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НАЦІОНАЛЬНИЙ УНІВЕРСТИТЕТ БІОРЕСУРСІВ І ПРИРОДОКОРИСТУВАННЯ УКРАЇНИ

Факультет аграрного менеджменту

ДОПУСКАЄТЬСЯ ДО ЗАХИСТУ
В.о. завідувача кафедри
адміністративного менеджменту та ЗЕД

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БАКАЛАВРСЬКА КВАЛІФІКАЦІЙНА РОБОТА

на тему

«Підвищення рівня продовольчої безпеки в Україні в умовах сучасних викликів»
«Improving the level of food security in Ukraine under the conditions of global challenges»

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КИЇВ – 2024

НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ БІОРЕСУРСІВ І ПРИРОДОКОРИСТУВАННЯ УКРАЇНИ
Факультет аграрного менеджменту

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ЗАВДАННЯ
на виконання бакалаврської кваліфікаційної роботи студенту
Бєлозерських Марії Василівні

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Перелік питань, які потрібно розробити:
1. ТЕОРЕТИЧНЕ ПІДГРУНТЯ ПРОДОВОЛЬЧОЇ БЕЗПЕКИ
2. ЗМІНИ ПРОДОВОЛЬЧОЇ БЕЗПЕКИ В УМОВАХ КОЛИВАННЯ ІНФЛЯЦІЇ, ЕКСПОРТУ ТА ІМПОРТУ ТОВАРІВ В УКРАЇНІ
3. ПОРІВНЯННЯ КОРЕЛЯЦІЇ ВВП ТА ІСЦ ДВОХ ПЕРІОДІВ ТА АНАЛІЗ ДІЙ ДЛЯ ЗАБЕЗПЕЧЕННЯ ПРОДОВОЛЬЧОЇ БЕЗПЕКИ НА РІВНІ УРЯДУ ТА БІЗНЕСУ

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INTRODUCTION

Food security is a critical issue facing nations worldwide, particularly in the context of global challenges such as pandemics and military conflicts. This thesis focuses on exploring the dynamics of food security in Ukraine, a country deeply impacted by both the COVID-19 pandemic and the invasion by Russia in February 2022. The aim is to shed light on the measures taken to safeguard food security in Ukraine during these tumultuous times, while also identifying the ongoing challenges faced by the nation.

The research effort seeks to delve into the practical implementation of food security strategies in Ukraine, examining the actions taken by the government and support programs initiated by partner countries. Additionally, the thesis includes a case study of an internal company, offering insights into efforts made at the enterprise level to enhance local food security. To guide this investigation, a central research question has been formulated:

"What are the challenges facing Ukraine in terms of food security during military conditions, and what actions should be taken by the government and businesses to address them?"

To address this research question effectively, several partial objectives have been outlined:

- Providing a theoretical background of food security, including its history and development.
- Analyzing the structure of agriculture in Ukraine.
- Researching changes in food security dynamics.
- Evaluating food inflation, export, and import of commodities in Ukraine.
- Examining governmental efforts regarding food security.
- Analyzing initiatives taken by enterprises to enhance local food security.
- Correlation comparison of the impact of COVID-19 and a full-scale invasion of food security.

The successful achievement of these objectives will contribute to a comprehensive understanding of the actions necessary to regulate food security in

Ukraine amid aggressive events. Moreover, the findings can inform the development of protocols for action in crisis situations within Ukraine and serve as a valuable resource for international organizations and individual countries facing similar challenges.

The thesis adopts a practical investigation approach, utilizing a combination of primary and secondary data sources. Secondary data sources, including journal articles, books, and reports from reputable institutions, were reviewed to establish background information. Context indicators such as welfare levels, export-import fluctuations, and household shares were integrated into the methodology to ensure the reliability and comprehensiveness of the collected data.

A quantitative research design was employed, involving a data survey complemented by the primary data collection method. The survey followed a four-step algorithm: information gathering, data evaluation and selection, data processing, and quantitative data design. Research activities were conducted online through scientific and statistical databases, allowing for a systematic and comparative analysis across different countries and regions. By integrating context indicators and utilizing quantitative methods, the research aligns with broader goals and emphasizes the importance of monitoring and evaluating progress towards food security objectives.

Thematic analysis was chosen as the method to analyze the data collected from the research, involving the following steps: data collection through transcription and processing, data analysis including familiarization, coding, and categorization, integration with theory by quoting and illustrating, and finally, offering recommendations and future perspectives through summarization.

In order to understand the relationship between the consumer price index and the gross domestic product, a correlation was used and divided for comparison into two periods: covid 19 and a full-scale invasion. Correlation is used to establish a potential linear relationship between two continuous variables. In economics, correlated variables can include the connection between demand and price, as well as the association between GDP and consumer spending.The Pearson formula was used

to calculate the correlation:

Formula 1: Calculation of correlation:

$$r = \frac{\mathrm{n}\,(\sum xy)\; - (\sum x\,)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x\,)^2] \cdot [n\sum y^2 - (\sum y\,)^2]}}$$

Where: n = the number of data points, i.e., (*x*, *y*) pairs, in the data set.

$\sum XY$ = the sum of the product of the *x*-value and *y*-value for each point in the data set.

$\sum X$ = the sum of the *x*-values in the data set.

$\sum Y$ = the sum of the *y*-values in the data set.

$\sum X2$ = the sum of the squares of the *x*-values in the data set.

$\sum Y2$ = the sum of the squares of the *y*-values in the data set.

Methodology included the following steps:

- Data Preparation: Consumer price index, gross domestic product were collected for 2017 – 2023 were organized in Excel spreadsheets.
- Period Division: We divided data for tree periods: whole period(2017-2023), Covid 19 (2019-2022) and full scale invasion(2022-2023).
- Calculation: For each periods, we calculated the correlation using the equation mentioned above.
- Validation and Interpretation: the interpretation of the results is described below.

1. THEORETICAL BACKGROUND OF FOOD SECURITY

1.1. Food security

Food security is established when every individual consistently has the means to obtain an ample supply of safe and nourishing food, both economically and physically, catering to their dietary requirements and preferences, enabling them to lead an active and healthy life (World Food Summit, 1996).

In the 2024th, humans are more protected than ever before due to human development and regulations that have been established throughout the centuries. These advancements have contributed to improved food production, distribution systems, and safety standards, ensuring that a larger proportion of the global population has access to adequate nutrition. However, despite these progressions, challenges such as climate change, economic disparities, and geopolitical conflicts continue to pose threats to food security, underscoring the need for ongoing vigilance and proactive measures to safeguard access to nutritious food for all.

The demand for food is on the rise due to various shifts in population and demographics, including population growth, shifts in population demographics, increased consumption, and urbanization. Contemporary food production methods contribute to significant waste and are linked to a rising public health concern related to obesity, diabetes, and other non-communicable diseases. Addressing the complexities of food security necessitates more than simply enhancing agricultural yields; it requires systemic changes in farming practices to ensure sustainable and resilient food production that can meet the nutritional needs of both local and global populations (Thomas, Murphy, Murray 2017).

Food insecurity, as evaluated in food security surveys and reflected in USDA reports, refers to a household's economic and social state characterized by restricted or uncertain access to sufficient food. Hunger, on the other hand, is an individual's physiological state that can arise due to food insecurity. Low food security is indicated by reports of diminished quality, variety, or appeal of the diet, without clear evidence of reduced food consumption. Conversely, very low food security is

denoted by reports of various disruptions in eating patterns and decreased food intake (United States Department of Agriculture 2023).

Merely having sufficient food available in a community is insignificant if there are barriers to accessing it. Genuine food security entails individuals having the means to acquire an adequate supply of nutritious food. Access to food is influenced by various factors including physical, social, and policy-related aspects. Elements such as prices, the proximity of households to suppliers, and the quality of infrastructure all impact our ability to access food (Fahy 2022).

Food security is better understood as a connected pathway that starts from production, goes through distribution and processing, and ends with consumption. Rather than viewing it as separate "pillars," it's recognized as a dynamic process. Food security and insecurity are influenced by various factors and change over time depending on how people deal with challenges. Finding universal indicators to measure food security is difficult, as different levels require different measures. When measuring food security at the household level, five categories of indicators are typically used: dietary diversity, food spending, consumption habits, personal experiences, and self-assessment. In recent discussions, food security, nutrition, and sustainability are often discussed together. Integrating food security into sustainability efforts would greatly contribute to this goal. Ultimately, the aim of all these initiatives is to achieve sustainable food security and nutrition for our planet (Ferranti, Berry, Jock 2019).

Food security is a crucial aspect of well-being that should not be overlooked. It encompasses the idea that everyone should have consistent access to enough safe and nutritious food that suits their dietary preferences, enabling them to lead active and healthy lives. In Sápmi, self-sufficiency in food is lacking, particularly as climate change and the reliance on trade for food systems continue to evolve. This shift raises concerns about traditional food security. There is potential to enhance the use of wild berries, herbs, and locally caught fish, provided issues related to environmental pollution are addressed (Veslemøy Andersen, Eirin Bar, Gun Wirtanen 2018) .

1.1.1. Historical background of food security

In the Declaration of the Human Rights, Article 1 states that every individual has the right to fight for the protection of human rights and fundamental freedoms (United Nations). According to the Special Rapporteur of the United Nations, the right to food is defined. The right to food is systematic, unlimited and stable, direct or through financial resources, access to food to ensure that individuals have access to food that meets both quantitative and qualitative standards, aligning with their cultural heritage, and promoting physical and mental well-being, both individually and collectively, fostering a life of fulfillment and dignity, devoid of fear (United Nations).

The term "food security" was coined in the mid-1970s during the World Food Conference (1974), emphasizing the assurance of stable availability and pricing of essential food items globally and domestically. This meant ensuring a consistent supply of basic foods to support continuous consumption growth and offset price and production fluctuations(FAO Agricultural and Development Economics Division).

Subsequently, in 1983, the Food and Agriculture Organization (FAO) emphasized food access, aiming to guarantee that all individuals always have the physical and economic means to obtain necessary food. Over time, the definition evolved to encompass analysis at individual, household, regional, and national levels (World Food Security1983).

In 1986, the World Bank Report on Poverty and Hunger focused on distinguishing chronic food insecurity, stemming from ongoing poverty and low incomes, from temporary food insecurity triggered by crises like natural disasters or economic collapse (World Bank. 1986). A food security threshold can be calculated as the sum of the cost of a food basket and the cost of other basic necessities, and then compared with available income (US Department of AgricultureWashington, DC, USA).

Attention has shifted towards the ethical and human rights aspects of food security. The Right to Food, recognized in the UN Declaration of Human Rights in 1948, gained formal acknowledgment during the 1996 World Food Summit, paving

the way for a rights-based approach to food security. Presently, over 40 countries include the right to food in their constitutions, with an estimated 54 countries potentially recognizing it judicially (FAO Agricultural and Development Economics Division).

