THE CONTRIBUTION OF THE AGRICULTURAL SECTOR TO ECONOMIC GROWTH IN ROMANIA

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Abstract
Although agriculture is one of the main economic sectors of Romania, its contribution to GDP has constantly decreased over the last 28 years, from 23.00% in 1989 to 4.37% in 2017. This phenomenon is explained by the fact that Romania's economy past from being an economy based on an agricultural structure to one based on services.
Even though the contribution of agriculture to GDP formation is declining, Romania still has the largest share of the agricultural sector in the GDP structure from all the countries of the European Union – about 3 times higher than the European average, and also the highest share of agricultural land in the total land area.
These aspects show that within the member countries of the European Union, Romania is the country most dependent on agriculture, with the largest number of people involved in agriculture and with the largest share of agricultural areas in total.
In this context, the paper analyzes the impact of the agricultural sector on Romania's economic growth, between 2000-2017. The empirical analysis is based on three independent variables (agricultural production, public expenditure on agriculture and direct investment in agriculture) and one dependent variable (GDP at constant prices). The data panel consists of information provided by the NIS (National Institute of Statistics), and the data are analyzed using multiple regression.

Keywords: Agriculture, Gross Domestic Product, Economic Development
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1. Literature review

Although the influence of agriculture on economic growth has been analyzed relatively often in the literature, the opinions are quite different.
Lewis (1954) and Ranis and Fei (1961) consider agriculture has a passive role, because it provides only raw materials for the development of the other economic sectors (industry and services). Hirschman (1958) and Christensen (1964) also suggest that agriculture contributes indirectly to economic growth, through labor force and the transfer of resources to the industry, which is considered to be more productive than agriculture.
Anderson (1987) considers that an economic growth accompanied by a slow evolution of the demand for food, together with a rapid growth of the farm in relation to the non-farm productivity, leads to the hypothesis that the role of agriculture decreases in relative terms as this economy developed. However, the importance of the agricultural sector in economic growth should not be neglected. The agricultural sector not only provides the necessary resources for the development of the non-agricultural sectors, but is also an important element

for the market, directly contributing to the economic growth (Subramaniam, 2009; Gollin, 2010; Istudor et al, 2014; Sertoglu et al, 2017).

2. The context of implementing the Common Agriculture Policy in Romania

A requirement for European agriculture is to reach by 2020 high levels of safe and quality food production, while preserving the natural resources agricultural productivity depends on. This goal can be achieved only through a competitive agricultural sector that operates within a functional supply chain and contributes greatly to the transformation of rural economy.
Given these aspects and taking into account the objectives of the 2020 Strategy, Romania brings its contribution to the CAP through the agricultural employment and related sectors. The Romanian agricultural population, although decreasing since 2000, is still considerable if compared both to the EU 28 average and to the euro area average.

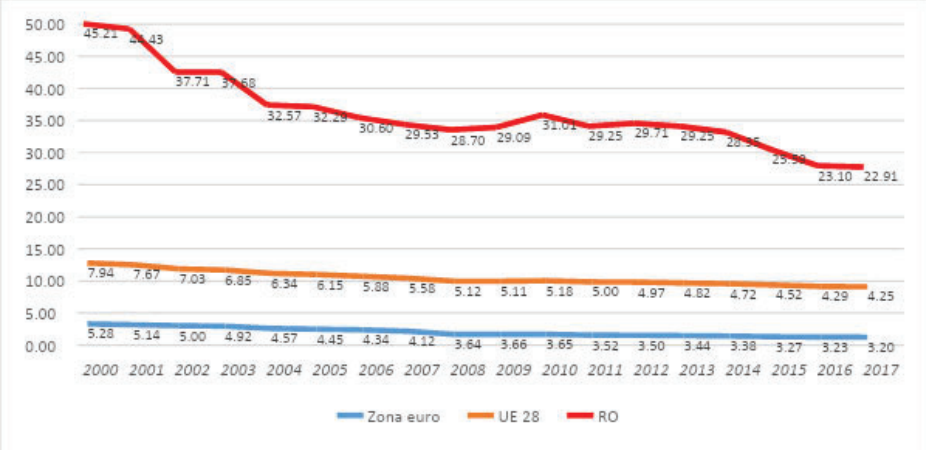

Figure 1. Share of the agricultural population in total population in Romania, compared with the EU average 28 and the euro area 20 (%, evolution 00-2017)

