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## DETERMINANTS OF ECONOMIC GROWTH IN THE ROMANIAN AGRI-FOOD SECTOR – DEVELOPMENTS AND TRENDS

### ABSTRACT

The economic growth determinants in a national economy or sector have been the subject of many debates among experts, starting from the identification of the indicators considered to be the economic growth drivers, to the correlations between them and to the interpretations of results. This approach aims to identify the extensive and intensive indicators with direct influence upon economic growth in the Romanian agro-food sector and to test the influence of factors upon the effect indicators by constructing an econometric model. Referring to the agri-food sector, the following were identified as indicators/influence factors of economic growth: gross value added, crop and livestock production value, livestock herds, agricultural production in terms of cereal units, employed population, consumption of main products, labor productivity, prices. The analysis of the data series of the indicators mentioned above and the correlations between them reveal their involutions in terms of efficiency and productivity, being still far from ensuring the sustainable economic growth in the agri-food sector.

**Key-words:** determinants, efficiency, results, agri-food sector.

**JEL Classification:** Q10, Q11.

### 1. INTRODUCTION

The economic growth issue has led to multiple debates among the specialists throughout the time, concerning both the identification of certain influence factors and solutions and alternatives for the improvement of the economic growth rate, both in overall national economy and in a single activity sector. While at the national economy level the range of indicators/factors of influence is wide enough, in a single activity sector the attempt to establish certain determinants of intensive and extensive nature should take into account the specific particularities and characteristics of the performed activity. The difficulties met in certain cases in constructing econometric models that should test the influence of certain indicators upon one resultative indicator – as expression of the economic growth mainly in the agri-food sector – have in view, among others, homogeneous and comparable data series at a time horizon that is significant from the statistical point of view. On the other side, the establishment of certain hypotheses in order to assess the economic

growth level on the short or medium term must take into account a multitude of more or less subjective factors, which are not necessarily related to the normal evolution of the analyzed indicators.

## **2. STATE OF KNOWLEDGE**

While at a national economy level, the approach to economic growth was the object of many studies, both at international and national level, their particularization by a single activity sector, most often the agri-food sector, is under continuous research, at least from the perspective of identifying and testing certain sectoral economic growth hypotheses. From this perspective, we consider that the present approach can be added to the already existing studies, adding value for those interested in such a theme.

## **3. MATERIAL AND METHOD**

The attempt to identify some economic growth determinants of intensive and extensive nature in the Romanian agri-food sector had as starting point, besides the economic concepts, the available statistical data supplied by the National Institute of Statistics (NIS), through the Tempo-Online database, as well as those made available by the National Prognosis Commission, through the medium-term forecasts. For the analysis of available data, statistical methods were used of comparison, dynamics and structure type, the results being presented both under table form and under the form of graphic representations. At the same time, it must be specified that in the case of the value indicators, these were transformed into comparable prices of the latest available statistical year, in order to avoid certain inadequate assessments of the results that incorporate inflation into nominal prices. In order to ensure data comparability, in the sense of eliminating inflation influence, the values were transformed into comparable prices of the latest available year (2011), the GDP deflator being used in this respect. We must also mention that for ensuring a time series, the period of the analysis was 2000-2011.

## **4. RESULTS AND DISCUSSIONS**

As an important part of national economy, the agri-food sector can be attributed a series of specific characteristics that lead to oscillating evolutions of the economic activity, with a direct impact on the sector contribution to the gross domestic product formation and on meeting the population's internal consumption needs. The high seasonality of production, correlated with the significant level of agricultural land fragmentation, to which other conditions of a more or less subjective

nature can be added, influence the establishment modality of the determinants of intensive or extensive nature with effect upon the sustainable sectoral economic growth.

As an economic indicator, the economic growth in the agri-food sector can be assessed from the perspective of the increasing rate of gross value added obtained in the sector, or of the agricultural output value, in the evolution of which we consider that an important role is played by the following factors(determinants), namely:

- land structure, from the perspective of the agricultural and arable area;
- structure of the population from the point of view of the population of working age, aged 14-64 years, per total country as well as in the rural area;
- average life expectancy per total country and by residence areas;
- population's educational level;
- number of employees implied in the production process;
- labour employment rate;
- activity rate;
- inflation rate;
- investments;
- marketable production level;
- intermediary consumption level;
- level of taxes on product;
- total final consumption level;
- level of exports.

We must specify that the present approach also had in view the calculation of derived indicators, the analysis of which reveals significant modifications produced in their structure, generated by the evolution of primary indicators on which their determination is based.

#### **4.1. Evolutions of the economic growth influence factors (determinants) in the agri-food sector in the period 2000-2011**

From the methodological point of view, we must specify that the present analysis covers the period 2000-2011 out of two reasons: the first, linked to ensuring some complete data series and the second, from the perspective of the possibility to ensure their comparability. From this perspective, the analysis revealed the following aspects:

The period 2000-2011 is characterized by a *stability tendency of the arable land area in the context of a slight agricultural area diminution* by 1.6%, i.e. from 14.9 mil. ha (2000) to 14.6 mil. ha (2011). Structurally, the agricultural area diminished its share in total area by 1% (from 62.3% in 2000 to 61.3% in 2011), while the arable area increased its share in total agricultural area also by 1% (from 63.1% in 2000 to 64.1% in 2011).