Food security is evaluated through various aspects, including food availability, which pertains to the presence of ample quantities of food meeting appropriate standards, sourced either domestically or through imports, which may include food aid. Another dimension is food access, which concerns individuals' ability to obtain necessary resources to acquire suitable foods for a balanced diet. These resources, termed entitlements, are determined by the socio-economic and political structure of the community, encompassing traditional rights like access to communal resources. Utilization is also crucial, involving the consumption of food alongside essential elements such as clean water, sanitation, and healthcare to attain nutritional well-being, addressing all physiological requirements. This underscores the significance of non-food factors in ensuring food security. Lastly, stability is a fundamental aspect, indicating sustained access to adequate food without the threat of disruption due to sudden crises, be they economic, climatic, or seasonal, thereby encompassing both availability and access dimensions of food security (World Food Summit, 1996).

1.1.2. Food security development

Predicting and comprehending the progression of food security and its responses to forthcoming trends is crucial for crafting effective policies and devising adaptable strategies. Despite an overall stabilization in global food security, there are underlying challenges. While upper middle-income countries exhibit promising advancements, lower middle-income nations witness only temporary progress, and low-income countries are projected to experience a further rise in food-insecure populations. Moreover, heavily indebted poor countries are notably susceptible, confronting economic hurdles and heightened levels of food insecurity. As global food security dynamics evolve, there is a growing need for increased financial resources to establish safety nets, particularly in low-income countries(Johannes

Andree, Lee, Ahmed, Dearborn 2024).

The rise in domestic food prices, indicated by the year-on-year change in a country's Consumer Price Index (CPI) for food, remains elevated. Recent data from the period between December 2023 and March 2024 show persistent high inflation rates in many low- and middle-income nations. Specifically, more than half of low-income countries experience inflation rates exceeding 5 percent, although this represents a slight decrease from the previous update. Similarly, a significant proportion of lower-middle-income countries also face high inflation rates, with no noticeable change. However, there is a slight decline in inflation rates among upper-middle-income countries. In contrast, high-income countries generally experience lower inflation rates. Furthermore, in real terms, food price inflation surpasses overall inflation in over half of the countries where data is available. The ten countries with the highest food price inflation, both nominal and real, are detailed in Table 1, based on the most recent available data between December 2023 and March 2024 (The World Bank, International Bank for Reconstruction and Development 2024).

Table 1: Food Price Inflation: Top 10 List

Country	Nominal food inflation (%YoY)	Country	Real food inflation (%YoY)
Argentina	304	Zimbabwe	37
Lebanon	103	Argentina	28
Zimbabwe	84	Palestinian territories	16
Türkiye	71	Viet Nam	13
Venezuela	59	Egypt	12
Myanmar	51	Malawi	9
Sierra Leone	50	Haiti	7
Egypt	45	Mauritius	6
Palestinian	44	Nigeria	6

territories			
Malawi	42	Guinea	5

Source: International Monetary Fund, Haver Analytics, Trading Economics, and World Bank Real Time Price estimates.

1.2. Food security in the ukrainian legislative

Food security, the state of having reliable access to a sufficient quantity of affordable, nutritious food, is a fundamental human right and a basis of national well-being. In Ukraine, ensuring food security is a critical function of public administration, encompassing a comprehensive legal framework that defines principles, establishes responsibilities, and outlines strategies to safeguard the nation's food supply.

1.2.1. Overview of the constitutional framework of food security in ukraine

The legal framework governing food security in Ukraine is anchored in the definition of food security itself. Article 2.13 of the Law of Ukraine "On State Support of Agriculture of Ukraine" defines food security as the protection of vital human interests, expressed in the state's guarantee of unhindered economic access to food products to maintain normal life activities. This definition underscores the state's responsibility to ensure that all citizens have the opportunity to purchase the necessary food products to meet their basic needs.

The legislation establishes a set of fundamental principles that underpin food security in Ukraine. These principles emphasize the primacy of human rights and freedoms, the rule of law, shared responsibility among stakeholders, timely action to address threats, clear demarcation of powers, and international collaboration. Recognizing the real and potential threats to food security, the legislation outlines strategies to mitigate these risks. Key threats identified include the shadow economy, illegal migration, inadequate food procurement, rising consumer prices, overreliance on external markets, and unsustainable land use practices. To address these threats, the legislation calls for stringent measures, including controls on hazardous imports,

proactive disease prevention strategies, and support for domestic agricultural production.

Article 8 of the legislation emphasizes the importance of domestic food production in ensuring food independence. To achieve this objective, the article establishes a requirement for a minimum share of domestic products in the overall consumption of the population, a figure determined annually by the Cabinet of Ministers. If this share falls below the established level, the government is mandated to implement measures to increase domestic production. Failure to act could be considered a threat to both food security and national security (Bondaryev, Sinichkina 2014).

The legal basis in the field of food security of Ukraine is determining:

- The Constitution of Ukraine;
- Law on Food Safety of Ukraine;
- Laws of Ukraine on the foundations of national security of Ukraine;
- Law of the subsistence minimum;
- Law of state support for agriculture of Ukraine;
- Law of grain and the grain market in Ukraine;
- Law of milk and dairy products;
- Law of the state material reserve;
- Law of the protection of the national producer from dumping imports;
- Law of the safety and quality of food products;
- Law of children's nutrition;
- Law of standardization;
- Law of confirmation of conformity;
- Law of protection of consumer rights;
- Law of ensuring the sanitary and epidemic well-being of the population;
- Law of protection of the population from infectious diseases;
- Law of the state biosafety system during creation, testing, transportation and use of genetically modified organisms (Law of Ukraine on Food Security of Ukraine Article 2. Legal basis of food safety).

The legislation defines the objects and subjects of food safety:

The objects of food security are a person, a household, an administrative-territorial unit, Ukraine. The subjects of ensuring food security are the President of Ukraine, the Verkhovna Rada of Ukraine, the Cabinet of Ministers of Ukraine, the National Security and Defense Council of Ukraine, ministries and other central bodies of executive power, local state administrations and local self-government bodies, citizens of Ukraine, citizens' associations (Law of Food Safety of Ukraine Article 3).

The President of Ukraine is responsible for ensuring the country's food security in accordance with the Constitution and laws of the country. The Verkhovna Rada of Ukraine defines the principles of state policy in this area and forms the legislative framework within its constitutional powers. The Cabinet of Ministers of Ukraine, in turn, is responsible for implementing the state policy of food security, ensuring domestic production of the necessary volume of food, and developing state target programs in this area.

Basic principles and tasks of food security formation:

1) Promoting the dynamic development of all sectors of the agricultural sector of Ukraine's economy, maintaining a high level of their competitiveness.
2) Implementing an effective system for preserving the fertility of agricultural land.
3) Ensuring domestic production of quality and safe food in the quantity necessary to guarantee Ukraine's food security.
4) Maintaining stability in the domestic food market by forming strategic reserves of basic food products.
5) Preventing internal and external threats to food security, minimizing their negative consequences.
6) Promoting among the population the principles of rational nutrition.
7) Improving the system of state regulation and management in the field of food security.

The National Security and Defense Council of Ukraine coordinates the

activities of executive authorities in the field of food security and initiates the development of relevant regulatory acts. Ministries and other central executive bodies perform tasks in the field of food security, ensuring compliance with legislation and developing regulatory acts in this area. Local state administrations are responsible for implementing the state policy in the field of food security in their respective territories and develop programs to improve food provision for the population.

The basic principles of forming food security include ensuring Ukraine's interests in the system of international food security, the food independence of the state, and the availability of quality and safe food for all population groups. The main tasks in this area include promoting the development of the agricultural sector, maintaining stability in the domestic food market, and preventing threats to food security. Also, important tasks include promoting among the population the principles of rational nutrition and improving the system of state regulation in this area.

The primary objectives in managing the local demand for food items involve establishing sensible consumption standards for essential food items across various income brackets to promote the well-being of Ukraine's population. When devising strategies to fulfill these objectives, it's crucial to recognize that food items are fundamental necessities for the population, implying their daily regulated consumption and resulting in limited responsiveness to price changes for basic food items. As a result, government interventions to regulate domestic food demand should encompass initiatives aimed at enhancing household incomes, providing various forms of support to alleviate food costs for specific low-income groups, implementing measures to lower and stabilize food prices, educating the public about the food market's status and the safety of food products, conducting awareness campaigns to encourage healthy eating behaviors, and establishing quality control mechanisms for food products sold while safeguarding consumer rights.

Main directions of the state policy of food security:

- ensuring economic food accessibility;
- physical food accessibility;

- food safety and quality assurance.

Economic accessibility focuses on supporting vulnerable groups through social food programs and regulating markets to maintain affordability of domestically produced food. Physical accessibility involves creating a robust food supply system and improving infrastructure to ensure widespread availability of essential food items. Lastly, ensuring food safety and quality entails incentivizing producers to adhere to quality standards, conducting research on food safety, and disseminating information to consumers about food quality and safety measures. Overall, these initiatives aim to safeguard the nation's food security and promote healthy food choices.

Tools of food security and information support:

1) To implement the main directions of state policy in the sphere of food security formation, government target programs for food security are developed.

2) The development and implementation of state target programs for food security are carried out in accordance with the Law of Ukraine "On State Target Programs".

The assessment of the state of food security in the Ukrainian legislative base is carried out on the basis of the system of criteria prescribed in the law.

Food safety criteria:

1) The threshold criterion for the indicator of food market independence is defined as the ratio of the volume of food grain in state food resources to the volume of domestic consumption of bread and bakery products per capita, as well as the ratio of the volume of import of a particular product in natural terms to the capacity of its domestic market, and it amounts to 20 percent.

2) The threshold criterion for the indicator of economic accessibility of food products is determined as the share of total food expenditure in the overall household expenditure, amounting to 50 percent. The threshold criterion of this indicator will change as real incomes of the population increase.

3) The threshold criterion for the indicator of population consumption of food products is defined as the sum of the products of the unit mass of individual types of

products consumed by a person during a day and their energy value, amounting to 3000 kilocalories per day.

1.2.2. Legislation on food security under martial law

From March 24, 2022, a month after the war, changes were made to certain legislative acts of Ukraine regarding the creation of conditions for ensuring food security under martial law.

The law (№ 2145-IX) introduces simplified legal mechanisms aimed at streamlining various aspects of land use and ownership in the agricultural sector. These mechanisms facilitate several key processes. Firstly, contracts for the utilization of agricultural land plots, regardless of ownership status, are automatically renewed for one year. Secondly, agricultural land owned by state and municipal authorities can be leased out for commercial agricultural production. Moreover, these authorities can also lease such land to their permanent users and leaseholders for the same purpose. Additionally, tenants and subtenants are granted the right to transfer lease and sublease rights of agricultural land for agricultural activities. Finally, the law mandates the state registration of land agreements, ensuring transparency and legal clarity in land transactions within the agricultural sector.

