DYNAMICS OF ROMANIA'S GROSS DOMESTIC PRODUCT, EXPORT AN IMPORT. A STUDY CASE IN AGRO-FOOD SECTOR, 2013-2022

Agatha POPESCU[1,2,3]

[1]University of Agronomic Sciences and Veterinary Medicine Bucharest, 59 Marasti Blvd, District 1, 011464, Bucharest Romania, Phone: +40213182564, Fax: +40213182888, E-mail: agatha_popescu@yahoo.com
[2]Academy of Agricultural and Forestry Sciences "Gheorghe Ionescu-Sisesti", 61 Marasti Blvd, District 1, 011464, Bucharest Romania, E-mail: agatha_popescu@yahoo.com
[3]Academy of the Romanian Scientists, 1 Ilfov Street, Bucharest, 030167, Romania, E-mail: agatha_popescu@yahoo.com

Corresponding author: agatha_popescu@yahoo.com

Abstract

The purpose of this study was to analyze the dynamics of Gross Domestic Product (GDP), Export (E) and Import (I) in Romania and also in its agro-food sector in the last decade 2013-2022 and to quantify the relationships between these macroeconomic indicators using the data provided by National Institute of Statistics. The methodology used in this study included; fixed basis and structural indices, growth rate, statistical econometric modeling using regression equations, coefficient of correlations, coefficient of determination, comparison and illustrative methods. In 2022 versus 2013, Romania's GDP accounted for Euro 285,884.8 Million (doubled), export raised by 85.51% and reached Euro 91,944 Million, imports accounted for Euro 126,034.07 Million (2.27 times higher) and the deficit of trade balance reached Euro -34,101 Million, being 5.92 times higher. The regression equations quantified the impact of the determinants on GDP as follows: an increase in E value by one unit will determine an increase by 3.5086 units of GDP; an increase by one unit of I will determine a growth by 2.1058 units of GDP; an increase by one unit of NE will shrink GDP by 5.10849 units. In agro-food sector, the situation was the following in 2022 versus 2013: GDP_A reached Euro 12,864.81 Million (+66%). E_A accounted for Euro 11,959.97 Million (2.26 times higher), I_A reached Euro 13,248.61 Million (2.7 times higher), NE_A attained Euro -1,288.64 Million (9.4 times higher compared to 2015 level). The regression assessed the impact of the determinants on GDP as follows: an increase in E_A will raise GDP_A by 0.8668 units; an increase by one unit of I_A will determine a growth by 0.7034 units of GDP_A; an increase by one unit of NE_A will shrunk GDP_A by - 1.2343 units. To balance the ratio between E and I with a beneficial impact on NE and GDP, Romania has to intensify exports and diminish imports, to increase production and quality of the exported products, to identify the products which should be purchased from abroad to cover the needs on the domestic market, to offer more subsidies to producers, to extend its commercial partners on the external market and better negotiate the trade transactions.

Key words: *Gross Domestic Product, Export, Import, agro-food sector, dynamics and relationships, Romania*

INTRODUCTION

Gross Domestic Product (GDP) characterizes the economy of a country, as it measures the monetary value of all the final commodities and services carried out within the borders of a country by the resident enterprises and bought by consumers in a given period.
GDP is important to be studied as it reflects the size and health of the country's economy and of the global economies as well [1].
GDP at market price could be determined by two methods:

-*Production method* which supposes that GDP is calculated summing "the value added" GVA at each stage of production and taxes on products (TP) and subtracting subsidies per product (SP), according to the formula: GDP = GVA + TP - SP, where: GVA represents total sales minus intermediate inputs into the production process.
-*Expenditures method*, according to which GDP is determined summing Final consumption (FC), Gross capital formation (GCF), export of commodities and services (E) and subtracting Import of goods and

services (I), as reflected by the formula: GDP = FC + GCF + E - I, where: FC is the final effective consumption in terms of the value of purchases of goods and services made by the final users: households, the government and foreigners; GFC represents the investments in fixed assets (machinery etc) by various companies [9].

The growth of GDP is a good sign showing that the economy is developing under the condition that inflation to be small and relatively stable.

When GDP is used for comparisons among countries, it needs to be adjusted taking into account price changes and using the so called "price deflator" which transform "the nominal GDP" (GDP at market prices) into "the real GDP" (GDP at constant prices or inflation-corrected GDP).

In its dynamics, GDP could grow or decrease. When it is growing, the status of the economy is good, we may talk about a "healthy economy", and employment could increase. But, when GDP is going down it is a sign that the economy is "not healthy" and employment declines [5].

Even though GDP increases, it does not tell anything about the social and environment status of an economy. To counteract this aspect, United Nations established the so called Human development index", OECD set a "Better life index" and Eurostat the so called "GDP and beyond".

A special situation is in the case when national entities earn income outside of the country's economy, of which the income earned by foreign nationals in the domestic economy are subtracted. The result is known as Gross National Income (GNI) which is another GDP variant.

GDP is used as a term of reference for many studies, researches and also it is important in the establishment of strategies and policies by Government, and other authorities. Usually, it is utilized in forecasting the development of the economy.

GDP is achieved by various economic branches of the economy whose contributions to GDP is different as volume and share.

In case of agriculture, for example, GDP is used in many analyses regarding the efficiency of various support mechanisms for increasing agricultural production and rural development.

To have a comprehensive and valuable image on the main drivers of the economic activity, we must study the components of GDP and related indicators: output, exports, imports, final consumption, investments as well as income and savings, all these are useful in setting up policies and strategies for economic development [4].

As mentioned above, GDP is influenced by many factors, among which export is a special component with a positive impact on the economic growth and GDP.

Export is a component of international trade which favors the flow of foreign currency into the payment balance of a country by selling its products and goods on the external markets. For this reason, it could strengthen the economic development and increase GDP.

The economic development of a country imposes commercial exchanges with other nations, which means to participate in the international trade [11].

For this reason, when GDP is analyzed, export and import of goods and services must also be taken into consideration as shown in its formula of calculation based on the expenditure method, besides other influencing factors like: final consumption, foreign investments, gross capital formation, employment, unemployment, inflation rate.

Export is another measure of the power of a country economy reflecting its capacity to achieve such a production to cover the demand in the domestic market and to produce supplementary amounts to be sold on various external markets.

An increasing export value shows that a country has a good economy and its products are of high quality and competitiveness in the international market. Export creates employment, investments, production and revenues. It contributes to the expand of the geographical area of influence in the international market and potential customers

at the global level. It also is beneficial for the trade companies stimulating sales and increasing their profits and the life cycle of their products. Market diversification could be of much help to spread business risk. More than this, exports valorize the domestic production surplus on foreign markets, bringing foreign currency in the payment balance of a country. A trade surplus could grow the price of the commercialized goods and services and strengthen the domestic currency [11].

Import has a great importance for a country economy when it brings raw materials and finished products and services which that country has not and cannot produce or produce in a small amount than needed or when the production costs for carrying out those products are higher than in other countries, and obviously the purchase price from those suppliers is smaller.

