Financial losses of Ukraine’s agricultural exports and ensuring food security during martial law

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Received: June 25, 2022 | Revised: June 26, 2022 | Accepted: June 27, 2022

JEL Classification: H56, Q14.
DOI: 10.38188/2534-9228.22.2.20

Abstract
This article is devoted to study of Ukraine’s agricultural exports and financial losses in agriculture due to russian military aggression. The dynamics and structure of Ukraine’s agricultural exports in 2021 and during martial war are analyzed. The main problems faced by agricultural enterprises during martial law have been identified. It has been established that the suspension of Ukraine’s agricultural exports is connected with blockade of the Black and Azov Seas by the russian military. The material assets and agricultural lands of enterprises were also significantly damaged, and thefts, exportation of grain crops, fuel and mineral fertilizers were observed in the occupied territories in Ukraine. Indirect financial losses of Ukraine’s agricultural exports and agriculture of Ukraine during martial law were determined. The directions of support of Ukraine’s agricultural exports by the Government of Ukraine, world leaders and international organizations during martial law are studied. The directions of optimization economic activity of agrarian enterprises of Ukraine during martial law are substantiated. Ways to diversify logistics routes for Ukraine’s agricultural exports and food security in the world during martial law are proposed. The need to unblock Ukraine’s agricultural exports in order to prevent food starvation in African countries and ensuring food security in the world is pointed out.

Keywords: agricultural products, export, Ukraine, war, food security, ports blockade, financial losses.

Introduction

Ukraine is one of the world leaders in export of agricultural products, which ensures food security not only in the country, but also in the world. Ukraine’s agricultural sector shows an increase in productivity compared to other sectors of the economy due to more efficient use of land resources, seeds and animals, fertilizers and equipment. All this allows us to increase agricultural exports in the world. Exports of agricultural products in Ukraine account for 40% of the country’s total exports, i.e. 15% of the country’s GDP (State Statistics Service of Ukraine, 2021). In peacetime, Ukraine exported agricultural products to 191 countries (Ministry of Agrarian Policy and Food of Ukraine, 2021). Agricultural products exported from Ukraine, such as wheat, corn, barley and sunflower oil, are helping to fight hunger in the Middle East and Africa. Executive Director for the UN World Food Programme, David Beasley, said that Ukraine was able to provide grain to 400 million people on earth (United Nations, 2022).

Russia’s full-scale invasion of Ukraine, which began on 24 February 2022, has threatened global food security. Agricultural sector of Ukraine is in a difficult situation: there is a decrease in exports

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due to the blockade of seaports in the Black and Azov Seas, theft and exportation of agricultural products from the occupied territories of Ukraine, disruption of sowing. All these negative processes in Ukraine threaten the supply of agricultural products to the world, which could lead to famine in Asia and Africa. In addition, the creation of a shortage of agricultural products by the war leads to higher prices and negatively affects food security, especially in Africa, the Middle East and partly Central America. According to the UN World Food Programme, already by November 2022, about 1.9 billion people will face food security problems (United Nations, 2022).

All world leaders are looking for effective solutions to alternative logistics routes for exporting agricultural products from Ukraine, unblocking seaports, abolishing export quotas and customs duties on exports from Ukraine, and, in general, ending the war and restoring normal conditions for economic entities.

The military actions of the Russian occupiers lead to significant losses of lives, enterprises and infrastructure. Every sector of Ukraine’s national economy has suffered losses as a result of aggression by Russia. The government estimates that Ukraine will lose 35-50% of GDP (Verkhovna Rada Ukrainy, 2022). Ukraine’s agricultural sector is no exception, which has also suffered significant losses of human resources, crop and livestock products, premises and equipment, fuel and fertilizers. Therefore, there is a need to study the processes taking place in Ukraine’s agricultural sector, to determine the financial losses during martial war, as soon as possible to find diversified areas to ensuring food security in the world.

It should be noted that in the literature there are no in-depth thorough studies of financial losses of Ukraine’s agricultural exports during Russia’s military aggression, including since early 2014. Some aspects of this scientific and practical problem are covered in the economic activity of Ukrainian agricultural enterprises by economic results and impact on food security (Iatsukh, et al., 2017). The authors argue that there is a direct dependence of the government in the formation of food security, which is carried out through appropriate mechanisms of state support. At the same time, as the authors note, due to the relevant state support, agricultural enterprises will be able to avoid threats of managerial nature and effectively use the available resource potential to ensuring food security. Thanks to the synergy of entrepreneurial initiative, state support for agricultural production, there is an opportunity to strengthen Ukraine’s export potential and ensuring food security.