The document aims to facilitate the swift placement of production facilities of enterprises relocated from conflict zones, critical infrastructure objects, and facilities for the temporary accommodation of internally displaced persons. This will be achieved without conducting land auctions and with relaxed leasing conditions. The designation of such enterprises will be made jointly by the two regional military administrations: the one from which the production facilities are being relocated and the one to which they are moving (Ministry of Strategic Industries of Ukraine 2022).

The placement of such production facilities, as well as the construction of river ports (terminals) and railway logistics centers (production-handling complexes), will occur without the need for land survey documentation, approved urban planning documentation, or associated costs. A motivated conclusion from the authorized body of urban planning and architecture of a rural settlement or urban council will suffice.

Furthermore, for these purposes, it is prohibited to use any nature reserves, lands of historical and cultural significance, and to violate land use restrictions. The executive bodies of rural, settlement, and city councils are authorized to provide land plots from municipal property for permanent use for the placement of facilities for the temporary accommodation of internally displaced persons (Press Service of the Apparatus of the Verkhovna Rada of Ukraine 2022).

2. CHANGES IN FOOD SECURITY UNDER THE CONDITIONS OF GLOBAL CHALLENGES

During the period of military aggression, Ukraine has faced significant challenges in ensuring food security, exacerbating an already complex situation. The ongoing conflict has disrupted various aspects of the food supply chain, from production to distribution, leading to heightened food insecurity for many Ukrainians.

One of the primary challenges has been the physical destruction of critical infrastructure, including farmland, storage facilities, and transportation networks, due to air and ground attacks. This destruction has severely hampered agricultural productivity, resulting in reduced crop yields and livestock losses. Additionally, the displacement of populations from conflict-affected areas has further strained food resources, as displaced individuals often lack access to adequate nutrition.

The conflict has also disrupted trade routes and logistics, making it difficult to import essential food items and agricultural inputs. This disruption has led to shortages of certain food products and increased prices, placing additional strain on vulnerable populations. Furthermore, ongoing military operations have created an atmosphere of instability and uncertainty, making it challenging for farmers to plan and execute agricultural activities effectively.

Amid these challenges, addressing food insecurity has become a pressing priority for the Ukrainian government and humanitarian organizations. Efforts to provide humanitarian assistance, such as food aid and nutritional support, have been critical in mitigating the immediate impacts of the conflict on vulnerable populations. Additionally, initiatives to rebuild damaged infrastructure and restore agricultural livelihoods are essential for ensuring long-term food security in Ukraine.

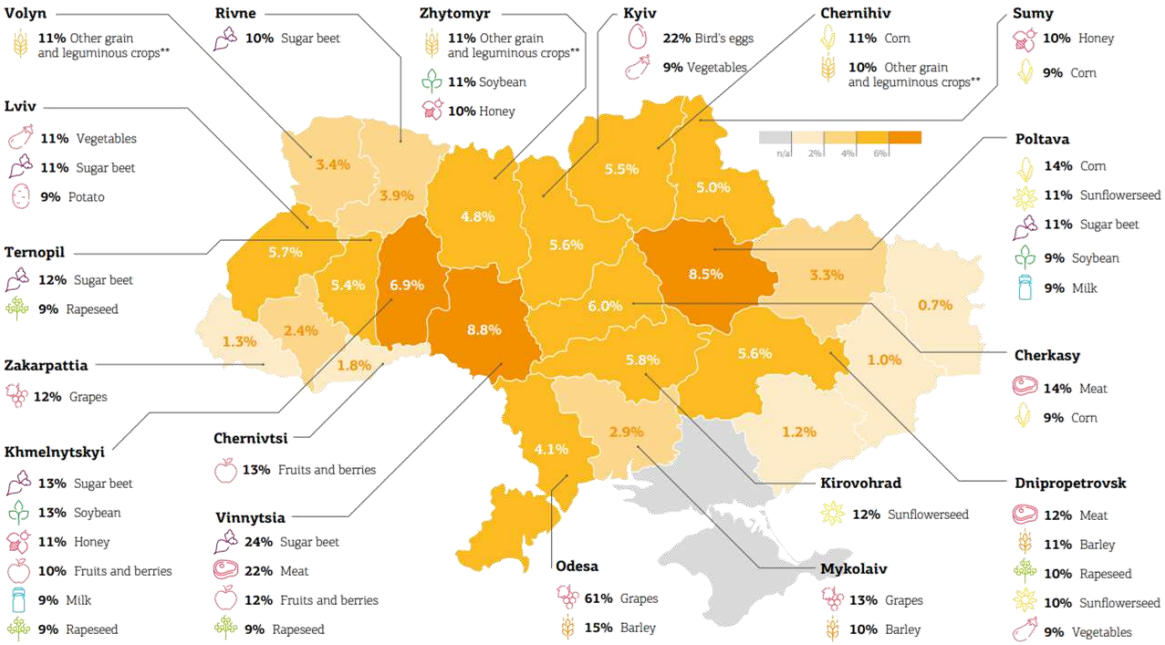
The conflict has forced approximately 3.7 million Ukrainians to flee their homes. Roughly half of these individuals come from southeast region (now occupied by Russia) and Kharkiv (located near the front lines in the northeast). Among the internally displaced population, there is a pressing need for financial assistance to secure food, as many have lost their sources of income. In regions currently under Russian military control and those near the front lines, access to humanitarian aid is

severely restricted. Consequently, many displaced individuals are resorting to cost-cutting measures such as purchasing cheaper food items and non-food essentials, reducing their overall food intake, relying on any savings they may have, or selling off assets when resources become scarce. These coping strategies are also prevalent among households that have not been displaced but still face food insecurity.

2.1. Agricultural production in ukraine

Agricultural production in Ukraine has long been a cornerstone of its economy, with the country's fertile soils and favorable climate making it one of the world's leading grain producers. Ukraine boasts vast expanses of arable land, particularly in the fertile black soil regions, which contribute significantly to its agricultural output. A third of all fertile land in the world is concentrated in Ukraine. The country is renowned for its production of grains such as wheat, barley, and corn, as well as oilseeds like sunflower and rapeseed. These crops are cultivated on a large scale across the country, with modern agricultural practices and machinery increasingly employed to maximize yields.

Figure 1: Share of regions in the country's agricultural production in 2022*, %

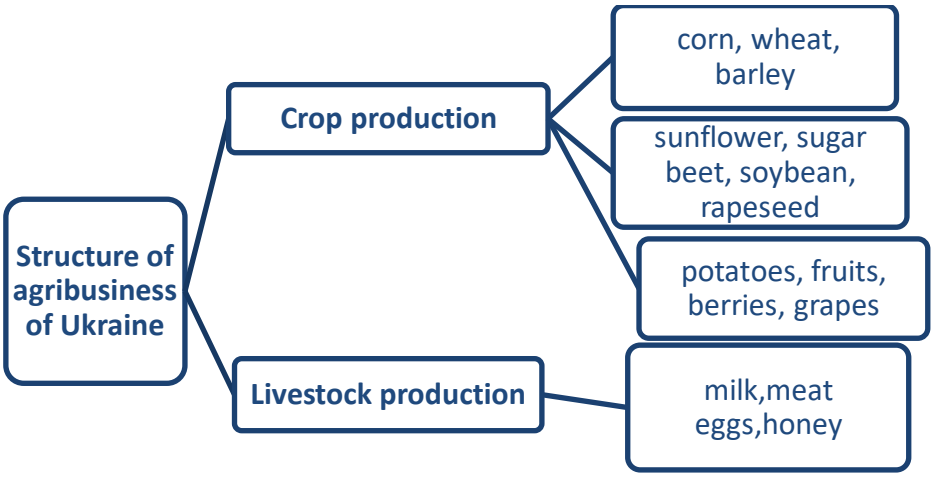


Source: Latifundist Media

In recent years before the full-scale invasion, Ukraine has emerged as a major player in the global agricultural market, leveraging its abundant natural resources and

strategic location to become a key exporter of agricultural commodities. The country's agricultural sector has undergone significant modernization and restructuring since gaining independence in 1991, transitioning from state-controlled farms to a more market-oriented system. This shift has led to increased efficiency and productivity in agricultural production, driving growth and expansion in the sector. Agribusiness in Ukraine consists of crop production and livestock production.

Figure 2: Structure of Agricultural industry in Ukraine



Source: author's own composition

Ukraine is noted for the power of its agro-industrial complex. It is the leader in terms of GDP share among all sectors of the economy. Table 4 shows in detail the dynamics of the share of agro-industrial complex in the country's GDP from 2019 to 2023. Recent years have been characterized by fluctuations in indicators. In particular, 2019 was significantly affected by the global COVID-19 pandemic. Its consequences, such as supply chain disruptions, labor shortages and demand fluctuations, are likely to have affected the overall contribution of agribusiness to GDP.

After a full-scale invasion, Ukraine's positions in the global market shifted. Some agricultural products lost their positions in global exports. However, Ukraine mostly managed to retain them, and in some cases, improve them. The positive change in Ukraine's position for certain products was mostly caused by the restoration of production and exports, as well as improved access of some goods to the European market.

Table 2: Agricultural in the total GDP of Ukraine for 2017-2023, (in million UAH)

	2017	2018	2019	2020	2021	2022	2023
GDP of Ukraine	2 981 227	3 560 302	5 474 745	5 269 289	5 450 849	3 883 262	4 090 019
GDP in the agro-industry in Ukraine	303 419	360 998	577 138	515 399	593 367	444 024	477 962
%, agro-industry in GDP	10,18	10,14	10,54	9,78	10,89	11,43	11,69

Source: author's own composition based on data from State Statistics Service of Ukraine

According to Table 2, it can be seen that the share of GDP in agriculture in the structure of the country is on average 10 percent, which indicates the importance of the industry in the total GDP of the country.

World grain prices have slightly decreased after a rapid rise in March 2022 but remain quite high. Additionally, prices for other agricultural products have significantly increased worldwide.

Due to logistical complications in supply routes, Ukraine's key partners are shifting to other suppliers. For instance, India increased imports of sunflower oil from Russia and Argentina, while China plans to boost corn imports from Brazil.