Imports could have a beneficial effect in a growing economy, because they are a source of technology and capital goods which could increase productivity for a long run and also diversify consumers' choice for higher quality products and services. But, imports also generates a flow of currency spent for purchasing goods and services from other countries, diminishing the payment balance.

For this reason, any country desire is to export more and import less to have a high efficiency of its foreign trade, reflected by an import coverage by export higher than 1, meaning that export value exceeds import value, and the trade balance is positive [11, 32].

GDP and its relationships with its factors of influence have been studied by many researchers.

An interesting approach had Wolla (2018), who commented GDP formula: GDP = C + I +G + (X-M), where: C is personal consumption, I is gross private investments, G is government purchase, X is export and M is import, and pointed out that apparently import subtracted from GDP has a negative impact on it. The author affirmed that import has not a negative impact, because imported goods are produced abroad and cannot be subtracted from GDP which represent the value of the

goods produced in the country. The author considers that "imports variable is an *accounting variable* and not an expenditure variable like C, I and G, because most domestically produced goods include some foreign parts or components and also while C, I, and G measure spending on only *final* goods and services, exports (X) and imports (M) also include *intermediate* goods". The author concluded that "the imports variable (M) corrects the value of imports that have already been counted as (C), (I), and (G). Therefore, the purchase of imported goods and services should have *no direct impact* on GDP" [35].

Other authors [33] studied the impact of foreign direct investments, import, export, growth rate, unemployment and inflation on GDP using a multiple linear regression model and affirmed that the effect on GDP is not always a positive one.

The relationship between GDP and employment and unemployment was approached by [14, 15] and in connection with the number of employees and export by [6].

The influence of the determinant factors on GDP was studied by [12] and the influence of fixed assets and employment using Cobb-Douglas production function was researched by [13].

The link between GDP and its resources was highlighted by [23]. GDP concentration and its convergence in rural development was studies by [17, 28].

Final consumption has a high influence on GDP as found [19] and also a positive and strong impact of final consumption and gross investment, but a very small impact of net exports on Romania's GDP was confirmed by [34].

Studying the relationship between export and GDP in five top exporting nations: USA, Germany, India, Japan and Singapore, Chauhan (2021) found that export had a beneficial impact on their economy [2].

A positive correlation between Export and GDP, but a negative connection of a negative trade balance on the economic growth was found by [3].

Other researchers highlighted the positive impact of export on GDP [7], and the positive impact of import on GDP was found by [8].

The contribution of agriculture to GDP was studied by [22].

In the last decade, it was noticed a controversial situation regarding the evolution of external trade and also in external agro-food trade of Romania [16]. At national level, both export and import of goods and services registered an upward trend, and the agro-food export and import as well [18]. The problem is that the imports value exceeded the export value resulting a negative trade balance, and the deficit is increasing year by year, reflecting that Romania is a net importing country [31].

In this context, the goal of the paper is to analyze the dynamics of Romania's GDP and the impact of Export and Import on its level, and also the evolution of GDP created in agriculture and the impact of export and import of agro-food products on it in the last decade 2013-2022 in order to quantify the measure of influences of these factors using econometric modelling based on regression equations.

MATERIALS AND METHODS

To set up this research, the data provided by National Institute of Statistics for the period 2013-2022 were used and processed utilizing varied methods: fixed index, structural index, descriptive statistics, regression equations, correlation coefficient, coefficient of determination, variance analysis, comparison method.

The main macroeconomic indicators approached in this study were: GDP, Export value (E), Import value (I) and Net export(NE) at the national level and also: GDP created in agriculture (GDP$_A$), Agro-food export value (E$_A$), Agro-food import value (I$_A$), and Net export in agro-food industry (NE$_A$).

Considering GDP as Y- dependent variable and the determinant factors one by one X-independent variable, there were constructed econometric regression models which were solved by Least squares method and using Excel facilities.

The results were illustrated in graphics and tables and were correspondingly interpreted.

RESULTS AND DISCUSSIONS

Analysis of GDP, Export value, Import value, Net export value at the national level
Dynamics of Romania's GDP
GDP doubled its value in the last decade from Euro 142,928.9 Million in 2013 to Euro 285,884.8 Million in 2022. The peak of GDP was attained in 2022, while the lowest one was registered in 2013. The general trend reflected growths from a year to another, except the year 2020, when the economy was affected by the measures taken by the authorities during the Covid-19 pandemic (Fig. 1).

To GDP formation, an important contribution has been brought by the following economic sectors: services, industry, constructions and agro-food sector.

