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SUNFLOWER OIL MARKET IN UKRAINE: STATE AND CHALLENGES

Abstract. This paper aims to provide analysis of state and challenges of the sunflower oil market in Ukraine. To conduct purposes in the article, the significance of agriculture was highlighted and evaluation of Ukrainian sunflower oil market was done.

Market research of sunflower oil market was divided on two periods: (1) before the russian invasion to Ukraine; (2) the period of the hostilities on the Ukrainian territory. The period until hostilities characterizes by growing tendency of sunflower oil production in Ukraine and increase of export capacities. Indeed, in 2020/2021 MY 5010 thousand t of sunflower oil was produced, where 93% was exported that is 40% on the world supply of sunflower oil on the market. At the same time Ukraine cover sunflower oil domestic needs, i.e. approximately 10% of total production. The indices of self-sufficiency ratio was increased each years and in 2020/2021 MY was equalled to 9.61%.

The second period in Ukraine could be distinguish by problems, which negatively harm the sunflower oil market due to hostilities, i.e. disturbance of supply chains due to blocked ports; partially mined the territory and ongoing hostilities, which decrease harvested area under sunflower; increase prices of input factors for sunflower oil production; sunflower seeds and sunflower oil prices volatility. In turn, these lead to the situation, when sunflower products manufacturing, export and economic indices are unpredictable.

Taking into account the fact that Ukrainian sunflower oil is export oriented product, accordingly on domestic market are influenced prices that formed at the world markets of vegetable oils. In the article the sunflower oil prices were forecasted for short time period. It showed price increase and at the end of the year could be reach to 1700 US dollar per tone. Indeed, positive trend on the world market will bring benefits for processing enterprises despite on uncertainty of country environment.

Key words: sunflower oil, sunflower seeds, market, export, Ukraine, hostilities

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Ринок соняшникової олії в Україні: стан та виклики

Анотація. Метою даної статті є аналіз стану та викликів на ринку соняшникової олії в Україні. Для реалізації поставлених цілей у статті висвітлено значення сільського господарства та проведено оцінку українського ринку соняшникової олії.

Виділено два періоди дослідження ринку соняшникової олії: (1) до російського вторгнення в Україну; 2) період бойових дій на території України. Довоєнний період характеризується тенденцією зростання виробництва соняшникової олії в Україні та збільшенням експортних потужностей. Так, у 2020/2021 МР вироблено 5010 тис. т соняшникової олії, 93% якої було експортовано, що в свою чергу становить 40% від світової пропозиції соняшникової олії на ринку. При цьому Україна покриває внутрішні потреби соняшникової олії, тобто близько 10% від загального виробництва. З кожним роком показники самозабезпеченості підвищуються та в 2020/2021 МР даний показник становив 9,61%.

Другий період в Україні відзначається проблемами, які негативно впливають на ринок соняшникової олії через військові дії, тобто порушення ланцюгів поставок через заблоковані порти; частково замінована територія, ведення бойових дій, що призводить до зменшення посівних площ соняшнику; підвищення вартості основних факторів виробництва соняшникової олії; волатильність цін на насіння соняшнику та соняшникову олію. У свою чергу, непередбачуваним стає виробництво соняшнику та продуктів його переробки, їх експорт, а також економічні показники виробництва і реалізації.

Враховуючи те, що українська соняшникова олія є експорто-орієнтованим продуктом, то на внутрішній ринок впливають ціни, які сформувалися на світовому ринку рослинних олій. У статті здійснено прогнозування цін на соняшникову олію на короткостроковий період. Результати засвідчують подальше зростання цін до досягнення рівня 1700 доларів США за тонну до кінця року. Позитивна динаміка на світовому ринку принесе користь переробним підприємствам, незважаючи на невизначеність умов середовища їх діяльності всередині країні.

Ключові слова: соняшникова олія, насіння соняшнику, ринок, експорт, Україна, бойові дії.

Introduction**.** The production of sunflower oil is one of the key branches of the agricultural complex in Ukraine. Over the last decade, it has turned into a powerful industry, the profitability of which is constantly increasing.

Along with other agricultural products, the production of oil crops and oil-fat products is one of the priority and promising areas of development of the agricultural sector of the Ukrainian economy. The development of oil production in Ukraine has great prospects both for ensuring domestic needs and opportunities for the development of export supplies abroad.