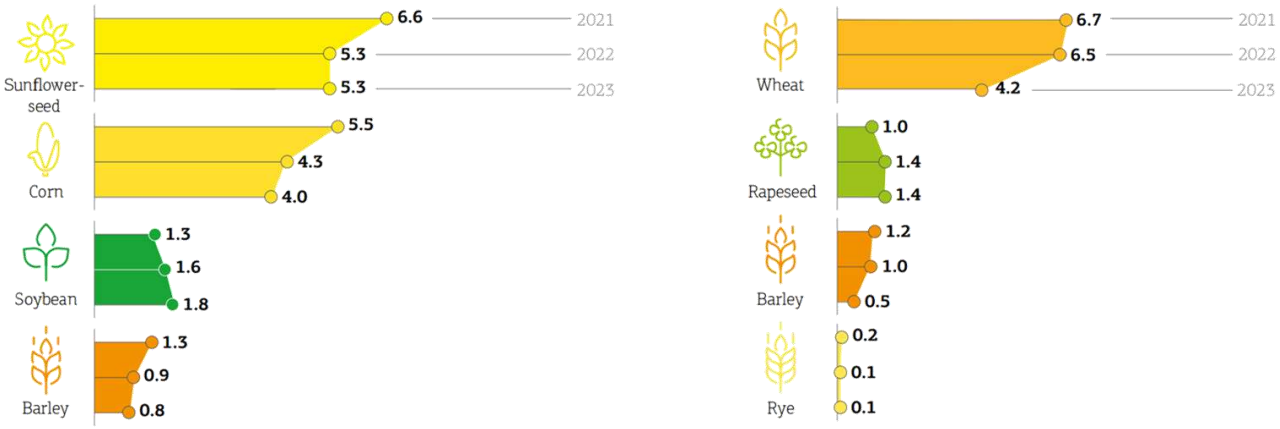
Possible famine in countries dependent on agricultural supplies from Ukraine and the disruption of the world's food system. This situation forces developed countries to allocate additional funds for food security. The situation has partially improved following the launch of the "grain corridor" from Ukrainian ports under the auspices of the UN.

2.1.1. Crop production

Traditionally, agriculture played a key role in the economic life of the Ukrainian people. Agriculture is one of the main branches of Ukraine's economy and is an important source of income for millions of rural residents. Today, Ukraine is known as one of the world's leading producers of grain crops, which include wheat, corn and barley. Crop production in Ukraine is a key sector that ensures food security not only of the country, but also of other countries of the world. A significant part of the products produced by Ukrainian soil is exported to foreign markets, contributing to the stability of the economy and international cooperation.

The general structure of Ukrainian agricultural production The first place belongs to crop production - this is the grain group (corn, wheat, barley). The second place belongs to technical crops - sunflower, sugar beet, soy, rapeseed. The third - for fruits and vegetables (potatoes, other vegetables, fruits, berries, grapes). The fourth place is processed products (sunflower oil, beer, flour, sugar, bakery products). Animal husbandry (milk, meat, eggs, honey) closes the main group of agricultural products in fifth place. The figure 4 describes the ratio of planted areas under winter and spring crops in 2023, based on this photo, you can visually see the ratio of the main crops and fluctuations in volumes over three years (2021-2023).

Figure 3: Sown areas of spring (from the right side) and whinter (from the left side) crops for the year's harvest, mln ha



Source: Latifundist Media

The structure of crop production is clearly demonstrated by the comparison of export volumes to the European Union described in Table 3. The data analyze

changes in exports from 2019 to 2023. A minimal decrease in export volumes is expected during the covid-19 pandemic and already with the beginning of a full-scale invasion. The increase in export volumes to the European Union is associated with changes in export logistics. By 2022, 98% of agricultural products were transported by sea. But due to the blocking of ports, insecurity and economic risks and Solidarity Lanes, the percentage of exports by sea for the period up to and including 2023 is 74.4%.

Table 3: Export structure of crop production to EU (2019-2023), in tons

Crops						
year	wheat	barley	corn	sunflower	soybeans	rapeseed
2022/2023	6 145 968	832 054	14 970 043	1 731 115	1 318 744	2 613 065
2021/2022	353 926	99 582	8 104 488	611 495	442 054	1 816 574
2020/2021	628 288	51 709	6 535 348	199 099	411 359	1 988 462
2019/2020	490 026	522 483	11 421 165	57 922	725 722	2 785 256
2018/2019	776 139	28 328	14 726 316	30 133	363 845	1 864 173
2017/2018	1 568 249	320 215	7 727 773	31 379	801 513	1 677 304
2016/2017	966 148	288 763	8 119 634	126 581	559 989	799 512

Source: author's own composition based on data from agridata.ec.europa.eu

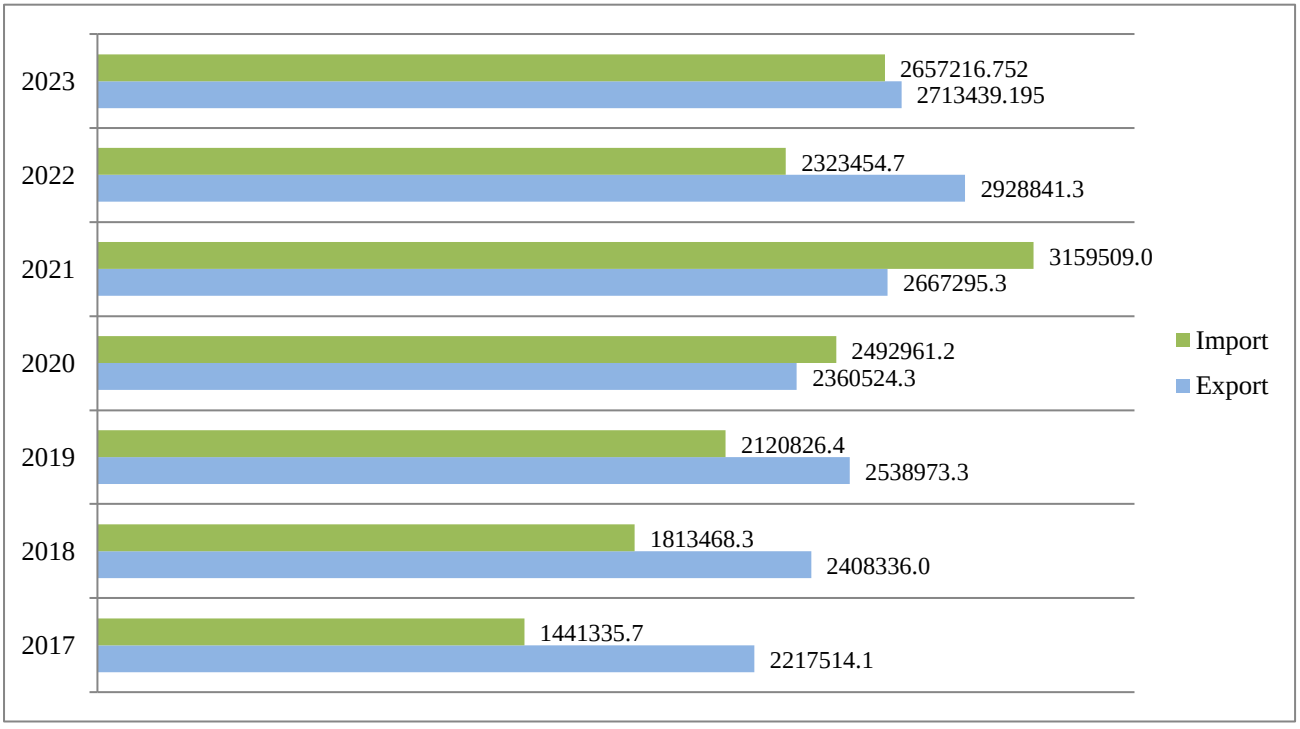
2.1.2. Animal production

Animal husbandry in Ukraine is an important branch of the agricultural industry. It covers the breeding, rearing and processing of various types of livestock, including cattle, pigs, poultry and sheep. Historically, animal husbandry was also an integral part of the agricultural heritage of Ukraine, thanks to the nomadic tribes, and later to the settled population, providing meat, milk and other livestock products for domestic consumption and export. Today, Ukraine is one of the leaders in the world in the production of poultry meat and eggs. In particular, Myronivskyi Hliboprodukt (MHP) is a world leader in the volume of production and export of chicken. The country's favorable climate, large arable land and relatively low production costs

contribute to its competitiveness in livestock production. Despite challenges such as fluctuating market prices, disease outbreaks and infrastructure constraints, the livestock sector continues to play an important role in Ukraine's economy, providing employment opportunities and contributing to food security both within the country. Figure 2 shows the geography of production of livestock products by regions of Ukraine.

A significant portion of the poultry population was lost due to occupation and hostilities in the eastern and southern regions of Ukraine. However, many unaffected poultry farms increased their livestock and established new logistic routes for exports. A positive factor for the poultry industry was improved access to the markets of EU countries, which helped avoid market saturation and slow down the rise in domestic prices.

Figure 4: Export and import of livestock products of Ukraine 2017-2023 (in thousand dollars USA)

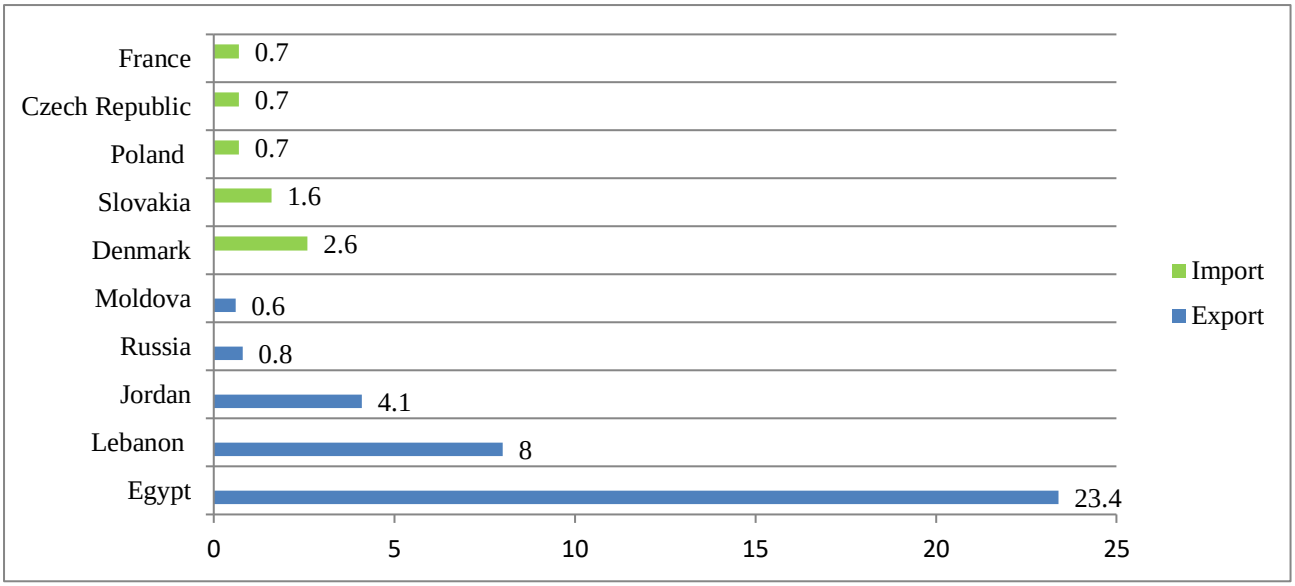


Source: author's own composition based on data from State Customs Service of Ukraine

Figure 5 shows the export and import of livestock products. The ratio of volumes decreased in general, this can be explained by the decrease in the population

in connection with the refugees from military operations and, accordingly, the amount of consumption of livestock products decreased.

