

CONTRIBUTION OF AGRICULTURE TO ROMANIA'S GROSS DOMESTIC PRODUCT

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Rezumat. *Lucrarea a avut ca scop analiza contribuției agriculturii la PIB-ul României pe baza datelor statistice oferite de Institutul Național de Statistică. Regresia și corelația au evidențiat că între PIB-ul creat în agricultură și PIB la nivel național există o legătură importantă, care a asigurat creșterea economică ridicată în perioada 2007-2016. Ponderele agriculturii în PIB este 4,6% în 2016 comparativ cu 5,7% în 2007. Creșterea PIB-ului creat în agricultură s-a datorat mai ales producției vegetale și animale. Valoarea producției agricole a crescut cu 47,58%, în timp ce producția vegetală a sporit cu 59,5% și producția animală cu numai 30 % în perioada analizată. Producția vegetală a contribuit cu 60% la valoarea producției agricole, în timp ce producția animală cu numai 33.8%. Agricultura trebuie să continue să se dezvolte acordând atenție îmbunătățirii mărimii fermelor, investițiilor, dotării tehnice și tehnologiilor moderne care să ducă la creșterea producției, productivității și competitivității.*

Abstract. *The paper aimed to analyze the contribution of agriculture to Romania's GDP based on the empirical data provided by the National Institute of Statistics. The regression and correlation pointed out that between the GDP created in agriculture and the GDP at the national level there is an important relationship, which assured the higher economic growth in the period 2007-2016. The share of agriculture in Romania's GDP is 4.6% in 2016 compared to 5.7% in 2007. The increase of the GDP created in agriculture is mainly due to vegetal and animal production. The value of agricultural production raised by 47.58%, while the vegetal production value increased by 59.5% and the animal production value by only 30% in the analyzed period. The vegetal production contributed by 60% to the agricultural production value, while animal production by only 33.8%. Agriculture must continue to pay an increased attention to the improvement of farm size, investments, technical endowment and applied technologies to achieve high production, productivity and competitiveness.*

Keywords: agriculture, GDP, GDP in agriculture, agricultural production value, Romania.

1. Introduction

Agriculture is an important branch in Romania's economy providing food and raw materials for households and industry, jobs and activities for the rural population, environment protection and the preservation of rural traditions.

In Romania, agriculture is a way of living in the rural space, and an important income source for the rural population.

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Despite the fact that in Romania there are 3.56 million holdings of a small average size, most of them being subsistence and semi-subsistence farms, just 1% of the holdings being commercial companies working about 48% of the total agricultural land of 13.9 million ha, agricultural production has continuously increased [9].

However, Romanian agriculture has still a low productivity due to the low technical endowment, the reduced use of fertilizers and pesticides, the small surfaces where irrigations are used, the soil degradation, the lack of financial resources and of a functional credit system. The lack of competitiveness is reflected by the low production performance per surface unit and animal, the low product quality which led to a small share of exports of agricultural products and a high share of imports required to cover the needs of the domestic market. For this reason, Romania is a net importing country of agro-food products [6, 12].

In the developed countries, agriculture is a real industrial branch whose competitiveness and stability is sustained by public funds. However, agricultural production is deeply influenced by climate change, price volatility of agricultural products and new energy resources [11]. Despite of the efforts to synchronise agriculture in the EU countries based on the Common Agricultural Policies, there are still significant differences among the Member States [2, 3].

The financial aids allotted to the agriculturists as direct payments within the National Programme of Rural Development have been useful, but not enough. The absorption degree of the funds received from the EU was low in Romania compared to other EU countries [8].

In this context, the paper aimed to analyze the relationship between GDP created in agriculture on Romania's GDP, the evolution of the value of agricultural production by its sources of origin: vegetal production, animal production, and agricultural services in the period 2007-2016 based on the empirical data provided by the National Institute of Statistics. The influence of GDP produced in agriculture on GDP at the national level was studied by means of the regression econometric model and correlation coefficient.

2. Materials and Methods

In order to set up this paper, the empirical data have been collected from the National Institute of Statistics, Tempo online Data base for the period 2007-2016.

The main specific indicators taken into consideration have been the following ones: GDP at national level, GDP created in agriculture, the share of agriculture in Romania's GDP, the value of agricultural production, the value of vegetal production, the value of animal production, the value of agricultural services.

The applied methodology consisted of the following methods:

The Trend method was utilized to identify the direction of the dynamics of a variable in a chronological series of data.