We consider that an alarming tendency from the perspective of the impact upon the economic growth capacity in the agri-food sector is also represented by the *structure of population by age groups*. From this perspective, per total country, the period 2000-2011 is characterized by a decreasing trend of the population in the age category 0-14 years by 21.6%, which represents a worsening of employed population situation in the future. At the same time, the population in the category 14-64 years old diminished by only 2.6% while the population over 65 years old increased by 7% in the 12-year period.

As an indicator with effect on the expenses of social nature and not only, *the average life expectancy* had an increasing trend both per total country and by residence areas (urban, rural) in the period 2000-2011. Thus, while per total country we can notice an increase of the average life expectancy from 70.53 years (2000) to 73.8 years (2011), i.e. by 4.6%, in the rural area, the average life expectancy increased from 69.53 years (2000) to 72.6 year (2011) (Table 1).

The specialty literature indicates among the determinants of the economic growth in an economic activity sector the *education level* of those involved in the gross value added formation process. From this perspective, in the present approach, we intended the creation of a derived indicator, i.e. the number of graduates/1000 inhabitants per total country and by residence areas. Thus, per total country, the number of higher education graduates/1000 inhabitants was down by 26.6% in the 12-year period (2000-2011), the most alarming trend being that of the vocational training through specialty education (-93.9%) (Table 2). The significant training level diminution has had a noticeable negative effect upon the quality of the performed activity and upon the improvement of the sectoral economic performance.

*Table 1*  
Evolution of the average life expectancy per total country  
and by residence areas in the period 2000-2011 (years)

	<b>Total</b>	<b>Urban</b>	<b>Rural</b>
2000	70.53	71.31	69.53
2001	71.19	71.94	70.2
2002	71.18	72.02	70.08
2003	71.01	71.81	70.08
2004	71.32	72.15	70.34
2005	71.76	72.53	70.78
2006	72.22	72.98	71.23
2007	72.61	73.34	71.64
2008	73.03	73.76	72.05
2009	73.33	74.16	72.23
2010	73.47	74.38	72.26
2011	73.77	74.62	72.63
2011/2000 (%)	4.6	4.6	4.5

Source: Calculations based on Tempo-Online data, NIS, 2013.

*Table 2*  
Evolution of the number of graduates in 1000 inhabitants per total country  
in the period 2000-2011 (number)

	<b>Higher education graduates/ 1000 inhabitants</b>	<b>Primary and secondary education graduates/ 1000 inhabitants</b>	<b>Vocational education graduates/ 1000 inhabitants</b>
2000	1.5	13.4	3.5
2001	1.3	13.9	3.0
2002	1.2	14.1	3.8
2003	1.0	13.7	3.6
2004	0.9	12.2	7.1
2005	0.7	10.7	6.9
2006	0.6	10.2	6.2
2007	0.6	9.6	5.3
2008	0.8	9.5	4.7
2009	0.9	9.3	4.2
2010	1.0	10.7	1.6
2011	1.1	8.6	0.2
2011/2000 (%)	-26.6	-35.7	-93.9

*Source:* Calculations based on Tempo-Online data, NIS, 2013.

In the rural area, the situation is even more alarming in the sense that the number of higher education graduates in 1000 inhabitants is getting fast close to zero, as a result of the diminution of the necessary financial possibilities, as well as of the difficulties to find a job according to the educational level. The situation is not better at the vocational education level either, in the sense that in 12-year time, the number of vocational education graduates/1000 inhabitants diminished by 94.2% in the rural area.

The diminution by more than 22% of the number of primary and secondary education graduates in 1000 inhabitants questions the sustainable economic development perspectives in the conditions of an educational level under continuous deterioration.

An important indicator in the economic growth analysis in the agri-food sector is represented by the employed population. In order to facilitate data comparability and continuity, as well as to obtain an aggregate indicator, in the present approach we focused on the analysis of the number of employees. From this point of view, the national statistics supply information on the number of wage earners in the period 2000-2011 both in agriculture and in the agri-food industry, which gives an overall picture on this issue.

The period 2000-2011 is characterized by a slight increasing trend of the total number of wage earners by 0.3%; not the same thing can be noticed in the number of wage earners in the agri-food sector. Thus, at the level of agriculture, the number of wage earners was down by almost 39% in the year 2011, while in the food industry, the most significant diminution came from tobacco manufacturing (63.42%) (Table 3).

*Table 3*  
The number of wage earners at the end of the year, per total country  
and in the agri-food sector (number)

	<b>Total</b>	<b>Agriculture*</b>	<b>Food and beverages industry</b>	<b>Tobacco manufacturing</b>
2000	4,646,287	160,057	164,473	4,300
2001	4,613,051	147,210	163,980	5,204
2002	4,614,720	137,555	167,206	3,823
2003	4,655,000	136,397	163,792	2,943
2004	4,652,704	136,719	170,688	2,718
2005	4,790,431	137,763	179,113	2,391
2006	4,910,088	128,229	187,542	1,908
2007	5,162,967	120,920	193,205	1,988
2008	5,232,694	103,626	192,247	1,687
2009	4,879,480	106,186	176,467	1,639
2010	4,580,989	94,963	163,892	1,512
2011	4,660,461	97,964	166,829	1,573

Agriculture\* – agriculture, forestry, hunting, forestry economy, fisheries and aquaculture.