As the growth rate ranged from an economic branch to another, some changes have appeared in the GDP structure by source. In 2022, services contributed by 57.7%, industry by 22.5%, constructions by 6.3%, agriculture by 4.5% and 1.3% others [10].
Dynamics of Export value
Export is one of the key factors which contributes to the increase of GDP. Romania's export value for all the commercialized goods and services raised by 85.51% in the analyzed interval from Euro 49,562.14 Million in 2013 to Euro 91,944 Million in 2022. The ascending trend was disturbed by a syncope only in the year 2020, when trade was affected by the Covid-19 pandemic, but in 2021, export has recovered and continued to grow till present (Fig. 2).
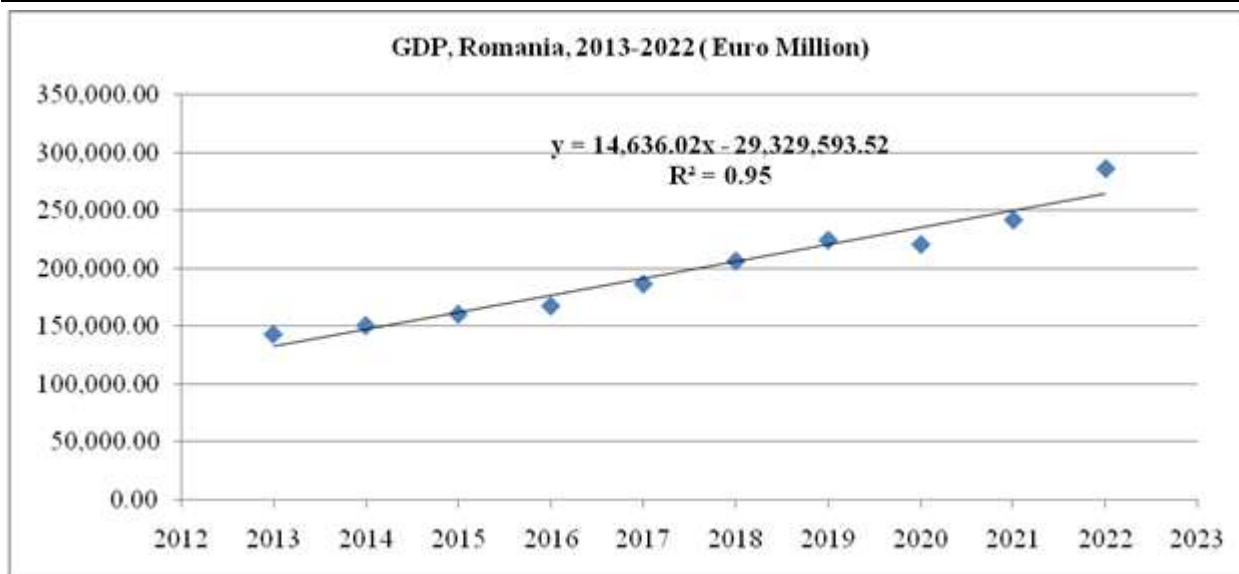
Fig. 1. Dynamics of Romania's GDP, 2013-2022 (Euro Million)
Source: Own design based on the data from National Institute of Statistics [10].
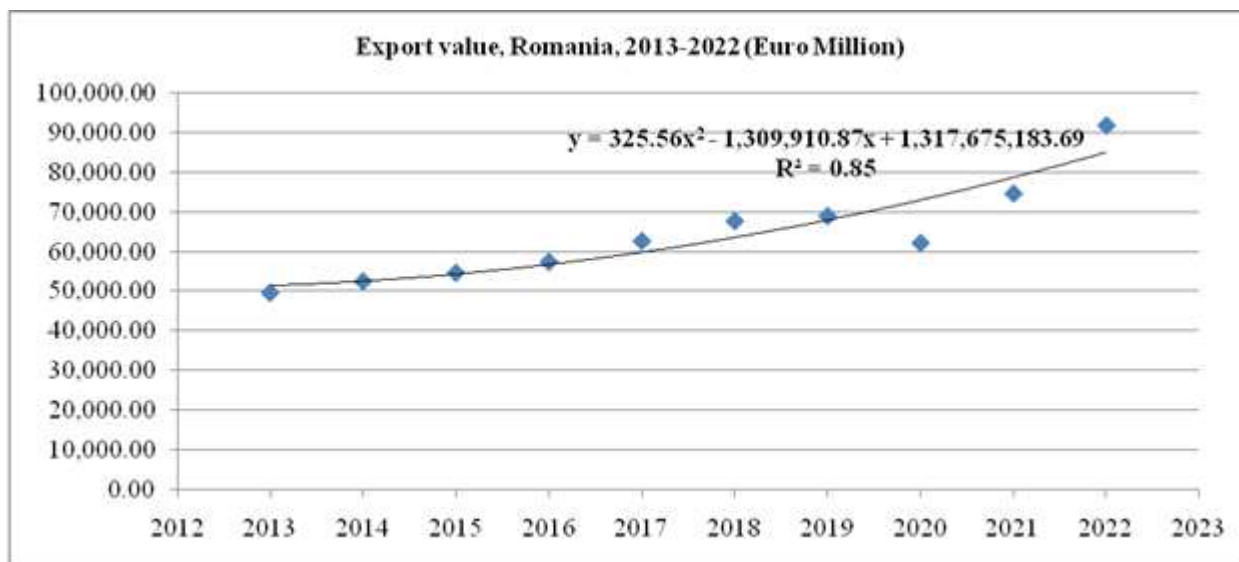

Fig. 2. Dynamics of Romania's export value, 2013-2022 (Euro Million)
Source: Own design based on the data from National Institute of Statistics [10].

Romania's export consists of many groups of commodities which are required on the international market. But, export value is conditioned by the sold quantity and export price. Sometimes, export price for some specific goods could be not satisfactory due to the volume of value added incorporated in that product and quality which is not as competitive as similar products commercialized by other countries, both on the EU and extra EU market.

Dynamics of import value

Imports had an ascending trend, in 2022, their value accounting for Euro 126,034.07 Million

being 2.27 times higher than Euro 55,317.36 Million in 2013 (Fig. 3).

Romania's imports consist of a large category of goods and services, whose amount differs and import price as well.

During the last decade imports raised in a high proportion on the internal market even more than necessary in some cases and, in other cases, they were justified to better satisfy consumers' requirements.

Dynamics of trade balance or net export value

Taking into account the evolution of export and import, net export value was negative in

each year of the studied period and, more than this, the deficit was higher and higher as the growth rate of imports exceeded the growth rate of exports. In 2022, the net export accounted for Euro -34,101 Million, being 5.92 times higher than in 2013 when it accounted for -5,755.22 (Fig. 4).

This had a negative impact on the coverage rate of imports by exports which registered a

very small and subunit level. This reflects that Romania's economy is not balanced and that there are still disturbances in production regarding quantity, structure and quality.

Importing more than exporting involves more expenditures to purchase the imported goods and services which spoil the payment balance of exchangeable currency.
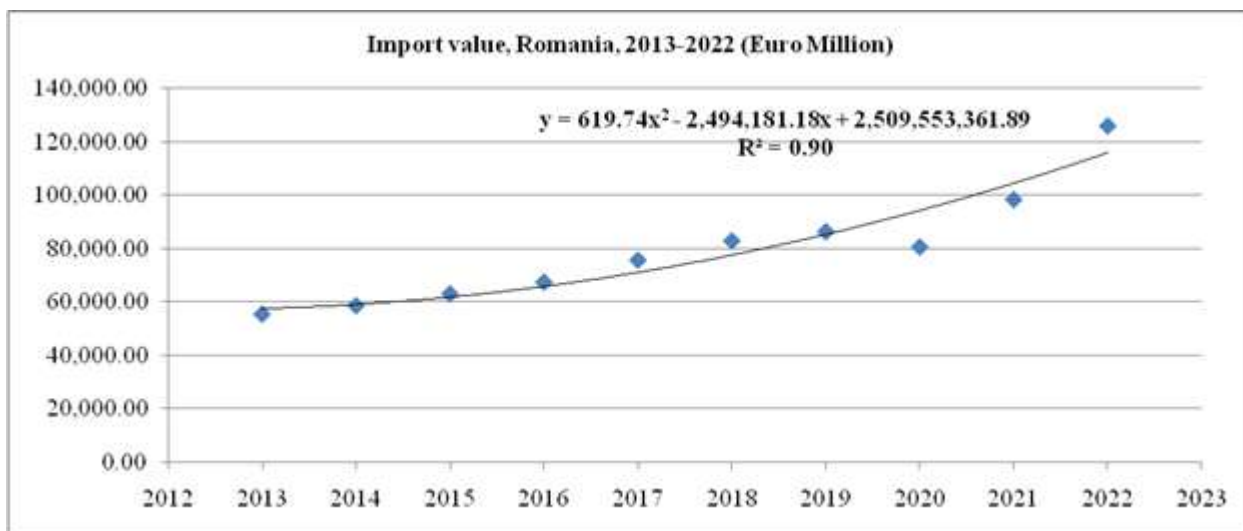

