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UKRAINE IN THE GLOBAL TRADE OF AGRICULTURAL PRODUCTS

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Abstract. Ukraine's trade in agricultural products plays the key role in determining the well-being of its citizens. *The objective of the paper* is to reveal the structural transformations in Ukraine's agricultural production, to analyze the geographical and commodity structure of exports with the focus on agro-food products, to identify the top world importers/exporters of the selected agro-food products, as well as to examine Ukraine's merchandise trade in 2022 and compare it with that of 2021. The data, taken from the State Statistics Service of Ukraine; the Trade Map, developed by the UNCTAD/WTO International Trade Center; the State Customs Service of Ukraine, as well as agricultural policies of the developed countries served as *the information source for research*, in which various methods have been used, e.g.: economic-mathematical, statistical, comparison, graphical, tabular, method of expert assessments, etc. *The results* demonstrate the empirical experience of the importance of agricultural exports for the country's ability to remain in international trade flows in the conditions of military operations in this country. An empirical example of the impact of the withdrawal of one of the leading suppliers of certain types of agricultural products from world trade is also considered, and the impact of some steps on the return of this country to world trade in the context of ongoing geopolitical shifts is determined.

Key words: agriculture of Ukraine, agricultural policy, industrial policy, foreign trade policy, exports, imports, agro-food products, commodity diversification.

JEL Classification: Q10, F10, L52, Q17

1. Introduction

The theoretical and practical aspects of the international trade, as well as the challenges, related to its development in the age of globalization, have become the focus of attention of many outstanding Ukrainian and foreign researchers in the field (e.g., Yerokhin, 2002; Jones & Weder, 2017; Keyzer et al., 2017; Halasiuk, 2019).

In the works of the Ukrainian economists special emphasis is put on the problems of ecological nature arising in the agricultural sector of Ukraine (e.g., Borodina & Krupin, 2018; Kyryzyuk et al., 2020; Moldavan et al., 2023), the necessity to upgrade it technologically to unlock the agro-processing enterprises' innovation potential (e.g., Hnatenko, Shtuler et al., 2021), as well as on various issues related to social and environmental aspects of agricultural development.

The objective of the paper is to reveal the structural transformations in Ukraine's agricultural production, to analyze the geographical and commodity structure of exports with the focus on agro-food products, to identify the top world importers/exporters of the selected agro-food products, as well as to examine Ukraine's merchandise trade in 2022 and compare it with that of 2021.

2. Agriculture of Ukraine: Production, Foreign Trade, Social and Environmental Aspects

The analysis of the dynamics of volume and share of Ukraine's agricultural production, which is divided into crop and animal, shows that during 2010–2021 ***some negative structural transformations in the domestic agricultural production have been observed***: *crop production rose from 70,5% to 81,4%*

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while animal production dropped from 29,5% to 18,6% (Table 1). The data shows that the production of ***industrial crops increased*** by 7% reaching 28,0%, from 98164,6 mln UAH to 199836,0 mln UAH respectively, while the production of ***potatoes, vegetables, cucurbits crops decreased*** by 3,2%, or grew only by 13068,0 mln UAH making it 80747,7 mln UAH, which is only 11,3% out of all Ukraine's agricultural production in 2021. At the same time the production of ***fruits, berries, grapes dropped*** by 0,7%, which is merely 2% out of all agricultural production of the country. Alarmingly, the production of ***agricultural animals, milk, eggs, wool, etc. suffered tragic decline*** as well, e.g.: animal production – from 13,8% in 2010 to 10,1% in 2021; milk production – from 50104,2 mln UAH or 10,7% in 2010 to 38766,3 mln UAH or 5,4% in 2021; while eggs production – from 4,2% to 2,3%.

Specifically, Table 2 focuses on the dynamics of *the number of livestock animals, including cows, pigs, sheep, and poultry, produced on the territory of Ukraine during 1915–2021.*

As it is shown (Table 2), the trends are transformed from positive (1915–1985) into negative ones (1990–2021), while the maximum number of pigs (20746 thsd. heads) was produced at the end of 1970; the maximum number of cows (9271 thsd. heads) – end of 1980; the maximum number of sheep (10062 thsd. heads) – end of 1960 (Figure 1). Clearly, ***for Ukraine now it is essential to focus primarily on satisfying the fundamental needs of its population***, among which the core ones for survival are food, water, air, along with clothing, shelter, health, education, etc.

It is important to keep in mind that the total area of eroded land in Ukraine increases by 80–100 thsd. hectares per year. As a result of erosion, about 500 mln tons of productive topsoil are washed away annually and 24 mln tons of humus, 1 mln tons of nitrogen-containing substances, 0.7 mln tons of

Table 1

The dynamics of volume (mln UAH) and share (%) of Ukraine's agricultural production by kinds, 2010–2021, in 2016 prices

	2010	2015	2018	2019	2020	2021
	mln UAH					
Agricultural production	**467474,7**	**596832,8**	**671294,0**	**680982,4**	**612121,5**	**712566,3**
crop production	***329646,3***	***453016,9***	***529347,5***	***538705,6***	***473377,0***	***580267,7***
grain and leguminous crops	126803,3	193390,3	225618,7	239728,2	207778,6	274271,9
industrial crops	98164,6	149263,1	190580,1	194847,6	162374,8	199836,0
potatoes, vegetables, cucurbits crops	67679,7	77346,2	80896,6	77753,1	78861,4	80747,7
fruits, berries, grapes	12757,9	14799,3	17144,5	14564,1	13410,0	14366,9
fodder crops	11048,0	10103,6	9677,3	8618,2	8128,9	8064,4
other crop production	13192,8	8114,4	5430,3	3194,4	2823,3	2980,8
animal production	***137828,4***	***143815,9***	***141946,5***	***142276,8***	***138744,5***	***132298,6***
agricultural animals (breeding)	64717,5	70153,8	72593,6	74165,4	73409,7	71663,4
milk	50104,2	47320,7	44813,7	42978,0	41199,6	38766,3
eggs	19797,5	19498,0	18729,2	19362,7	18770,2	16337,0
wool	103,0	55,0	46,8	42,6	38,8	36,7
other animal production	3106,2	6788,4	5763,2	5728,1	5326,2	5495,2
	2010	**2015**	**2018**	**2019**	**2020**	**2021**
	Percentage to total					
Agricultural production	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**
crop production	***70,5***	***75,9***	***78,9***	***79,1***	***77,3***	***81,4***
grain and leguminous crops	27,1	32,4	33,6	35,2	33,9	38,5
industrial crops	**21,0**	**25,0**	**28,4**	**28,6**	**26,5**	**28,0**
potatoes, vegetables, cucurbits crops	14,5	13,0	12,1	11,4	12,9	11,3
fruits, berries, grapes	2,7	2,5	2,6	2,1	2,2	2,0
fodder crops	2,4	1,7	1,4	1,3	1,3	1,1
other crop production	2,8	1,3	0,8	0,5	0,5	0,5
animal production	***29,5***	***24,1***	***21,1***	***20,9***	***22,7***	***18,6***
agricultural animals (breeding)	13,8	11,8	10,8	10,9	12,0	10,1
milk	**10,7**	**7,9**	**6,7**	**6,3**	**6,7**	**5,4**
eggs	**4,2**	**3,3**	**2,8**	**2,8**	**3,1**	**2,3**
wool	0,0	0,0	0,0	0,0	0,0	0,0
other animal production	0,8	1,1	0,8	0,9	0,9	0,8