The russian invasion disrupted Ukraine's main export industries. Sunflower oil was no exception. Before the war, the production of sunflower oil in Ukraine significantly exceeded the needs of domestic consumption. In recent years, about 6 million tons of sunflower oil was produced in Ukraine, where approximately 90% of it was exported. With such indicators, Ukraine was significantly ahead of the world leaders in the export of these products. The main supplies of domestic products were made by sea transport. Indeed, among the main products of the oil sector, for which the opening of ports is the most important, is sunflower oil.

Due to ports were unblocked, the volume of sunflower oil shipments in 2022/23 MR may reach 4.6 million tons according to estimates of APK-inform agency (2022). However, it is worth noting that even unblocked ports, oil exports will not return to the pre-war level. This is caused by many factors, among which it is worth highlighting: the reduction of the sunflower harvest in 2022 and the overall supply on the market, as well as the uncontrolled export of oil. In addition, there is a constant threat of missile strikes on ports.

In these circumstances this article is important and actual due to changes and challenges that appear as on domestic and foreign markets.

Analysis of recent researches and publications. The issues related to problems of oilseeds production and their processing domestically were researched by many national and foreign scientists, i.e. Bodnar, O. (2009), Chekhova, I. (2018), Hamulczuk, M. (2021), Kuts, T. (2020, 2021, 2022), Makarchuk, O. (2020, 2021, 2022), Maslak, O. (2013), Nastase, M. (2014), Pugachov, M. (2022), Rotaru, G. (2014), Shpychak, O. (2009), etc. Their work covers the economic, social and ecological problems of oilseeds production and processing them into vegetable oils; market analysis in view of prospects of global competition, trade, food safety, biofuels production, state regulation, logistics, etc. At the same time, the analysis of scientific works on the vegetable oils showed that these areas, despite its significant strategic importance, have a number of problems that were appear in Ukraine due to hostilities. Understanding of existing problems on domestic market could be realized due to deeper evaluation of tendencies and factors that influence on vegetable oils markets, in particularly, sunflower oil market.

The necessity of the state support of the agricultural branch of the economy in conditions of hostilities in Ukraine was researched by Halanets (2022).The author notes that government support is necessary due to the disruption of supply chains, which in turn led to a sharp rise in prices on world markets; Ukraine's energy infrastructure is destroyed; restrictions on the supply of fuel and mineral fertilizers have made it difficult to conduct agriculture and lead to significant losses in production and exports.

Hamulczuk et al. (2021) analyzed the sunflower oil market in Ukraine, where export-import regulation with European Union (EU) was scrutinized. There is price integration was assessed with the use of the ARDL-ECM method. Herewith the Toda-Yamamoto results showed that EU prices are a Granger-cause for Ukrainian prices. ARDL-ECM models were used to estimate long run relationships between Ukranian and EU sunflower oil prices. Indeed, results showed that in the long run 1% increase in EU sunflower oil prices leads to increase of UA sunflower oil prices from 0.91% to 1%.

Evaluation of the main features of regional production of sunflower seeds as raw materials for sunflower oil in Ukraine was researched by Makarchuk and Kuts (2022). They evaluated the potential and perspective of further sunflower seeds production by regions in Ukraine taking into account natural and climatic zones; hostilities and occupied territory by russia.

Diverse approaches to market research of sunflower oil were met in the literature review. Nowadays, analyzing Ukrainian sunflower oil market and fulfill its complete investigation, it should be included as internal factors and external factors, which influence on the market.

Purpose. The aim of the article is to analyze the state of Ukrainian sunflower oil market; evaluate main factors of development and challenges before the russian invasion to Ukraine and during the hostilities.

Materials and methods of research. The methodical basis of the paper is the provision of statistical data on sunflower oil. Based on statistical data about sunflower oil, there were analyzed the place of Ukrainian sunflower oil among crops production, and defined percentages in global production and exports. To achieve the purpose in the article was evaluated the balance of Ukrainian sunflower oil. Herewith the self-sufficiency ratio is calculated and graphically represented domestic consumption by regions.

Market analysis of sunflower oil market was researched based on two periods: before the russian invasion to Ukraine; the period of the hostilities on the Ukrainian territory. There were used a descriptive analysis to distinguish main tendencies before and during the war in Ukraine.