Fixed Index Method was used to emphasize the deviations of each variable value in the analyzed period, based on the formula: $I_{FB} = (X_n/X_{n-1}) * 100$, where: X = the variable taken into consideration, $n= 1,2,3...i$, the years of the chronological series. The year 2007 was considered as reference term.

The statistical parameters: mean, standard deviation, and variation coefficient have been also determined using the well known formulas.

The linear regression model was used to analyze the relationship between GDP created in agriculture, the independent variable X and GDP at the country level, the dependent variable Y , using the regression function: $Y= a + bX$, where: a and b are the parameters, determined by means of the Least Square Method applied to solve the system of equations.

The Bravais-Pearson correlation coefficient was also used to identify the direction and intensity of the relationships existing between GDP created in agriculture and Romania's GDP.

The results were tabled and graphically designed and also interpreted.

3. Results and Discussions

3.1. The evolution of GDP and GDP in agriculture

Romania's GDP has registered an ascending trend in the analyzed period. It increased by 82.05 % from Lei 418 billion in the year 2007 to lei 761 billion in the year 2016. The economic analysts have appreciated that Romania is the country with the highest economic growth in the EU-28 in the last year of analysis (Fig. 1). The GDP created in agriculture has also increased by 43.09% from lei 23.9 billion in 2007 to lei 35 billion in 2016 (Fig. 2).

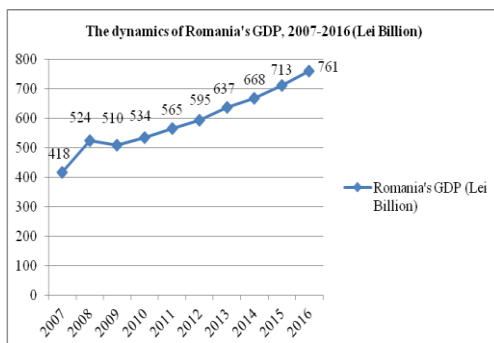


Fig. 1. Evolution of Romania's GDP.
Source: Own design based on NIS data.

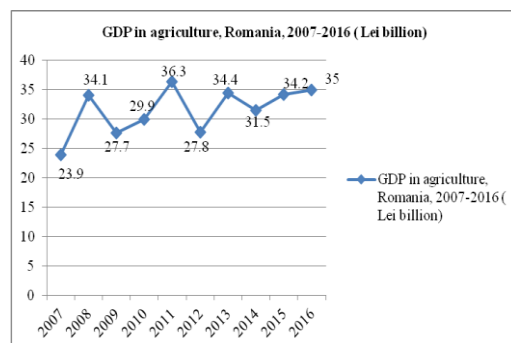


Fig. 2. Evolution of GDP in agriculture.
Source: Own design based on NIS data.

As a result, the share of agriculture in Romania's GDP has recorded a decreasing trend from 5.7% in 2007 to 4.6% in 2016. Even though in 2016, the economic growth in Romania was the highest in the EU, agriculture registered the lowest contribution to GDP in the last 20 years, being of almost 4 times lower than in 1995 [1, 10, 14] (Table 1).

Table 1. The dynamics of the share of agriculture in Romania's GDP in the period 2007-2016 (%)

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
5.7	6.5	5.4	5.6	6.4	4.6	5.4	4.7	4.7	4.6

Source: Own calculation based on the National Institute of Statistics Tempo online Data base, 2017.

Table 2. The dynamics of the share of agriculture in Romania's GDP in the period 1995-2014 (%)

1995	2000	2001	2004	2007	2011	2014
18.1	10.8	13	12.5	4.8	6.4	4.7

Source: [10].

The evolution of the share of agriculture in Romania's GDP in the period 1995-2016 is presented in Table 2. This decline of the share of agriculture in GDP is not a negative aspect, as in the developed countries this contribution is very small. This means that other economic branches have a higher contribution to the national economy. In 2016, the contribution of the economic branches to the gross value added in Romania's economy was the following: 23.1% industry, 18.1% wholesaling and retailing, vehicle repairs, transport and storage, hotels and restaurants, 5.6% information and communications, 7.4% professional, scientific and technical activities, administrative and support services; 6% constructions; 3.9% agriculture, 3.7% financial transactions and insurances, 8.2% real estate transactions, 10.2% public administration, defence, social insurance, education, health, social assistance, 3.3% shows, cultural and recreation activities, repair works of household appliances and other services [15].