Source: State Statistics Service of Ukraine database [Agriculture of Ukraine 2021, p.45]. https://ukrstat.gov.ua

Table 2
The number of livestock animals in 1915–2021 on the territory of Ukraine,
(end of year; thsd. heads)

		1915	1940	1950	1960	1970	1980	1985	Trends
CATTLE	total	9132	10996	11182	17632	21352	25368	26638	y = 3265,4x + 4409,7
	of which **cows**	4116	5965	4812	7814	8563	9271	8851	y = 877,43x + 3546,3
PIGS		6469	9186	7766	18194	20746	19783	20088	y = 2679,7x + 3885,9
SHEEP and GOATS	total	6904	7325	6740	10631	8971	9051	9222	y = 451,32x + 6601
	of which **sheep**	6849	6700	5465	10062	8614	8815	8879	y = 481,04x + 5987,9
POULTRY, mln. heads		-------	-------	-------	129.6	155.2	233.6	252.6	y = 44,74x + 80,9

		1990	1995	2000	2005	2010	2015	Trends 1990–2015
CATTLE	total	24623	17557	9424	6514	4494	3750	y = – 4184,7x + 25707
	of which **cows**	8378	7531	4958	3635	2631	2167	y = – 1345,1x + 9591,1
PIGS		19427	13144	7652	7053	7960	7079	y = – 2225,5x + 18175
SHEEP and GOATS	total	8419	4099	1875	1630	1732	1325	y = – 1223,3x + 7461,6
	of which **sheep**	7896	3209	963	872	1101	744	y = – 1205x + 6681,7
POULTRY, mln. heads		246.1	149.8	123.7	162.0	203.8	204.0	y = – 0,2914x + 182,59

		2016	2017	2018	2019	2020	2021	Trends 2016-2021
CATTLE	total	3682	3531	3333	3092	2874	2644	y = – 211,49x + 3932,9
	of which **cows**	2109	2018	1919	1789	1673	1544	y = – 114x + 2241
PIGS		6669	6110	6025	5727	5876	5609	y = – 180x + 6632,7
SHEEP and GOATS	total	1315	1309	1269	1205	1140	1094	y = – 47,886x + 1389,6
	of which **sheep**	719	727	699	659	621	607	y = – 26,229x + 763,8
POULTRY, mln. heads		201.7	204.8	211.7	220.5	200.6	202.2	y = – 0,0371x + 207,05

Source: authors' calculations based on the State Statistics Service of Ukraine database [Statistical Yearbook of Ukraine for 2021, p. 296]. https://ukrstat.gov.ua

phosphate, and 1.0 mln tons of potassium are lost. The annual damage to agricultural land from soil erosion exceeds UAH 80 bln. Erosion, caused by degrading of soil fertility, disrupts the complex of the ecological system established over a long evolutionary period and changes the nutrient cycle in the biosphere. In the process of erosion, plant nutrients are removed from the small biological cycle and drawn

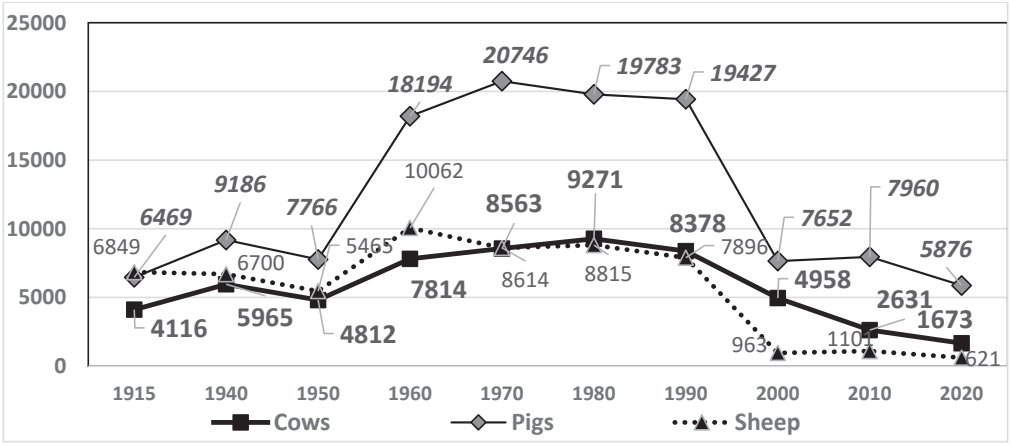

Figure 1. The dynamics of the number of cows, pigs, sheep, produced in Ukraine, thsd. heads

Source: authors' illustration based on the State Statistics Service of Ukraine database [Statistical Yearbook of Ukraine 2021]. https://ukrstat.gov.ua/druk/publicat/kat_u/2022/zb/11/Yearbook_21_e.pdf

into the large geological cycle, which means that they are actually lost forever for agriculture (Moldavan et al., 2023, p. 6).

