Ukraine-EU-Africa: the agro-exports correlation issues

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Abstract

The aggression towards Ukraine resulted in blocking its agro–products exports, and threatened the food security in many African countries, making the agro–exports topic of not only economic but also of political importance. Therefore, the research aims to analyse whether the agricultural products exports of Ukraine to the EU are correlated with the exports of the EU to Africa and if they are, how strong the correlation is. The data under research are the agricultural products exports from Ukraine to the EU and from the EU to Africa, which were taken from the Eurostat database. The agricultural products are the goods from the SITC Groups 0+1. SITC stands for Standard International Trade Classification, in which Group 0 comprises food and live animals and Group 1 – beverages and tobacco. The timeframe under analysis is ten years – from the year 2011 to 2020 included. To reach the aim of the research, empirical analysis, comparative analysis, statistical analysis, different visualization tools, tabular method, method of trends, etc., were used. The research itself and its results will be interesting and useful for public administration officials, companies involved in international trade and agriculture, academic society representatives, decision-makers at all levels, beginner and experienced data analysts.

Keywords*: agricultural products exports, Ukraine, the EU, Africa, correlation*

Introduction

The challenges of nowadays, like the COVID-19 pandemic, climate change, the horrible events in one of the European countries, Ukraine, the migration of people as the consequence of these events, etc., made the governmental bodies in general and every single person, in particular, understand the vital importance of food security and do everything one can to secure the amount of food necessary for the population survival. Agriculture is the main source of food for human beings and forage for domestic animals. Besides that, the agricultural economy sector is the backbone of many economies in the world. It provides the basic ingredients mankind

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needs to live and function as well as the raw materials necessary for many industry branches. In addition to providing food for people and raw materials for industry, it also provides employment opportunities (IMPOFF, 2019). The proof of the statement can be found, among others, in the information provided by the Economic Research Service of the U.S. Department of Agriculture, where it is stated that, thanks to the 150.1 billion USD agricultural goods exports in 2020, 1.13 million jobs were supported (ERS USDA, 2022a). Having added the foreign exchange earnings provision and additional economic activities availability makes the agricultural economy sector vitally important for the whole of mankind's survival, in general and a single person in particular.

As many countries are located in areas with climatic conditions unfavourable either for agriculture, in general, or for a single agricultural product in particular, international trade comes into play to provide equal access to opportunities of a more diversified agricultural products assortment. International trade is important for the economic well-being of a nation and a region (Bairak & Hughes, 1996) as it influences all the national and local economy sectors, directly or indirectly. Thanks to the diversification of the logistics roots and means, international trade can help meet the ever-changing market demands. The market demands for agricultural products in the national and global markets are gradually expanding – due to population growth, income gains, and increased urbanization – generating new opportunities and challenges (World Bank, 2015). That is why, agricultural export is extremely important as, besides earning precious foreign exchange for a country, exports help farmers/producers/exporters take advantage of wider international markets and increase their income. Exports also result in increased production in the agriculture sector by increasing area coverage and productivity (Ministry of Agriculture and Farmers Welfare, 2020).

The system of the global agricultural and food trade is undergoing rapid change, with important implications for the economic development of every subject involved (Maertens & Swinnen, 2014). Talking about the system of global agricultural and food trade, not only the agricultural and processing enterprises were meant. The countries as independent subjects, containing definite sub-subjects of the system influence and make it change rapidly under the pressure of economic, political, etc., challenges. According to the Economic Research Service of the U.S. Department of Agriculture (ERS USDA, 2022b), although the United States and the European Union remain among the largest exporters and importers of agricultural products, the following five countries, i.e. Brazil, China, India, Indonesia, and Russia became important traders in the global agricultural market. As one can notice, the biggest exporters are, at the same time, the biggest countries in the world in terms of their territory. It seems to be quite logical as a big territory means more land, capacities, and workforce to produce more agricultural products. Ukraine is not among the biggest countries of the world, holding the 45th position in terms of its territory, and we will not find the country among the biggest global net exporters or the agro-exporters as, according to the data from

Eurostat (Eurostat, 2022b), the country took the 32nd position in the top world exporters, accounting for 43 billion EUR (0.3 %), going after Israel (€ 44 billion, 0.3 %) but preceding Kazakhstan (€ 41 billion, 0.3 %). Despite that, the country takes a prominent place among the leading agro–producers and exporters in the world in terms of sunflower, grains, maize, and soybeans. The advantageous location, the favourable climatic conditions, fertile soils, and available workforce, as well as the country's efforts to use the said competitive advantages make Ukraine a remarkable player in the global agricultural market.