Source: by the authors based on the data: https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?end=2017&locations=RO&start=2000

As can be seen from Figures 1 and 2, in 2000, the Romanian active population from agriculture represented 45.21% of the total active population (the next country after Romania being Poland with 18.67%, according to the World Bank data). In 2017 the Romanian agricultural population decreased, reaching 22.91% of the total working population, which is still about 6 times higher than the EU28 average (4.25%) and about 7 times higher than the euro area average (3.20% at the level of 2017).
Regarding the contribution of agriculture to the total gross added value, it declined from 13.05% in 2001 to 4.37% in 2017, registering since 2014 a tendency of staying below 5%. This phenomenon is a result of the transitoion of the Romanian economy from one based on agriculture to one based on services.

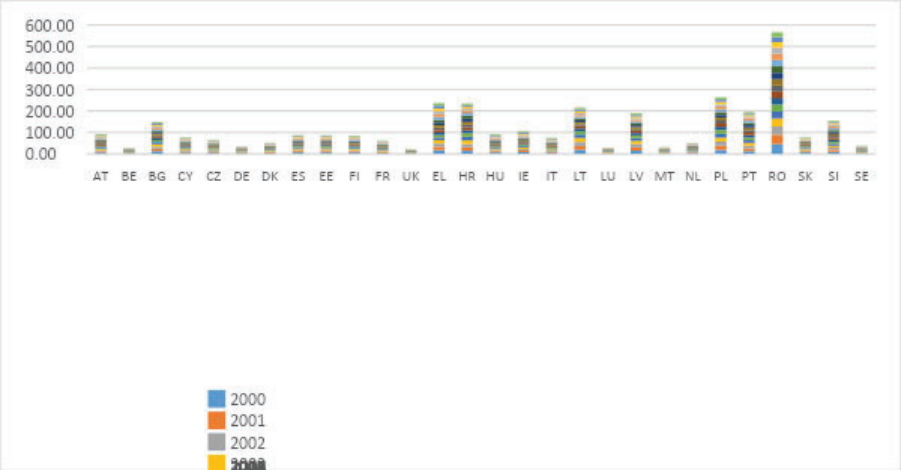

Figure 2. Share of agricultural population in EU Member States 28 (%, evolution 2000-2017)

Source: by the authors based on the data: https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?end=2017&locations=RO&start=2000