The main cause of the problem is that after the beginning of the 2000s, due to the acceleration of investments, including the inflow of foreign capital, crop production began its steady increase. Currently, a wide range of medium and large agricultural enterprises follow an export-oriented production strategy based on cultivating a limited number of crops: wheat, barley, corn, rape, sunflower, and soya. Due to their limited access to capital, some (mostly small and medium-sized) farms do not have the capacity to maintain the necessary equipment for cultivating a diversified number of crops. Therefore, they usually grow no more than two or three crops. Such limited crop rotation leads to soil depletion: humus content decreased by 15% between 1991 and 2005 (Kyryzyuk et al., 2020, p. 8). If the government stays away from setting industrial priorities for investment and avoids the necessary state policies modernization, foreign investors will mostly seek access to a raw material base and/or cheap labour, which will in no way contribute to economic restructuring (Halasiuk, 2019, p. 79).

The above mentioned means it is critical to follow the example of the developed countries, e.g.: the USA, the EU. For instance, *U.S. agricultural policies target a wide array of policy objectives, which includes providing an income safety net for agricultural producers, minimizing negative environmental impacts of agricultural production, ensuring that agricultural supply chains are equipped to* ***provide adequate quantities of safe food to consumers,*** *and helping* ***address food and nutrition insecurity amongst vulnerable populations***. Different policy tools are used to meet these objectives – including cost share, direct payments, provision of credit, or access to services (U.S. Agricultural Policy Review, 2023). Similarly, the *EU common agricultural policy* (CAP), which is focused on ***social, environmental, and economic goals***, is built around ten key objectives: 1) to ensure a fair income for farmers; 2) to increase competitiveness; 3) to improve the position of farmers in the food chain; 4) climate change action; ***5) environmental care; 6) to preserve landscapes and biodiversity;*** 7) to support generational renewal; 8) vibrant rural areas; ***9) to protect food and health quality;*** 10) fostering knowledge and innovation (Key policy objectives of the CAP).

Unfortunately, the government of Ukraine aims to transform the country into an 'agricultural superpower at the international level' not realizing that the utilization of Ukrainian agricultural potential as an economic growth engine requires a fundamental change in the interpretation of the purpose, which is currently focused on profit-making export-oriented commercial activity. The multifunctional nature of the sector needs to be emphasized, the purpose of which is not only the production of agricultural and food products, but also the creation of public benefits, such as the development opportunities and means for existence for 14 mln Ukrainian rural inhabitants, maintenance of ecological balance, regeneration of soil fertility and preservation of rural landscapes (Borodina, Krupin, 2018).

Moreover, the examination of the development of Ukraine's meat and milk industry suggests that the key aim of agricultural policy modernization should be the strengthening of domestic food security (Radziyevska, 2023b). According to *"EU agricultural outlook 2021–2031: consumer behaviour to influence meat and dairy markets"*, despite the reduced EU growth, the EU is expected to remain ***the largest dairy trade supplier in 2031, representing 30% of global dairy trade.*** Growth of the EU's two biggest competitors will also be moderate, with New Zealand at 0.2% per year and the US at 1%. EU fresh dairy products could benefit from growing exports, which are expected to reach 1.8 mln tonnes in 2031 (EU agricultural outlook 2021–2031). Sustainability, with its environmental, economic and societal objectives, is expected to play an increasingly prominent role in EU meat markets, both for producers and consumers. With a total cow herd set to decrease by 7% (down 2.1 mln heads), EU gross **beef** production is expected to fall by 0.6 mln tonnes (- 8%) over the outlook period. In terms of EU consumption, it will continue its downward trend between 2021 and 2031 and drop from 10.6 kg to 9.7 kg per capita. China should have fully recovered by 2026, having a massive impact on **EU pigmeat exports**. For the **poultry** sector, EU consumption growth could slow down, from 2% per year in 2011–2021 to 0.6% in 2021–2031, resulting in an increase from 23.5 kg per capita in 2021 to 24.8kg in 2031. EU **sheep meat** production is expected to increase slightly by 0.3% per year in 2021–2031, to 660000 tonnes in 2031, supported by coupled income support, small world supply and improving producer prices. EU per capita consumption of sheep meat is expected to grow slightly by 2031 and reach 1.4 kg per capita thanks to the diversification of the meat diet and changing consumption patterns (EU agricultural outlook 2021–2031).

Since Ukraine has experienced the most dramatic drop in the production of the number of livestock animals since 1915, it is no wonder that the country is importing more and more food products each year. Our country's economic relations with the EU during 2016–2021 may serve as an example: the dynamics and the structure of the formation of both surpluses and deficits by the main commodity groups of Ukraine's foreign trade balance with the EU is presented in Table 3. The calculations

demonstrate that the negative balance of trade by commodity groups I, IV, VI, VII, XVI, and XVII in 2021 reached nearly 14 bln USD – evidence for poor performance of the national economy, and imperativeness for agro-industrial complex reindustrialization. Special focus in the policies should be put on environmental aspect of crop production, animal husbandry revival, food processing modernization, agricultural machinery production, etc., as well as on supportive facilities improvement: storage, transportation, distribution of food and agricultural products, etc. Well-known scholar Viktor Halasiuk stresses that the main directions of tariff policy should be the establishment of barriers for import of finished products and the abolition of import duties on high-tech innovative equipment, as well as restrictions on the export of raw materials (Halasiuk, 2019, p. 81).

Indeed, deeply specialized, monocultured, export-oriented agriculture is inherently unable to fulfill not only environmental, but also social functions. The latter primarily includes providing the society with physiologically necessary food products of appropriate quality at the level of food sovereignty and productive employment of the rural population (Moldavan et al., 2023, p. 6).

Table 3
Ukraine's balance of goods trade with the EU by commodity groups, 2016–2021