Fig. 3. Dynamics of Romania's import value, 2013-2022 (Euro Million)
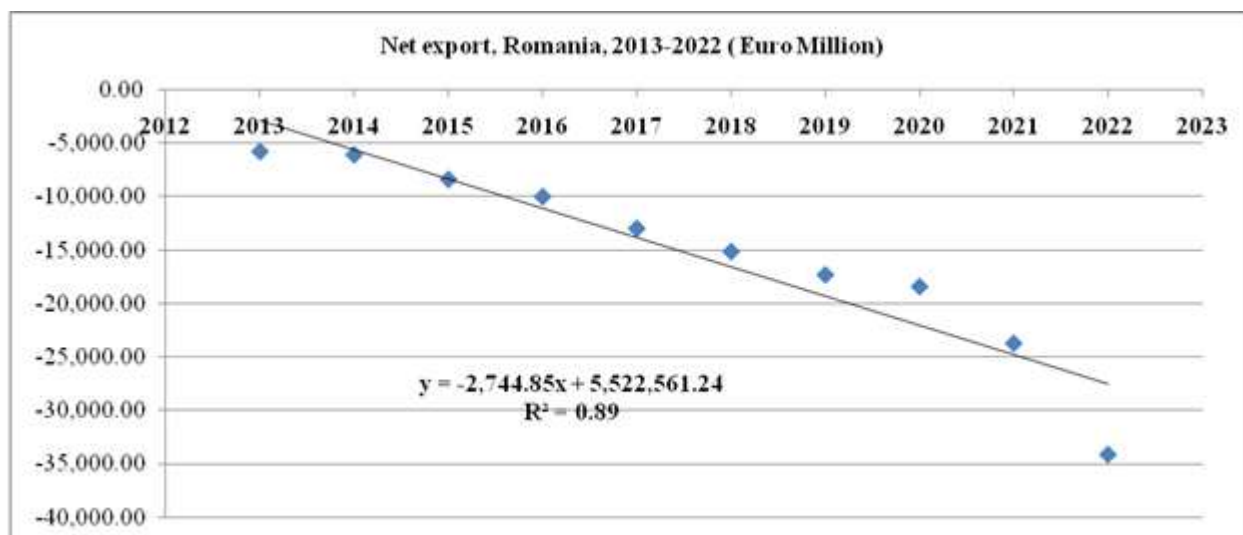Source: Own design based on the data from National Institute of Statistics [10].

Fig. 4. Dynamics of Romania's net export value, 2013-2022 (Euro Million)
Source: Own design based on the data from National Institute of Statistics [10].

Descriptive statistics for GDP, export value, import value and net export value is shown in Table 1.

Table 1. Descriptive statistics for Romania's GDP, export value, import value and net export value, 2013-2022, n=10

	GDP	E	I	NE
Mean	198,516.61	64,222.30	79,389.92	-15,170.82
St. Error	14,396.24	3,961.46	6,7--.53	2,780.91
Median	196,235.7	62,408.81	78,087.08	-14,038
St. Dev.	45,524.93	12,527.26	21,188.96	8,794.01
Kurtosis	-0.263	1.681	1.599	1.1895
Skewness	0.590	1.173	1.159	-1.100
Min	142,928.9	49,562.14	55,317.36	-34,101
Max	285,884.8	91,944.57	126,034.07	-5,755.22

Source: Own calculations based on the data from NIS [10].

Regression statistics for GDP and its factors of influence: Export, Import, Net export
GDP was considered Y- dependent variable and Export, Import and Net export, were considered, one by one, X-independent variable. The regression equations set up separately for each pair of Y and X variables was solved using the Least square method and Excel facilities. The results regarding the regression analysis are shown in Table 2.

Table 2. Regression statistics for GDP depending on E, I and NE

Variable	Coefficient	St. Error	t - stat	Prob.
Regression analysis for Y- GDP and X- E				
C-constant	-26.745.0501	21,858.2543	-1.2235	0.2559
X - Export	3.5086	0.3346	10.4837	5.96-E
R squared	0.9321	Mean of dependent var.Y	198,586.61	
Adjusted R squared	0.9236	St. Dev. of dependent var.	45,524.93	
St. Error of regression	12,577.5385			
Sum squared residuals	1,265,555,797			
Regression equation: GDP = -26,745.05 + 3.5086 E				
Regression analysis for Y- GDP and X- I				
C-constant	31,406.0468	12,341.624	2.5447	0.0344
X - Import	2.1058	0.1507	13.9735	6.67-E
R squared	0.9606	Mean of dependent var. Y	198,586.61	
Adjusted R squared	0.9557	St. Dev. of dependent var.	45,524.93	
St. Error of regression	9,579.535			
Sum squared residuals	734,140,000.3			
Regression equation: GDP = 31,406.0468 + 2.1058 I				
Regression analysis for Y- GDP and X- NE				
C-constant	121,086.602	5,131.151	23.5983	1.11-E
X - Net export	-5.10849	0.2963	-17.2369	1.31-E
R squared	0.9737	Mean of dependent var. Y	198,586.61	
Adjusted R squared	0.9705	St. Dev. of dependent var.	45,524.93	
St. Error of regression	7,818.798			
Sum squared residuals	489,068,932.7			
Regression equation: GDP = 121,086.602 - 5.10849 NE				

Source: Own results.

The regression equation   GDP = -26,745.05 + 3.5086 E   reflects that an increase in Export value by one unit will determine an increase by 3.5086 units of GDP. The determination coefficient, $R^2 = 0.9606$ tells us that 96.06% of the variation of GDP is caused by the variation of Export value.

The regression equation GDP = 31,406.0468 + 2.1058 I shows that an increase by one unit of Import will determine a growth by 2.1058 units of GDP. The $R^2 = 0.9737$ highlights that

97.37% of GDP variation is determined by the variation of Import.

However, this result does not suit the GDP formula used when it is applied the expenditure method, GDP = FC + GCF + E - I, but it could much better fit the comments made by [35], who affirmed that "the purchase of imported goods and services should have *no direct impact* on GDP".

But, this result is similar with the one found by Marinescu et al (2016) who affirmed that it was a positive relationship between GDP and Import in the interval 1990-2015 in Romania, according to the following regression equation: PIB=8,916.779+2.248633*Import, which tells us that an increase by one unit of import will determine an increase of GDP by 2.248633 units [8].

The regression equation: GDP = 121,086.602 - 5.10849 NE reflects that, if Net export will increase by one unit, GDP will decrease by 5.10849 units. The determination coefficient $R^2 = 0.9797$ reflects that 97.97% of the variation of GDP is caused by the variation of net export.

The correlation coefficients between GDP and Export, Import an Net export are presented in Table 3. The value of the correlation coefficients are very high reflecting a strong and positive relationship between GDP and these factors of influence.

Table 3. The correlation coefficients between GDP and Export, Import an Net export, Romania, 2013-2022

	Export value	Import value	Net export value
GDP	0.965	0.980	0.986

Source: Own results.

Analysis of GDP, Export value, Import value, Net export value in the agro-food industry
Dynamics of GDP created in agro-food industry
Agro-food sector is very important in the economy of any country as it is called to sustain the coverage of the population needs in food products, which emphasize its role in assuring food security and also raw materials for other economic sectors.

The sum of the value of all the agro-food products in a year in the country forms GDP created by agro-food sector.

Agro-food products are of a large variety, depending on various criteria such as: origin, technological processing degree, packaging type, purpose of use and nutritional function. From a commercial point of view, they are classified in four groups: I Live animals and products of animal origin, II. Vegetal products, III. Animal and vegetal fats and oils and IV. Food products, beverages and tobacco [16, 18].

Also, the Combined Nomenclator is used for assessing the performance in international trade [10].