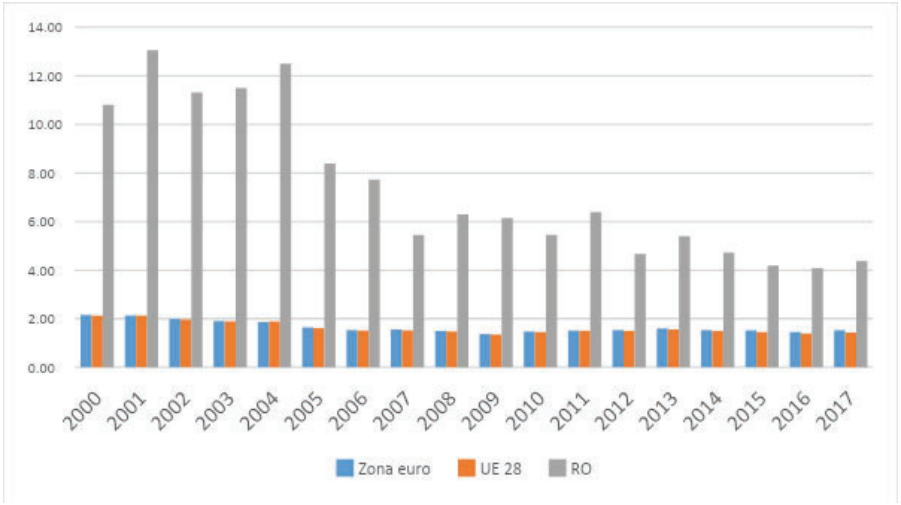

Figure 3. Share of the sector "Agriculture, forestry and fisheries" in GDP (%), comparative evolution Romania – EU28 average – euro area, 2000-2017

Source: by the authors based on the data: https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS

Although the contribution of agriculture to GDP is declining, Romania still registers the highest share of the agricultural sector in the GDP structure from all the countries of the European Union – about 3 times higher than the European average (see Figure 4), and also the highest share of agricultural land in the total land area (see Figure 5).

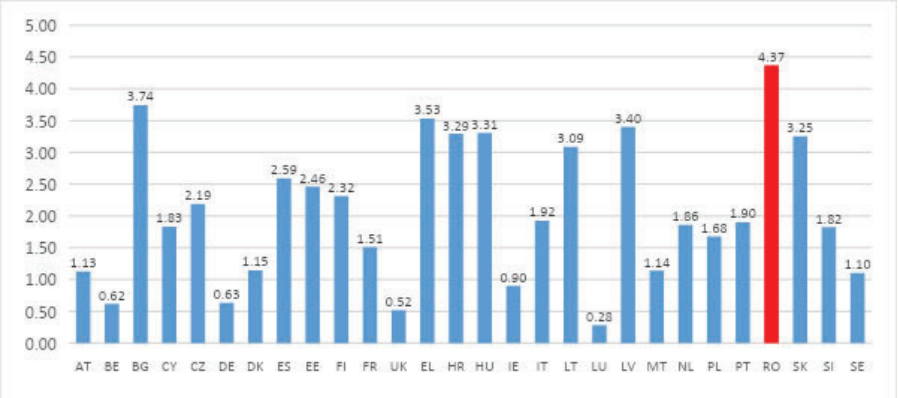

Figure 4. Share of the sector "Agriculture, forestry and fisheries" in GDP (%),, comparative evolution Romania – EU28 (2017)

Source: by the authors based on the data:
https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS

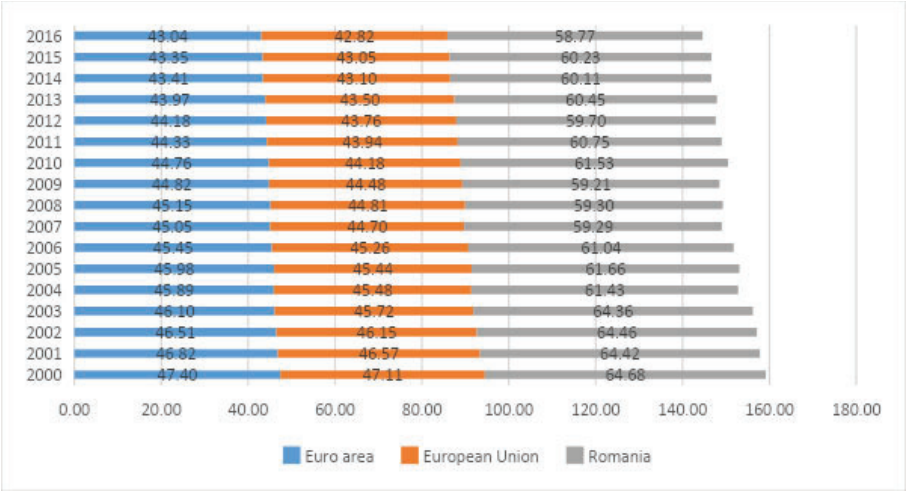

Figure 5. Share of the agricultural areas in the total land area (2000-2016, %)

Source: by the authors based on the data:
https://data.worldbank.org/indicator/AG.LND.AGRI.ZS?view=chart

Therefore, the data presented show that, within the member countries of the European Union, Romania is the country most dependent on agriculture, with the largest number of people involved in agriculture and with the largest share of agricultural areas in total.