One of important driver for sunflower oil market is prices on domestic and world markets. To make the forecast for Ukrainian sunflower oil prices, there was taken into account world sunflower oil prices as factor sign that influence on domestic market. Prices were taken weekly for the period from January 2021 until August 2022 from internet source the APK inform. To establish a relationship between Ukrainian sunflower oil prices and European, regression analysis was done. On the basis of getting regression, the forecast of sunflower oil prices in Ukraine was made. In order to be able to make this forecast, there was forecasted the value of the factor sign, i.e. EU sunflower oil prices. To predict values of this sign, the Holt's method was implied. At the same time, the reliability of the forecast of the factor characteristics were checked using the indicators MAE, MAPE, MSE, RMSE. Then there were substituted the predicted values of the factor values into the regression equation and determined the forecasted values of the Ukrainian sunflower oil prices.

Results of the research and their discussion. The agricultural sector is very important in the national economy of Ukraine due to its purpose to provide population of food, industry for raw materials, livestock for valuable feeds, renewable energy for agricultural residues and wastes.

Indeed, Ukraine is one of the world's top agricultural producers and exporters and plays a crucial role in supplying oilseeds and processing products, grains to the global market. Agriculture is the third most important sector of the Ukrainian economy, with a gross domestic product (GDP) share of 10.5% in 2020. In 2020 in this sector provides employment for 17% of Ukraine's

population (Ukrstat, 2022). Herewith agricultural products are Ukraine's most important exports, e.g. in 2021 they assumed 27.8 billion US dollar, accounting for 41% of the country's 68 billion US dollar in overall exports (USDA-FAS, 2022). In the table 1 is presented data on agricultural production and exports in Ukraine.

Table 1

Ukrainian agricultural production and exports for 2022/2023 MY

Products	Production			Exports		
	Volume, 1000 t	Rank among global producers	In the % of global production	Volume, 1000 t	Rank among global exporters	In the % of global exports
Corn	25000	8	2.1	9000	4	4.9
Wheat	21500	9	2.8	10000	8	4.9
Sunflower seeds	9500	3	19.3	750	1	20.7
Barley	5700	7	3.9	1800	6	5.9
Sunflower oil	4085	3	21.4	3600	1	34.7
Sunflower meal	3924	3	19.0	2700	1	39.8
Rapeseed	3200	6	4.0	2750	3	16.6

Source: USDA-FAS, 2022

The table 1 is showed that Ukraine remains the third to products of sunflower seeds, sunflower oil and sunflower meal in rank among global producer in 2022/2023 MY. At the same time in the rank among global exporters Ukraine takes place one for sunflower seeds, sunflower oil and sunflower meal. In the percentages expression Ukrainian export of sunflower seeds is amounted to 21%, sunflower oil 34.7% and sunflower meal 39.8%. Indeed, top markets in 2021 were India (31%), the EU (30%), and China (15%). Ukraine usually supplies sunflower meal nearly 2/3 of the world's sunflower meal, with exports valued at 1.2 billion US dollar in 2021. However, there is projected by USDA-FAS that Ukraine's share of global exports decline to 40% in 2022/2023 MY (USDA-FAS, 2022).

The production of sunflower oil is one of the key branches of the agricultural complex in Ukraine. Over the last decades, it has turned into a powerful industry, the profitability of which is constantly increasing.

Studying the sunflower oil market, we divided the research period before the russian invasion to Ukraine and the period of the hostilities on the Ukrainian territory.

Untill the russia invasion the oil industry of Ukraine has remained one of the few that even in the conditions of the global financial and economic crisis, is developing rapidly and is a budget-forming branch of the agro-industrial complex with a strong export potential. There were functioning 64 processing enterprises and 48 oil extraction factories; exports were diverse and accounted more than 120 countries of the world.

The need for state regulation in the activities of the oil and fat complex of Ukraine was manifested in its crisis period due to the mass uncontrolled export of sunflower seeds abroad. With the gross harvest of sunflower seeds in the amount of 2.4-2.8 million tons, the needs of the domestic market in both oil raw materials and products of its processing were not met. Processing enterprises, the capacities of which allowed processing the entire grown crop of sunflower seeds, were idle, some of them went bankrupt. Salary arrears at some enterprises exceeded a year and a half period.

For stabilization on the sunflower oil market in Ukraine the Law of Ukraine "On rates of export duty on seeds of certain types of oil crops from September 10, 1999, No. 1033-XIV, entered into the force. According to this law a 23% export duty on seeds of certain types of oil crops (linseed, sunflower, and redhead) was established. Then, the Law of Ukraine "On Amendments to

Certain Laws of Ukraine" dated June 21, 2001, No. 2555-III reduced the rates of export duty on seeds of certain types of oil crops from 23% to 17% and prohibited the processing of sunflowers abroad in conditions of delivery (Resolution No 1033- XIV, 2012).