Figure 5: Top 5 trade destinations of Ukraine animal products in 2022, in mln USD



Source: author's own composition based on data from Latifundist Media

The image shows a linear graph of Ukraine's export and import of livestock products in five countries: Egypt, Lebanon, Jordan, Russia and Moldova. Russia is included in this schedule due to export volumes prior to the start of a full-scale invasion on February 24, 2022.

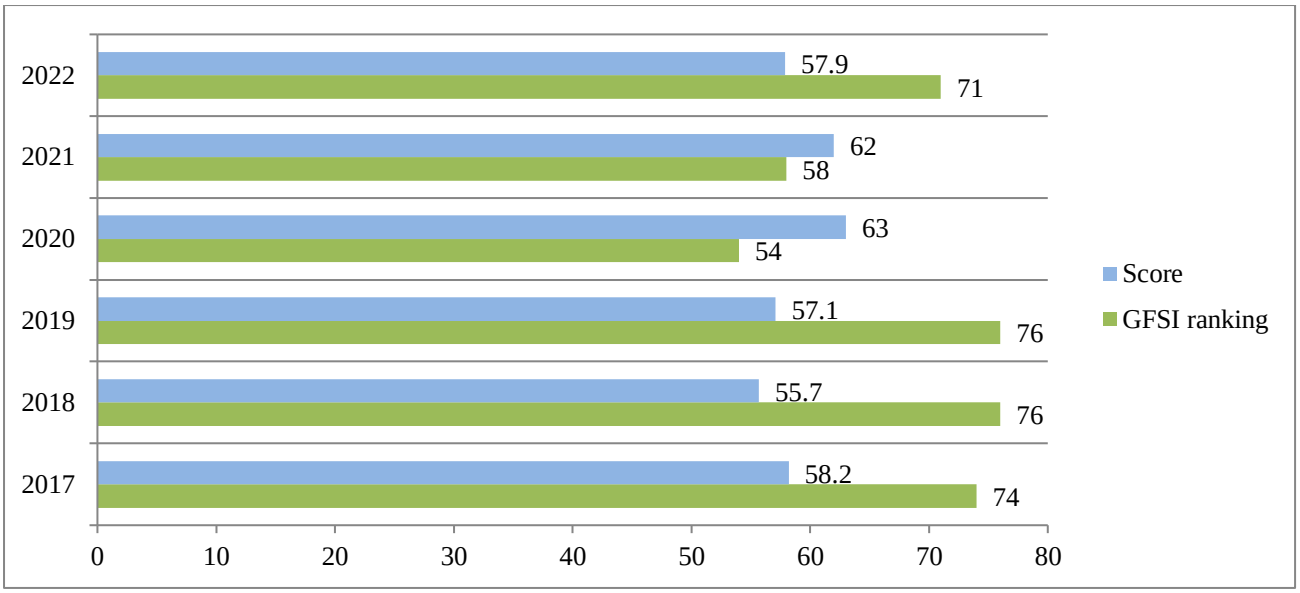
2.2. Food security change

The Global Food Security Index (GFSI) checks every year how safe our food is to eat. It looks at how easy it is to get food, how good the food is, and if it's safe to eat. It also checks if people can afford to buy food and if there are plans to help if food prices go up. It looks at how much food is made, how likely it is that there will be enough food, and if there are ways to make more food. It also looks at how healthy the food is and if it's safe from things that could make us sick and checks how ready countries are for things like climate change and if they're doing things to protect our food in the long run.

Fluctuations in food security can be linked to geopolitical, economic and climatic factors. There is an undeniable trend in the world that the most decisive

factor is the geopolitical one. The decrease in food security is an interrelated process with the onset of military aggression. In addition, the crisis caused by the covid-19 pandemic is a vivid example of an economic crisis.

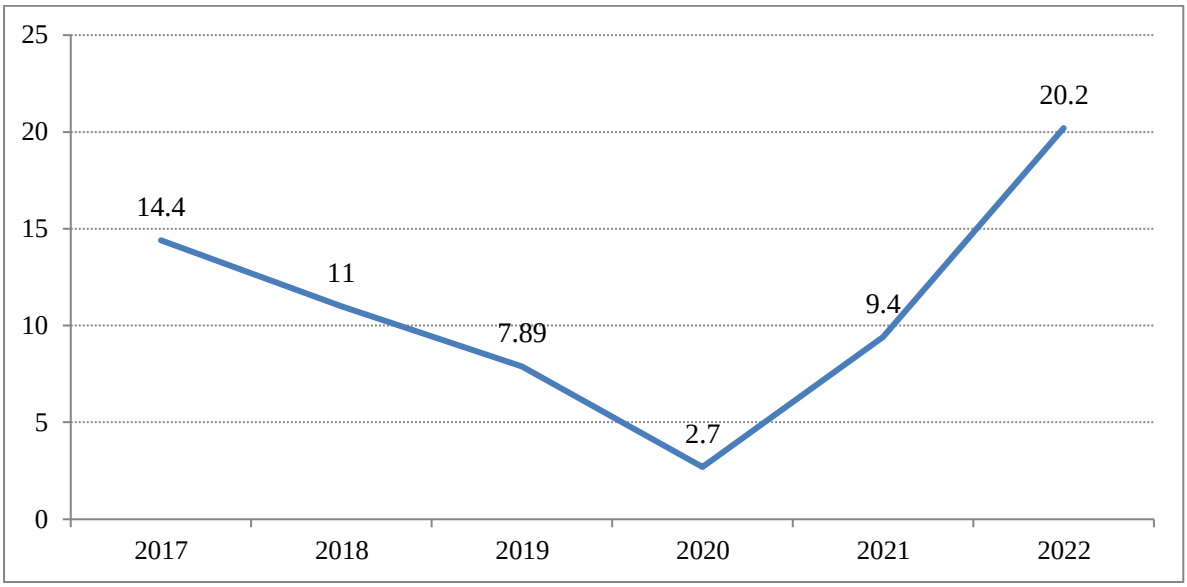
Figure 6: Global Food Security Index of Ukraine 2017-2022



Source: author's own composition based on data from Economist Impact

The figure 6 describes the fluctuations of the country's food security index in the overall global food security rating. Improving food security was one of the conditions of the Association Agreement between Ukraine and the European Union, which entered into force on September 1, 2017. In this way, Ukraine fulfilled its promises and improved food security, which we can see in the positive dynamics from 2017 to 2018, in 2019, the global covid 19 pandemic began, which provoked an economic crisis, which entailed problems with price inflation, unemployment and negative dynamics on well-being in the world in general. In 2022, on February 24th, a full-scale war began, which in turn is one of the most significant factors in food security problems in general in the world. GFSI score overall represents the Global Food Security Index, and the Score indicator determines Ukraine's place in the world ranking.

Figure 7: Inflation rate 2017-2022

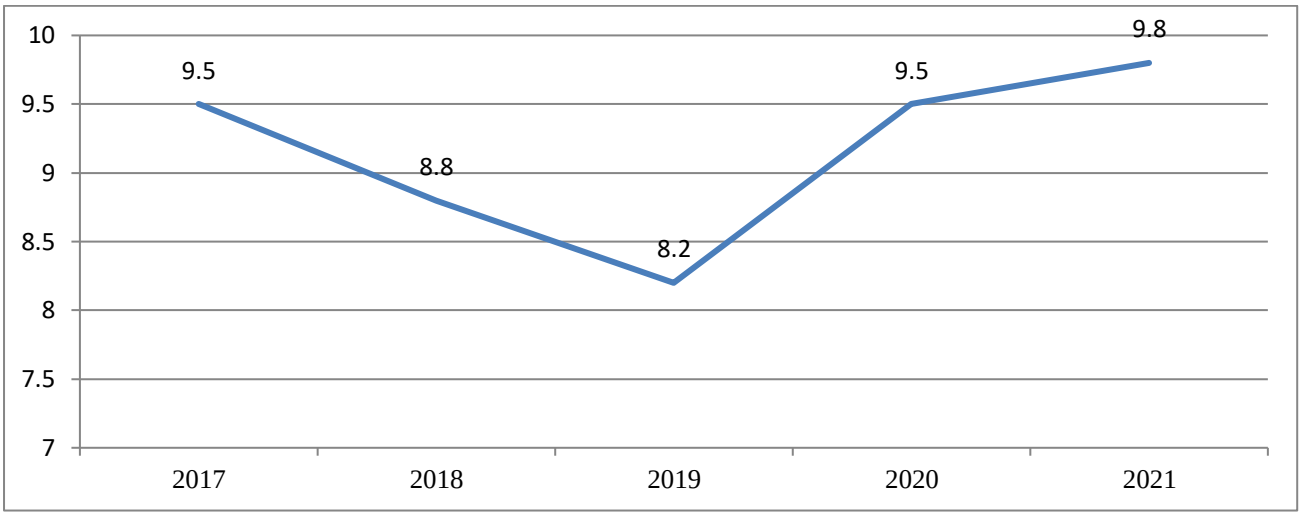


Source: author's own composition based on data from World Bank

The figure 7 shows the average annual inflation rate in Ukraine for the period from 2017 to 2022, as well as the annual change. The level of inflation is measured by percentage changes in the consumer price index for a year.

During the period from 2017 to 2022, Ukraine faced significant fluctuations in the inflation rate. It is worth noting that in 2017, inflation in the country was high, but gradually decreased in the following years. In 2018, it increased slightly due to the increase in the prices of gas and other energy carriers. However, in 2019, there was a noticeable decrease in inflation thanks to the stabilization of the economic situation and the slowdown in price growth. Inflation rose again in 2021, mainly due to the COVID-19 pandemic, which affected the country's economy and led to higher prices for some goods and services.

Figure 8: Unemployment 2017-2021



Source: author's own composition based on data from World Bank

Figure 8 shows changes in unemployment from 2017 to 2021. The last report from the State Statistics Service of Ukraine was published in 2022 for 2021 and was no longer updated.

In 2017, unemployment in Ukraine was at a fairly high level, as the country continued to recover from difficult economic conditions. During the following years, particularly in 2018-2019, unemployment gradually decreased, reflecting some improvement in the economic situation and an increase in the number of employed persons.

In 2020, as a result of the COVID-19 pandemic and related economic difficulties, unemployment in Ukraine increased again. Many companies suffered losses and reduced their workforce, leading to an increase in the number of unemployed.

In 2021, unemployment stabilized again at a certain level, although the economy continued to recover from the challenges of the pandemic. The exact unemployment rate can vary depending on various factors, such as employment policies, market conditions and economic reforms.