With a number of 3,422.030 farms out of a total of 6,488,887 farms at EU 28 level, Romania has a record percentage of 52.74% of the total European farms (see Table 1). However, if we consider the total area of farms in EU 28 (171,641,555 ha), from the data presented in Table

1.1. it is noted that Romania has only 7.28%, with a cultivated agricultural area of 12,502,540 ha, which means that most farms in Romania have a small area (under 5 hectares).

Table 1. Agricultural indicators (2017) in EU 28

Country	Farms number	Utilized Agricultural area – hectares	Farms with livestock	Standard output – mill. euros	Employed workforce – Annual work unit	Farms whose households consume over 50% of final production
Belgium	3.689	1.354.250	2.544	8.038	5.535	*missing data*
Bulgaria	20.272	4.468.500	13.497	3.843	24.802	0
Czech Republic	2.653	3.455.410	1.868	5.082	10.327	412
Denmark	3.505	2.614.600	2.067	10.062	4.948	0
Germany	27.612	16.715.320	18.469	49.249	49.006	0
Estonia	167	9.951	696	802	1.988	49
Ireland	137.560	4.883.650	126.590	6.325	160.750	*missing data*
Greece	68.495	4.553.830	23.852	7.575	44.822	1.096
Spain	94.502	23.229.750	2.167	38.366	80.116	334
France	45.652	27.814.160	24.757	61.343	70.817	704
Croatia	13.446	1.562.980	9.147	2.035	15.936	7.013
Italy	1.145.710	12.598.160	154.680	51.689	874.950	289.880
Cyprus	3.494	11.193	998	617	1.668	1.956
Latvia	6.993	1.930.880	4.497	1.221	7.686	2.716
Lithuania	15.032	2.924.600	953	2.226	14.835	6.743
Luxembourg	197	13.065	154	365	34	*missing data*
Hungary	430	4.670.560	26.154	6.532	39.173	2.571
Malta	921	1.112	274	98	511	263
Netherlands	5.568	1.796.260	3.696	23.087	1.472	0
Austria	1.325	2.669.750	9.392	6.142	10.174	0
Poland	1.410.700	14.405.650	71.824	25.006	1.649.400	259
Portugal	25.898	3.641.690	17.235	5.144	31.383	10.838
Romania	**3.422.030**	**12.502.540**	**2.567.430**	**12.105**	**1.587.650**	**2.956.380**
Slovenia	699	4.884	5.658	1.159	7.997	4.015
Slovakia	2.566	1.889.820	1.612	1.931	4.669	158
Finland	4.971	2.233.080	1.661	3.515	7.909	0
Sweden	6.294	3.012.640	3.429	5.159	5.597	0
UK	18.506	16.673.270	13.805	25.403	28.576	*missing data*
Total	***6.488.887***	***171.641.555***	***3.109.106***	***364.119***	***4.742.731***	***3.285.387***

Source: http://ec.europa.eu/eurostat/web/agriculture/data/database

Considering the first objective of the CAP, namely, that people should enjoy good food at affordable prices, and farmers should earn a fair living, from the data presented in Table 1.1.

it is observed that the CAP has failed to support so far the farms in Romania and other Eastern European countries The fact that about 90% of the Romanian farms consume more than 50% of the final production in the household shows that they are completely missing the mechanism necessary to ensure them functioning as economic units.
Another contradictory element noticed in the Romanian economy is the fact that, despite a large number of agricultural workers, in conjunction with a large number of farms and an extremely large agricultural area compared to EU Member States, productivity per worker is at the lowest level of all Member States (see Figure 6).