By negotiation process regarding Ukraine's accession to the World Trade Organization (WTO), the issue of reducing the export duty on sunflower seeds was settled by the Ukrainian side through the adoption of the Law of Ukraine from July 7, 2005, No 2773-IV "On Amendments to the Law of Ukraine "On export rates duty on the seeds of certain types of oil crops", which entered into force after Ukraine became a full member of the WTO on May 16, 2008. According to this law an annual reduction of the current 17% customs duty rate by 1% (to 10% in the final period) after Ukraine's accession to the WTO (Law of Ukraine No. 2773-IV, 2005).

Due to the effect of the mentioned laws, the oil and fat complex of Ukraine has received intensive development. As a result of the consequences of the export duty, the profitability of growing sunflower seeds in Ukraine has increased rapidly from 19-22% (the level in the last years preceding the introduction of the duty) to 88.4% (in 2002) and remains at this level even now. Sunflower growing has become the most profitable technical crop.

Addition to mentioned laws, the Law No. 6776-D that entered into force from 1 March 2018 has foreseen that Ukraine will not reimburse VAT taxation by the rapeseed, soybean and sunflower export. There is the time limit was set, i.e. temporarily exempted from VAT taxation exports of soybeans from 1.09.2018 to 31.12.2021; rapeseed from 1.01.2020 to 31.2021. The necessary of the regulation is stressed for development the domestic processing rapeseed and soybean for vegetable oil and their further export, thus obtaining surplus to supply chain [3].

Such measures made it possible to reorient the structure of the export of the oil-fat complex from raw materials to final food products and make Ukraine a world leader in the production and export of sunflower oil.

In the table 2 it could be observed growing tendency of sunflower oil production in Ukraine, in particularly, in 2020/2021 MY there were produced 5010 thousand t of oil that is on 5 times higher than in 2000/2001 MY. At the same time, 93% of produced sunflower oil in 2020/2021 MY went for export, where Ukrainian sunflower oil was accounted to 40% on the world market. The largest importers of Ukrainian sunflower oil remain EU countries (approximately 30% of the total export). The self-sufficiency coefficient increased annually, which indicates the coverage of domestic consumption production.

Table 2

The balance of sunflower oil in Ukraine, thousand t

Indices\ Marketing year	2000/2001	2005/2006	2010/2011	2015/2016	2020/2021
Beginning stocks	12	293	144	344	269
Production	970	1925	3335	5010	4515
Imports	0	0	1	1	0
Total supply	982	2218	3480	5355	4784
Export	550	1514	2652	4500	4200
Domestic consumption	417	417	530	550	470
Total demand	967	1931	3182	5050	4784
Ending Stocks	15	287	298	305	114
Coefficient of self-sufficiency	2.33	4.62	6.29	9.11	9.61

Source: USDA-FAS, 2022

Average domestic consumption of vegetable oil per capita by regions in 2020 is amounted to 12.3 kg (Fig. 1). Total domestic consumption in 2020/2021 MY was equalled to 470 thousand t that is consist10.4% of total production.