While analysing the global trading flows, the biggest and most influential players, like the USA or the EU are taken into consideration. Due to all these reasons, the research was initiated trying to answer the following scientific questions – can relatively small countries, such as Ukraine, be correlated with the biggest ones in terms of agricultural products exports? The scientific hypothesis, which is to be confirmed or rejected as a result of the research, is that even the smallest country can be correlated with the biggest global agro-trade market players; therefore, the territorial component is not the most important one when taking into account the country's economic and political influence on the supranational and global stages. In the case of the present research, the attempt to assess the presence/absence of the correlation (and its strength in the case of its presence) between the territorially different agro-market subjects is to be treated as its novelty as an attempt has been made to compare the subjects, which seem to be incomparable at the first sight. In addition, the decision to conduct the present research was prompted by the current events taking place in Europe, precisely speaking the aggression towards Ukraine, which resulted in blocking its agro–products exports, threatened the food security in many African countries, thus making the agro–exports topic of not only economic but also of political importance. At the same time, the European Union has intensive trade relations either with Ukraine, thanks to the signing and implementation of the Deep and Comprehensive Free Trade Area (DCFTA), or with many African countries, being a strong and influential trade market player.

1. Materials and methods

The vital importance of agriculture as the source of food for people, forage for animals, and raw materials for industry goes without saying. Thanks to international trade, these functions of agriculture are fulfilled with the help of its means and tools. The current challenges have showed the extreme importance of exports as part of international trade for the supply of the necessary items. Especially facing the challenges of nowadays, the decision makers of all spheres and at all levels realized the need to plan the exports/imports amounts to ensure the successful functioning of all the subjects. Making the analysis of the available data to the fullest extent possible will help international flows function without interruptions even in front of different challenges providing people with all the goods and services needed.

The data under research are the agricultural products exports amount from Ukraine to the EU and the agricultural products exports amount from the EU to Africa. The analysed data were taken from the Eurostat database. The agricultural products are the goods from the SITC Groups 0+1. SITC stands for Standard International Trade Classification. Group 0 comprises food and live animals and Group 1 comprises beverages and tobacco. The timeframe under analysis is ten years – from the year 2011 to 2020 included. The purpose of the research is to analyse whether the agricultural products exports of Ukraine to the EU are correlated with the exports of the EU to Africa and if so, how strong the correlation is. To reach the purpose of the research, the amount and dynamics of the agricultural products exports from Ukraine to the EU and the ones from the EU to Africa were compared by using line graphs for better data visualization. The differences to the previous periods in the agricultural products exports from Ukraine to the EU and the ones from the EU to Africa were analysed by using bar charts for better data visualization. The trend lines were built and the projections for the following two periods were made by using the power functions in both cases.

The choice of the right function was made by choosing from the exponential, linear, logarithmic, polynomial, and power ones judging by the R^2 coefficient values. The basic statistic measures of location, that is mean, median, and mode, were calculated and analysed by using the tabular method for better data presentation. The basic statistical measures of variability, that is, standard deviation, variance, range, and interquartile range, were calculated and analysed by using the tabular method for better data presentation. The scatterplot of the agricultural products exports of Ukraine to the EU vs of the EU to Africa was built to preliminarily visualize the presence/absence of the correlation between the exports. The Pearson and Spearman correlation coefficients and their corresponding p-values were calculated and analysed. The conclusions about the possibility to confirm/reject the H0 hypothesis about zero correlation between the subjects under analysis were made based on the research results. Taking into account the fact that the agricultural products exports of Ukraine, their functioning and, especially, blocking by another country have become more than just an economic issue, the present research, as well as its results, give us a better understanding of the correlations, that is, interrelations, between the global trade market players, providing us, in turn, with the more precise information about the way, according to which the global market functions. The subjects for whom the research itself as well as its results would be interesting and useful have been defined and the directions of the research expansion have been outlined.

2. Results and discussion

The current political and economic relations between Ukraine and the EU are regulated by the Association Agreement between the European Union and the European Atomic Energy Community and their Member States and Ukraine (AA), including a Deep and

Comprehensive Free Trade Area (DCFTA) (Ministry of Foreign Affairs of Ukraine, 2021b). The Deep and Comprehensive Free Trade Area between Ukraine and the EU defines the legal framework for the free movement of goods, services, capital, and partial labour force between the above-mentioned subjects (Cabinet of Ministers of Ukraine, n.d.). The AA/DCFTA was negotiated in the timeframe from 2007 until 2011 and initiated in 2012 (Ministry of Foreign Affairs of Ukraine, 2021b). The political part of the AA was signed on the 21st of March 2014, while its economic part – on the 27th of June of the same year.