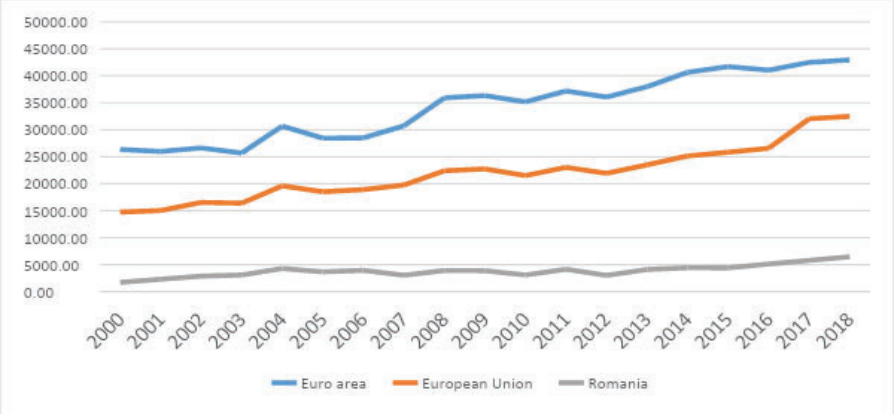

Figure 6. Agriculture value added per worker (agriculture, forestry and fisheries) USD at constant prices 2010, evolution 2000-2018
Source: by the authors based on the data:
https://data.worldbank.org/indicator/NV.AGR.EMPL.KD?locations=XT

Although the value added per agricultural worker in Romania has increased from USD 1,707 (at the level of 2000) to USD 6,447 in 2018, it is still about 7 times lower than the value added in the euro area and about 5 times lower than the added value average of EU 28.

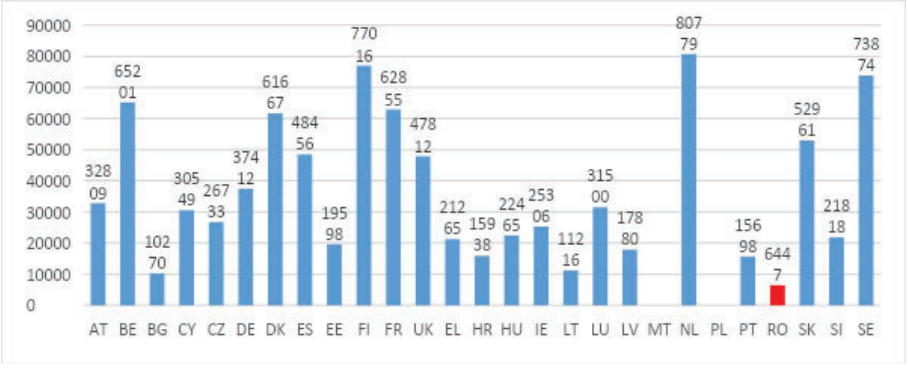

Figure 7. Added Value per Worker (agriculture, forestry and fisheries) USD at constant prices 2010 in Member States EU 28 (2018)
Source: by the authors based on the data:
https://data.worldbank.org/indicator/NV.AGR.EMPL.KD?locations=XT

Compared to the other EU 28 countries it is observed that Romania is last regarding the efficiency of the use of resources, the gap with the first states being a huge one (Netherlands: 80,779 USD; Finland: 77,016 USD; Sweden: $ 73,874).
The high level of land fragmentation is another obstacle to agricultural development. The low economic potential of small farms and their inefficient management have also led to the underdevelopment of the agricultural products processing sector.
In meeting these limitations, certain key political priorities at European level were defined for which CAP funds are used such as: jobs and growth, sustainability, modernization, and innovation. An important tool is the fact that Romania has the flexibility to transfer a percentage from the direct payments to the rural development program according to its specific needs.