Source: Calculations based on Tempo-Online data, NIS, 2013.

As share in total employees, the agri-food sector diminished its share from 7.1% (2000) to 5.7% (2011), which represents a diminution by 1.4%. As indicators closely linked to the labour force and to the economic growth process implicitly, the employment and activity rate had an oscillating and divergent evolution in the 12-year period. Calculated as percentage ratio of the employed civil population to the labour resources, the employment rate followed a negative trend, down from 64.6% (2000) to 59.6% (2011). The same diminishing trend, even stronger, was also noticed in the activity rate, which accounted for 62.8% in the year 2011. The explanation for this phenomenon resides in the diminution of the employed civil population, under the background of the increase of labour resources. Among the indicators with impact upon the economic growth, the inflation rate cannot skip our analysis. From this point of view, the period 2000-2011 was characterized by a diminishing trend of the monthly average inflation rate per total and by categories of commodities, the oscillation ranging from -2.6% per total to -3.1% for the food commodities (Table 4).

Going deeper into the analysis of the economic growth determinants in the agri-food sector, we cannot overlook the impact of the investments. We should specify that in order to ensure data compatibility, the values of investments were deflated by the GDP deflator and converted into the prices of the year 2011. The obtained results following deflation reveal a decreasing trend of the investments value by 54.2% per total country and by 77% in the agri-food sector for the period 2000-2011. In other words, from the value of investments made in the year 2000 worth 25,193.9 mil. RON in 2011 prices, after 12 years these reached only 5,806 mil. RON. From the analysis of data, it results that in the agri-food sector, the investments followed a noticeable increasing trend in the period 2000-2004, and afterwards, following the fracture produced after 2005, a continuous decreasing trend followed (Table 5).

The investments made in the Romanian agri-food sector in the 12 year-period followed a decreasing trend as regards their share in total investments. Thus, from 13.1% in total investments in the year 2000 this share was down to only 6.6% in the year 2011, with a noticeable decline after 2004.

The significant increase of the value of the obtained agricultural production, expressed in 2011 prices, under the background of the investment process diminution, resulted in the increase of the obtained production per one RON invested, from 1.7 RON (2000) to 23.3 RON (2011), which can be explained by a better utilization of the available resources, both internal and attracted resources.

*Table 4*  
Evolution of the monthly average inflation rate by commodities  
and services purchased in the period 2000-2011 (%)

	<b>Total</b>	<b>Food commodities</b>	<b>Non-food commodities</b>	<b>Services</b>
2000	2.9	3.2	2.7	2.7
2001	2.2	2.0	2.3	2.6
2002	1.4	1.2	1.4	1.6
2003	1.1	1.1	1.1	1.2
2004	0.7	0.6	0.9	0.7
2005	0.7	0.5	0.8	1.0
2006	0.4	0.1	0.7	0.4
2007	0.5	0.7	0.3	0.7
2008	0.5	0.5	0.5	0.6
2009	0.4	:	0.6	0.6
2010	0.6	0.5	0.8	0.5
2011	0.3	0.1	0.4	0.3

Source: Calculations on the basis of Tempo-Online data, NIS, 2013.

*Table 5*  
Evolution of investments per total country and in the agri-food sector  
in the period 2000-2011 (mil. lei 2011 pr.)

	<b>Total</b>	<b>Agri-food sector</b>
2000	191,739.5	25,193.9
2001	296,417.2	40,482.8
2002	375,400.9	61,576.0
2003	468,012.1	51,495.0
2004	509,554.3	38,799.8
2005	55,592.1	4,497.2
2006	74,124.1	5,660.5
2007	84,745.1	6,493.3
2008	93,956.9	7,600.2
2009	75,745.5	5,999.1
2010	73,885.2	5,169.3
2011	87,815.8	5,806.5

Source: Calculations on the basis of Tempo-Online data, NIS, 2013.

As an aggregate indicator that characterizes the economic growth level, the *value of market production* obtained in the agri-food sector significantly grew in the 12-year period in all the agri-food economy segments. The most significant growth came from fisheries and aquaculture, in which the market production increased from 30.8 mil. RON (2000) to 288.7 mil. RON (2011). The second place is occupied by forestry and forest operations, while the manufacturing of tobacco products is on the last place (Table 6).

*Table 6*  
Evolution of the market production obtained in the agri-food sector  
by main activities in the period 2000-2011 (mil. RON 2011 pr.)