The ratification of the AA was held by the Parliament of Ukraine and the European Parliament simultaneously on the 16th of September 2014 (Cabinet of Ministers of Ukraine, n.d.). As a result, the AA/DCFTA can be called a comprehensive trade agreement that aims at reducing and eliminating the tariffs applied to each other's products, liberalizing access to services markets, and also at aligning Ukraine's business-related rules and regulations with those of the EU, to ensure that products can be traded freely between the two countries and Ukrainian companies, products, services, and institutions treated equally with those of the EU (Hellyer & Pyatnitsky, 2013). Since the 1st of January 2016, the trade relations between Ukraine and the EU have been regulated by Chapter IV of the AA "Trade and Trade-related Matters". Even earlier, since 2014, the EU has become the main trading partner of Ukraine. For example, in 2020, the share of the EU in the total trade in goods and services of Ukraine was 41% (in trade in goods - 40.7%, and in services - 43.1%) (Ministry of Foreign Affairs of Ukraine, 2021a). However, in 2021, Ukraine was the 17th largest partner for the exports of goods (1.3 %) from the EU (Eurostat, 2022b). Thanks to the implementation of the AA/DCFTA, Ukraine has become the fourth biggest exporter of agri-food products to the EU, to the benefit of Ukrainian agricultural producers (Dombrovskis, 2021). Though Ukraine is not among the top trade partners of the European Union, the EU is one of the most significant trade partners for Ukraine.

To further proceed with the research, let us cast a look at the subject of the global trade market, the potential of which has been noted by the most politically and economically influential market subjects, including the EU. The statement is about Africa which, while benefitting from huge natural resources and human potential, has become an emerging centre of world development, as well as a zone of clash of interests of all the major geopolitical players (Abravitova, 2019). The cooperation of the African countries with those of the European Union is regulated by such frameworks as the Cotonou agreement and the joint Africa-EU strategy. The Cotonou agreement is the overarching framework for the EU relations with African, Caribbean, and Pacific (ACP) countries, covering the EU's relations with 79 countries, including 48 countries in sub-Saharan Africa. The joint Africa-EU strategy was adopted in 2007 and is implemented through periodical action plans (European Council, 2022). The trade relations between the African and the European continents have been evolving for centuries. One can define two main periods in the trade relations of the two continents. These are from 1975 to 2000 and from 2000 until nowadays. The first

period was marked by the signing of the Lomé Convention and the introduction of non-reciprocal trade preferences. The second one is identified by the signing of the Cotonou Partnership Agreement, mentioned above (Dieye, 2021). The evolvement of the EU - Africa trade relations has moved upwards as in 2020, the largest trade partner for Africa was the EU, with 33 % of exports to, and 31 % of imports from non-African countries. In both cases, China was the second largest partner, with 17 % of exports and 22 % of imports (European Commission, 2021). The first step of the research is to provide the comparative analysis between the agricultural products exports of Ukraine to the European Union and those from the EU to Africa, which is presented in Figure1.

Figure 1. Agricultural Products Exports from Ukraine to the EU and from the EU to Africa, mln EUR

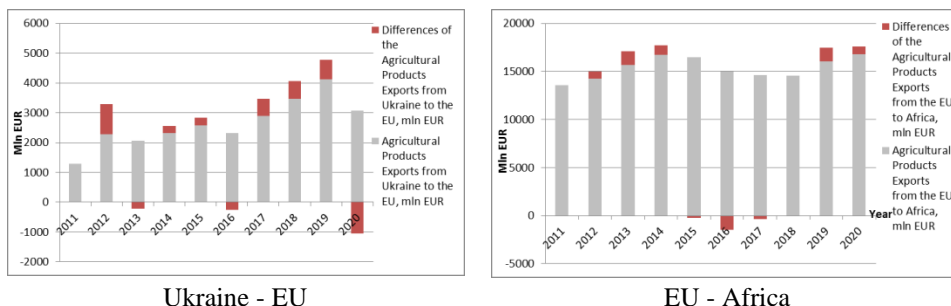<div align="center">Ukraine - EU   EU - Africa</div>
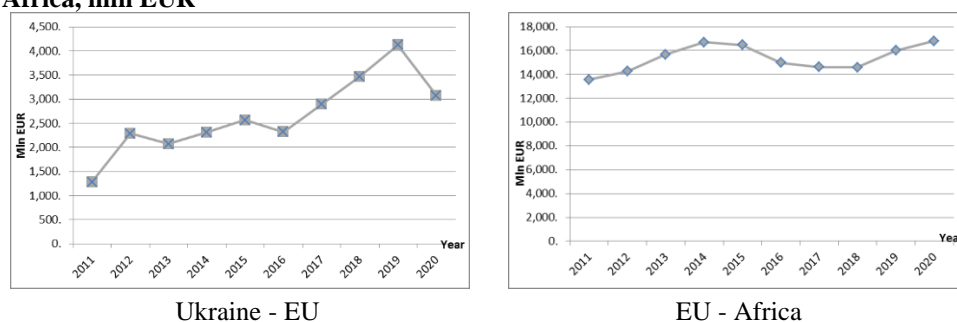
Source: Author's representation based on the data from Eurostat (2022a)