GDP created in agriculture followed a general increasing trend from Euro 7,718.16 Million in 2013 to Euro 12,864.81 Million in 2022, which means a level by 66% higher than in the previous year of the study (Fig. 5).

If we compare with the doubled value of Romania's GDP in 2022, we may affirm that the volume and the growth rate of GDP created in agro-food sector is much smaller.

In the year 2020, the year of the Covid-19 pandemic, GDP formed in agro-food field was only Euro 8,598.97 Million, being even lower than the level achieved in 2018 and which accounted for Euro 8,861.09 Million.

In 2022, agriculture and food industry contributed to Romania's GDP by 4.5%, compared to 5.4% in 2013. If we compared these figures with the share of other economic sector to GDP, we may notice that agro-food sector comes the fourth in this hierarchy, after services, industry and constructions. The lowest share of agro-food industry in GDP was 3.9% recorded in ten years 2016 and 2020.

The gap between agro-food sector and other economic branches is caused by the specificity of conditions in which agriculture is running its activity: soil and climate

conditions which differ on the map of Romania from a region to another, climate changes which have started to affect more and more the production performance in agriculture (high temperatures, droughts, floods, hail etc), the existence of very small subsistence and semi-subsistence farms with an average physical size of 4.2 ha/farm, a standard output of Euro 4,029/farm, the smallest among the EU countries, the low training level of the farmers, the lack of modern technologies and equipment, the low productivity compared to the EU member states [20, 21, 27], the aging of the farmers and rural population, and more intense migration [24, 25, 26, 30], low subsidies, and discriminatory subsidies among the vegetal and animal sector which led to an unbalanced ratio between these two sectors: 65.5 % vegetal and 21% animal in the agricultural output value.
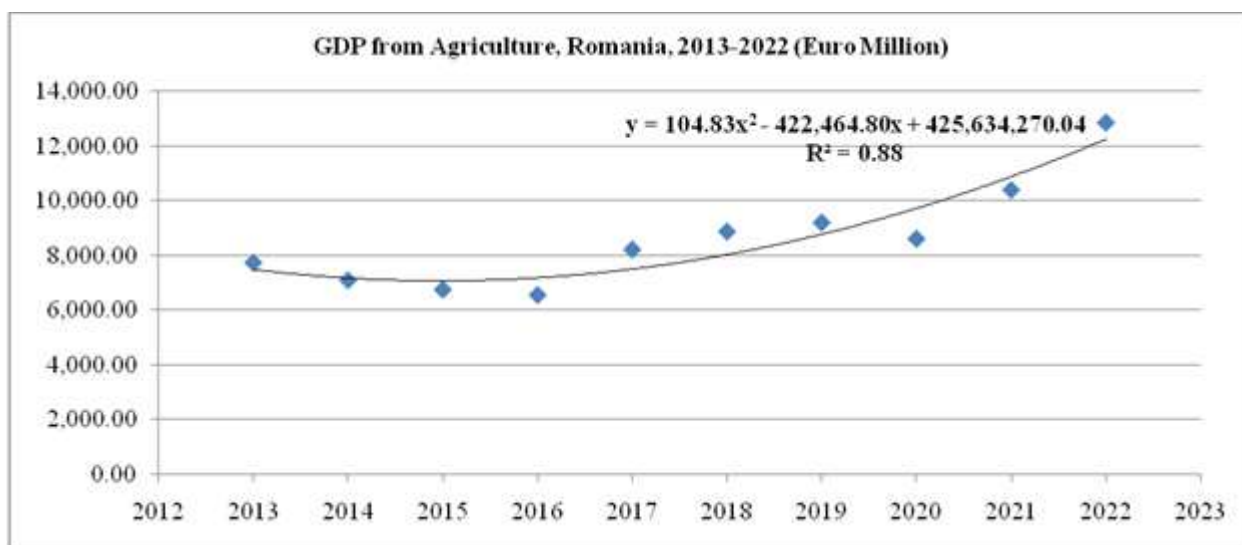

Fig. 5. Dynamics of GDP created in agro-food sector, Romania, 2013-2022 (Euro Million)
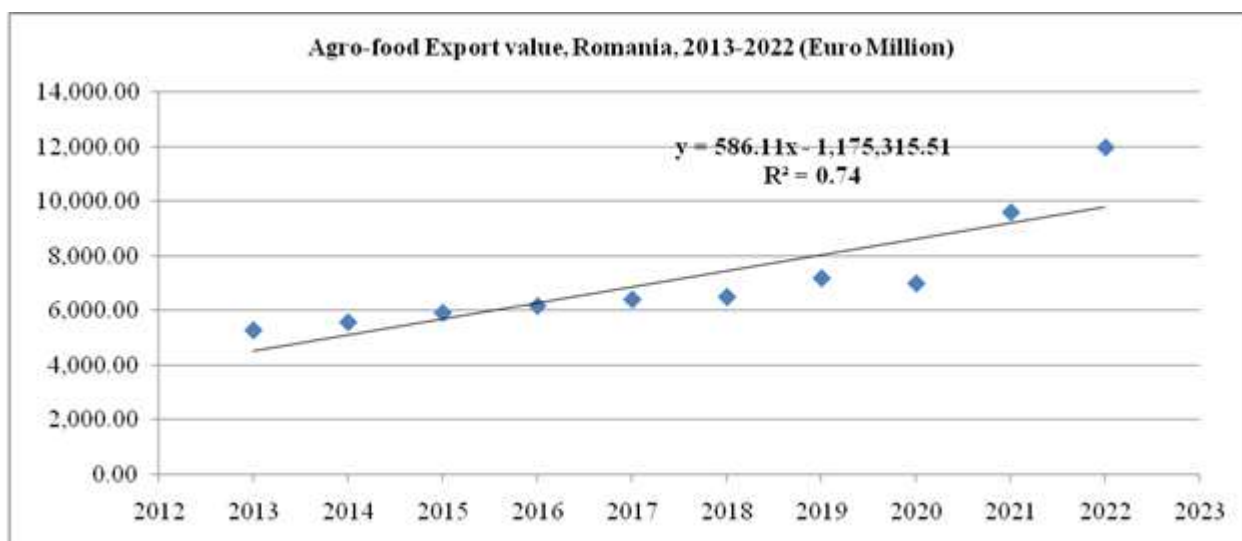Source: Own design based and calculation based on the data from NIS [10].

Fig. 6. Dynamics of Export value of agro-food products, Romania, 2013-2022 (Euro Million)
Source: Own design based and calculation based on the data from NIS [10].

Dynamics of Export value of agro-food products

Romania has intensified its external trade with agro-food products, but there is still a huge

difference between export and import value regarding their levels and growth rates.

The export value of agro-food products increased from Euro 5,284.41 Million in 2013 to Euro 11,959.97 Million in 2022, which means 2.26 times. In 2020, an inflexion was noticed when the export value declined to Euro 6,994.05 Millions due to the restrictions imposed by the authorities during the Covid-19 pandemic (Fig. 6).

The increased export is a positive aspect in the economy, but it depends on the sold amount and also on the export price got on the external market.