	<b>Agriculture, hunting and related services</b>	<b>Forestry and forest exploitation</b>	<b>Fisheries and aquacult ure</b>	<b>Food industry</b>	<b>Beverages fabrication</b>	<b>Tobacco products fabrication</b>
2000	14,683.5	1,008.8	30.8	9,117.8	3,031.9	687.3
2001	25,638.7	1,293.0	43.3	13,631.7	5,728.7	1,002.8
2002	26,858.9	1,613.9	51.3	17,741.7	6,475.9	1,213.9
2003	32,747.5	2,219.3	76.4	20,879.6	8,790.3	1,142.1
2004	45,303.1	2,217.0	70.8	24,128.3	8,607.2	1,081.6
2005	34,455.5	2,230.8	77.8	27,381.1	9,452.0	678.2
2006	37,428.5	2,329.9	85.7	29,762.8	10,289.8	1,004.7
2007	35,567.9	2,499.9	97.4	35,446.8	11,191.6	1,157.0
2008	46,564.1	2,632.6	155.5	39,633.0	12,166.1	1,210.1
2009	44,987.3	2,810.4	370.9	36,800.6	12,925.0	1,341.1
2010	60,287.4	3,344.5	181.0	35,538.0	12,892.2	1,302.7
2011	56,975.0	4,892.4	288.7	33,056.3	9,142.3	920.5
2011/2000 (%)	288.0	385.0	836.3	262.5	201.5	33.9

*Source:* Calculations on the basis of Tempo-Online data, NIS, 2013.

By component activities, the share of agriculture in total market production value in the agri-food sector increased by 4% in the period 2000-2011, i.e. from 55.1% (2000) to 59.0% (2011). At the same time, the share of food industry and the industry of beverages and tobacco declined by 4% in total agri-food sector (from 44.9% in the year 2000 to 41% in the year 2011). In the analysis of the economic growth in the agri-food sector, an extremely important indicator that we cannot overlook is represented by the value of commodity taxes. From this perspective, the period 2000-2011 was characterized by a strong increasing trend of the tax level, mainly in the activities included in the agriculture sector. We mainly refer here to the activities in the field of fisheries and aquaculture, followed at a short distance by agriculture, hunting and related services. A relatively paradoxical situation is to be found at the level of beverages fabrication, where the value of the commodity taxes increased by only 25.6% in the 12-year period (Table 7).



Table 7

Evolution of the value of taxes by product within the agri-food sector by component activities in the period 2000-2011 (mil. lei pr. 2011)

	<b>Agriculture, hunting and related services</b>	<b>Forestry and forest exploitation</b>	<b>Fisheries and aquaculture</b>	<b>Food industry</b>	<b>Beverages fabrication</b>	<b>Tobacco products fabrication</b>
2000	245.9	34.8	3.1	1,240.1	1,765.1	971.7
2001	227.6	42.1	4.4	1,552.5	1,001.0	1,508.7
2002	1,560.0	60.9	5.7	1,783.7	1,423.4	1,631.8
2003	2,007.9	72.2	7.0	2,227.3	1,544.1	2,617.0
2004	2,176.5	75.0	7.4	2,682.4	1,668.5	3,082.2
2005	2,907.4	101.8	10.0	3,091.8	2,128.8	3,510.8
2006	3,132.9	102.7	8.8	3,423.9	2,210.6	3,255.2
2007	3,572.0	118.9	10.2	3,747.2	2,449.8	3,667.0
2008	4,019.1	134.1	11.5	4,157.3	2,598.7	4,840.5
2009	3,523.2	117.6	10.1	3,621.0	2,367.2	6,881.8
2010	3,142.3	178.1	36.8	3,353.1	2,185.6	6,539.1
2011	3,688.4	221.6	61.9	3,999.5	2,217.2	8,070.7

Source: Calculations on the basis of Tempo-Online data, NIS, 2013.

Unlike the market production value, the commodity taxes are obtained in the agri-food sector mainly by the food, beverages and tobacco industry. However, in the period 2000-2011, the share of commodity taxes was down by 15.1% in the food, beverages and tobacco industry, from 93.3% (2000) to 78.2% (2011), while the share of taxes in agriculture increased instead. As an expression of the utilization of available resources in the process of gross value added formation, the intermediary consumption significantly increased in the period 2000-2011, both in agriculture and in the food industry, agriculture having the most significant share in the agri-food sector, ranging from 52.5% (2000) to 64.4% (2011) (Table 8).

Last but not least, the export of goods and services pertaining to the agri-food sector followed an increasing trend in the period 2000-2011, mainly at the level of food, beverages and tobacco industry. Agriculture is not an exception either, the export of goods and services from this activity field significantly increasing (Table 9).

Finally, the variation of stocks in the agri-food sector had an oscillating and diverging trend across the years and also by component activities. Thus, except for the tobacco products fabrication where the stock variation followed a descending trend, for the remaining activities this indicator is characterized by an increasing dynamics (Table 10).

As a resultative indicator, the value of agricultural production, expressed in 2011 prices, increased about three times compared to the year 2000, to reach 76,508.7 mil RON in the year 2011. In relation to the intermediary consumption, the value of the obtained agricultural production experienced a slight diminution in

12-year time, i.e. from 0.9 RON production/1 RON intermediary consumption (2000) to 0.88 RON production/1 RON intermediary consumption (2011), which can be explained by the faster rate of the intermediary consumption increase to the detriment of the obtained production value.