Having compared the agricultural products exports of Ukraine to the European Union with those from the EU to Africa, as shown in the figure above, it can be stated that the overall dynamics of the Ukraine-EU agro–exports is sharper than those of the EU–Africa. The dynamics of the agro–exports from Ukraine to the EU has two sharp, in 2012 and 2019, and one flatter peak, in 2015. If we take a look at the dynamics of the agro-exports from the EU to Africa, we will notice that it is a lot flatter than that of Ukraine–EU. There are two peaks in it, in 2014 and 2020, but they are not as sharp as those by Ukraine–EU agro–exports. It is worth mentioning the fact that the years of the said peaks are completely different in both cases, without any overlaps. Another interesting issue is the change in the compared dynamics in the year 2020 – in the case of the agro–exports from Ukraine to the EU, we see a sharp decrease in the exports amount which is, in turn, absolutely logical, as it can be explained by the consequences of the COVID-19 pandemic and all the negative moments connected with it, which clearly influenced the amount and trading routes of the agricultural products exports. At the same time, in the case of the agricultural products exports from the EU to Africa, we see a gradual increase in the export amount as a continuation of the overall upward tendency starting in 2019. To better understand the similarities and differences between the agro–exports under research, let us analyse the agricultural products exports from Ukraine to the EU and those

from the EU to Africa with their changes when compared to the previous periods with the help of the data displayed in Figure 2.

Figure 2. Differences in the Agricultural Products Exports from Ukraine to the EU and from the EU to Africa, mln EUR
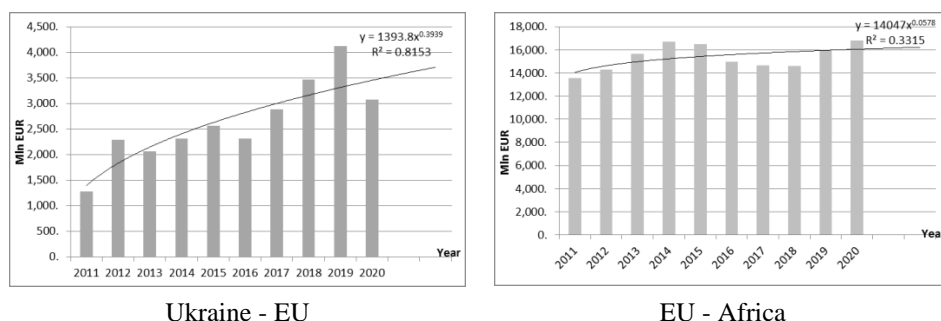

| Ukraine - EU | EU - Africa |

Source: author's representation based on the data from Eurostat (2022a).

Just like with the data provided in the previous figure, the ones in Figure 2 look completely different, either if we pay attention to the years of differences for the agro-exports amounts, or to the size of the differences. As we can see, the magnitude of the changes is bigger in the case of Ukraine–EU agro–exports. The agricultural products exports from Ukraine to the EU during the timeframe under analysis can be divided into two dynamics tendencies, containing at least two-year periods. The first one contains the years 2014 and 2015 and is an upward one and the second group is from the year 2017 to 2019, being also an upward one. In all the other years, with either an increase or decrease in the agro–exports, the data changed on a one-year basis. It should also be added that the biggest increase in the agricultural products exports from Ukraine to the EU can be observed in 2012 and the smallest exports increase – in 2014. One of the factors that influenced the biggest agro–exports increase and, perhaps, one of the main ones, was the initialization of an association agreement between Ukraine and the EU which, in turn, provided for the creation of a free trade zone and visa facilitation; nevertheless, an increasing number of the EU country - members have diversified their foreign policies through the last decade (Kacziba & Hasan, 2022). The consequences of the political turbulences in the country, as well as the annexation of some of the country's territories could be accepted as an explanation for the smallest agricultural exports increase in 2014. At the same time, the biggest decrease in the exports amount can be seen in 2020 while the smallest decrease in 2013. The consequences of the Covid-19 pandemic can be seen as the explanation for the biggest agro–exports decrease in 2020 because, as soon as the COVID-19 pandemic reached Europe, its politics immediately raised a variety of unsolved questions and problems (Schmidt, 2022), while the initialization of the Free Trade Agreement between Ukraine and the EU in 2012 had its positive impacts in the form of the smallest exports decrease in 2013.