In the case of Romania, even though agriculture contribution to GDP has registered a low level, agriculture productivity is still the lowest in the EU-28 due to the lack of technical endowment, the low investments in this area, the low training level of the farmers, the high number of population dealing with agriculture.

3.2. The evolution of agricultural production value

The increase in absolute figures of the contribution of agriculture to GDP is justified by the growth of agricultural production value. In 2016, the agricultural production value accounted for lei 70.4 billion, being by 4758 % higher than in 2007 (Table 3).

Table 3. The dynamics of the agricultural production value in Romania, 2007-2016 (lei billion)

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
47.7	66.9	59.9	64.4	76.5	64.2	78.4	74.5	68.7	70.4

Source: Own calculation based on the National Institute of Statistics Tempo online Data base, 2017.

The growth of agricultural production value was due to the development of vegetal and animal production in the highest manner and of agricultural services in a smaller way. The vegetal production value increased by 59.58% from lei 28.7 billion in 2007 to lei 45.6 billion in 2016, while the animal production value raised by 30% from lei 18.3 billion in 2007 to lei 23.8 billion in 2016 (Fig. 3 and Fig. 4).

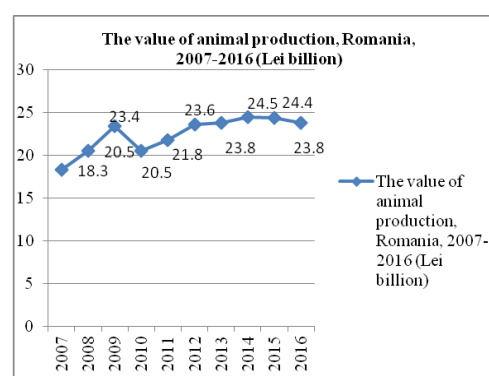
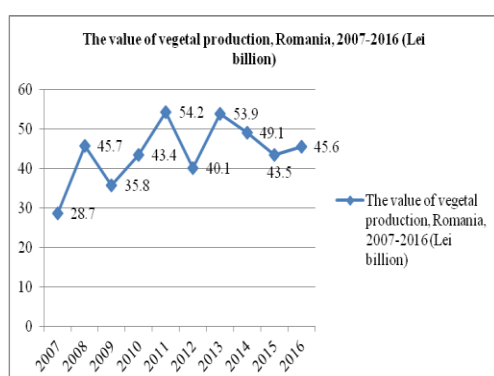


Fig.3. The vegetal production value, 2007-2016. **Fig.4.** The animal production value, 2007-2016.
Source: Own design based on NIS data.

The value of agricultural services registered only 14.28% increase from lei 0.7 billion in 2007 to lei 0.8 billion in 2016. The agricultural production value in Romania represents 3.4% of the EU agricultural production value. Also, it is 5.4 times lower than in France, 4.1 times lower than in Germany, 3.5 times lower than in Italy, 3.1 times lower than in Spain, 2.1 times lower than in the United Kingdom, 1.9 times lower than in the Netherlands and 1.6 times lower than in Poland (Table 4).

Table 4. Agricultural production value in Romania compared to other EU countries in 2012 (Euro billion)

	EU	Romania	France	Germany	Italy	Spain	Netherlands	United Kingdom	Poland
Agric. prod.	390.5	13.3	73.0	55.5	46.6	41.4	25.9	28.2	22.5
Crop prod.	208.0	9.1	43.9	27.6	24.9	24.9	12.7	10.9	11.7
Livestock prod	163.6	4.1	25.4	26.0	16.6	16.1	10.3	16.0	10.3

Source: [13].

The increase of agricultural production value in Romania is based on the large used agricultural surface (UAA) accounting for 13.9 million ha, for which Romania comes on the 6th position in the EU after France (29 million ha), Spain (23.6 million ha), the United Kingdom (17.3 million ha), Germany (16.7 million) and Poland (14.4 million ha) [17].

Also, the agricultural production value increased both in the animal and vegetal sector based on the performance in production.

In 2015 compared to the level of 2007, in the vegetal sector, the production increased by: +146.78% for cereals, +161.51% for wheat, +133.1% for maize, +226.3% for sunflower, +39.68% for sugar beet, +16.43% for vegetables, and by +10.05% for fruit. In the animal sector, the production increased by: +329.42% for meat (live weight), +133.79% for milk, + 0.5% for eggs, +6.26% for wool and +88.88% for extracted honey. The only production which declined was the potatoes output (Table 5). Similar results were found by [4, 5, 7].