*Table 8*

Evolution of the intermediary consumption value in the agri-food sector by component activities in the period 2000-2011 (mil. RON 2011 pr.)

	<b>Agriculture, hunting and related services</b>	<b>Forestry and forest exploitation</b>	<b>Fishing and aquaculture</b>	<b>Food industry</b>	<b>Beverages fabrication</b>	<b>Tobacco products fabrication</b>
2000	13,810.0	815.1	31.8	8,118.9	3,535.6	1,629.2
2001	19,688.4	1,028.0	52.7	10,019.8	4,084.0	2,537.6
2002	21,207.5	1,490.9	72.3	13,998.4	4,327.4	2,655.8
2003	28,598.2	2,005.4	145.8	18,064.9	6,184.1	3,701.6
2004	37,259.5	2,046.9	174.1	21,510.4	6,401.6	4,037.0
2005	31,282.3	2,117.3	195.1	23,447.3	5,800.4	4,036.2
2006	31,494.3	2,206.6	187.0	23,774.8	6,959.1	3,975.1
2007	28,173.7	2,411.4	249.6	28,447.6	7,499.2	4,057.7
2008	39,733.5	2,669.8	364.0	30,694.3	10,143.7	5,206.6
2009	39,011.2	2,796.1	470.0	28,810.6	10,149.8	5,509.7
2010	46,175.9	1,772.6	236.0	16,524.6	9,684.7	5,625.8
2011	52,257.4	3,187.3	377.5	15,930.0	8,251.2	6,679.3

*Source:* Calculations on the basis of Tempo-Online data, NIS, 2013.

*Table 9*

Evolution of the value of goods and services exports from the agri-food sector by component activities in the period 2000-2011 (mil. RON 2011 pr.)

	<b>Agriculture, hunting and related</b>	<b>Forestry and forest exploitation</b>	<b>Food industry</b>	<b>Beverages fabrication</b>	<b>Tobacco products fabrication</b>
2000	746.2	173.5	409.0	69.5	7.8
2001	1,195.1	80.0	654.0	101.0	42.0
2002	1,349.9	60.4	632.9	131.7	65.9
2003	1,597.2	106.7	853.6	140.6	40.4
2004	1,717.9	114.5	1,022.2	139.0	15.5
2005	1,688.9	88.9	1,086.0	116.9	17.0
2006	1,754.9	88.6	1,195.4	120.5	27.6
2007	2,077.3	97.5	1,233.2	135.6	64.4
2008	3,883.0	79.6	1,875.3	181.7	71.8
2009	5,262.9	147.1	2,309.6	244.7	161.3
2010	7,972.9	289.3	3,639.4	281.3	1,644.1
2011	9,904.6	632.4	5,082.3	340.0	1,944.5
2011/2000 (%)	1,227.4	264.5	1,142.7	389.3	24,753.7

*Source:* Calculations on the basis of Tempo-Online data, NIS, 2013.

*Table 10*  
Stock variation evolution in the agri-food sector by component activities  
in the period 2000-2011 (mil. RON 2011 pr.)

	<b>Agriculture, hunting and related services</b>	<b>Forestry and forest exploitation</b>	<b>Fishing and aquaculture</b>	<b>Food industry</b>	<b>Beverages fabrication</b>	<b>Tobacco products fabrication</b>
2000	193.6	35.1	3.2	138.5	11.4	6.7
2001	591.7	190.0	11.8	486.6	51.4	37.9
2002	68.4	55.3	3.6	280.7	45.5	63.0
2003	194.9	-3.7	11.7	130.4	38.3	23.6
2004	2,811.8	74.7	15.2	424.2	76.7	31.6
2005	106.8	85.5	15.8	51.0	13.0	-0.2
2006	677.0	98.1	50.5	297.3	33.9	1.5
2007	496.7	97.4	62.2	339.4	40.7	12.3
2008	58.9	7.6	7.7	-294.4	-15.0	-18.8
2009	952.0	38.0	48.9	3,552.9	1,166.7	1,983.0
2010	1,181.9	90.3	40.4	381.1	155.7	-219.0
2011	1,706.0	35.5	37.6	787.4	89.8	-530.2
2011/2000 (%)	781.2	1.1	1,067.1	468.4	691.0	-7,954.9

*Source:* Calculations on the basis of Tempo-Online data, NIS, 2013.

A similar analysis can be made having in view the gross value added in the agri-food sector, on the basis of the available statistical information from the national accounts. It must be mentioned that at present the national accounts supply information until the level of the year 2010. Nevertheless, in order to ensure data comparability, the estimates of the National Prognosis Commission for the year 2011 were also used for the agricultural sector. At the same time, for the food industry, the gross value added for the year 2011 was estimated taking into consideration the annual average growth rate in the period 2000-2010.

Having in view the above-mentioned methodological specifications, the gross value added was deflated utilizing the same GDP deflator, the analysis of the obtained data leading to the following conclusions. The period 2000-2011 was characterized by a noticeable increasing tendency of the gross value added in the agri-food sector, both in agriculture and mainly in the processing industry (Table 11).