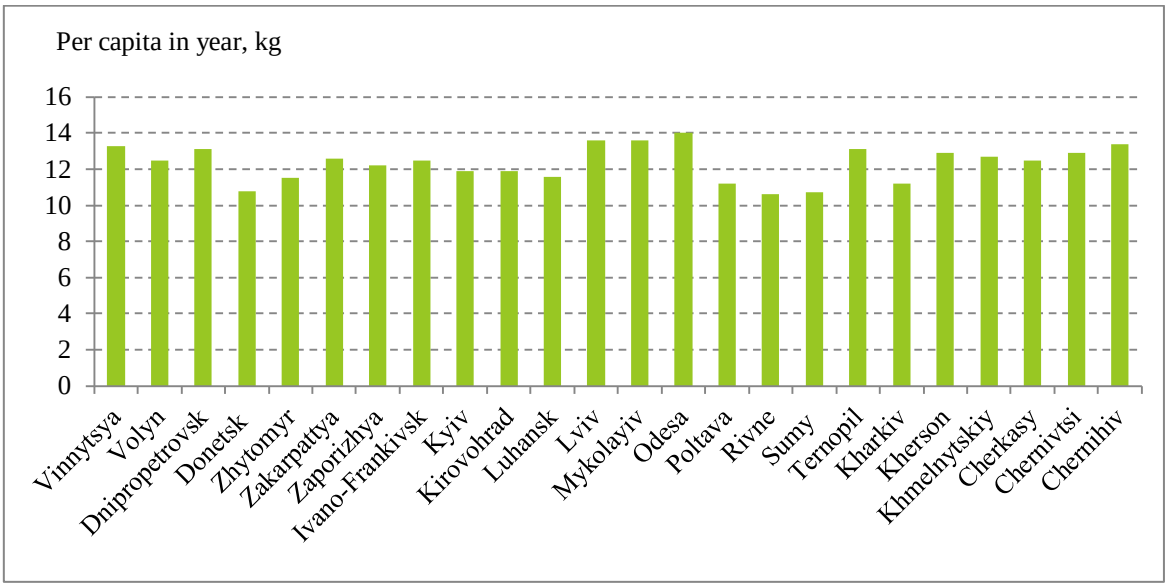

Fig. 1. Consumption of vegetable oil by regions in Ukraine in 2020, kg per capita in year
Source: Own representation based on data of the State Statistical Services of Ukraine, 2022

Since russia has irrupted to Ukraine, sunflower oil market was suffered significantly. Main problems that have appeared: (1) logistics and supply chains are significantly disrupted due to blocked ports; (2) a large part of the territory has been mined or is going hostilities and as a result decrease of gross harvest of sunflower seeds for processing to sunflower oil; (3) growth in fuel prices and mineral fertilizers for sunflower seeds production; their supply restrictions; (4) sunflower seeds and sunflower oil prices fluctuations. These reasons make farming difficult and lead to significant losses by sunflower seeds and sunflower oil production and export. In March 2022, all processing enterprises in the country was stopped. Nowadays, 15 oil extraction plants have renewed operation in Ukraine, which is about 15-20% of capacities. According to Ukroliyaprom association, more then 20 factories are currently ready for launch, but they are not put into operation due to the impossibility or limitations of selling final products. At the same time sunflower oil prices continue to rise under the pressure of global market trends. The supply prices have increased on July 2022 to 1585-1600 US dollar/t (Fig. 2). However, there is a rather powerful restraining factor in the market in the form of low purchasing activity from India, which is the world's largest importer of vegetable oils; another factor that facilitates to price growth was the increase in quotes for soybean oil, e.g. the May futures of soybean oil on the exchange in Chicago for the period from April 12 added more than 22% in price (APK-inform, 2022).

As we can see from the fig. 2 Ukrainian sunflower oil prices follow EU sunflower oil prices. The linkage between sunflower oil prices were confirmed by the author and Kuts, where results showed that past changes in sunflower oil prices in the EU allow to forecast current changes in Ukrainian sunflower oil prices and vice versa (Makarchuk & Kuts, 2022).