There is research on the concept “economic security” at the individual or household level, which affects the economic affordability of food and economic security of the country. A close relationship has been established between food consumption indicators and the country’s macroeconomic indicators (Mostenska, et al., 2022).

There are studies of impact of COVID-19 on food security in the country. It is stated that Ukraine’s agricultural sector is less vulnerable to a pandemic. Reductions in agricultural production, barriers to access to commodity markets and the closure of borders have led to logistical problems. At the same time, new opportunities for Ukraine’s agricultural sector have emerged – digitalization and expansion of agricultural export markets (Kaminskyi, et al., 2021).

The consequences of military actions on grain exports during 2021-2022 due to the blockade of seaports and the impact on food security in the world have been studied. The directions of partial restoration of agricultural product exports from Ukraine and saturation of raw material markets in the conditions of military actions and post-war restoration are offered (Ostashko, 2020).

A positive aspect in the context of the study of food security in Ukraine and in the world is the various studies and positions of international organizations in the field of agriculture. In particular, such studies concern food security and food in the world, variability in food prices, information support on agricultural exports, the impact of the war on food security in Ukraine, ways to overcome food crises, etc. (CFS, 2015; FAO, IFAD, UNICEF, WFP, WHO, FSIN, HLPE, 2021; FAO, 2022; IFPRI, 2022).
Material and methods

Data from State Statistical Service of Ukraine, the Ministry of Agrarian Policy and Food of Ukraine and analytical results of research by Kyiv School of Economics were used to study the volumes of Ukraine’s agricultural exports and financial losses from Russia’s military aggression. Methods of analysis, dynamics, structure, generalization, comparison, graphic method were used to estimate the volumes of Ukraine’s agricultural exports and financial losses. In the process of analyzing the literature on the problems of agricultural exports and financial losses during martial law, the monographic method was used. Materials from international organizations that study the problems to ensuring food security in the world were also used — CFS, FAO, IFAD, UNICEF, WFP, WHO, FSIN, HLPE, IFPRI, UN.

Results and discussion

The indicator that characterizes the volume of activity agricultural enterprises is the gross harvest. In commodity structure of grain growing in the agricultural enterprises of Ukraine are dominated by grain and oilseeds. The gross harvest of cereals, legumes and oilseeds in Ukraine during 2018-2021 increased (Fig. 1). In 2021, the gross harvest of grain crops in Ukraine increased by 13.9 million tons (by 19.8%), and oilseeds – by 1.9 million tons (by 9.2%) compared to 2018. Compared to 2020, the gross harvest also increased by 19.0 million tons (by 29.2%) and 4.1 million tons (by 22.2), respectively. It should be noted that due to favorable natural and climatic conditions, efficient and timely implementation of agricultural work, agricultural enterprises of Ukraine managed to collect a record amount of grain and oilseeds.

Increasing the yield of grain and oilseeds in Ukraine contributed to the growth of exports and revenues from the sale of agricultural products abroad.

The monthly dynamics of Ukraine’s agricultural exports abroad characterized by seasonal fluctuations (Fig. 2). Before beginning of Russia’s military aggression in January-February 2022, the export of agricultural products exceeded the indicators of 2021 by 2.2 and 1.5 times, respectively. In March 2022, Ukraine’s agricultural exports decreased by 57.1% compared to 2021. The lowest volumes of Ukraine’s agricultural exports were observed in April 2022 – 0.9 million tons (decreased by 73.5%). In May 2022, the volume of Ukraine’s agricultural exports decreased by 62.5%.

![Figure 1. Gross harvest of cereals, legumes and oilseeds in Ukraine, 2018-2021, million tons](source)

![Figure 2. Ukrainian grain exports, 2021-2022, million tons](source)
The decrease in the volume of Ukraine’s agricultural exports in June 2022 is evidenced by the data in Table 1.