However, in relation to the intermediary consumption, the gross value added experienced a slight recoil, generated by the faster growth rate of the intermediary consumption compared to that of GVA. Thus, at agriculture level, GVA/1 RON intermediary consumption diminished by 17.2% in the year 2011 as compared to the year 2000, while in the food, beverages and tobacco industry, an increase from 0.5 RON GVA/1 RON intermediary consumption (2000) to 0.7 RON GVA/1 RON intermediary consumption could be noticed in the year 2011.

*Table 11*  
Evolution of the gross value added obtained in the agri-food sector  
in the period 2000-2011 (mil. RON 2011 pr.)

	<b>Agriculture</b>	<b>Food, beverages and tobacco industry</b>
2000	13,459.0	7,956.2
2001	22,705.9	12,497.1
2002	23,885.1	13,668.3
2003	29,993.1	15,874.1
2004	37,577.1	18,354.8
2005	28,221.3	20,295.2
2006	28,929.0	21,448.6
2007	24,303.2	23,407.6
2008	32,216.9	25,870.9
2009	32,645.3	26,950.2
2010	30,531.4	29,574.2
2011	36,400.0	34,365.5

*Source:* Calculations on the basis of Tempo-Online data, NIS and of NPC estimates.

#### **4.2. The influence of determinants upon the sectoral gross value added – an econometric analysis**

The analysis of the factors / determinants from their evolution perspective, as well as of the modifications produced in the 12-year period has been deepened by the construction of an econometric model, whose correlation relations put into evidence the determinants of intensive nature or better said the direct determinants, with effect upon the resultative indicator of the economic growth – the gross value added. In this respect, on the basis of the available information, as time series, a data series was constructed for the period 2000-2011, in which the gross value added of the agri-food sector is defined in function of these ones. We must mention that in the case of the value indicators, these were transformed into comparable prices of the year 2011, by using the GDP deflator. For testing the influence of the above-mentioned factors upon the gross value added in the agri-food sector, the software E-views was used which enables the modelling of phenomena and influences of the different effort factors (input) upon an effect indicator (Y). In order to determine the correlation between the effort indicators and the effect indicators, the correlation coefficient was calculated, through descriptive statistics, the results indicating different intensities both as regards the value and the sign (+/-). From the analysis of information it results that a high correlation degree exists between the gross value added and the following indicators:

- Final Consumption (FC) – 95.6%;
- Intermediary Consumption (IC) – 95.1%;
- Exports – 76.9%;
- Commodity taxes – 91.1%;
- Agricultural output value – 98%;

- Market production value – 95%;
- Stock variation – 40.1%.

For these seven effort indicators and for the effect indicator, a descriptive analysis of the data series was made in the first place, taking into consideration both the evolution in time and the indicators of the mean, median and mean square deviation, etc. For the construction of an econometric model, of an equation respectively, the gross value added is considered as being function of the indicators with which it is found in significant correlation, according to the above-mentioned results. In this respect, for the explanation of the economic phenomenon enounced in the approach theme, we utilized a multi-factorial model (with several explanatory variables of *back-looking* type) (Figure 1).

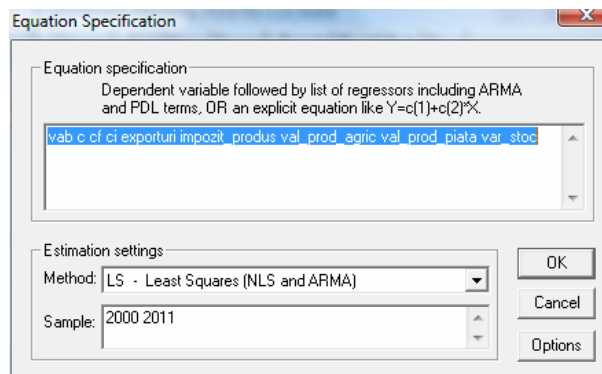


Figure 1. Multi-factorial model equation.

By applying this equation, the following model was obtained (Figure 2):

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3146.451	796.0359	-3.952650	0.0168
CF	0.530770	0.070578	7.520365	0.0017
CI	0.388151	0.099822	3.888443	0.0177
EXPORTURI	0.038048	0.081663	0.465920	0.6655
IMPOZIT_PRODUS	-1.081011	0.370678	-2.916304	0.0434
VAL_PROD_AGRIC	0.402825	0.059619	6.756679	0.0025
VAL_PROD_PIATA	-0.346248	0.057085	-6.065456	0.0037
VAR_STOC	0.506021	0.057043	8.870802	0.0009
R-squared	0.999782	Mean dependent var	49260.83	
Adjusted R-squared	0.999402	S.D. dependent var	13263.30	
S.E. of regression	324.4553	Akaike info criterion	14.63689	
Sum squared resid	421085.0	Schwarz criterion	14.96016	
Log likelihood	-79.82136	F-statistic	2625.390	
Durbin-Watson stat	1.988148	Prob(F-statistic)	0.000000	

Source: Own calculations.