Table 4: GDP per capita of Ukraine 2017-2022

Year	GDP Per Capita (US $)	Annual Growth Rate (%)
2022	$4,534	-6.09%
2021	$4,828	28.68%
2020	$3,751	2.47%
2019	$3,661	18.24%
2018	$3,096	17.37%
2017	$2,638	20.60%

Source: author's own composition based on data from World Bank

During the period from 2017 to 2022 (table 4), Ukraine faced various economic conditions that affected the level of income in the country. In 2017, the economy of Ukraine gradually recovered after difficult economic conditions, and, in general, the profits of enterprises and citizens gradually increased.

In 2018-2019, a certain stabilization of the economic situation in the country was observed, and profits increased due to the improvement of business conditions and the growth of investments.

In 2020, the COVID-19 pandemic took place, which significantly affected the country's economy and caused a decline in the profits of many sectors, especially those that were most vulnerable to the effects of the pandemic.

In 2021, Ukraine's economy continues to recover from the pandemic, and profits may begin to grow again. In 2022, changes took place due to the start of a full-scale recession and inflation.

2.2.1 Food security after covid-19 crisis

The COVID-19 crisis had a big effect on how people could get food all around the world. When countries closed down and people couldn't move around much, it made it tough to grow, sell, and buy food like normal. Because many people lost their jobs or had less money during the pandemic, they couldn't afford to buy as much food as they needed. This led to more hunger and not having enough to eat for many families.

In some places, there weren't enough workers or it was too hard to move things around, so it became difficult to grow crops or make food. This meant there was less food available, and some crops got wasted because they couldn't be harvested or sold on time. When markets, restaurants, and stores had to close, it made it even harder for farmers to sell their food. Some food went bad before it could be sold, which meant farmers lost money and people missed out on getting fresh food. With all these problems, the prices of food went up in many places. This made it even tougher for people who didn't have much money to buy enough food for themselves and their families.

Impact of Covid-19 on inflation

The annual change in inflation in Ukraine varied over the course of the emerging period. Based on figure 7 inflation rate was 7.89% in 2019 and then decreased to 2.74% in 2020. Inflation rate rose again to 9.36% in 2021.

Ukraine's GDP per capita, measured in US dollars, experienced a rollercoaster ride from 2019 to 2022. After enjoying steady growth in 2019 (18.24%) and a more modest increase in 2020 (2.47%), the country reached its peak GDP per capita of $4,828 in 2021 (table 3). From table 3 we can conclude that the crisis caused by the covid-19 pandemic had a minimal impact on GDP.

Impact of Covid-19 on unemployment

The percentage (figure 8) of unemployment increased during the crisis caused by the covid-19 pandemic, due to sanitary restrictions, people could not freely visit work, the borders of the countries were closed, which also complicated logistics, and against the background of the constant stay in closed conditions, the percentage of divorces and mental disorders increased.

One of the factors in the reduction of jobs was the optimization of processes in connection with the transition of operational activities and all branches that can work remotely. Thus, it turned out that with remote work, automation and optimization, the number of employees is actually less engaged, besides, due to the restriction of the

work of catering establishments in the field of obedience and entertainment, many people lost their jobs.

Impact of Covid-19 on food security index

According to Figure 6, we can see that the rating of food security in 2019 - 2021 decreased significantly, which indicates an improvement in the level of food security, which means the availability of food, product quality, and, accordingly, standards. In 2019, the GFSI rating was 76 with an index of 57.1. In 2020, the rating dropped again to 54 from a score of 63.

2.2.2. Food security after full-scale invasion

The impact of a full-scale invasion on food security in Ukraine is connected the Ukrainian agricultural sector has suffered substantial losses in resources and infrastructure following the complete invasion. Elevator capacities, in particular, have experienced significant setbacks, with many being destroyed, damaged, or seized by Russian forces. The rehabilitation of Ukraine's agriculture industry is a complex endeavor that hinges on various factors, such as securing investment and funding, stabilizing export channels, and implementing innovative agricultural methods.

Reviving Ukrainian agriculture has the potential to catalyze the adoption of contemporary farming technologies, leading to more efficient resource utilization and enhanced competitiveness. This restoration process holds promise for modernizing agricultural practices, promoting sustainability, and fostering economic growth in the sector. By embracing progressive approaches, Ukraine can leverage its agricultural potential to recover from the impacts of the invasion and emerge stronger in the global market.

Impact of war on inflation

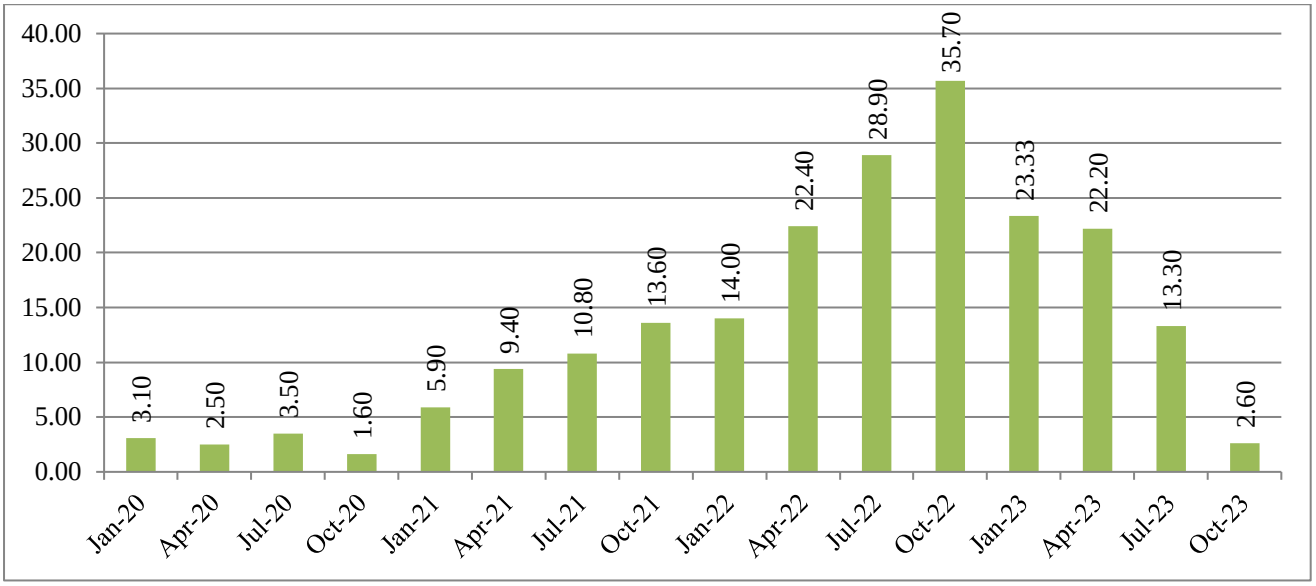
At the end of February 24 in 2022, there was a panic caused by the beginning of a full-scale invasion, due to massive attacks, people began to suddenly withdraw cash, open cells and empty all accounts. This natural phenomenon is associated with a crisis situation.

In order to be able to purchase weapons on the domestic market and to meet needs during the first period of the war, the National Bank of Ukraine (NBU) printed cash, which caused inflation but helped the country survive the first months of a full-scale invasion before international partners began to provide support.

In 2022, due to the start of a full-scale recession and inflation of 10.8% compared to the previous year, the profit did not change significantly (Figure 7).

Despite the ongoing conflict and a bombing campaign by Russia, there have been recent improvements in livelihood conditions in Ukraine. While still significant, the number of people facing food insecurity decreased during 2023 by 1.6 million, dropping from an estimated 8.9 million in 2022, as indicated in the 2024 Humanitarian Response Plan for Ukraine. Additionally, there have been improvements in macroeconomic conditions, with Ukraine's economy showing signs of recovery from the deep recession experienced in 2022. Following a 30% decline in 2022, real GDP increased by 5.7% in 2023. Inflationary pressures have also eased, with overall inflation returning to pre-war levels of 4%-5% annually. Food price inflation also softened, falling from a peak of 35% at the end of 2022 to under 10% in the second half of 2023, then easing further to 3% (year over year) in February 2024 (Figure 1). Food price inflation could be contained in good part because of favorable weather conditions and higher crop production.

Figure 9: Ukraine: Consumer food price inflation Mar 2019-Feb 2024 (y-o-y; in %)



Source: Food Security Portal and Trading Economics

The peak point in October 2022 is associated with massive bombardments of critical infrastructure points, which entailed power outages, manufacturers and stores began to use energy sources such as generators and ecoflow, which significantly increased the cost of food production and storage.

Impact of war on unemployment

Before February 2022, the State Statistics Service of Ukraine was doing a monthly survey to find out about jobs. They asked more than 15 thousand families about work. But since 2022, they stopped doing this survey. So, now we don't have official data about jobs. Instead, we use other ways to guess about the job situation. For example, the central bank looked at surveys from the InfoSapiens research agency and other information. They think the jobless rate in 2022 was about 21 percent. They expect it to go down a bit to 19 percent in 2023. Before 2021, it was only 9.8 percent.

One big problem is that many people can't find work because of big changes. Buildings and things for making things got broken or taken over. Lots of people had to leave their homes and go somewhere else in Ukraine or to another country. But sometimes, their skills aren't what people need in the new place. Also, like in other parts of Europe, there are a lot of older people in the workforce. So, it's important for

people to learn new things or get better at what they know. There are some government programs to help with these problems, but more needs to be done.

Impact of war on food security index

According to figure 6, the index of food security in the international arena has sharply deteriorated from 58 rank to 71 in terms of GFSI overall rankings. The problems in Ukraine also affect the world market as a whole due to less opportunity to grow agri-food products. This is connected with the mining of territories and the conduct of hostilities on them. Technological development in Ukraine today is aimed at the production of demining equipment, the high cost of such equipment fully offsets the risks associated with the death of tractor drivers from military equipment during the sowing campaign and tillage.

2.3. Food inflation, export and import of commodities in ukraine

The full-scale invasion of Ukraine has triggered a cascade of issues related to food security. Food inflation within Ukraine has skyrocketed due to disruptions in agricultural production, transportation networks, and global supply chains. While specific data for 2023 may not be readily available, pre-war trends likely involved global food price fluctuations impacting Ukraine as well.

Ukraine's role as a major agricultural exporter has also been severely compromised by the war. Damaged infrastructure, port closures, and logistical hurdles have significantly reduced export volumes of key commodities like wheat, corn, sunflower oil, barley, and rapeseed. These products are vital for global food security, and their absence from the market puts additional strain on the system. Ukraine may be exploring alternative export routes through neighboring countries, but this process takes time and resources.

According to Figure 7, fluctuations in inflation in Ukraine are more than 10%, which is spread over the cost of food products. Such a trend is jaggedly reflected in the graph, which indicates the instability of the price situation. In more detail, commodity cost inflation is visualized in Figure 9. The gradual increase in cost between October 2020 and the same period next year is driven by challenging

economic conditions, including the impact of the COVID-19 pandemic, changes in exchange rates, and increases in energy and raw material prices.