Table 1. Exports from Ukraine of cereals, legumes (with products of their processing) and flour 2020/2022 marketing years, thousand tons, 24 June 2022

<table>
<thead>
<tr>
<th>Agricultural products</th>
<th>2020/2021 marketing year</th>
<th>2021/2022 marketing year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>including in June</td>
</tr>
<tr>
<td>Cereals and legumes, total</td>
<td>43939</td>
<td>1747</td>
</tr>
<tr>
<td>wheat</td>
<td>16413</td>
<td>436</td>
</tr>
<tr>
<td>barley</td>
<td>4210</td>
<td>64</td>
</tr>
<tr>
<td>rye</td>
<td>15,8</td>
<td>11,5</td>
</tr>
<tr>
<td>corn</td>
<td>22596</td>
<td>1223</td>
</tr>
<tr>
<td>Wheat flour</td>
<td>123,7</td>
<td>12</td>
</tr>
<tr>
<td>Other flour</td>
<td>1,1</td>
<td>0</td>
</tr>
<tr>
<td>Flour together</td>
<td>124,8</td>
<td>12</td>
</tr>
<tr>
<td>Export together (grain and flour)</td>
<td>44105</td>
<td>1763</td>
</tr>
</tbody>
</table>

Source: calculated by authors based on the Ministry of Agrarian Policy and Food of Ukraine

In June 2022, all types of agricultural exports decreased. In June 2022, compared to the same period last year, the largest reduction in exports among cereals was wheat – by 79.6%, and flour – by 86.7%. In general, the volume of Ukraine’s agricultural exports in June 2022 decreased by 41.3% compared to the same period in 2021.

In the structure of export revenue from the sale of agricultural products, occupy the largest share by cereals and oilseeds (Fig. 3).

In 2021, the largest amount of export revenue received from sale of grain crops – 15.5 billion dollars USA and oilseeds – 7.0 billion dollars USA. The total amount of export revenue from sale of agricultural products in Ukraine in 2021 amounted to 27.6 billion dollars USA. In January-April 2022, Ukraine received 4.72 billion dollars USA from exports of agricultural products abroad, which is 3.0% more than in the same period last year (Ministry of Agrarian Policy and Food of Ukraine). It should be noted that the changes were due to rising prices for agricultural products in foreign markets (in commodity form, the volume of exports according to previous studies decreased, Fig.2).

Figure 3. Export revenue from sales of agricultural products in Ukraine, 2021, billion dollars USA

Source: calculated by authors based on the State Statistics Service of Ukraine

The largest consumers of Ukrainian agricultural products are Asian countries – 49% and the EU – 30% (Fig.4).
Consider the financial losses of Ukraine’s agricultural exports due to Russia’s military aggression in terms of losses due to declining production in crop and livestock, blocking seaports in the Black and Azov Seas, rising fuel and fertilizer prices (Table 2). It should be noted that we consider financial losses of Ukraine’s agricultural exports not only from the reduction of foreign exchange earnings, but also at the level of economic activity of Ukraine’s agricultural enterprises, as there is damage to property and equipment, agricultural machinery, other infrastructure, seeds and animals, reducing the size of sown areas, etc. As of 09 June 2022, indirect financial losses due to reduced production in crop production amounted to 9851 million dollars USA, in animal husbandry – 2995.26 million dollars USA.

The decrease in the volume of agricultural production in crop production is due to direct soil damage, mine pollution, especially in the frontline and occupied territories of Ukraine. The liberated territories of Ukraine, which have been fighting until recently, are also a threat, as unexploded ordnance remains there, posing a mortal danger and a threat to agricultural enterprises and farmers for fieldwork. Such agricultural land requires careful inspection, demining and additional costs for land restoration.

The decline in agricultural production in livestock is due to the death of animals from active hostilities and limited physical access to them, opportunities to purchase feed and provide veterinary services.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial losses due to reduced production in crop production:</td>
<td>9851</td>
</tr>
<tr>
<td>wheat</td>
<td>2027</td>
</tr>
<tr>
<td>corn</td>
<td>1296</td>
</tr>
<tr>
<td>barley</td>
<td>564</td>
</tr>
<tr>
<td>sunflower</td>
<td>2427</td>
</tr>
<tr>
<td>grain crops</td>
<td>35</td>
</tr>
<tr>
<td>bone cultures</td>
<td>98</td>
</tr>
<tr>
<td>berries</td>
<td>89</td>
</tr>
<tr>
<td>other cultures</td>
<td>3315</td>
</tr>
<tr>
<td>Financial losses due to reduced production in livestock:</td>
<td>2995.26</td>
</tr>
<tr>
<td>Animal</td>
<td>Quantity</td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
</tr>
<tr>
<td>cattle</td>
<td>64</td>
</tr>
<tr>
<td>pigs</td>
<td>327</td>
</tr>
<tr>
<td>sheep and goats</td>
<td>2316</td>
</tr>
<tr>
<td>bird</td>
<td>41</td>
</tr>
<tr>
<td>milk</td>
<td>0.26</td>
</tr>
<tr>
<td>eggs</td>
<td>247</td>
</tr>
</tbody>
</table>