3. The contribution of the Romanian agriculture to the economic growth. An empirical analysis

The size of a country's GDP depends on a number of endogenous factors, and knowing their influence can contribute to taking more appropriate decisions. In the current analisys, the aim is to show the influence that agriculture has on the economic growth, expressed by GDP.
By using regression analysis (simple and multivariate), our intention is to analyze:

- The influence that the agriculture added value per worker has on the GDP per inhabitant (USD, current prices);
- The influence that net investments and public expenditures in agriculture (allocated from the state budget) have on national GDP (USD millions, constant prices 2010).

The statistical analysis is based on the time series data 2000-2017 provided by the NIS. In order to eliminate the influence of national currency denomination, the data were converted into USD at the annual average rate.

a) The influence of the agriculture value added per worker on the GDP per inhabitant

In order to determine the influence of the agriculture value added per worker on the GDP we use the bivariate regression equation as follows:

$$Y = c + c1*x1 \quad (1)$$

Based on this equation, the multiple correlation coefficient (R) has been determined. The coefficient reflects the association between the dependent variable (y) and the independent variable (x). The multiple correlation coefficient shows how much can we predict the variation of the dependent variable (y) knowing the independent variable (x).
In other words, the value of R^2 shows what is the variation in the variable Y (dependent variable) explained by the variation in the independent variable x, which schematically can be shown in the Figure 8.

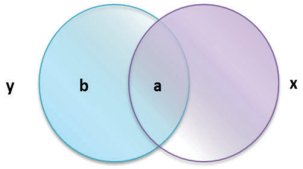

Figure 8. Diagram of bivariate regression

Therefore, the area marked with "a" is the one to which refers the value of R^2 and it can be explained by the bivariate regression model. The area marked with b is the influence of other factors that we cannot measure.
By noting GDP per inhabitant with y and agriculture value added per worker with x and by using the bivariate regression in SPSS, the following results were obtained.

Table 2. General parameters, the ANOVA test and the coefficients that generate the regression equation

SUMMARY OUTPUT		**The impact of agriculture added value per worker on GDP/inhabitant at current prices**					
Regression Statistics							
Multiple R	0.954						
R Square	**0.910**						
Adjusted R Square	0.904						
Standard Error	1014.94451						
Observations	18						
ANOVA							
	df	*SS*	*MS*	*F*	*Signifi-cance F*		
Regression	1	1.657E8	1.657E8	160,860	0,000		
Residual	16	1.648E7	1030112.365				
Total	17	5.964E13					
Coefficients	*B*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Toleranc e*
Constant	293.370	573.418	0.512	0.616	-922.222	1508.963	
AAV/ Worker	2.067	0.163	12.683	0.000	1.722	2.413	1.000

a. Predictors: (Constant), VA/worker
b. Dependent Variable: GDP/inhabitant
Source: by authors using SPSS

Based on the results obtained above, it can be estimated that to an increase of one unit of value added per worker, the GDP per inhabitant increases on average by 2,067 units. This relation generates the following regression equation:

$$GDP/inhabitant = 2{,}067*AAV/worker + 293{,}370 \quad (2)$$

The Pearson coefficient (multiple R = 0.954) presents a direct and high intensity link, while the determination report (R Square) shows that the variable AAV/worker explains 91.0% of the GDP/inhabitant variation. This is because the variable Y also depends on other factors that have less influence, and as a consequence the alternative solutions can be accepted.
The significance level is 95% and the probability at which the regression parameter was calculated shows with a 5% error probability that the analyzed model explains significantly

more variation than that due to other factors, unforeseen or uncontrolled. (P-value = 0) (Figure 9).