A minimal increase is observed from October 2021 to January 2022, this is explained by public unrest in connection with the build-up of the military industrial complex on the part of Russia on the border with Ukraine in the area of the anti-terrorist operation (started in 2014).

Ukraine thrived as a major exporter of agricultural commodities. Key exports included wheat, corn, sunflower oil, barley, and rapeseed. These products played a vital role in global food security, with Ukraine being a leading supplier.

The ongoing war has severely disrupted Ukraine's ability to export commodities. Damaged infrastructure, port closures like those in Odesa, and logistical difficulties have significantly reduced export volumes. Ukraine is exploring alternative routes for exporting commodities through neighboring countries like Poland and Romania. However, establishing these new routes takes time and resources, hindering the flow of exports. Ukraine's import profile likely focused on specific food items and resources not abundantly produced domestically.

Due to disruptions in domestic production caused by the war, Ukraine might need to increase imports of certain food commodities to meet domestic demand.The war could lead to shortages of specific food items, particularly those heavily reliant on pre-war imports. Additionally, increased import dependence could put upward pressure on food prices within Ukraine.

The export structure of Ukraine was discussed in more detail in the previous sections, so here it will be appropriate to consider the structure of the import of goods to Ukraine:

Table 5: Top trading partners of Ukraine in 2023: Import to Ukraine

Country	**Share (%)**	**Value (billion US$)**
China	16.4	10.4
Poland	10.3	6.57
Germany	7.96	05.06

Turkey	7.43	4.72
USA	4.51	2.86
Italy	3.58	2.27
Bulgaria	3.49	2.22
India	2.96	1.88
Czech Republic	2.81	1.78
France	2.76	1.75

Source: author's own composition based on data from Trend Economy

Determining factors in the formation of such import partners are geopolitics, diversification and the profile of the country.

Table 6: Ukraine's Import Structure in 2023

Commodity Group	Description	Share (%)	Value (billion US$)
Mineral fuels, mineral oils	Fuels, oils, and related products	16.3	10.3
Vehicles other than railway or tramway	Vehicles (cars, motorcycles, etc.) and parts	10.9	6.96
Electrical machinery and equipment	Electrical machinery, appliances, and parts	9.37	5.95
Nuclear reactors, boilers, machinery and mechanical appliances	Machinery, mechanical appliances, and related parts	8.33	5.3
Commodities not specified according to kind	Unclassified goods	7.73	4.91
Plastics and articles thereof	Plastic products	4.4	2.79
Pharmaceutical products	Pharmaceuticals and medical	3.36	2.14

	supplies		
Optical, photographic, medical instruments	Optical, photographic, and medical instruments	2.25	1.43
Iron and steel	Iron, steel products, and related items	02.05	1.3
Fertilizers	Fertilizers for agricultural use	1.93	1.23

Source: author's own composition based on data from Trend Economy

The war has led to a shift in Ukraine's import needs, prioritizing essential goods like energy, transportation equipment, and machinery. Ukraine's import needs in prioritize essential goods like:

- Energy: Fuels, oils, and related products (Code 27) are crucial for powering the country's economy and infrastructure, with a significant share (16.3%) of imports.
- Transportation: Vehicles (cars, motorcycles, etc.) and parts (Code 87) are essential for mobility and maintaining supply chains, representing 10.9% of imports.
- Machinery: Electrical machinery, appliances, and parts (Code 85) are vital for various industries and infrastructure, with a combined share of 9.37% and 8.33% (Code 84).

3. ANALYSIS OF ACTIONS TO ENSURE FOOD SECURITY AT THE GOVERNMENT AND BUSINESS LEVEL AND CORRELATION CALCULATIONS

3.1. Food security strategy

The Ministry of Agrarian Policy and Food has developed a project of the Food Security Strategy of Ukraine, according to which it intends to increase the production potential of domestic agricultural products to 200 million tons, and of grain and oil crops to 150 million tons in the medium term. That is, the main goal is to double the volume of export deliveries of Ukrainian agricultural products and products of their processing, ready-made food products.

Food security is among the highest priorities both for Ukraine and for many international organizations that help countries to establish a food system and develop their own agro-industry. For Ukraine, the issue of restoring agriculture and developing the processing industry is also a key issue. To restore or develop a business, or to start one's own business, including in the processing industry, the Government provided Ukrainian entrepreneurs with access to financing, in particular, through grant programs.

In order to regulate and develop food security, the government adopted the Strategy for the Development of the Agricultural Complex. The strategy was published on July 3, 2023. The main goals of the Strategy for the Development of the Agricultural Complex include:

- Full vertical integration and localization and import substitution for $4.2 billion
- Process at least 50% of the harvest (model of the Netherlands, France, Germany). Develop animal husbandry and food production (proteins, special fats, gluten, dairy products, meat products, etc.)
- Complete processing of secondary waste produces 10 billion m^3 of biomethane

3.1.1. Vertical integration

Against the background of global trends of automation and digitization of processes, which leads to an increase in manufacturability and an increase in labor productivity, the number of jobs in agriculture is decreasing.

Full vertical integration contributes to the production of mineral fertilizers ($6.8 billion per year). Production of agricultural machinery is $4.5 billion per year, of which 110,000 tons are tractors, combines and trailed equipment. Plant protection products are produced for $3.3 billion per year, which is 360,000 pesticides. Seeds produce $4.2 billion a year, which is 5 million tons of all types of seeds combined. Irrigation includes 2 million hectares of infrastructure for irrigation systems. The expected results are an increase in the production of grain and oil crops, vegetables, fodder crops and fruits.

3.1.3. Expansion of the processing industry

The importance of infrastructure development for processing agricultural products is an important component of the sustainable development of food security. Deep processing should be at least 50% and include the following components:

1. Meat products ($10.8 billion/year):
    - 0.5 million tons of beef (+50%);
    - 1.5 million tons of pork (+100%);
    - 3.4 million tons of chicken (+150%);
2. Animal feed ($3 billion/year):
    - 10 million tons of compound feed and feed additives;
3. Vegetable oil ($8 billion/year):
    - 8.6 million tons of sunflower oil;
    - rapeseed oil;
    - soybean oil;
4. Deep processing ($1.9 billion/year):
    - 1.5-2.5 million tons of proteins;
    - special fats;

- gluten;
- starch and molasses;

5. Dairy products ($4.6 billion/year):
    - 2.6 million tons of dry milk butter and whole milk products.

3.1.4. Processing of secondary waste

Biofuel processing is important for providing food energy because this resource is for production capacity. In the conditions of war and constant massive attacks, it is harmful to use all energy resources and develop new alternatives.

Ukraine plans to build about 2,000 biomethane production plants with a total capacity of 10 billion m3, with an average capacity of 5 million m3, and to create an extensive network of biogas and biomethane production in the locations of raw materials, increase the sustainability of the energy system, and develop biomethane exports.

3.1.5. Export of agri commodities after the full scale invasion

In the 2022/23 season, 74.4% of agricultural produce was exported via sea transport, a significant decrease from the pre-war level of 98%. The conflict necessitated farmers to explore alternative export routes. Given that sea transportation formed the backbone of Ukrainian agricultural exports, the blockade of most ports dealt a severe blow to the economy.

The Russian Federation's withdrawal from the "Grain Initiative" led to an increase in shipments through the Danube and land ports. Despite market adaptation to these new circumstances, farmers continue to grapple with challenges such as sales issues stemming from ongoing port infrastructure shelling and export restrictions imposed by neighboring countries. Therefore Black Sea Grain Initiative and Solidarity Lanes were established.

Black Sea Grain Initiative

In July 2022, the Black Sea grain initiative was arranged by Turkey, the UN. Its goal was to help Ukraine, a major grain producer, export its grain through the

Bosphorus strait. This was important because other routes, like roads through Poland or canals through Romania, couldn't handle the large amounts of grain needed.

Turkey got involved because it's in charge of maritime traffic in the Bosphorus strait, according to a treaty from 1936. This initiative was one of the few positive outcomes since the war began. It allows Ukraine to export food and fertilizers from three key ports in the Black Sea – Odesa, Chornomorsk, and Pivdennyi (formerly Yuzhny). Ukrainian ships guide cargo ships away from mined areas and into international waters, then along an agreed route towards Istanbul. Inspectors from Russia, Turkey, Ukraine, and the UN check ships coming to and from Ukrainian ports. Additionally, a separate agreement was made to reduce the impact of sanctions on Russian food and fertilizer exports. Both deals are reviewed every two to four months.

Solidarity Lanes

After the blockade of Ukrainian Black Sea ports, the Solidarity Lanes were set up to create new routes for transportation, connecting the EU to Ukraine. This was done because Russia's war had severely affected Ukraine's ability to export agricultural products and trade with the EU. These Solidarity Lanes are now working well enough to allow Ukraine to export to other countries, even though the Black Sea corridor is unavailable.

In May 2023, the President of the European Commission and Ukraine's President announced a coordination Platform to improve trade flow of Ukrainian grain and keep the Solidarity Lanes working smoothly. The Platform is led by Executive Vice-President Valdis Dombrovskis and involves efforts from the Commission and countries like Bulgaria, Hungary, Poland, Romania, Slovakia, Ukraine, and Moldova. Their goal is to make trade between Ukraine and the EU better, including moving goods to other parts of the world.

Thanks to the efforts of the Joint Coordination Platform and temporary measures, trade between Ukraine and the EU has improved. Exceptional measures that were put in place on imports from Ukraine have now expired, as there are no longer any issues in the bordering Member States. Ukraine has agreed to take

measures to control the export of certain goods to prevent any problems in neighboring countries, and until then, trade is expected to continue smoothly.

3.2. Case study: company action to increase the local food security

In the rating of "Top 100 latifundists of Ukraine", the MHP company takes the 2nd place. Therefore, this is an excellent option for a company against the background of which food security can be considered.

MHP, a multinational corporation based in Kyiv, boasts an expansive presence with production facilities not only in Ukraine but also within the Balkans under the Perutnina Ptuj Group. Diversifying its interests, MHP operates across the food, agricultural, and technological sectors. Complementing its Kyiv headquarters, MHP's subsidiaries are strategically dispersed, encompassing key locations such as Great Britain, Saudi Arabia, the UAE, Balkan Peninsula nations, and several other countries within the European Union (Latifundist Media).

The company's main steps to ensure food safety:

- humanitarian program to support the civilian population and the military;
- project to support the arrangement of shelters in schools, kindergartens and medical facilities;
- supporting small farmers.

Humanitarian program to support the civilian population and the military

The Mironivskyi Bread Products company's charity foundation provided food, household items, medical equipment, transportation, and building materials, as well as military ammunition and special equipment. They supported soldiers, civilian adults and children, medical workers, and patients in medical facilities and social institutions.