Financial losses from blocking seaports:
- wheat: 1,193,500,000 USD
- corn: 2,958,000,000 USD
- barley: 412,700,000 USD
- sunflower: 4,180,000,000 USD

Losses of production resources:
- fertilizer: 859,000,000 USD
- fuel: 480,000,000 USD

Total: 25,640,200,000 USD

Source: calculated by authors based on the Ministry of Agrarian Policy and Food of Ukraine and the Kyiv School of Economics

After 24 February 2022, Russian troops completely blocked the seaports of the Black and Azov Seas, destroying port infrastructure, seizing and blocking merchant ships. Most seaports had to be closed, and the invaders seized the ports of Skadovsk, Kherson, and Berdyansk, stopping Ukraine’s agricultural exports abroad. Financial losses from the blockade of seaports estimated at 1,193.5 million dollars USA.

Fertilizers and fuel of Ukraine’s agricultural enterprises were also physically damaged and stolen through looting by the Russian occupiers. The total financial losses from these production resources is 859 million dollars USA.

In addition, the destruction of refineries in Ukraine has led to a significant increase in the cost of fuels and lubricants, which may affect production costs and selling prices for agricultural products.

In structure of indirect financial losses of Ukraine’s agricultural sector, the largest share occupied by losses from the blockade of seaports – 51%, which directly affected the decrease in exports of cereals and oilseeds and foreign exchange earnings, as well as decrease in crop production – 42% (Fig. 5).

As a result of the blockade of the seaports of the Black and Azov Seas, Ukraine’s agricultural enterprises faced oversaturation of the domestic market of export-oriented products and an increase in the cost of export logistics. This led to decrease in domestic prices for the main export-oriented crops (wheat, corn, barley, sunflower) by more than 30%, depending on the types of agricultural products (Fig. 6).

![Figure 5. Structure of indirect financial losses of Ukraine’s agricultural sector by categories during martial law, 24 February – 14 June 2022, %](image-url)

Source: calculated by authors based on the Kyiv School of Economics
We have considered the financial losses of Ukraine’s agricultural sector in the categories of resources the agricultural enterprises during martial law (Table 3, Fig. 7). The total amount of damage as of 14 June 2022 amounted to 4291.6 million dollars USA. The greatest damage was suffered by agricultural lands and unharvested winter crops – 2135 million dollars USD (50% of total financial losses) and machinery – 926.1 million dollars USA (22% of total financial losses).

Figure 6. Losses of Ukrainian agricultural producers by type due to naval blockade during martial law, 24 February – 14 June 2022, %

Source: calculated by authors based on the Kyiv School of Economics

Table 3 – Amount of losses in the agricultural sector of Ukraine by category during martial law, million dollars USA, 14 June 2022

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural lands and unharvested winter crops</td>
<td>2135,0</td>
</tr>
<tr>
<td>Agricultural machinery</td>
<td>926,1</td>
</tr>
<tr>
<td>Warehouses</td>
<td>272,4</td>
</tr>
<tr>
<td>Livestock</td>
<td>136,4</td>
</tr>
<tr>
<td>Perennial crops</td>
<td>89,1</td>
</tr>
<tr>
<td>Fuel</td>
<td>119,6</td>
</tr>
<tr>
<td>Stored agricultural products</td>
<td>613,0</td>
</tr>
<tr>
<td>Total:</td>
<td>4291,6</td>
</tr>
</tbody>
</table>

Source: calculated by authors based on the Kyiv School of Economics

Figure 7. Structure of losses in the agricultural sector of Ukraine by category during martial law, 14 June 2022, %

Source: calculated by authors based on the Kyiv School of Economics
Taking into account our research, we will identify and describe the key problems faced by Ukraine’s agricultural enterprises regarding the export of products during martial war:

1. Blocking the export of agricultural products due to closure of seaports.
2. Overloading of land logistics routes due to offer of orders other economic entities.
3. Deficiency of fuel and lubricants, high price for it.
4. Difficult financial condition of Ukraine’s agricultural enterprises due to inability to pay on loans from commercial banks.
5. Destruction by the occupiers of tangible assets of agricultural enterprises in the occupied territories of Ukraine.
6. Theft by the occupiers and exportation of agricultural products.
7. Damage and mining of large areas of agricultural land.
8. Expectations of low gross harvest of grain and oilseeds.