Commodity Groups	Balance, mln USD					
	2016	**2017**	**2018**	**2019**	**2020**	**2021**
Ukraine's balance of goods trade with all countries	-2888,1	-6342,5	-9852,6	-10745,6	-5144,3	-4770,8
Balance of goods trade with the EU	*-3644,5*	*-3266,0*	*-3059,5*	*-4261,5*	*-5187,4*	*-2161,3*
I. Live animals and livestock products	**-86,8**	**-46,3**	**-52,2**	**-160,7**	**-308,1**	**-358,0**
II. Plant products	1616,6	2555,4	3210,3	3899,8	2749,6	3177,3
including						
10 cereals	1172,8	1596,3	2105,9	2510,8	1570,6	1843,0
12 oil seeds and fruits	496,4	966,3	1022,8	1399,6	1016,4	1332,8
III. 15 Animal or plant fats and oils	1148,3	1422,6	1083,8	1475,6	1776,0	2274,0
IV. Finished food industry products	**-268,0**	**-296,7**	**-536,3**	**-741,5**	**-874,0**	**-1183,3**
V. Mineral products	-1150,7	-831,1	-568,8	-100,9	5,6	652,9
including						
26 ores, slags, ashes	960,5	1538,8	1809,2	1763,6	1443,5	3000,8
27 mineral fuel, petroleum and petroleum distillation	-2196,8	-2511,6	-2537,1	-2025,4	-1579,4	-2594,0
VI. Products of chemical and allied industries	-2693,3	-3138,6	-3434,3	-3824,8	-3762,0	-4367,5
including						
30 pharmaceutical products	-1122,5	-1277,2	-1396,9	-1539,3	-1696,2	-1995,0
VII. Polymeric materials, plastics and articles of them	-1259,8	-1422,7	-1517,9	-1478,9	-1455,0	-1794,5
including						
39 plastics and polymeric materials	-1030,3	-1150,7	-1223,4	-1160,9	-1136,0	-1400,1
IX. Wood and articles of wood	665,1	700,3	890,3	853,0	822,2	1221,8
XV. Base metals and preparations thereof	2214,8	2710,0	3209,1	2471,0	1900,0	4835,0
including						
72 ferrous metals	2437,9	2922,0	3391,0	2805,7	2061,3	5039,1
73 preparations from ferrous metals	-21,7	-5,3	68,1	-30,1	12,6	108,7
XVI. Machines, equipment and mechanisms, electric and technical equipment	**-1645,4**	**-2050,6**	**-2275,4**	**-2610,6**	**-2211,1**	**-2690,5**
including						
84 nuclear reactors, boilers, machines	-2043,4	-2520,8	165,4	-2818,7	-2492,1	-3247,4
85 electric machines	398,0	470,2	462,1	208,1	197,0	557,0
XVII. Ground, air, and water transport,	**-1398,0**	**-2092,8**	**-2160,1**	**-3164,0**	**-2451,5**	**-3265,1**
including						
87 ground transport facilities excluding railway	-1417,6	-2134,4	-2175,8	-3211,0	-2509,8	-3218,2

Source: (Radziyevska, 2023a)

Table 4
The dynamics of balance of trade, turnover, exports to imports ratio of goods of Ukraine, 2002–2021, bln USD

Years	Balance of trade in goods	Turnover of goods	Exports to imports ratio (goods)	Years	Balance of trade in goods	Turnover of goods	Exports to imports ratio (goods)
2002	0,95	34,90	1,06	**2012**	-15,96	153,35	0.81
2003	0,05	46,09	1	**2013**	-13,67	140,31	0.82
2004	3,67	61,66	1,13	**2014**	-0,47	108,29	0.99
2005	-1,89	70,35	0,95	**2015**	0,61	75,64	1,02
2006	-6,65	83,39	0.85	**2016**	-2,89	75,61	0.93
2007	-11,31	109,89	0.81	**2017**	-6,01	92,87	0.88
2008	-18,50	152,40	0.78	**2018**	-9,85	104,52	0.83
2009	-5,72	85,11	0.87	**2019**	-10,83	110,54	0.82
2010	-9,31	112,17	0.85	**2020**	-4,59	103,37	0.92
2011	-14,21	151,00	0.83	**2021**	-4,09	135,83	0.94

Source: authors' calculations based on International Trade Center database. https://intracen.org/resources/data-and-analysis/trade-statistics

3. Trade in Agricultural Products: Ukraine and the World

The analysis of the dynamics of Ukraine's goods turnover shows that overall exports and imports of all products increased 3.9 times from 34.90 bln USD to 135.83 bln USD during 2002–2021 (Table 4). The balance of trade in goods has been negative throughout the analyzed period, except for 2002–2004, 2015, and it varied from positive of 3.67 bln USD (2004) to negative of 18.5 bln USD (2008).

The number of trading partners is of great importance for Ukraine's foreign trade development: therefore, the export market concentration index has been calculated according to the formula:

$$EMC = 100 \cdot \left[\sqrt{\sum_j \left(\frac{X_{ij}}{X_i} \right)^2} \right] \quad (1),$$

EMC_{ij} – export market concentration index;
X_{ij} – the export of country i to country j;
X_i – the total export of country i (Gurova, 2009, p.94).

The value of the export market concentration index has slightly dropped (Table 5), indicating an increase in the number of trading partner countries and the geographical diversification of Ukraine's exports.

Table 5
Ukraine's export market concentration index

2002–2006	2007–2011	2012–1016	2017–2021
24.0	28.2	23.9	19.2

Source: authors' calculations based on International Trade Center database. https://intracen.org/resources/data-and-analysis/trade-statistics

During 2002–2021 the total merchandise exports of Ukraine rose from 17927.4 mln USD in 2002 to 65870.3 mln USD in 2021, i.e. 3.7 times, while those of agricultural commodities – increased 11.2 times; and excluding those agricultural commodities, the overall exports grew only 2.5 times. The share of agro-food products in total goods exports has skyrocketed – from 13.33% (2002) to 40.48% (2021), and during the analyzed period the share has been ranging from 10.62% (2004) to 44.9% (2020). The correlation between the export of cereals and finished grain products is revealed, the value of the correlation coefficient is significant (0,8). It is important to underline that the exports of cereals disturbingly exceed those of finished grain products: within the range between 4.6 and 35.8 times (Figure 2).

The geographical structure of Ukraine's exports is of particular importance, therefore let's move on to the examination of the selected types of products. ***Table 6 reveals that cereals have been exported mostly to China, Egypt, Turkey (39,70%); sunflower seeds – to Turkey, Finland, Germany (58,0); soybeans – Turkey, Belarus, the Netherlands (60,56);*** *sunflower oil – India, China, the Netherlands (55,36); vegetables – Turkey, Poland, Pakistan (26,07); edible fruits and nuts – Poland, Germany, France (45,02); preparations of cereals, flour, etc. – Kazakhstan, Romania, Moldova (28,57); preparations of vegetables, fruit, nuts or other parts of plants – the USA, Poland, Belarus (45,94); dairy produce; birds' eggs; natural honey, etc. – to Poland, Moldova, and Germany (28,14%).*

Thus, among the European and Asian key importers of the selected agro-food products of Ukraine are Turkey, China, Poland, Germany, etc. ***Table 7 presents the largest exporters and importers of the above mentioned product types on the world markets.***