After the Armed Forces of Ukraine liberated the Kyiv, Sumy, and Chernihiv regions from occupiers, the foundation's activities became even larger, more efficient, and more professional. The foundation resumed work on traditional projects but also established crucial connections with new partners and donors. They began working

on new projects necessary due to the country's circumstances, communities, and citizens affected by the state of war or its consequences.

Thus, only in the first year of the full-scale invasion, the fund transferred 600 thousand kilograms of humanitarian aid purchased abroad and imported into Ukraine. At the company's enterprises, 2.8 thousand cans of conservation were made from the harvested crop with seeds and animal products grown in Ukraine. In addition, the fund additionally allocated 295.4 million hryvnias to support the vulnerable population.

600+ food kits were provided to people affected by the war in the Kitaygorod village community in the Dnipropetrovsk region.

"Social Shop" initiative consists of 5 mobile and 10 stationary stores located in 200 settlements in the Cherkasy, Vinnytsia, Kyiv, and Dnipropetrovsk regions. These establishments provide residents from privileged categories with the opportunity to purchase high-quality and fresh products of social significance at reduced prices.

During the operation of the "Social Shop" initiative, 11.5 thousand tons of meat products from MHP were sold at preferential prices. This facilitated access to quality meat products for people with limited resources and ensured their access to a healthy and balanced diet.

Project to support the arrangement of shelters in schools, kindergartens and medical facilities

The fund is a powerful platform for attracting international partners, thus a joint project with Ukrainian-Danish Youth House created Fun Hub. On March 11, 2022, a Russian missile hit the Fun Hub Youth Center in Baryshivka, Kyiv region. A year earlier, our Foundation allocated funds for its opening as part of the "Time to Act, Ukraine!" competition. After the de-occupation of the Kyiv region, activists began to restore Fun Hub, and on November 4, 2022, it fully reopened. The Foundation also contributed to its restoration.

The Youth Council of the Baryshivka community, together with the Foundation, won a grant from the Ukrainian-Danish Youth House (donor

contribution of 240,766 UAH) to create a new space. There was also a relocation: now the hub is located in a shelter and hosts guests for cultural, psychological, and developmental events.

Small enterprises support

Business idea competition to support small enterprises in regions. Entrepreneurs who already have an existing business and those relocating their production can apply for the competition. The grant amount is up to 100,000 UAH. 34% of projects are directly aimed at food security.

Medical initiative - Doctor for the village.

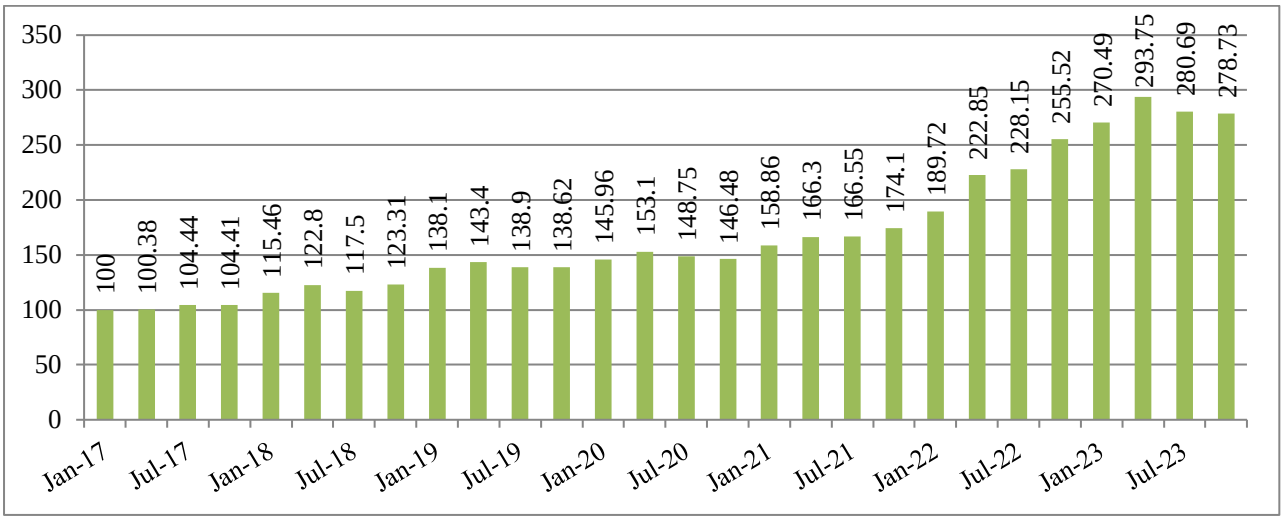
A social initiative, within which is specially equipped with reagents and medical with the equipment, the ambulance drives through small towns points of different regions. Local residents have the opportunity free consultation with an ophthalmologist, therapist, check the blood sugar level, receive the necessary medical supplies as prescribed by the doctor.

3.3. Statistical comparison of the impact of covid-19 and a full-scale invasion on food security

The purpose of the correlation analysis is to determine and compare the impact of two significant crisis phenomena – the COVID-19 pandemic and a full-scale military invasion – on food security in Ukraine. Using the food price index (%) and quarterly gross domestic product (GDP) as the main indicators and establish the degree of relationship between these indicators in different periods and identify possible trends.

Correlation and regression analysis will help understand how much and in what direction food prices changed in response to changes in GDP during the COVID-19 pandemic (2019-2022) and during a full-scale invasion (2022-2023). This will make it possible to draw conclusions about the nature of the impact of each of these crisis periods on food security, as well as to identify which of these factors had the greatest impact on the change in the food price index.

Figure 10: Consumer price index for products of Ukraine (2017-2023), %



Source: author's own composition based on data from Minfin

On gravel, you can observe a clear increase in the indicator, which indicates the increase in food prices and is a factor that affects the economic ability to ensure food security. Data on the food price index and GDP was taken from official sources and divided into two parts: the period of covid (2017-2022) and the period of war (2022-2023). Correlation matrices were calculated for each period separately. The first period is from 2017 to 2022, it covers the years of the covid-19 pandemic, accoding to which you can follow the relationship between the gross domestic product and the price index. Gross domestic product is a macroeconomic indicator that determines the market value of final products and services. The food price index determines changes over time in the general level of prices for goods and services purchased by the population for non-productive consumption. It is an indicator of changes in the value of a fixed set of consumer goods and services in the current period compared to the base period. Thus, 2017 was taken as the base period, when the situation in Ukraine was relatively stable.

Table 7: Results of Correlation for three periods

Analyzed period	Correlation
Whole period (2017-2023)	-0,59
Covid 19 (2019-2022)	-0,56
Full scale invasion (2022-2023)	0,3

Source: Author's own elaboration

Whole period

Based on the analysis of the entire period from 2017 to 2023, there is a significant negative correlation between Ukraine's GDP and the Consumer Price Index (CPI), with a correlation coefficient of -0.59 ($r(25) = -0.59$, $p < 0.001$). This inverse relationship indicates that as GDP increases, the CPI tends to decrease, and vice versa. This suggests that higher economic growth is associated with lower consumer prices, making goods more affordable for the population and improving food security. Conversely, during periods of economic decline, consumer prices tend to rise, reflecting increased costs and reduced affordability. This negative correlation underscores the impact of economic conditions on consumer prices over the analyzed period.

Covid 19

The correlation during the crisis caused by covid-19 is little different from the correlation for the whole period, which indicates the opposite proportionality: the higher the GDP, the smaller the product consumption index, which is quite logical considering the dependence of welfare and pricing on profit. Although the significance level of 0.03 also indicates a slight decrease in this dependence.

Full scale invasion

During a war, the correlation between GDP and the food price index can become positive, whereas in the pre-war period it was negative, due to several key factors:

- destruction of infrastructure and disruption of logistics chains, this can lead to rising food prices even as GDP falls.
- reduced productive capacity because military action restricts access to agricultural land, reducing the amount of labor in agriculture and reducing productive capacity. This reduces the amount of food production, increasing its cost.

- a shift in government spending priorities as the government diverts resources from peacetime programs, including agriculture, to military needs during wartime, affecting food production and food costs.

Based on the analysis of the entire period from 2017 to 2023, there is a significant negative correlation between Ukraine's GDP and the Consumer Price Index (CPI), with a correlation coefficient of -0.59, indicating that higher GDP is associated with lower consumer prices. During the Covid-19 pandemic, this inverse relationship persisted, as higher GDP correlated with a lower product consumption index, suggesting improved affordability and food security. However, during the full-scale invasion, the correlation turned positive due to factors such as infrastructure destruction, reduced productive capacity, and shifts in government spending priorities towards military needs, leading to rising food prices despite falling GDP. These varying dynamics highlight the complex interplay between economic conditions and consumer prices under different circumstances.

CONCLUSION

The thesis delves into the contemporary challenges facing food security in Ukraine amidst military aggression. It aims to comprehensively analyze the crisis situations within the realm of food security, develop strategic frameworks to bolster food security in Ukraine, and assess the ramifications of military aggression on the nation's agricultural exports. Moreover, the study scrutinizes the endeavors of enterprises dedicated to safeguarding food security and devises strategies to mitigate the fallout of military aggression on this vital sector. A quantitative study that analyzed indicators such as the food security index, the unemployment rate, price and food inflation, and GDP per capital.

In summary, this study sheds light on the multifaceted dimensions of food security in Ukraine, encompassing its current status, international positioning in the food market, and the disruptive effects of military aggression on agricultural exports. By examining crisis scenarios and formulating strategic responses, the research endeavors to fortify the stability and sustainability of food security in Ukraine, while also evaluating the efficacy of enterprises engaged in this endeavor.

The agriculture sector in Ukraine continues to face monumental challenges, even amid some improvements. The ongoing war, marked by air and ground attacks that disrupt economic activities, particularly impacts Ukraine's agrifood sector. Critical infrastructure, such as homes, energy facilities, ports, and warehouses, has suffered significant damage, constraining food availability and eroding livelihoods.

In the practical part, the actions to meet food security in the conditions of war at the government and business level were investigated, as well as a comparative analysis was carried out with the method of correlation and simple regression, which demonstrate the relationship between the Consumer Price Index (CPI) and Gross domestic product (GDP) during global challenges. From 2017 to 2023, Ukraine's GDP and the Consumer Price Index (CPI) showed a strong negative relationship, meaning when GDP was higher, consumer prices were lower, with a correlation coefficient of -0.59. During the Covid-19 pandemic, this pattern continued, indicating that a higher GDP was linked to lower prices, improving affordability and food

security. However, during the full-scale invasion, this relationship changed to a positive one. Destruction of infrastructure, reduced production capacity, and increased government spending on military needs caused food prices to rise even as GDP fell. These changes show the complex relationship between the economy and consumer prices in different situations.

The theses analyze actions that will encourage food safety at the state, international, and internal company levels. To effectively achieve food security, all sectors must work to create a high-quality collaboration to prevent a humanitarian disaster.

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