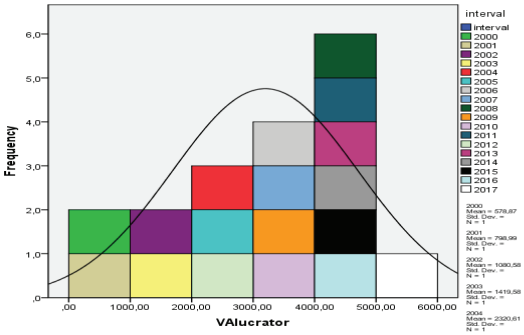

Figure 9. Figural representation of the regression equation
Source: processed by authors using SPSS

b) The influence that the net investments in agriculture and the public expenditures for agriculture have on the national GDP

In contrast to the previous model, we propose to associate two independent variables (x1 and x2) with the dependent variable (y), According to the Figure 10. the value of R^2 shows which is the variation in variable Y explained by the variation in variables x.

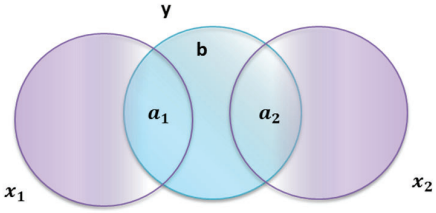

Figure 10. Multiple regression diagram

The regression equation in this case is:

$$y = c + c1*x1 + c2*x2 \quad (3)$$

The purpose of this analysis is to estimate the impact of public expenditure on agriculture and net investments, also, in agriculture on the economic growth, expressed by GDP. In order to eliminate the influence of inflation and to ensure the comparability of the data, the values in lei provided by NIS were transformed into USD at current prices, 2010.
It is important to mention that compared to the previous model, this analysis offers as many models as independent variables we take in consideration. In this case, we have two models, from which the regression coefficients will be related to each model (1 – for the public expenses for agriculture and 2 – for the net investments in agriculture).
In this case, we have two models, and the regression coefficients are related to each model (1 – for the public spending on agriculture and 2 – for the net investments in agriculture).

Table 3. General parameters, the ANOVA test and the coefficients that generate the regression equation

SUMMARY OUTPUT							
Regression Statistics							
Multiple R1	0,641	**The impact of agriculture added value per worker on GDP/inhabitant at current prices**					
Multiple R2	0,641						
R Square 1	**0,411**						
R Square 2	**0,411**						
Adjusted R Square 1	0,374						
Adjusted R Square 2	0,333						
Standard Error 1	22266,31751						
Standard Error 2	22295,80677						
Observations	18						
ANOVA							
	df	*SS*	*MS*	*F*	*Significance F*		
Regression 1	1	5.542E9	5.542E9	11.177	0.004		
Residual 1	16	7.933E9	4.958E8				
Total 1	17	1.347E10					
Regression 2	2	5.542E9	2.771E9	5.240	0.019		
Residual 2	15	7.933E9	5.288E8				
Total 2	17	1.347E10					
Coefficients	*B*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Tolerance*
Constant	122494,136	23793,194	5,148	0,000	71777,144	173205,129	
Public expenditure	24,297	7,652	3,175	0,006	7,988	40,606	0,966
Net invest	-0,425	13,626	-0,031	0,976	-29,469	28,618	0,966

Dependent Variable: GDP/inhabitants
Source: by authors using SPSS

The results obtained above generate the following regression equation:

GDP = 122494,136 + 24,297*public expenditure + (-0,425)*net investments (4)

The Pearson correlation coefficient for both independent variables is 0.641. It shows the existence of a direct link, but below average intensity (R square = 0.411), which explains quite a bit of the GDP variation (37.4% in the case of public expenditure on agriculture and 33.3% in the case of net investments for agriculture).

The t-test applied to the non-standardized coefficients shows the relative importance in the model of the independent variables and these scores > 2 or < -2 represent what is important. In our case, according to the value of t, only the public expenditures on agriculture have a significant importance for the model (t = 3,175). This does not mean that net investments are not important, but the results indicate a minor importance.
The significance level is 95% and the probability at which the regression parameter was calculated shows with a 5% error probability that the analyzed model only the public expenditures explain significantly more variation than the one due to the net investments and other factors unforeseen or uncontrolled. (P-value = 0.006 for public expenditure and 0.976 for net investment)
The correlation between the three variables is shown in the Figure 11.