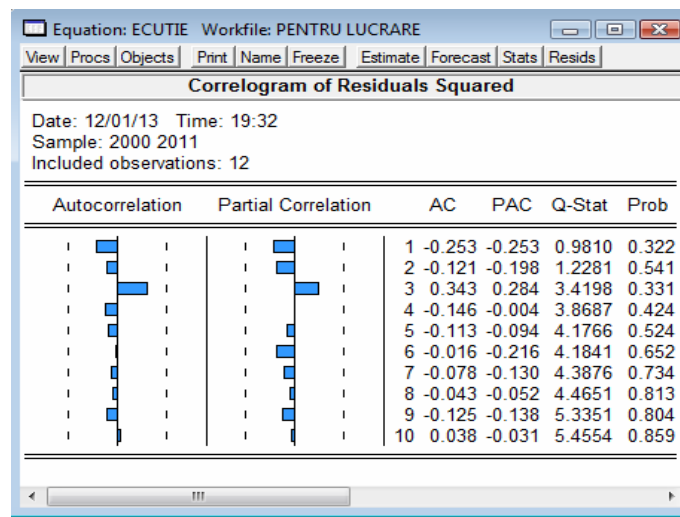
Figure 2. Influence of indicators upon the gross value added in the agri-food sector.

Analyzing the estimated parameters, it can be noticed that these are statistically significant at a 5% signification threshold. As in the Prob column the values for the probabilities associated to the t-statistic tests are lower than 0.05, we can state with a probability of 95% that the estimated parameters are statistically significant. At the same time, analyzing the data from the table, it can be noticed that 99.97% of the resultative variable variation is explained by the variation of the explanatory variables included in the model. This high value of  $R^2$  reveals that the proposed model explains the economic phenomenon in the reality very well. For testing the model in the level, the following steps were made:

a) **testing the existence of auto-correlations at residual level**; for this the correlogram of residuals was obtained, with 24 lags. Analyzing this correlogram, it is noticed that there are no auto-correlations (all the probabilities associated to the statistical Q test - Ljung-Box Test  $> 0.1$ ) (Figure 3);

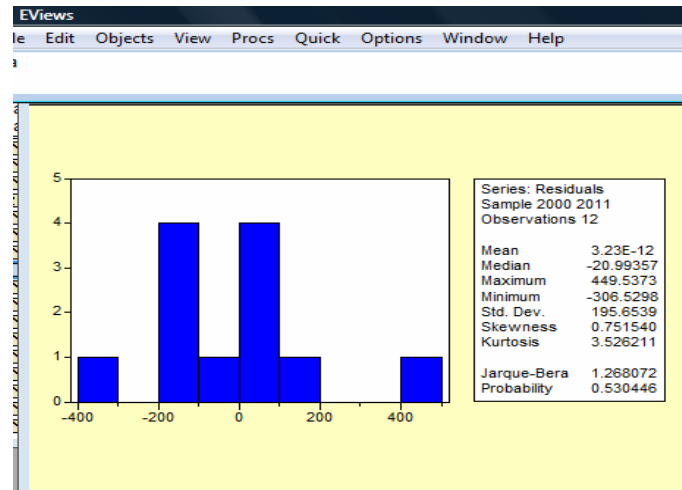
b) **obtaining a normality test of residuals**, in order to verify if the residuals follow a normal distribution; the value of Jarque-Bera Test = 1.268072, with an associated probability of 0.53. As a result, the null hypothesis is not rejected, at a signification threshold of 5%, according to which the residual is normally distributed (Figure 4);

c) **testing the model stability**, by using CUSUM tests (Figure 5) based on the cumulative sum of recursive errors of the regression equation, Square CUSUM (Figure 6) (it is calculated and interpreted similarly to the CUSUM test, with the difference that squared recursive errors are used in the place of the recursive errors), as well as the test of recursive coefficients, of the coefficients of the regression equation calculated recursively respectively (Figure 7).



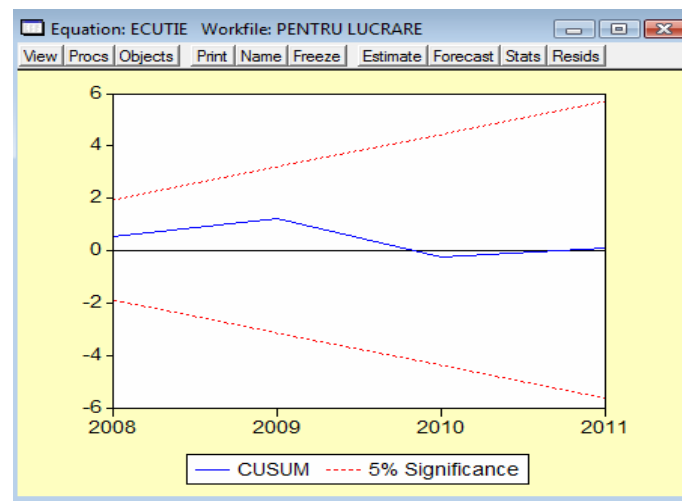
Source: Own calculations.

Figure 3. Correlogram of residuals.