Tables 6 and 7 indicate that out of the top 10 major importers: China, Iran, Egypt, Turkey, Indonesia are among the key consumers of Ukraine's cereals; Turkey, Bulgaria, Germany, Hungary belong to the main buyers of our country's sunflower seeds; China, the Netherlands, Egypt, Germany – those of soybeans; India, China, the Netherlands, Spain, Italy, Iraq – sunflower oil; the USA – of vegetables;

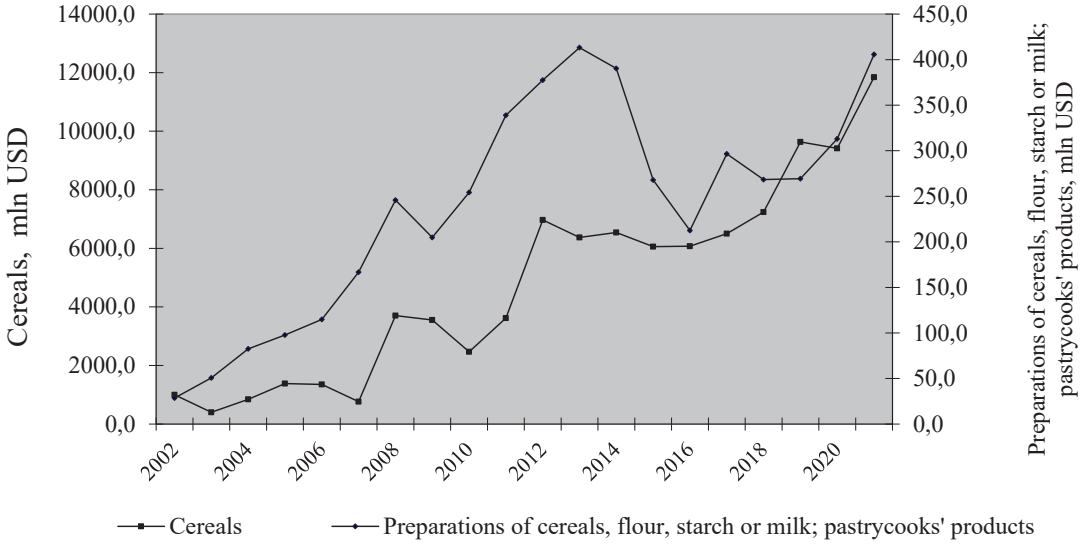

Figure 2. Exports of cereals and finished grain products of Ukraine, 2002–2021

Source: authors' calculations based on International Trade Center database. https://intracen.org/resources/data-and-analysis/trade-statistics

Germany, the Netherlands, France, Italy – edible fruits and nuts; Germany – finished grain products (preparations of cereals, flour, starch or milk, etc.); the USA, Germany, Canada – vegetable processing products (preparations of vegetables, fruit, nuts or other parts of plants); Germany, Belgium – dairy produce; birds' eggs; natural honey; edible products of animal origin, etc.

It seems logical to diversify the geographical structure of exports, in particular vegetables and ready-made products from cereals since out of the 10 largest importers, only one country is included: for vegetables – the USA, for products from cereals – Germany; while for cereals, sunflower seeds, soybeans, sunflower oil – respectively 5, 4, 4 and 6 states. Interestingly, for edible fruits and nuts, among the main importers of Ukraine, there are 4 EU member-states, so it might be possible to expand exports on the EU market and increase production; regarding vegetable processing products, the top importers of Ukraine are the USA and Canada – the developed countries of North America.

Importantly, the main competitors of Ukraine are presented in table 7 as the largest world exporters: the USA, Germany (except for sunflower oil), the Netherlands. It is worth noting that the Netherlands

Table 6
The key importers of Ukraine's main agro-food products, 2021

Product type	Ten top importers of Ukraine
Cereals	**China,** Egypt, Turkey, Spain, Indonesia, Netherlands, Iran, Pakistan, Morocco, Tunisia
Sunflower seeds, whether or not broken	**Turkey,** Finland, Germany, Bulgaria, Georgia, Moldova, Hungary, USA, Denmark, Czech Republic
Soya beans, whether or not broken	**Turkey,** Belarus, Netherlands, Italy, Germany, Egypt, China, Greece, Hungary, France
Sunflower-seed, safflower or cotton-seed oil and fractions thereof, whether or not refined,...	**India,** China, Netherlands, Spain, Italy, Iraq, France, United Kingdom, Saudi Arabia, Poland
Edible vegetables and certain roots and tubers	**Turkey,** Poland, Pakistan, Italy, Belarus, Spain, Malaysia, Djibouti, Egypt, USA
Edible fruit and nuts; peel of citrus fruit or melons	**Poland,** Germany, France, Netherlands, Italy, Austria, Greece, Lithuania, Czech Republic, Belgium
Preparations of cereals, flour, starch or milk; pastrycooks' products	**Kazakhstan,** Romania, Moldova, Oman, Belarus, Germany, Poland, Georgia, Libya, Azerbaijan
Preparations of vegetables, fruit, nuts or other parts of plants	**USA,** Poland, Belarus, Germany, Austria, Canada, Moldova, Georgia, Latvia, Israel
Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	**Poland,** Moldova, Germany, United Arab Emirates, Kazakhstan, Azerbaijan, Georgia, Latvia, Israel, Belgium

Source: compiled by the authors' based on International Trade Center database. https://intracen.org/resources/data-and-analysis/trade-statistics

Table 7

The world's top exporters and importers of the selected types of agro-food products, 2021