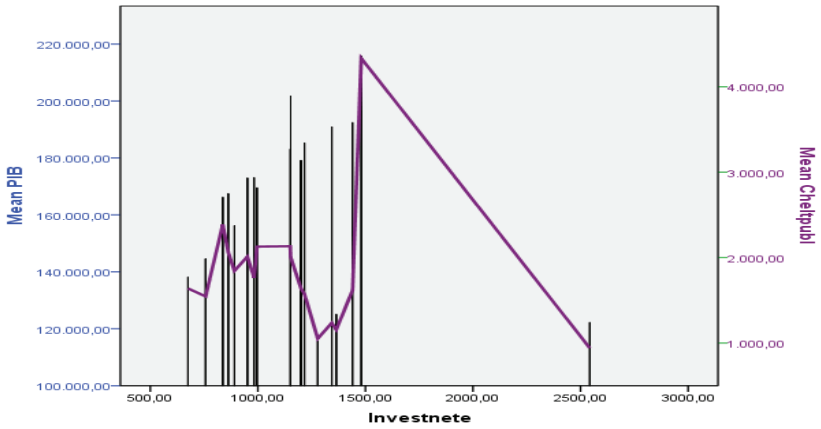

Figure 11. The correlation between the GDP dependent variable and the independent variables public expenditure for agriculture, respectively, net investments in agriculture

Even if this prediction does not totally overlap with the reality, taking into account the deviations from it as can be seen in the table above, the results obtained from the analysis highlight the importance of agriculture for the sustainable economic growth of Romania pointing the directions to which the decision makers should turn their attention.

Conclusions

Overall, in the period of implementing CAP in Romania the main indicators describing the importance of agriculture in economy *show an adjustment in progress* as follows:

- the agricultural population in total population decreased from 29,53% in 2007 to 22,91% in 2017;
- the contribution of agriculture to the total gross added value fluctuated between 4% and 7% between 2007 and 2017, registering since 2014 a tendency of staying below 5%;
- the productivity per worker expressed by the value added per agricultural worker has increased from USD 3,025 in 2007 to USD 6,447 in 2018.

Although agriculture is a very important sector of the national economy, employing 22.91% (2017) of the working population and contributing with 4.37% to the GDP (2017) in

conjunction with a large number of farms and an extremely large agricultural area compared to EU Member States, *the productivity is extremely low*.

Starting from the hypothesis that the size of a country's GDP depends on a number of endogenous factors, and knowing their influence can contribute to making appropriate decisions, in this paper we have analyzed the influence that agriculture has on the economic growth, expressed through GDP. Using the regression analysis (simple and multivariate), we analyzed by using two models. On one hand, the influence that the value added per worker in agriculture has on the GDP per inhabitant (USD, current prices), and on the other hand, the influence that the net investments in agriculture and the public expenditures for agriculture (allocated from the state budget) have on the national GDP (millions of dollars, at constant prices 2010).

In the first model, the bivariate regression equation was used to determine the influence of the value added per worker in agriculture on GDP. The result of the empirical analysis highlights that at an increase by one unit of the agriculture added value per worker, the GDP per inhabitant at current prices would go up, on average, by 2,067 units.

In the second model, we associated two independent variables (x1 and x2) with the dependent variable (y), the value of R2 showing which is the variation in variable Y explained by the variation in variables x. The purpose of this analysis was to estimate the impact of public spending in agriculture and net investments in agriculture on economic growth, expressed through GDP. The results suggest that, with a probability error of 5%, the variation of the national GDP is explained by the level of the public expenses, and the net investments and other unforeseen or uncontrolled factors have a law influence.

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