A different situation is with the agricultural products exports from the EU to Africa, whose dynamics is flatter than that of Ukraine–EU and whose differences are smaller. The agro–exports of the EU to Africa dynamics can be divided into three clear groups, the first one is from the year 2012 to 2014 included, being the upward one. The second group, which is the downward one, contains the data for the years 2015 to 2018 included, & the third group, another upward one, is from the year 2019 until the end of the timeframe under analysis. In addition, the biggest increase in the agro–exports under analysis can be seen in 2019 while the smallest increase is identified in 2012. The biggest decrease in the exports was in 2016 while the smallest decrease was in 2018. To further conduct the research, let us build the general trend lines for the agro–exports amounts under analysis with the projection for the following two periods, that is, for two years (Figure 3).

Figure 3. Agricultural Products Exports from Ukraine to the EU and from the EU to Africa with Trend Lines and Projections, mln EUR

Ukraine - EU   EU - Africa

Source: author's representation based on the data from Eurostat (2022a).

Though the dynamics of the agricultural products exports from Ukraine to the EU and from the EU to Africa are different, the trend lines for both cases were built by using the same function type – the power one. The choice of the right function to build the trend lines was made by choosing from the exponential, linear, logarithmic, polynomial, and power ones by taking into account the R^2 coefficient values. Surely, the value of the R^2 coefficient is only one of the indicators to choose the right function from so as to build a trend line and make a projection, but the research is not a purely statistical one; for these reasons, this particular indicator has been considered robust enough in this case. Despite the peaked outlook of Ukraine - EU agro–exports amount, the trend line is upward through the whole timeframe under analysis and two projection periods, as well. As it has already been stated, a big decrease in the exports can be seen in 2020, but the upward trend line gives hope for the agricultural products exports from Ukraine to the EU to increase, as it can be seen from the data displayed in the figure given above. In the case of the agro–exports from the EU to Africa, whose dynamics is flatter than that of Ukraine–EU, its trend line is upward. Taking into

account the big increase in the exports under research in 2020, the projection for the following two years, according to the trend line built, is for the exports decrease. To choose the right tool for the calculation of the correlation between the exports under research, let us take a look at the basic statistical measures of location to make the preliminary conclusions about the normality/non-normality distribution of the data under research (Table 1).

Table 1. Basic Statistical Measures of Location of the Agricultural Products Exports from Ukraine to the EU and from the EU to Africa

Basic Statistical Measures of Location		
	Ukraine - EU	EU - Africa
Mean	2639.07	15366
Median	2443.8	15318.75
Mode	-	-

Source: author's elaboration based on the data from Eurostat (2022a).

Having compared basic statistical measures of location presented in the table given above, we can make a judgment about the difference in the amounts of the agricultural products exports of Ukraine to the EU and those of the EU to Africa. The mean of the agro–exports of Ukraine to the EU is approximately 6 times smaller (to be precise – 5.8 times) than that of the EU to Africa. The median of the said exports of Ukraine–EU is 6.3 times smaller than that of EU–Africa. The absence of the mode values in the table can be explained in the following way – the data sets under analysis are not so big to contain similar values. The next step of the research is to further analyse the statistical properties of the data sets under research. Table 2 contains the basic statistical measures of variability to be analysed.

Table 2. Basic Statistical Measures of Variability of the Agricultural Products Exports from Ukraine to the EU and from the EU to Africa

Basic Statistical Measures (Variability)		
	Ukraine - EU	EU - Africa
Standard Deviation	791.96	1123
Variance	627204	1261697
Range	2838	3244
Interquartile Range	786.4	1883

Source: author's elaboration based on the data from Eurostat (2022a).