Product type	10 largest exporters	% of world exports	10 largest importers	% of world imports
Cereals	**USA** (19,80), Argentina, India, Ukraine, Australia, Russia, Canada, France, Brazil, Romania	73,69	**China** (11,93), Iran, Mexico, Japan, Republic of Korea, Egypt, Turkey, Vietnam, Italy, Indonesia	41,43
Sunflower seeds, whether or not broken	**Romania** (20,85), Bulgaria, China, France, Hungary, Turkey, USA, Moldova, Austria, Spain	82,90	**Turkey** (10,78), Bulgaria, Netherlands, Russia, Spain, Romania, Germany, Ukraine, France, Hungary	61,23
Soya beans, whether or not broken	**Brazil** (49,00), USA, Paraguay, Argentina, Canada, Uruguay, Ukraine, Netherlands, UAE, Russia	98,15	**China** (58,26), Argentina, Mexico, Thailand, Netherlands, Egypt, Japan, Spain, Germany, Chinese Taipei	79,31
Sunflower-seed, safflower or cotton-seed oil and fractions thereof, whether or not refined,...	**Ukraine** (36,36), Russia, Turkey, Netherlands, Bulgaria, Argentina, Hungary, France, Spain, United Arab Emirates	84,33	**India** (13,64), Iran, China, Turkey, Netherlands, Spain, Italy, Germany, Belgium, Iraq	58,64
Edible vegetables and certain roots and tubers	**China** (12,21), Spain, Mexico, Netherlands, Canada, USA, Belgium, France, Italy, Turkey	67,16	**USA** (16,08), Germany, United Kingdom, France, Canada, Netherlands, China, Belgium, Japan, India	55,56
Edible fruit and nuts; peel of citrus fruit or melons	**USA** (10,56), Spain, Netherlands, Mexico, Chile, China, Thailand, Turkey, Peru, Vietnam	54,23	**USA** (14,34), China, Germany, Netherlands, France, Great Britain, Canada, Russia, Hong Kong, Italy	59,80
Preparations of cereals, flour, starch or milk; pastry cooks' products	**Germany** (9,26), Italy, Netherlands, France, Canada, Belgium, USA, Poland, Mexico, Spain	56,62	**USA** (12,56), China, Germany, Great Britain, France, Canada, Netherlands, Belgium, Italy, Spain	51,83
Preparations of vegetables, fruit, nuts or other parts of plants	**China** (11,65), Netherlands, USA, Italy, Belgium, Spain, Germany, Turkey, Canada, Thailand	61,37	**USA** (16,06), Germany, France, Japan, Great Britain, Netherlands, Canada, Belgium, China, Italy	58,58
Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	**New Zealand** (12,21), Germany, Netherlands, France, USA, Italy, Belgium, Ireland, Poland, Denmark	68,07	**Germany** (10,51), China, Netherlands, France, Belgium, Italy, Great Britain, USA, Russia, Spain	51,40

Source: authors' calculations based on International Trade Center database. https://intracen.org/resources/data-and-analysis/trade-statistics

is a relatively small country, but the appropriate state policies enable it to obtain the impressive results. In addition, the main exporters of finished products are developed countries: the USA, Canada, EU member-states. Table 8 demonstrates the dynamics of Ukraine's share in global exports of the selected agro-food products.

Our analysis reveals that Ukraine is the 49th-largest exporter of vegetables worldwide in 2021, and it lost not only to China, Spain, Mexico,

Table 8

Ukraine's share in global merchandise exports, 2010–2021

Product type	Ukraine's share in world exports, %					
	2010	2011	2015	2016	2020	2021
Cereals	2,91	3,08	5,83	6,30	7,89	7,68
Sunflower seeds, whether or not broken	7,41	6,54	0,68	2,23	1,38	0,84
Soya beans, whether or not broken	0,44	1,03	1,57	1,88	1,08	0,79
Sunflower-seed, safflower or cotton-seed oil and fractions thereof, whether or not refined,...	36,37	31,87	35,14	37,83	39,87	36,36
Edible vegetables and certain roots and tubers	0,21	0,21	0,15	0,22	0,22	0,23
Edible fruit and nuts; peel of citrus fruit or melons	0,28	0,25	0,15	0,14	0,18	0,24
Preparations of cereals, flour, starch or milk; pastry cooks' products	0,53	0,60	0,42	0,32	0,38	0,46
Preparations of vegetables, fruit, nuts or other parts of plants	0,44	0,40	0,31	0,24	0,27	0,28
Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	0,92	0,82	0,51	0,45	0,47	0,38

Source: authors' calculations based on International Trade Center database. https://intracen.org/resources/data-and-analysis/trade-statistics

the Netherlands, Canada, the USA, Belgium, France, Italy, etc., but also to Morocco (with 1,8% of world exports), Iran (1,05), Peru (0,90), Ethiopia (0,79), Vietnam (0,52), Guatemala (0,50), Israel (0,37), Kenya (0,37), Azerbaijan (0,27% of world exports) etc. Taking into account Ukraine's natural resources, geographical location, climate, the structure of crop production, as well as the concluded regional trade agreements, it is worth paying attention to increasing the production of vegetables and stimulating their exports as well. Regarding edible fruits and nuts, the situation is similar, Ukraine is the 49th-largest exporter worldwide.

Besides, Ukraine's share in the world exports of ready-made grain products is only 0,46% or the 36th rank among suppliers, while for cereals it is 7,68% or the 4th place, respectively. Therefore, it is necessary to promote the processing of cereals and exports of finished products. Currently, even Malaysia, Saudi Arabia, Vietnam, Greece and many other countries, which are not among the world's largest cereals exporters, are far ahead of Ukraine. As for the vegetable processing products, Ukraine occupies the 43rd position, and it also lost to many countries, among which are Egypt, Costa Rica, Indonesia, Saudi Arabia, Iran, Ecuador.

On the one hand, the growth of exports indicates high demand for Ukrainian agricultural raw materials, and could serve a reason for boosting production volumes, still, on the other hand, we firmly believe that since those commodities already account for almost half of the country's total exports, where an impressive share is accounted for by raw materials, the adequate regulatory measures are to be taken urgently to meet the challenge. In this context it's important to emphasize that *Ukraine's top exports (2021) are cereals, sunflower oil, seeds and fruits of oil plants,* while only five agro-food product groups account for 35.54% of the total and 87.80% of all agro-food exports of Ukraine. More than half of them are raw materials – cereals and seeds and fruits of oil plants, which account for 17,98 and 3,21%, respectively. In addition, separately for each of the other 19 commodity groups of agro-food products, the share in the total exports has not exceeded 0,68%. Thus, for vegetables, edible fruits and nuts, sugar and confectionery, the indicator values were 0.28 %, 0.51%, 0.38%, respectively, and for products of the flour and grain industry and finished grain products – 0.22% and 0.62%, despite the fact that Ukraine is one of the top exporters of cereals in the world.

4. Foreign Trade of Ukraine in Conditions of Full-scale War in 2022. The Role of Grain Exports

Initially, the full-scale military operations created grounded fears that Ukraine would not be able to keep its share of international trade on the world markets, captured before February 2022.