In general, Romanian export of agro-food products is dominated by less processed products like cereals, sunflower seeds, and just a small part of food products, for which the export price is small and directly connected with the quality of the products.

Dynamics of import value of agro-food products

In case of the import value of agro-food products, it was noticed also an ascending tendency from Euro 4,902.04 Million in 2013 to Euro 13,248.61 Million in 2022, a figure 2.7 times higher (Fig. 7).
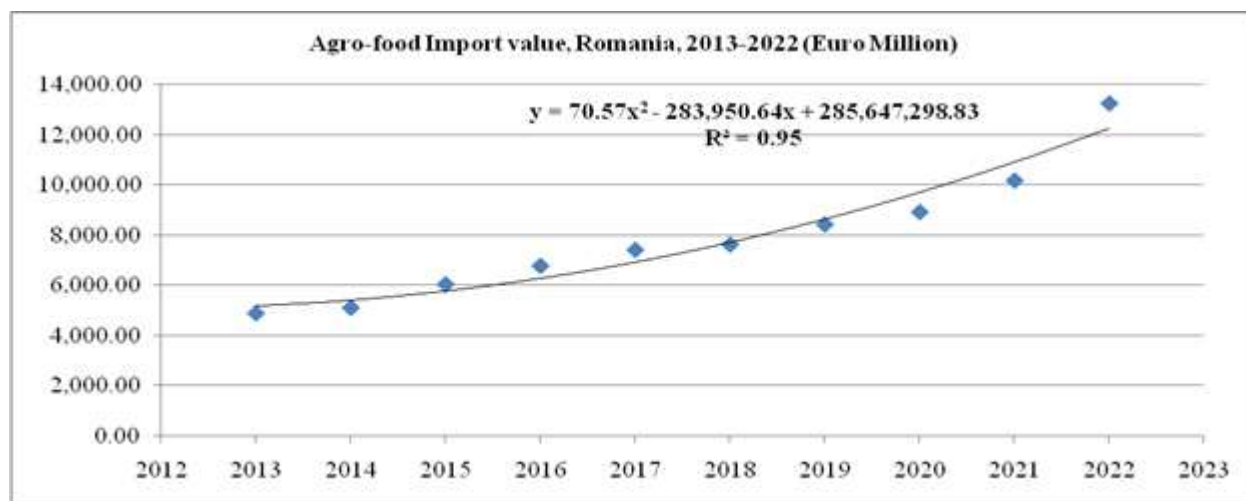

Fig. 7. Dynamics of Import value of agro-food products, Romania, 2013-2022 (Euro Million)
Source: Own design based and calculation based on the data from NIS [10].

Comparing import with export value of agro-food products, we may notice that import value is much higher than export value. In 2022, this surplus was 10.77% compared to the year 2013, when it accounted for only 7.24%.

If in 2013 and 2014, Romania was a net exporting country of agro-food products, starting from 2015, it has become a net importing country, as the import value exceeded the export value.

High imports on the domestic market are justified to diversify the offer and cover much better the demand, as long as production is not able to ensure the necessary for certain products. But, too many imports have disadvantaged the local producers and also

have produced a flow of currency to the external suppliers [29].

Dynamics of the net export value of agro-food products

Taking into account the evolution of export and import value of agro-food products, we may easily notice that agro-food trade balance was positive just in the years 2013 and 2014, and since 2015, it became negative with a higher and higher deficit year by year.

in 2022, the deficit accounted for Euro -1,288.64 Million compared to Euro -137 Million in the year 2015, being 9.4 times higher, and compared to the positive net export in 2013, which was Euro +382.37 Million, the gap is much larger (Fig. 8).
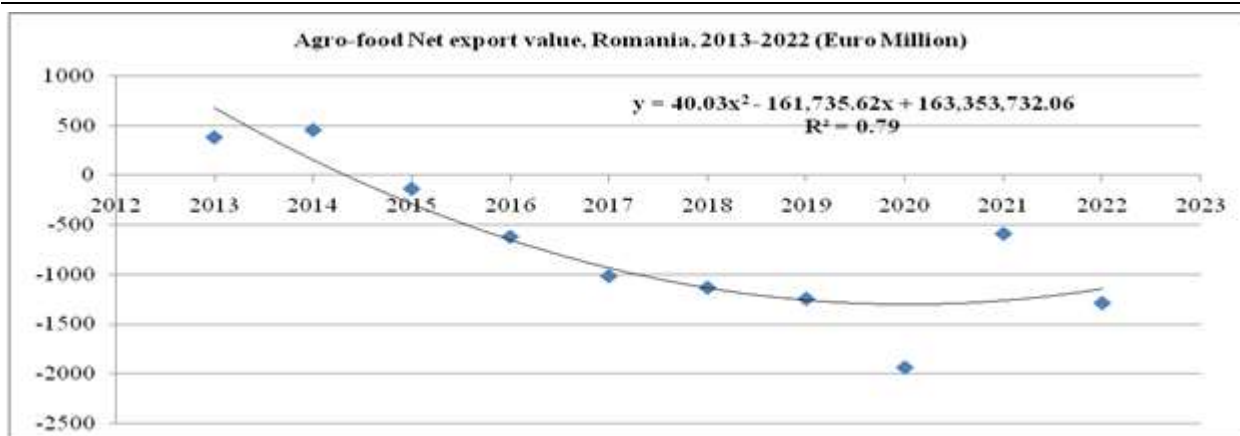
Fig. 8. Dynamics of Net export value of agro-food products, Romania, 2013-2022 (Euro Million)
Source: Own design based and calculation based on the data from NIS [10].

Descriptive statistics for GDP, Export, Import, Net export of agro-food products

Descriptive statistics for GDP, export value, import value and net export value is shown in Table 4.

Table 4. Descriptive statistics for Romania's GDP, export value, import value and net export value, 2013-2022, n=10

	GDP$_A$	E$_A$	I$_A$	NE$_A$
Mean	8,616.193	7,158.846	7,871.99	-713.153
St. Error	604.0063	654.303	794.428	242.8608
Median	8,399.28	6,454.01	7,529.08	-818.205
St. Dev.	1,910.035	2,069.15	2,512.204	767.99
Kurtosis	1,7874	2,6719	1.2108	-0.6356
Skewness	1,2411	1,639	1,0051	0.2523
Min	6,532.08	5,284.41	4,902.04	-1,938.44
Max	12,864.81	11,959.97	13,248.61	455.99

Source: Own calculations based on the data from NIS [10].

Regression statistics for GDP in agro-food sector and its factors of influence: Export, Import, Net export

GDP$_A$ was considered Y- dependent variable and Export$_A$, Import$_A$ and Net export$_A$, were considered, one by one, X-independent variable. The regression equations set up separately for each pair of Y and X variables was solved using the Least square method and Excel facilities. The results regarding the regression analysis are shown in Table 5.

The regression equation GDP$_A$ = 2,410.198 + 0.8668 E$_A$ reflects that an increase in Export value of agro-food products by one unit will determine an increase by 0.8668 units GDP$_A$. The determination coefficient, R^2 = 0.8560 tells us that 85.6% of the variation of GDP$_A$ is caused by the variation of Export value of agro-food products, and the difference by other factors.