Table 5. Crop and animal production in Romania in 2015 compared to 2007

	<i>MU</i>	2007	2015	2015/2007 %
Cereals	Thousand tons	7,814.8	19,286	246.78
Wheat	Thousand tons	3,044.5	7,962	261.52
Maize	Thousand tons	3,853.9	8,984	233.1
Sunflower	Thousand tons	546.9	1,785	326.3
Sugar beet	Thousand tons	748.8	1,946	139.68
Potatoes	Thousand tons	3,712	2,625	70.70
Vegetables	Thousand tons	3,116.8	3,629	116.43
Fruit	Thousand tons	1,085.8	1,195	110.05
Meat (live weight)	Thousand tons	333	1,430	429.42
Milk	Tons	21,025	49,156	233.79
Eggs	Thousand pieces	6,522	6,555	100.50
Wool	Tons	21,025	22,343	106.26
Honey	Tons	14,767	27,893	188.88

Source: Own calculations based on [16].

Taking into account these absolute figures regarding the vegetal and animal production, important changes have appeared in the structure of agricultural production value.

While the weight of the vegetal production value in the total agricultural production value increased from 60.1% in 2007 to 65% in the year 2016, with the top share 70.8% in the year 2011, the share of animal production value declined from 38.3% in 2007 to 33.8% in 2016, with the top share 39% in the year 2009 and the lowest share 28.5% in 2011 (Table 6).

Table 6. The share of vegetal production (VP) and animal production (AP) in the agricultural production value in Romania, in the period 2007-2016 (%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
VP	60.1	68.3	59.7	67.3	70.8	62.4	68.7	65.9	63.3	65.0
AP	38.3	30.6	39.9	31.8	28.5	36.7	30.3	32.8	35.5	33.8

Source: Own calculation based [16].

The low share of animal production in the agricultural production value was due to the reduction of the livestock, mainly of the cattle, pig and poultry livestock, except the sheep and goat livestock which registered an increase.

As a result both milk and meat production was affected by the reduced number of animals and low production performance in terms of milk kilograms per head and average live weight at slaughter.

As a consequence the demand/offer ratio was balanced mainly by imports of food of animal origin to cover consumption requirements.

The agricultural production value is not uniformly distributed in the territory by the 8 micro regions. In 2016, the highest share of the agricultural production value was registered in South Muntenia (19.1%), South East (17.3%), North East (16%), North West (12.6%) and South West Oltenia (11.4%).

The value of vegetal production is the highest in the same micro regions as in the case of agricultural production value as follows: South Muntenia (20.8%), South East (18.7%), North East (14.5%), North West (12%), and South West Oltenia (12%).

The value of animal production is the highest in the following micro regions: North East (19.6%), South Muntenia 916.1%0, Center (14.4%), North West (14.4%) and South East (13.9%).

3.3. The statistical parameters characterizing GDP and agricultural production value

The statistical parameters in terms of mean, standard deviation and the coefficient of variation for the main indicators used in this study are presented in Table 7.

In general, the coefficients of variation registered values below 30% reflecting a good homogeneity degree and representativeness of the mean value.

However, in the case of GDP in agriculture, the value of agricultural production and the value of animal production, the coefficient of variation varied between 0-15%, reflecting that the dispersion of the data is very small and the mean is representative because the data are homogenous.

In the case of Romania's GDP and the value of vegetal production, the dispersion of the data is a medium one and the average is still representative.

Table 7. The statistical parameters of the main indicators of the main indicators

	MU	Mean	Standard deviation	Coefficient of variation (%)
Romania's GDP	Lei Billion	582.5	103.6	17.48
GDP in agriculture	Lei Billion	31.48	4.03	12.80
Value of agricultural production	Lei Billion	67.16	8.99	13.38
Value of vegetal production	Lei Billion	44.02	7.82	17.76
Value of animal production	Lei Billion	22.46	2.08	9.26

Source: Own calculations based on [16].

3.4. The regression of Romania's GDP depending on GDP in agriculture

The regression function estimated between Romania's GDP and GDP in agriculture was the following: $Y = 61.814 X + 63.204$.

The determination coefficient, $R^2 = 0.427$ reflected that 42.70% of the variation of Romania's GDP is due to the variation of the GDP created in agriculture, the difference of 57.30% variation being determined by other branches of the economy.

This confirms the validity of the regression model (Fig. 5, Table 8).