Nevertheless, the examination of 2022 foreign trade of the country demonstrates that the real value volumes of the reduction in turnover amounted just to 27% compared with 2021 (State of foreign trade in goods, 2023). However, the decline in exports was more impressive (by 35%) than that of in imports (by 19%). In the beginning of the year, with a 27% reduction in the value volume of merchandise turnover, the physical volume decreased by 42%, indicating an increase in the world prices for the leading trade commodities of Ukraine (Total volume of imports, 2022). If the value volumes of exports decreased by 35%, their physical volumes decreased by 38%. Even more significant difference has been observed for imports of goods: the decrease in the value of imports by 19% occurred against the background of a decrease in the physical volumes by 49%. According to the results of 2022, exports of goods dropped by 23.9 bln USD compared to 2021, and amounted to 44.2 bln USD. The growth of exports during the first two, mostly pre-war, months of 2022 by 37% could not compensate for its significant reduction in March-December by 45%. But in the beginning of fall, the exports reduction slowed down a bit: in September 2022 exports decreased by 36% compared to September 2021, in October – by 39%. Moreover, at the end of 2022, growth has been observed again: in November – by 44%, in December – by 49%.

In fact, during 2022, compared to 2021, decline has been observed in exports of ferrous metals and products from them by 62% or 10 bln USD – while in January and February of 2022 exports of this commodity group increased by 35% (Foreign Trade of Ukraine, 2023). Along with the impossibility of using the main metallurgical plants, another factor that contributed to the drop in exports of metallurgical products was the blockade of sea ports through which Ukraine supplied raw materials to various countries. The challenge of using sea ports was also the reason for the drastic decline of various merchandise exports. As a result, exports of mineral products decreased by 4.3 bln USD or by 57%; exports of food and agricultural products – by 4.3 bln USD or 16%; exports of chemical industry products – by 2.2 bln USD or 55%; and exports of machines, equipment, transport facilities – by 1.9 bln USD or 31%. At the same time, there was an increase in exports of fuel and energy products

by 257 mln USD or by 33%. Such an unexpected growth under the military conditions was largely due to the start of the so-called "energy visa-free regime" with the EU (ENTSO-E, 2022). In 2022, compared to 2021, Ukraine's exports of electricity doubled, or grew by 332 mln USD. It is worth emphasizing that such sectoral export dynamics resulted in modifications of product structure. ***The importance of agricultural raw materials and products for Ukraine has grown significantly, which is reflected in the fact that the share of agricultural products in the commodity structure of Ukraine's exports has risen from 41% to 53%, while the share of metals and their products has dropped from 23% to 14%.*** It is a well-known fact that these two commodity groups account for almost two-thirds of the total commodity exports of Ukraine. Thus, among other things, there was a forced change in the commodity structure of exports towards decrease in the share of goods, the production of which causes greater damage to the ecology of Ukraine and the world. Such a change will most likely lead to the fact that after the end of hostilities and the recovery of Ukraine's economy, the total emissions of greenhouse gases into the atmosphere will be significantly lower than those before the war. After all, enterprises that had comparatively higher emissions of greenhouse gases in previous periods were destroyed or significantly damaged. In addition, the recovery of Ukraine's economy will be done with a clear emphasis on increasing the level of environmental friendliness of production (Putting the green, 2022).

The analysis of Ukraine's foreign trade reveals that imports of goods in 2022 decreased by 13.8 bln USD compared to 2021, and amounted to 59.5 bln USD. The notable decrease in imports of goods was formed by decline in the amount of 7.3 bln USD, or 31%, in purchases of machines, equipment, transport facilities. In addition, Ukraine imported less chemical industry products – by 5 bln USD, or 34%, as well as food and agricultural products – by 1.8 bln USD, or 23%. At the same time, Ukraine's need for fuel and lubricants resulted in 14% rise in their imports. In addition, customs clearance of a significant amount of natural gas (imported in 2014–2016) was carried out in December 2022, which also affected the growth of imports of fuel and lubricants. The above-mentioned dynamics resulted in an increase in the share of products of this group in the commodity structure of Ukraine's imports from 20% to 29%. The share of machines, equipment, transport facilities decreased from 32% to 27% over the same period.

In general, the higher rates of reduction of exports than imports of goods resulted in three times increase in the negative balance of foreign trade – from 5.2 bln USD at the end of 2021 to15.3 bln USD at the end of 2022. On the one hand, *the tendency towards the rise of the negative balance of Ukraine's foreign trade in goods began in May: if in May the negative balance was 0.9 bln USD, in June – it reached 1.6 bln USD, and in July – already 1.8 bln USD, but in August the negative balance amounted to 1.2 bln USD, in September – 0.5 bln USD. In October and November, there was a return to the trend of increasing the negative balance: in October – 1.2 bln USD, and in November – 1.5 bln USD. However, in December, the negative balance amounted to 6.5 bln USD which was based on the decision to carry out the customs clearance (in December of 2022) of a significant amount of natural gas imported to Ukraine during 2014–2016.* On the other hand, it was possible to change the trend of increasing the negative balance thanks to the opened-up opportunities for cereal exports of Ukraine. Implementation of the "Black Sea Grain Initiative" began at the end of July 2022 (Joint Coordination Centre, 2022) which allowed Ukraine to use three Black Sea ports. In other words, Ukraine's ability to use sea routes for cereals exports, blocked at the end of February, was unblocked. The implementation of the "Black Sea Grain Initiative" resulted in an increase in exports of cereal and grain from 410 mln USD in July up to 590 mln USD in August, and approximately to 1 bln USD during the period from September to December (Figure 3). First of all, there was an increase in revenues from exports of wheat.

The information about the start of the implementation of the "Black Sea Grain Initiative", along with the other factors, resulted in the decline in the world prices for cereals (World Bank Commodity Price Data, 2022). Thus, the dynamics of the physical volume of cereals exports was much more significant compared to the dynamics of the value volume. Consequently, the physical volumes of wheat exports in December compared to July increased more than four times – from 376,000 tons to more than 1.6 mln tons. During the same period, the physical volume of corn exports increased from 1.1 mln tons to 3.1 mln tons, or almost three times.

Certain proof of the key role of the "Black Sea Grain Initiative" was the fact that after its termination, cereal exports from Ukraine crucially dropped to 381 mln USD in July 2023 and 387 mln USD in August 2023 (Foreign trade of Ukraine by commodity groups, 2023) despite the fact that Ukraine's cereal exports peaked in March 2023, when the economy managed to export 1.2 bln USD worth of commodities belonging to this group. Thus, exports of food and agricultural products in March 2023 amounted to 2.5 bln USD while in July 2023 – just 1.3 bln USD.