The regression equation GDP$_A$ = 3,078.62 + 0.7034 I$_A$ shows that an increase by one unit of Import of agro-food products will determine a growth by 0.7034 units of GDP$_A$. The R^2 = 0.8560 highlights that 85.6% of GDP$_A$ variation is determined by the variation of Import $_A$.

This result does not suit to the formula of GDP calculation, which shows a negative influence of import, but it suits to the comments made by [35]. who affirmed that "the purchase of imported goods and services should have *no direct impact* on GDP".

The regression equation: GDP$_A$ = 7,735.88 - 1.2343 NE$_A$ reflects that, if Net export of agro-food products will increase by one unit, GDP$_A$ will decrease by - 1.2343 units. The determination coefficient R^2 =0.2463 reflects that only 24.63% of the variation of GDP is caused by the variation of NE$_A$ and the

711

remaining of 75.27% is caused by other factors.

The correlation coefficients between GDP_A and $Export_A$, $Import_A$ an Net $export_A$ are presented in Table 6.

The value of the correlation coefficients are very high reflecting a strong and positive relationship between GDP_A and Export $value_A$ and Import $value_A$, but a moderate and positive connection with Net export $value_A$.

Table 5. Regression statistics for GDP_A depending on E_A, I_A and NE_A

Variable	Coefficient	St. Error	t - stat	Prob.
Regression analysis for Y- GDP_A and X- E_A				
C-constant	2,410.198	832.4154	2.8954	0.0200
X - $Export_A$	0.8668	0.112139	7.7306	5.58-E
R squared	0.8819	Mean of dependent var. Y	8,616.193	
Adjusted R squared	0.8771	St. Dev. of dependent var.	1,910.035	
St. Error of regression	686.0959			
Sum squared residuals	3,876,395			
Regression equation: $GDP_A = 2,410.198 + 0.8668 E_A$				
Regression analysis for Y- GDP_A and X- I_A				
C-constant	3,078.6296	838.862	3,6700	0.0063
X - $Import_A$	0.7034	0.1019	8.8971	0.00012
R squared	0.8560	Mean of dependent var. Y	8,616.193	
Adjusted R squared	0.8380	St. Dev. of dependent var.	1,910.035	
St. Error of regression	768.666			
Sum squared residuals	4,726,790			
Regression equation: $GDP_A = 3,078.62 + 0.7034 I_A$				
Regression analysis for Y- GDP_A and X- NE_A				
C-constant	7,735.883	778.2547	9.8400	8.88-E
X - Net $export_A$	-1.2343	0.7633	-1.6170	0.1445
R squared	0.2463	Mean of dependent var. Y	198,586.61	
Adjusted R squared	0.1521	St. Dev. of dependent var.	45,524.93	
St. Error of regression	1,758.75			
Sum squared residuals	24,745.720			
Regression equation: $GDP_A = 7,735.88 - 1.2343 NE_A$				

Source: Own results.

Table 6. The correlation coefficients between GDP_A and $Export_A$, $Import_A$ and Net $export_a$, Romania, 2013-2022

	Export $value_A$	Import $value_A$	Net export $value_A$
GDP	0.939	0.925	0.496

Source: Own results.

CONCLUSIONS

This study analyzed the GDP and foreign trade dynamics in terms of Export, Import and Net export in the last decade 2013-2022 in Romania.

The results proved that, in 2022 versus 2013, Romania's GDP accounted for Euro 285,884.8 Million, meaning a double value.

Export raised by 85.51% and reached Euro 91,944 Million, while imports accounted for Euro 126,034.07 Million, being 2.27 times higher.

Romania's trade balance registered a higher and higher deficit which reached Euro -34,101 Million, being 5.92 times higher.

Studying the impact of Export, import and Net export on Romania's GDP it was found that: an increase in Export value by one unit will determine an increase by 3.5086 units of GDP; an increase by one unit of Import will determine a growth by 2.1058 units of GDP; an increase by one unit of Net export will shrink GDP by 5.10849 units.

Compared to 2013, in 2022, agro-food sector contributed by 4.5% to Romania's GDP. GDP

produced in this sector had also an ascending trend and reached Euro 12,864.81 Million (+66%). agro-food export accounted for Euro 11,959.97 Million, being 2.26 times higher; agro-food import reached Euro 13,248.61 Million in 2022, being 2.7 times higher; the deficit of Net export attained Euro -1,288.64 Million being 9.4 times higher compared to 2015 level.

The regression equations quantified the impact of each determinant on GDP created in agro-food sector as follows: an increase in Export value of agro-food products by one unit will determine an increase by 0.8668 units GDP_A; an increase by one unit of Import of agro-food products will determine a growth by 0.7034 units of GDP_A; an increase by one unit of Net export $_A$ will shrunk GDP_A by -1.2343 units.

These results confirm the existence of relationships between diverse economic factors and GDP both at the national level, and in this study case regarding agro-food industry.

They also proved that there are still gaps and disturbances which could unbalance the economy, and this has to continue in more details to identify the aspects which have to be improved.

Multiple regressions could be more useful than simple regression to quantify the joined effect of many factors of influence on GDP.

The results allow to draw some main recommendations to balance the ratio between export and imports with a beneficial impact on GDP and trade balance as well.

Romania's export has to be intensified on a larger international market and with a higher efficiency. In this respect, producers oriented to exports have to increase production of the products highly requested on the external market and also to improve product quality for getting a better export price.

Imports have to be analyzed and restructured in the sense to purchase from abroad mainly products which could not be carried out or are produced in a small quantity in Romania. High imports are not justified, because they affect the domestic producers and diminish the currency in the payment balance.

Subsidies have to continue to sustain the internal producers in a higher amount to enable them to increase production and its quality and stimulate the export of the Romanian products.

The small export/import ratio reflects a non corroborated development of the commercial transactions which increased the deficit in the trade balance of Romania and also in the agro-food sector.

The Romanian products destined to be exported needs to have more value added and higher quality to be competitive on the external market.

REFERENCES

[1]Callen, T., Groos Domestic Product: An economy's all. International Monetary Fund, https://www.imf.org/en/Publications/fandd/issues/Series/Back-to-Basics/gross-domestic-product-GDP#:~:text=GDP%20measures%20the%20monetary%20value,the%20borders%20of%20a%20country. Accessed on November 30, 2023
[2]Chauhan, V., 2021, Relationship between exports and gross domestic product (GDP), International Journal of Creative Research Thoughts (IJCRT), Vol.8(4), 2697-2702.
[3]Eric, O., Popovic, G., Popovic, S., 2019, Foreign trade liberalisation and economic growth: The case of the Republic of Srpska. Economics, Vol.7(2), 99-108.
[4]Eurostat Statistics Explained, 2023, National accounts and GDP, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=National_accounts_and_GDP, Accessed on November 20, 2023.
[5]Eurostat Statitics explained, Beginners:GDP - What is gross domestic product (GDP)? https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Beginners:GDP_-_What_is_gross_domestic_product_(GDP)?, Accessed on November 20, 2023.
[6]Grigorescu, L., Marinescu, A.I., 2020, The economic-social content of the indicators used in the analyses of the macroeconomic proportions and correlations, Romanian Statistical Review, Suppl. 2, 51-73.
[7]Manole, A., Anghelache, C., SJ Jweida, I.J., Nita, G., Marinescu, A.-I., 2016, A regression model utilized for analyzing the correlation between GDP and export, Romanian Statistical Review, Suppl. 10, 85-88.
[8]Marinescu, R.T., Diaconu, A., Badiu, A., Bodo, G., 2016, Analysis of the correlation between GDP and import using a statistic-econometric model, Romanian Statistical Review, Suppl. 10, 93-97.
[9]National Institute of Statistics, 2023, Methodology for calculating GDP.