The first statistic from the table given above is standard deviation, which is 1.4 times smaller in the case of the agricultural products exports of Ukraine to the EU than that of the EU to Africa. The variance of the agricultural products exports of Ukraine to the EU is approximately two times smaller than that of the EU to Africa. The range of the agro–exports of Ukraine to the EU is 1.5 times smaller than those of the EU to Africa. Taking into account the difference between the measures of location of the

analysed data sets, such a range difference points to the relatively big data dispersion of Ukraine–EU compared to the EU–Africa agro–exports. The difference between the basic statistical measures of variability increases when we come to that between the interquartile ranges of the data under research. The interquartile range of the agricultural products exports of Ukraine to the EU is 2.4 times smaller than that of the EU to Africa. An interesting observation – the difference between the range and interquartile range of Ukraine–EU is 1.5 bigger than that of EU–Africa. To proceed to the very essence of the research, a scatterplot of the agricultural products exports of Ukraine to the EU and those of the EU to Africa was made (Figure 4) (a scatter plot is a chart type that is normally used to observe and visually display the relationship between analysed variables (CFI Team, 2022)).

Figure 4. Scatter Plot of the Agricultural Products Exports from Ukraine to the EU vs from the EU to Africa
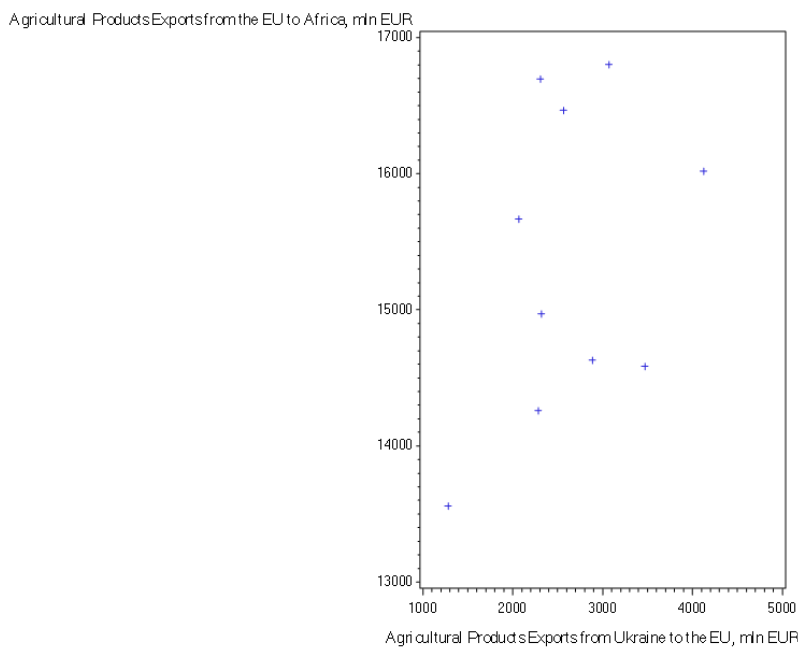
Source: author's calculations based on the data from Eurostat (2022a), made with the help of (Social Science Statistics (n.d.a)

The data relation displayed in Figure 4 cannot be called unambiguous as a clear positive correlation between the data under research can be seen; however, we cannot see clear relationships between the variables under analysis. In order to confirm/deny the correlation between the variables from the data sets under research, the correlation coefficients are to be calculated. Whether the data under research are

normally distributed should be analysed so as to choose the most robust statistical tool to calculate the correlation coefficients. Taking into account the basic statistics presented in Table 1, we can state that the data of the EU–Africa agricultural products exports are practically normally distributed while the ones of Ukraine–EU are lightly positively skewed. At the same time, the values of skewness and kurtosis point to the fact that the Ukraine–EU agro–exports are slightly leptokurtic and minimally positively skewed, while the data of the EU–Africa agro–exports – slightly platykurtic and negatively skewed. On the one hand, the deviations from normality are very small in both data sets, so the Pearson correlation coefficients of the agricultural products exports from Ukraine to the EU and the ones from the EU to Africa (with the number of observations equalling 10 and the H0 of Rho equalling zero) were calculated and presented in Table 3.

Table 3. Pearson Correlation Coefficients of the Agricultural Products Exports from Ukraine to the EU and from the EU to Africa

Pearson Correlation Coefficients		
	Agricultural Products Exports EU to Africa	Agricultural Products Exports Ukraine to EU
Agricultural Products Exports EU to Africa	1	0.3792 *p*=0.2798
Agricultural Products Exports Ukraine to EU	0.3792 *p*=0.2798	1

Source: author's calculations based on the data from Eurostat (2022a) made with the help of Social Science Statistics (n.d.a)