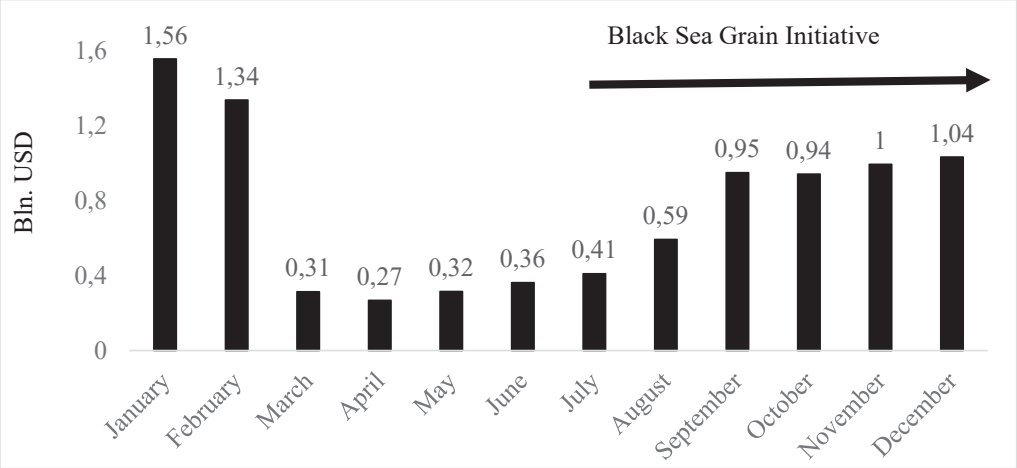

Figure 3. Monthly value volumes of grain exports from Ukraine in 2022, bln USD

Source: authors' calculations based on the State Customs Service of Ukraine

Out of the indicated 1.2 bln USD of the reduced exports of food and agricultural products of Ukraine in July 2023 compared to March 2023, the decline of 330 mln USD is calculated for China; 318 mln USD – the five EU countries since they imposed restrictions on the Ukrainian wheat, corn, sunflower seeds, and rapeseed (data on these 4 types of goods); 207 mln USD – to Turkey. Moreover, deliveries to Spain, the Netherlands, Egypt, Bangladesh dropped by almost 200 mln USD during the analyzed period.

The solution to the problem of reducing the export of food products from Ukraine lies in the creation of safe transportation of such products by sea from Ukraine, both through the return to the implementation of the Black Sea Grain Initiative and through other opportunities.

In terms of trade with the EU, it is necessary to achieve the waiver of restrictions on goods from Ukraine, or the implementation of infrastructure projects to minimize the participation of warehouses in EU countries neighboring Ukraine for the storage of domestic agro-industrial products. One of these projects is the "Dry Port" near the village of Horonda in Zakarpattia Region, which should become a regional hub for providing intermodal logistics and the possibility of storing grain, vegetable oil and containers. With transshipment capabilities from broad gauge (1520 millimeters) to narrow gauge (1435 millimeters), as well as storage facilities and container solutions, the project will improve the flow of Ukrainian grain and sunflower oil to the EU. Since the project is implemented with the participation of Italian investors, it is planned that it will connect Ukraine with Italian cities, and from there domestic products will reach other countries of the world.

Over and above that, Ukraine's foreign trade experienced extreme challenges because of geographical limitations caused by the military operations. The only direction in which foreign trade could take place was the western one (Foreign trade of Ukraine, 2023). Logically, ***the growing role of the EU as Ukraine's main trading partner has become even more evident. In the geographical structure of foreign trade in goods, the share of the EU increased from 40% in 2021 to 53% in 2022.*** Compared to other countries, this was facilitated by a slight decrease in turnover by 2%, which consisted of an increase in exports of goods by 4.2% with a decrease in imports of goods by 7.5%. At the end of 2022 in the overall structure of Ukraine's goods exports, the share of the EU was 63%, and in the overall structure of imports – 46%; although, at the end of 2021, the share of exports and imports to the EU was 39% and 40% respectively.

To a large extent, the growth of exports to the EU was based on the fact that Ukraine used the EU countries to redirect its exports of agricultural products – primarily cereals – to other markets. For example, in 2021 Ukraine did not supply wheat to Romania at all, while in 2022 the physical volumes of its exports amounted to almost 1.5 mln tons. The increase in corn exports to Romania is even more impressive: if in 2021 corn exports amounted to 526 tons, in 2022 corn exports amounted to 3.4 mln tons. In general, the physical volumes of cereals exports from Ukraine to Romania increased 3346 times, while the value volumes increased 672 times. Such figures indicate that the seaports of Romania contribute to the logistics of Ukraine's cereal exports in the conditions of military operations.

The share of the EAEC countries in Ukraine's trade turnover in 2022 was 8%; thus, it reduced significantly compared to 2021 when it was 13%.

Such changes are quite logical because foreign trade operations with the leading economies of the EAEU – the Russian Federation and Belarus – practically have not taken place since the beginning of full-scale military operations. As for trade with the other countries, their share in the geographical trade of Ukraine was 38% at the end of 2022. Compared to 2021, the turnover with them decreased by 41% and the share of these countries in geographical trade was 47%. At the same time, the rate of export reduction (by 58%) significantly exceeded the rate of import reduction (by 21%).

In general, it should be noted that Ukraine's foreign trade in 2022 has served an empirical example of how full-scale military aggression against a country can affect the country's foreign trade operations, also it has demonstrated Ukraine's foreign trade stability. In addition, it underlined the importance of cereal exports from Ukraine for global food security, and therefore how a war in an agricultural exporting country affects the whole world.

5. Conclusions

The publication reveals the negative structural transformations in the domestic agricultural production, substantiates the necessity of strengthening the domestic food security following the example of the developed countries, stresses the importance of the formation and implementation of the modernized state policies where special focus is put on reindustrialization of the national economy. The largest importers of the selected types of agro-food products of Ukraine have been identified. The main global importers and exporters of the examined commodities have been described. The major competitors of Ukraine have been determined. Special efforts should be made towards meaningful diversification of the merchandise structure of the production and that of exports with the emphasis on the exports of finished agro-food products. The key role should be played by the state in regulating foreign economic activity with the aim of adapting the economy of Ukraine to the conditions of the Fourth Industrial Revolution.

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