[10]National Institute of Statistics, 2023, Tempo online, www.insse.ro, Accessed on November 20, 2023.

[11]Popescu, A., 2010, Home and foreign trade, Dominor Rawex Coms Publishing House, 176-244.

[12]Popescu, A., 2015, Analysis of the dynamics of Gross Domestic Product and of its main factors of influence in Romania's agriculture, Proceedings of 25th IBIMA International Conference Innovation Vision 2020: from Regional Development Sustainability to Global Economic Growth, Amsterdam, The Netherlands, May 7-8, 2015, pp.1379-1393.

[13]Popescu, A., David, L., 2015, The use of the Cobb-Douglas production function to analyze the relationship between GDP, Fixed assets and Employment in Romania's Agriculture, Proceedings of 25th IBIMA International Conference Innovation Vision 2020: from Regional Development Sustainability to Global Economic Growth, Amsterdam, The Netherlands, May 7-8, 2015, pp. 1366-1378.

[14]Popescu, A., 2016a, Research on the Relationship between GDP, Unemployment and Employment in the EU-28, Proceedings of 27th IBIMA International Conference Innovation Management and Education Excellence Vision 2020: from Regional Development Sustainability to Global Economic Growth, Milan, Italy, May 4-5, 2016, pp.686-695.

[15]Popescu, A., 2016b, Research on the Correlation between Economic Growth, Unemployment and Employment. A case study-Romania, Proceedings of 27th IBIMA Conference Innovation Management and Education Excellence Vision 2020: from Regional Development Sustainability to Global Economic Growth, Milan, Italy, May 4-5, 2016,606-706.

[16]Popescu, A., 2017a, The Intra-Industry Trade in Agro-Food Products - The Case of Romania, Proceedings of 29th IBIMA International Conference on Education Excellence and Innovation Managmenet through Vision 2020: from Regional Development Sustainability to Global Economic Growth, Vienna, Austria, May 4-5, 2017, pp.1261-1278.

[17]Popescu, A., 2017b, Convergence of Regional Development in Romania in Terms of Gross Domestic Product, Proceedings of 29th IBIMA International Conference on Education Excellence and Innovation Managmenet through Vision 2020: from Regional Development Sustainability to Global Economic Growth, Vienna, Austria, May 4-5, 2017, pp.1279-1293.

[18]Popescu, A., 2017c, Trends and correlations in Romania's agro-food foreign trade in the period 2007-2016, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development,Vol.17(4)293-304.

[19]Popescu, A., 2018, The Influence of Final consumption on Gross Domestic Product in Romania, Proceedings of 31st IBIMA International Conference on Vision 2020: Education Excellence and Management of Innovations through Sustainable

Economic Competitive Advantage, Milan, April 25-26, 2018, pp.2411-2423

[20]Popescu, A., 2019, Trends in Labour Productivity in Romania's Agriculture, Proceedings of 34th IBIMA International Conference on Vision 2025: Education Excellence and Management of Innovations through Sustainable Economic Competitive Advantage, 13-14 Nov.2019, Madrid, Spain, pp.9999-10016.

[21]Popescu, A., 2019, Trends in Labour Productivity in the European Union's Agriculture, Proceedings of 34th IBIMA International Conference on Vision 2025: Education Excellence and Management of Innovations through Sustainable Economic Competitive Advantage, 13-14 Nov.2019, Madrid, Spain, pp.9982-9998.

[22]Popescu, A., 2020, Contribution of Agriculture to Romania's Gross Domestic Product, Proceedings of 36th IBIMA International Conference on Vision 2025: Education Excellence and Management of Innovations through Sustainable Economic Competitive Advantage, November 4-5, 2020, Granada, Spain, pp.2207-2220.

[23]Popescu, A., David, L., 2017, The Relationship between GDP and its Resources in Romania's Economy, Proceedings of 30th IBIMA International Conference, Madrid, November 8-9, 2017, pp.449-468

[24]Popescu, A., Dinu, T.A., Stoian, E., 2018, Demographic and economic changes characterizing the rural population in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.18(2), 333-346.

[25]Popescu, A., Tindeche, C., Marcuta, A., Marcuta, L., Hontus, A., Angelescu, C., 2021, Labor force in the European Union agriculture - Traits and tendencies, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.21(2), 475-486.

[26]Popescu, A., Dinu, T., A., Stoian, E., Şerban, V., 2021, Efficiency of labor force use in the European Union's agriculture in the period 2011-2020, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.21(3), 659-672.

[27]Popescu, A., Tindeche, C., Marcuta, A., Marcuta, L., Hontus, A., 2021, Labor productivity in Romania's agriculture in the period 2011-2020 and its forecast for 2021-2015, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.21(3), 673-678.

[28]Popescu, A., Serban, V., 2021, Dynamics of Concentration in Gross Domestic Product achieved in Romania's Agriculture, Proceedings of 38th IBIMA International Conference, Sevilla, Spain, November 23-24, 2021, pp.6972-6981.

[29]Popescu, A., 2022, The importance of production and import for ensuring food availability in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.22(1), 533-548.

[30]Popescu, A., Dinu, T.A, Stoian, E., Serban, V., 2022, Population occupied in agriculture and agricultural production value in Romania, 2008-2020, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.22(1), 503-514.

[31]Popescu, A., Dinu, T.A, Stoian, E., Serban, V., 2022, Romania's agro-food foreign trade concentration with the European Union countries, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.22(2), 565-578.

[32]Sangho, K., Lim, H., Park, D., 2009, Imports, Exports and Total Factor Productivity in Korea. Applied Economics 41 (14): 1819-1834. https://doi.org/10.1080/00036840601032243.

[33]Stanic, S., Racic, Z.V., 2019, Analysis of macroeconomic factors effect to Gross Domestic Product of Bosnia and Herzegovina using the multiple linear regression model, Economics, Vol.7(2), 91-97.

[34]Villanueva, A., 2020, Analyzing Romania GDP: Final consumption, gross investment, and net exports influence compared to previously published models, Theoretical and Applied Economics, Vol. XXVII, No. 4(625), Winter, pp. 169-176.

[35]Wolla, S.A., 2018, How Do Imports Affect GDP? Page One Economics, 1-6. https://research.stlouisfed.org/publications/page1-econ/2018/09/04/how-do-imports-affect-gdp, Accessed on November 25, 2023.