The results of the calculations presented in the table above confirm the author's previous assumptions made as explanations for the scatterplot (Figure 4). If we take the Pearson correlation coefficient of the agricultural products exports from Ukraine to the EU and the ones from the EU to Africa, we see that we have got the value indicating a moderate positive linear relationship between the variables under research that, in turn, echoes with the data in Figure 4, as we saw the analysed data being strongly positively correlated at the beginning of the scatter plot, losing it after 3 – 4 points, making the overall correlation moderate. But the corresponding *p*-value does not allow us to state that the mentioned correlation is statistically significant, that is the H0 hypothesis cannot be rejected. Just for comparison purposes, the Pearson correlation coefficient of the agricultural products exports from Ukraine to the EU and the exports from the EU to the Central African Republic was calculated, reaching value 0.9127, which points to the strong positive correlation between the analysed subjects. The corresponding *p*-value of the calculated coefficient is 0.000228, making the result of the calculations significant at $p < 0.05$. Just to explain – the Central African Republic was chosen because of either its territorial area or the geographical location being situated at the crossroads from/to different countries' significance with Ukraine.

To continue the research, let us remember the statement about the normality/non-normality of the data under research distribution. There are some deviations from normality in both data sets analysed. To double-check the presence/absence of the correlation between the agricultural products exports of Ukraine to the EU and from the EU to Africa, as well as to be sure that all the necessary calculations were made, the Spearman correlation coefficients for the data under research (with the number of observations equalling 10 and the H0 of Rho equalling zero) were calculated and presented in Table 4, as the Spearman correlation test is not normality sensitive.

Table 4. Spearman Correlation Coefficients of the Agricultural Products Exports from Ukraine to the EU and from the EU to Africa

Spearman Correlation Coefficients		
	Agricultural Products Exports EU to Africa	Agricultural Products Exports Ukraine to EU
Agricultural Products Exports EU to Africa	1	0.3697 *p*=0.2931
Agricultural Products Exports Ukraine to EU	0.3697 *p*=0.2931	1

Source: author's calculations based on the data from Eurostat (2022a), made with the help of Social Science Statistics (n.d.a)

The values of the Spearman correlation coefficient calculated for the agricultural products exports from Ukraine to the EU and from the EU to Africa do not differ much from the Pearson correlation coefficients presented in Table 3. The Spearman correlation coefficient points to a moderate positive linear relationship between the agro–exports amounts. Another similarity between the calculated correlation coefficients is that, just like in the case of the Pearson correlation coefficient, the Spearman correlation coefficient cannot be considered statistically significant due to its corresponding *p*-value. Therefore, the H0 hypothesis cannot be rejected either. For comparison purposes, just like in the case of the Pearson correlation coefficient, the Spearman correlation coefficient of the agricultural products exports from Ukraine to the EU with the ones from the EU to the Central African Republic was calculated reaching value 0.8062, pointing to the strong positive correlation of the subjects under research. The corresponding *p*-value is very small (2E-05), pointing to the statistical significance of the obtained calculations results. The reason for choosing the African country for the comparison has been given earlier in the paper.

Conclusions

The international trade of agricultural products is a powerful tool for supplying people in different parts of the world with food and agricultural raw materials to ensure the

survival and successful functioning of various industry branches. The current challenges have made the international trade face and overcome many obstacles to further function successfully, providing people with the necessary items. Big and powerful global players in the international trade market rule its flows. But are such big though not so influential trade market players, like Africa, or relatively small ones, like Ukraine, correlated with the powerful market players in terms of agricultural products provision? The EU is among the top most powerful and influential economic and political global players, with intensive trade relations with big and small countries throughout the world. The African continent has become one of the priority directions for the economic and political cooperation expansion, not only for the EU but for the other global players, as well, due to the huge potential of the continent, such as climatic conditions favourable for agriculture, large unused territories, young, strong and educated workforce, etc. To intensify the cooperation between the continents, the leaders of the African and the EU countries agreed on a new agenda for their partnership. As a result, the relations between the European and African continents are likely to become stronger and progressive, with the EU becoming Africa's largest trading partner, both in exports and imports. More than that, an increasing number of sub-Saharan African countries are concluding Economic Partnership Agreements (EPAs) with the EU (Hogan, 2020).