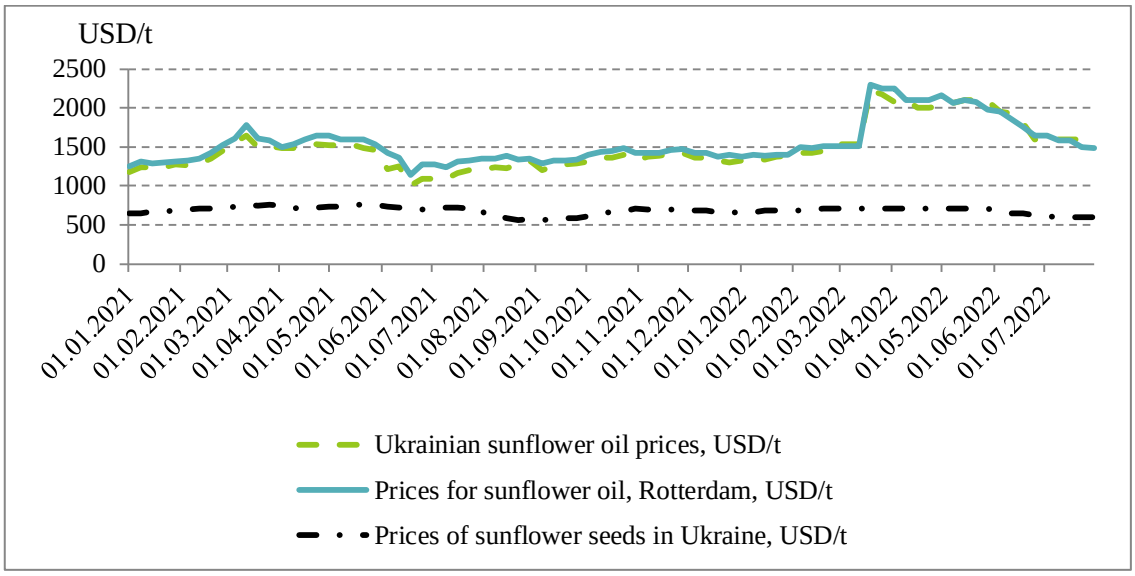

Figure 2. Weekly prices for sunflower oil and seeds in Ukraine and EU
Source: Own representation based on data of APK-inform, 2022

To forecast Ukrainian sunflower oil prices for shortcoming period, firstly the regression model between Ukrainian sunflower oil prices (S_oil prices_Ukraine) and EU sunflower oil prices (S_ oil prices_EU) was done. Results are the following (table 3).

Table 3

Regression model between Ukrainian and EU sunflower oil prices

Specification	Regression equation: S_oil prices_Ukraine=-139.5+1.05 *S_ oil prices_EU
R	0.98
R^2	0.95
P-value for parameter a1	0.0007
P-value for parameter a2	0.0000

Source: author's calculations.

Obtaining results confirmed the correlation of sunflower oil prices in Ukraine from EU sunflower oil prices, i.e. with increasing of 1 US dollar of sunflower oil prices in EU will lead to increase by 1.05 US dollar in Ukraine. Indeed, this fact confirmed by the prices illustrated in the fig. 2. The regression analysis indicates on close linkage between researched factors, where the multiple correlation coefficient R=0.97 that means tight connection. The model is significant that is confirmed by P-value for the parameter a1, which is lower than critical value 0.05.

Based on the reliability of getting regression model, there was forecasted Ukrainian sunflower oil prices. The Holt's method was applied to forecast the value of the factor sign, i.e. the EU sunflower oil prices. At the same time, the forecast substantiality of the factor sign was checked using forecast errors: mean absolute error (MAE) is 10.9, mean absolute percentage error (MAPE) is 9.51, and standard deviation (RMSE) is 107.8.

The next step of the forecast was based on substitute of the predicted value of EU sunflower oil prices into the regression equation and determined the predicted value of the Ukrainian sunflower oil prices (Fig. 3).