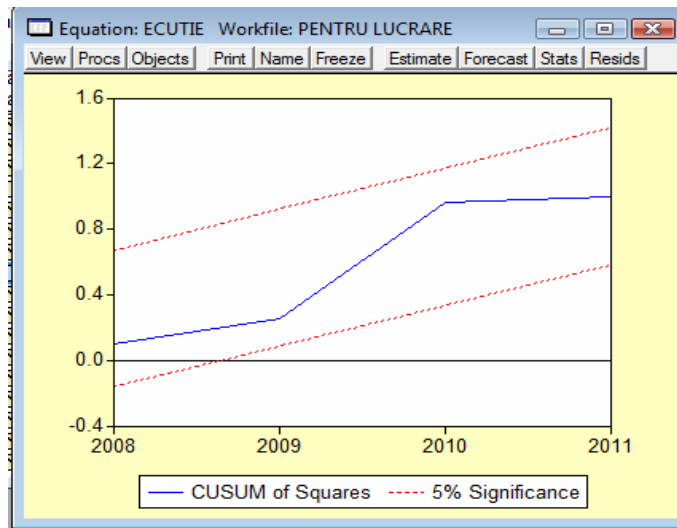
Source: Own calculations on the basis of NIS data, 2011.

Figure 4. The normality test.



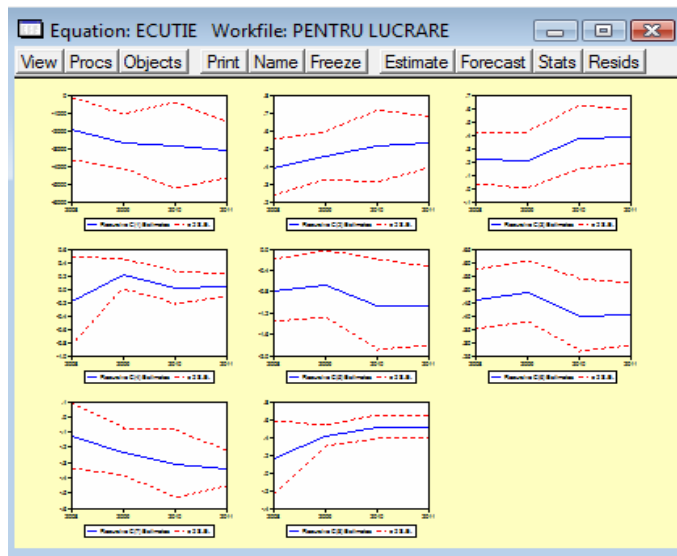
Source: Own calculations.

Figure 5. CUSUM Test.



Source: Own calculations.

Figure 6. Square CUSUM Test.



Source: Own calculations.

Figure 7. Recursive coefficients Test.

From the analysis of the CUSUM test one can notice that there are certain shocks of the explanatory variables, which do not create obvious instability at the explanatory variable level.



**The coefficients recursivity test indicates that the chosen model is stable.** In the trials to identify certain valid models, the introduction of other variables was also experimented, which generated weaker results, as regards model testing inclusively; thus, the proposed model was maintained and it was considered as being relevant. To sum up, it was proved that **the investigated model was valid and that it very well captures the influence of the investigated factors upon the gross value added in the agri-food sector.**

## 5. CONCLUSIONS

As a continuous subject of debates, generated both by the need to identify new factors of influence but also by their impact upon the value added creation in the economy, the problem of the economic growth in the agri-food sector and of the determinants of intensive or extensive nature continues to stir vivid debates, taking into account the specific characteristics of this activity sector and its importance in meeting the domestic population's food needs at national level.

Starting from the general economic theory, the present approach has tried to identify a series of determinants (intensive and extensive factors) that influence the economic growth process in the Romanian agri-food sector. In this respect, having in view the particularities of the agri-food economy, including here both agriculture and the food, beverages and tobacco industry, the present approach highlights the existence of significant correlations between the gross value added and a series of factors, the evolution of which fully impacts the sectoral economic growth.

From this perspective, it should be specified that among the determinants of extensive nature, one can include the intermediary consumption, the final consumption and the level of taxes on product, while from the category of the intensive determinants, the agricultural output value, the marketable production value, the stock variation and the exports value.

Although a significantly higher number of economic growth determinants exists in the specialty literature, their analysis and particularization at the agri-food sector level revealed a weaker influence on the sectoral gross value added level.

The analysis of the data series revealed that the value of total agricultural output and that of the gross value added per 1 RON intermediary consumption had a diminution tendency in the period 2000-2011, mainly in agriculture, which reflects the continuously extensive character of the Romanian agri-food sector value.

## REFERENCES

1. Barro R. J. (1997), *Determinants of Economic Growth: A Cross-Country Empirical Study*, Cambridge MA, MIT Press.
2. Cătăneț, D. et al. (2007), *Determinanții creșterii economice și competitivitatea României. O analiză empirică*, în volumul: România în Uniunea Europeană. Calitatea integrării. Creștere. Competență. Ocupare.
3. \* \* \* (1990-2013), Tempo-Online database, NIS.
4. \* \* \* (2013), Prognoză pe termen mediu 2013-2016, Comisia Națională de Prognoză.