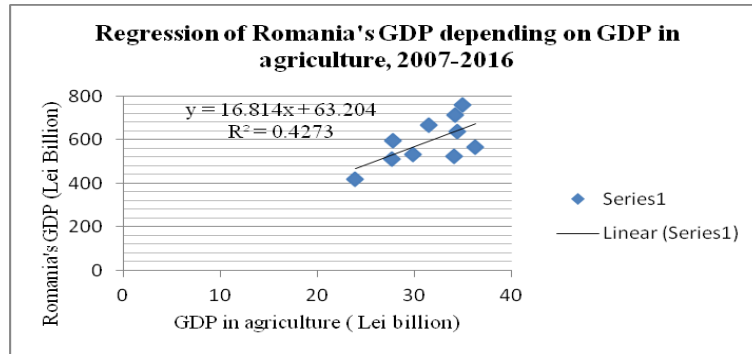


Fig. 5. Regression model regarding Romania's GDP depending on GDP in agriculture.
Source: Own design based on [16].

The Standard Error, $St\ Err = 6.992$ reflects the deviation of the observed values from the theoretical value situated on the regression slope. The availability of the regression model is also confirmed by $F\text{-test} = 0.043$, this statistical value being higher than the tabled value, as also attested by $Sign. F = 0.00623$. The parameters of the regression model are situated among the following confidence intervals: $440.07 < a < 566.47$ and $0.943 < b < 32.68$.

Table 8. The estimated regression model for Romania's GDP depending on GDP in agriculture

<i>Regression statistics</i>						
Multiple R	0.653					
R Square	0.427					
Adjusted R Square	0.355					
Standard Error	83.21					
Observations	10					
<i>ANOVA</i>						
	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	1	41329.82	41329.83	5.968	0.040	
Residual	8	66396.67	6924.58			
Total	9	96726.50				
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	63.203	218.244	0.289	0.779	-440.07	566.47
X Variable 1	16.813	6.882	2.443	0.043	0.943	32.68

Source: Own calculation.

The coefficient correlation Bravais-Pearson between the GDP at national level and the GDP in agriculture was $R = 0.653$ reflecting that the two indicators are positively and strongly correlated.

Conclusions

(1) The GDP created in agriculture has increased in the analyzed period by 43.09%, accounting for lei 35 billion in 2016. As the GDP at the country level recorded a higher growth rate, 82% in the period 2007-2016, the share of agriculture GDP in Romania's GDP declined from 5.7% in 2007 to 4.6% in 2016.

(2) This small contribution is similar to the one achieved in the developed countries, but the low productivity and competitiveness remain the main features of Romania's agriculture. The small holding size, the subsistence and semi-subsistence agriculture technologies, the low technical endowment, low investments, and farmers' training level, the lack of an attractive credit system and the great number of the population dealing with agriculture are still the main restraining factors in the development of a modern and competitive agriculture in Romania.

(3) The value of agricultural production has recorded an ascending trend, reaching lei 70.4 billion in 2016, when it was by 47.58% higher than in 2007. The growth of the agricultural production was due mainly to the development of vegetal production and animal production whose values accounted for lei 28.7 billion and, respectively for lei 23.8 billion in 2016. In the period 2007-2016, the value of the vegetal production increased by about 60%, while the value of animal production raised by about 30%.

(4) The growth of the agricultural production value was determined by the increase in the production level both in the vegetal and animal sectors. But the high growth rate in the vegetal sector has modified the structure of agricultural production in favour of vegetal production. In 2016, the vegetal production accounted for 65% in the agricultural production value compared to only 33.8% in the case of animal production.

(5) Even though the agricultural production value in Romania increased, it has a very small share of only 3.4% in the EU agricultural production value. Therefore, it is very small compared to the one achieved in other Member States.

(6) The regression function estimated between Romania's GDP and GDP in agriculture, reflected that between the two economic indicators exists an important relationship, attested by the determination coefficient which showed that 42.70% of the variation of Romania's GDP is due to the variation of the GDP

created in agriculture. And this was also confirmed by *F*-test and the value of Bravais-Pearson correlation coefficient.

(7) Taking into consideration these results, the economic growth of Romania depends on how all the economic branches, including agriculture, bring their contribution. Agriculture has favourable conditions and a long tradition, but agriculturists must be aware that the organization in associations is compulsory to increase the average farm size, the fixed, working and financial capital, to apply high performance technologies, and grow agricultural production and the quality of the products, to stimulate exports and reduce imports of agro-food products.

(8) The National Programme for Rural Development 2014-2010 provides important measures to encourage and support farmers to improve production, economic efficiency and competitiveness in agriculture.

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