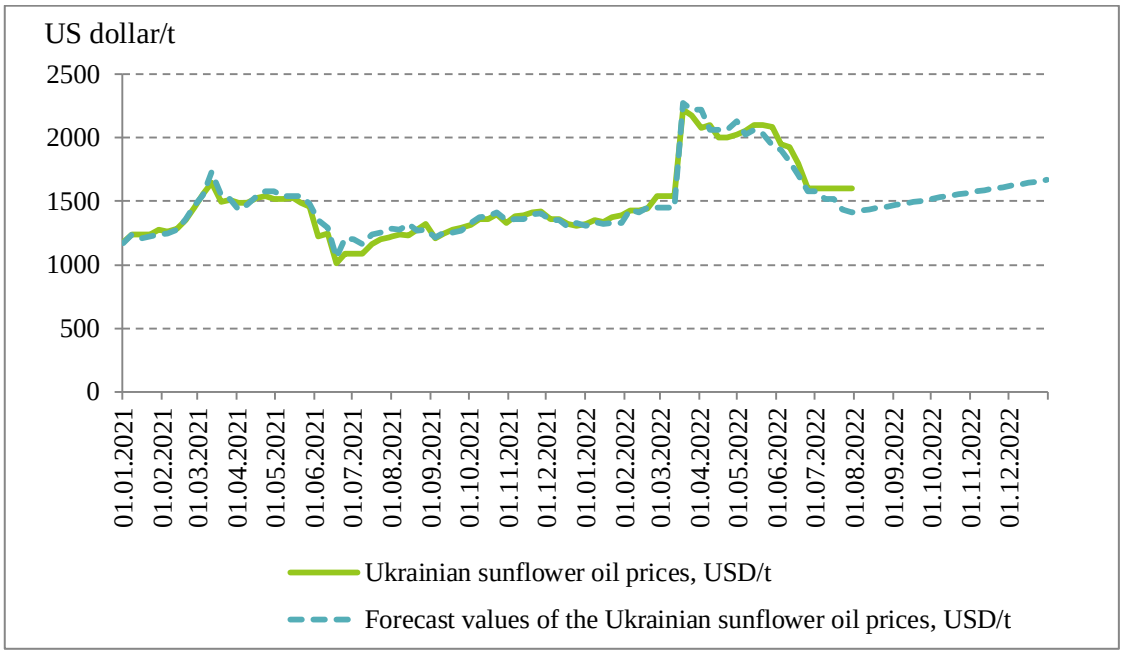

Figure 3. Actual and forecasted values of sunflower oil prices, US dollar/t
Source: Own representation

The forecast of sunflower oil prices in Ukraine is showed that prices will increase and at the end of the year it could be equalled approximately 1700 US dollar/t. In this circumstances processing enterprises will receive profit despite disturbance of logistics, price increase of input factors, i.e. sunflower seeds, gas etc. However, the war in Ukraine has added uncertainty to the forecast on sunflower oil market. The prices of sunflower oil on the world markets in 2022 will depend on internal and external factors: (1) the extent to which Ukraine will be able to establish exports. Indeed, many experts state that the return of sunflower oil prices to the pre-war state is possible only in case of complete logistics renew, in particularly, uninterrupted activities of Ukrainian seaports; (2) the situation on the world markets of other vegetable oils, i.e. rapeseed, soybean, palm, etc., since the oils are interchangeable; (3) the demand in the market of the EU, China and India that will have a significant influence on the formation of the sunflower oil price in Ukraine; (4) good new gross harvest of sunflower seeds, rapeseed and soybeans in the EU and the USA, imports of substitutes to Europe, in particular palm oil, and the supply of last year's oil residues from Ukraine could be factors that will ensure the beginning of a slow downward trend in sunflower oil prices in 2022.

Conclusions and future perspectives of the study. Ukrainian sunflower oil market is export oriented, where approximately 90% of it goes for export. The global demand is constantly growing, in particular, from the EU, China and India. In turn it positive influence on domestic processing enterprises to increase production capacities. Indeed, profitability of sunflower oil production, sufficient raw material, growing investments in technology, high prices and others make benefits for enterprises of the oil and fat complex.

The research of Ukrainian sunflower oil market was divided into the period before the russian invasion to Ukraine and the period of the hostilities.

The first period is characterized by the prosperity of the sunflower oil industry, a budget-forming branch of the agro-industrial complex with high export possibilities. Indeed, 64 processing enterprises and 48 oil extraction factories were functionining, where produced sunflower oil was exported to more than 120 countries worldwide. In 2020/2021 MY sunflower oil was produced in the volume of 5010 thousand tones and 4200 thousand tones of it or 93% was exported. At the same

time the self-sufficiency coefficient increased annually and in 2020/2021 MY was equalled to 9.61 that means the coverage of domestic consumption.

The second period is distinguished by military actions in Ukraine and their negative impact on agriculture in general and, in particular, on the sunflower oil market. Main problems that have arisen due to the war are the following: disrupted logistics and supply due to blocked ports; partial mined territory or going hostilities, which cause to decrease of gross harvest of sunflower seeds for processing enterprises into sunflower oil; growth prices of input factors and their constraints; prices fluctuations on sunflower seeds and sunflower oil on domestic and foreign markets. Due to these reasons, nowadays, only 15 oil extraction plants are functioning in Ukraine that is approximately 15-20% of capacities (Puhachov, 2022). At the same time sunflower oil prices continue to rise on the world market. In these circumstances, in the article the forecast for short term period of prices was done. According to forecast the results, sunflower oil prices in Ukraine will continue to grow, in particular, at the end of the year they could reach to 1700 US dollar per tone. However, on forecasted values many internal and external factors are influenced, thereby prices on sunflower oil could be changed.

The consequences of the war in Ukraine are expected to bring the destruction of productive capacity, damage to arable land, and reduced labor supply, especially if refugees do not return. Wars, in general, make particularly severe damage to productivity for several years, through reducing and disrupting the labour force, weakening capital deepening, breaking value chains, and hindering innovations (World Bank, 2022). Under these conditions the listed outcomes may also affect the oil and fat industry of Ukraine. The subject of further study may be an assessment of the economic, ecological and social sequences of the war on sunflower oil market.

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