Ukraine's economy has been experiencing a difficult situation for some years already, with the conflicts in Crimea and Eastern Ukraine hindering its development since 2014 (GIZ, 2021). Climate changes and COVID-19 pandemics added to the challenges that not only the Ukrainian economy has had to adjust to. Being located at the crossroads between powerful global political and economic players, Ukraine has become the place of a war conflict that Europe has not experienced since World War 2. Though Ukraine is neither among the biggest, nor among the most economically and politically powerful countries in the world, it is still a prominent player in the world agricultural trade market. The country has dynamic trade relations with many countries in different parts of the world as it occupies leading places among the biggest producers and exporters of such vitally important agricultural products as wheat, maize, soybeans, sunflower, and others. Ukraine has declared Euro integration the priority direction of its policy and, after the signing and ratification of the AA/DCFTA, the European Union became the most important trade partner of Ukraine. Adjusting its own rules and requirements to those functioning in the EU, Ukraine will surely increase its trade flows, as well as its competitiveness on the global market. The further implementation of the AA/DCFTA will surely decrease the costs and obstacles for Ukrainian enterprises while going on the European and global markets since many trading nations around the world apply EU standards (Dombrovskis, 2021).

To answer the scientific question of whether a small country like Ukraine can be correlated with big and powerful agricultural traders like the EU and Africa, the agricultural products exports of Ukraine to the EU were compared with those of the EU to Africa. The overall dynamics of the Ukraine–EU agro–exports is sharper than

those of the EU–Africa. The peaks of the agro–exports dynamics of Ukraine to the EU are three in number and sharper than those of the EU to Africa, which are two in number and can be observed in the years different from those of Ukraine–EU. A very interesting issue is the change in the exports in the year 2020 – in the case of Ukraine–EU, we see a sharp decrease while in the case of EU–Africa - a gradual increase. In addition, the changes are more significant in the case of Ukraine–EU agro–exports than those between EU - Africa. The agricultural products exports from Ukraine to the EU during the timeframe under analysis can be divided into two dynamics tendencies, containing at least two-year periods, both upward ones. The agro–exports of the EU to Africa dynamics can be divided into three clear groups, two upward and one downward. The trend lines for both cases were built by using the same function type, that is, the power one. The trend lines are upward in both cases, though showing different projections for the following two periods – the increase of the agro–exports in the case of Ukraine–EU and the decrease in the case of EU–Africa. The basic statistical measures of the location of the agro–exports of Ukraine to the EU are approximately 6 times smaller than those of the EU to Africa. The basic statistical measures of variability of Ukraine–EU are approximately twice as small as those of EU–Africa. In a scatterplot, a clear positive correlation between the data under research can be seen for the first few observations, but then we cannot see clear relationships between the variables under analysis. The value of the Pearson correlation coefficient indicates a moderate positive linear relationship between the agricultural products exports of Ukraine to the EU and of the EU to Africa. But, the corresponding p-value does not allow us to state that the mentioned correlation is statistically significant. The Spearman correlation coefficient points to a moderate positive linear relationship between the agro–exports amounts. But the mentioned coefficient cannot be considered statistically significant due to its corresponding p-value. Therefore, the H0 hypothesis cannot be rejected taking into account both calculated correlation coefficients. The research results are very interesting and intriguing as Ukraine itself exported \$2.9 bn in agricultural products to Africa in 2020, of which wheat accounted for roughly 48%, maize for 31%, and sunflower oil, barley, and soybeans accounted for the remainder (Mwakideu, 2022).

Despite the research results, the African countries are a promising direction for the trade relations expansion of Ukraine and vice versa. Just for comparison purposes, the Pearson and Spearman correlation coefficients of the agricultural products exports from Ukraine to the EU and the exports from the EU to the Central African Republic, as well as their corresponding p-values were calculated. Both coefficients point to the existence of a strong positive correlation between the analysed subjects, while their corresponding p-values point to the result of the calculations as statistically significant at $p < 0.05$. The novelty of the research resides in the attempt to assess the existence/absence of correlation between the global agro-trade market of different territories and level of influence. The added value of the presented research resides in its results being a powerful tool to dig into and resolve the issues of the Ukrainian

agro–exports to Africa as well as the EU being an influential global intermediate player, able to help resolve the above-mentioned issues, with win-to-win results. For these reasons, the results of the presented research, as well as the research itself will be interesting and useful for public administration officials, big and small company employees involved in international trade, any company manager dealing with agriculture, academic society representatives researching any issue connected either with agriculture or international trade, decision makers at all levels, as well as beginners and experienced data analysts. It would be interesting to expand the research towards analysing which countries' agricultural products exports to Africa have the highest coefficient correlation, what countries' agricultural products exports from the African countries correlate with each other, all these while building alongside the trend lines and making projections for the agricultural exports of the African continent as a whole and separate African countries in particular, etc. The African continent has a lot of potential in many economic spheres. The development and the right use of its potential to expand economic ties with the EU, Ukraine and other countries and unions will be resulted in the benefit both for Africa and all the trade subjects involved

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