In order to support Ukraine’s agricultural exports, stabilize the activities of agricultural enterprises and ensuring food security, the government, world leaders and international organizations have taken the following measures during martial law:

- The government has approved a plan to ensuring food security during martial law (Ministerstvo ahrarnoi polityky ta prodovolstva Ukraïny).
- From 01 March 2022 and for another year after the end of martial law, the territories where hostilities were fought or which were temporarily occupied were exempted from paying land tax and rent for land (Verkhovna Rada Ukrainy, 2022).
- On 30 March 2022, the government approved a resolution on guaranteeing the safety of navigation in the waters of Ukrainian ports in the Danube region and transportation by rail (Kabinet Ministriv Ukraïny, 2022).
- Abolition of import duties on Ukrainian goods by the United Kingdom, the European Union and Canada (EEAS, Government of UK, Government of Canada, 2022).
- Creation of “solidarity routes” for grain exports and imports of necessary goods for Ukraine in order to speed up the passage of goods at the borders between Ukraine and the EU (Ministry for Europe and Foreign Affairs, 2022).
- The European Commission, together with V_labs and the Rail Cargo Group, has launched the Grainlane grain trading platform, which will help optimize grain exports from Ukraine to EU member states. The platform created for sale and purchase of agricultural goods, uniting and strengthening contacts between representatives of European logistics and Ukrainian traders and farmers at the international level. (Verkhovna Rada Ukraïny, 2022).

We consider it expedient to supplement our own proposals to ensure access of agricultural products to international markets and to promote Ukraine agricultural exports during martial law:

1. Construction of temporary storage facilities for grain storage in the border areas with the European Union (Poland, Slovakia, Romania) and the development of transport logistics for the supply of agricultural products to consumers.
2. Development of alternative routes for sea (Black and Baltic Seas) and river exports (Danube) using the potential of ports in the cities of Constanta, Klaipeda, Gdansk, Swinoujscie and the formation of humanitarian corridors (Bulgaria, Turkey, Romania).
3. Increasing the capacity of railways and road transport to increase export opportunities for sales of agricultural products in Ukraine and abroad.
4. Acceleration of customs procedures for registration of export cargoes of agricultural products abroad.
5. Arrangement of points reloading of cargoes from railway cars from the territory of Ukraine to the EU countries through various railway tracks in the countries.
6. Use of multimodal transportation, when part of the way Ukrainian cargoes with
agricultural products are overcome by rail or road transports, and then – through the seaports of other countries to the destination. In our opinion, the areas of optimization economic activity and improvement of financial condition of Ukraine’s agricultural enterprises during martial law, which will promote the export of agricultural products and ensuring food security, should be:

- Revision of technological processes in order to optimize operating costs.
- Transfer of equipment and agricultural machinery from dangerous regions of Ukraine to other facilities or warehouses.
- Suspension of investment and production projects.
- Development of alternative logistics routes, storage, transshipment and review of markets for agricultural products.
- Search for alternatives to import substitution of production resources (mineral fertilizers, fuels and lubricants) for agricultural production.

Conclusions

Ukraine’s agricultural sector focused on meeting domestic needs and exporting agricultural products abroad in order to ensuring food security. Ukraine’s agricultural enterprises have sufficient resource potential to organize production in the crop and livestock sectors. Much of agricultural products exported abroad. The main markets are Asia and Africa, the European Union. Studies have shown that in 2021, Ukraine’s agricultural enterprises received high yields of grain and oilseeds, which contributed to increased exports of agricultural products abroad and ensure food security. Negative changes caused by Russia’s military aggression and occupation of Ukraine have given rise to a number of problems in agricultural sector of the national economy. First of all, it concerns the export of grain and oilseeds abroad and the threat to food security, especially in Africa. Ukraine’s agricultural enterprises faced the problems of destruction of material assets, damage to land, timely implementation of fieldwork, theft and importation of grain crops, etc.

During martial law, Ukraine suffered significant financial losses in various sectors of the economy. Indirect financial losses in the agricultural sector due to difficulty of exporting grain and oilseeds, and the activities of agricultural enterprises amounted to about 25.6 billion dollars USA. The main financial losses related to blockade of the Black and Azov Seas and the impossibility of exporting agricultural products abroad.

The government, world leaders and international organizations have taken decisive action to find ways to grain exports, support agricultural enterprises and diversify logistics routes for the supply of agricultural products to ensuring food security.

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