the agri-food market requires consolidation of efforts by the international community with the dominance of global social priorities, as countries' implementation of protectionist policies ensures short-term local effects at the national level but increases the impact on global price volatility.

Building a resilient global food security system in turbulent times is a key task for ensuring sustainable development, the anti-trends of which are growing hunger and poverty and the environmental footprint of military operations. The global hunger rate in 2023 did not change significantly (the index value was 18.1), but the proportion of undernourished people actually increased from 7.5% in 2017 to 9.2% in 2022, reaching approximately 735 million. The duration of Russia's aggression causes the world's reactions to its consequences and ways of resolving it to be chaotic. On the one hand, they are manifested in uncoordinated attempts to regulate exports through trade restrictions or speculative measures. On the other hand, countries that have experienced restrictions in access to food or resources for agricultural production are trying to mitigate potential risks or attract the world's attention to resolve the preconditions of the food crisis. The war's further impact on global food security may be exacerbated by the aggravation of the problem of hunger due to the reduction in production by the countries involved in the armed conflict and the effect of sanctions imposed on Russia, or by a surge in prices on the global food and input markets; and by an international response that may either exacerbate the crisis (through trade regulation instruments) or mitigate it (based on the experience of the previous global crisis).

The unpredictability of the timing and outcome of the end of the armed conflict in Ukraine makes it important to continue research in this area. Priority will be given to developments focused on assessing the loss of the country's economic (including export) potential and arguing for the possibility of restoring it, finding ways to restore positions in international commodity markets, and developing multidimensional and multi-lateral efforts to build a sustainable food system.

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CONFLICT OF INTEREST

The authors of this study declare no conflict of interest.

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Війна в Україні: вплив на світову торгівлю агропродовольчою продукцією

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Анотація. Кон'юнктура та тенденції розвитку світового ринку агропродовольчої продукції є еластичними до кризових та конфліктних ситуацій за участю основних ринкових гравців, що ставить під загрозу можливість забезпечення продовольчої безпеки завдяки блокуванню сталих можливостей міжнародної торгівлі внаслідок руйнування виробничого потенціалу та ланцюгів створення вартості, каналів постачання продукції до країн-споживачів. Метою статті було дослідження особливостей та наслідків впливу російсько-української збройного конфлікту на світову торгівлю аграрною продукцією та продовольчу безпеку на національному й світовому рівнях. Отримані наукові висновки є результатом застосування економіко-статистичного (ряди динаміки, індексний та факторний аналіз) та діалектичного (прийоми індукції та дедукції, аналізу та синтезу) методів наукового пізнання. Встановлено, що універсальними ознаками війн є спроможність впливати на світову економіку, формувати нову геополітичну та економічну невизначеність, стрімке зростання цін на критичні ресурси (енергоносії) та забезпечувати дестабілізацію глобальних ланцюгів створення вартості. Як наслідок, порушення сталих торгових потоків, зумовлене військовими конфліктами, є важливим джерелом змін у світовій економіці та становищі окремих країн і регіонів. Доведено, що військові дії на території України призвели до обмежень у веденні сільського господарства та вимушеної адаптації агробізнесу до факторів критичного рівня вразливості. Фіксуються тенденції до скорочення виробництва та злам традиційних ланцюгів постачання агропродовольчої продукції внаслідок руйнування логістичної інфраструктури, що разом зі скороченням експортних поставок агропродукції та добрив з росії обумовило зростання світових цін на продовольство. В результаті цього формується «ціна» російсько-української війни для світової економіки, елементами якої є зростаючі голод та бідність, а також екологічний слід військових операцій. Практичне значення результатів дослідження полягає у можливості їх застосування в процесі стратегічного планування та обґрунтування напрямів повоєнної відбудови національної економіки в цілому та її аграрного сектора зокрема, а також відновлення й посилення ролі України у глобальних продовольчих ланцюгах та протидії голоду

Ключові слова: глобалізація; міжнародна торгівля; світовий ринок продовольства; кон'юнктура ринку продовольства; продовольча безпека