Statistical analysis on the evolution of economic activity in Romania

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Abstract. *During this period, the macroeconomic activity, in all the fields with differentiated degree of influence, is in the process of trying to resettle the economic activity in conditions of pandemic and financial-economic crisis.*

In the main branches of the industry the activity is not at the level of the capacity of the Romanian national economy, context in which there are reductions of production in the case of industry to internal and external orders, and in the case of agriculture In this context, analysing the situation of salaries, economic activity, the evolution of the number of employees, there are slight improvements without the security of operation at the maximum level of macroeconomic capacity.

The analysis suggests that there are still difficulties in stimulating the workforce by increasing gross and net wages, trying to avoid unreported work (gray market) or concluding important contracts, especially for export production.

The data are important in that they will suggest the trend of evolution of the national economy. Table series structured data are presented, as well as graphs that suggest the perspective of Romania's macroeconomic evolution.

Keywords: national economy, European Union, industry, agriculture, crises.

JEL Classification: E23, Q10.

Introduction

Macroeconomic activity takes place in a way influenced by a number of factors. Thus, in addition to all factors affecting macroeconomic developments, such as labour productivity, the number of employees, the endowment of fixed assets, the absorption of unemployment, keeping inflation under control and much more, there are also destabilizing elements such as crises economic and financial.

Economic and financial crises are those that have an effect on maintaining a macro-stability, maintaining a possibility of evolution in the future.

The trend that can be calculated using statistical and econometric methods and models must be accurately established, so that measures can be taken in the government program, in the annual budget allocations, so that certain areas that are suffering can be recovered.

Referring to prices, we will see that they will tend to increase, to the labour force we will find that it will stagnate if it does not decrease, and to the increase of the Gross Domestic Product we must keep in mind that it will increase. Of course, the increase in all three elements mentioned is differentiated according to the sector of activity, but it also depends a lot on the intervention through programs of measures.

The methodology used is that of the National Institute of Statistics and Eurostat, using structural studies, comparative analysis, correlation analysis or graphoscopic analysis, using data series and graphical representations that facilitate the understanding of the phenomenon. At the same time, the authors used a large volume of data to draw these conclusions and will continue to use them.

The problem is topical. The National Institute of Statistics itself conducts quarterly studies in order to identify certain changes in the evolutionary trend in macroeconomic activity.

Literature review

The analysis of the main trends of economic evolution is a priority for macroeconomic management, especially now when the world economy is facing an unprecedented crisis due to the pandemic crisis, combined with the economic and financial. A number of researchers and specialists in the field have paid attention to the study of these aspects, vital to maintain good cooperation to implement the national and community objectives in progress or those that will be initiated in accordance with directives and development programs. of the European Union. In this sense, Anghelache, C. and others (2020), Anghelache, C. and others (2019) have extensively approached the study of the evolution of agriculture in Romania in crisis conditions and difficult meteorological conditions (prolonged drought). The European Union's policy in the field of rural, agricultural and industrial development is also being researched. The need to link national programs with the Community strategy is emphasized. Also, Anghelache, C. in 2012 and 2018 conducts two studies on the economic situation in crisis conditions and the structural analysis of the evolution of the Romanian economy. Hansen, M.C. Potapov, P.V. et all (2013) conduct an extensive study on the effects of great globalization on the evolution of humanity in the

future, and Lowder, S. et all (2017) refer in their studies to income, social protection in the conditions of globalization, suggesting the need for a Global Fund of World Food Security. Mogues, T., Fan, S. and Benin, S. (2015) express in a study the opinion that attention should be paid in the future to public investment in agriculture, which aims to ensure food security. Kazantzev, S.V. (2008) published a very interesting paper on regional potential, which should be the basis of domestic and wider international competitiveness, suggesting the placement of investments and grants in this framework.

Methodology

In order to facilitate the understanding of the analysis made in this article, we will briefly present some methodological aspects used by the National Institute of Statistics. Thus, the cultivated area represents the area sown / planted in its own field, in the reference agricultural year (October 1 - September 30) with a main crop (occupying the land for the longest time) or in previous agricultural years for biennial, triennial crops or perennial, and vegetable agricultural production represents the physical production obtained in the reference period (the year in which the harvest is made), less the crop losses, expressed in physical units according to the nature of the products and product groups and includes: crop production in own field; intercropping production; production of successive crops; production obtained in family gardens (for vegetables, potatoes and grapes).

Data on the rate and number of vacancies are obtained through a quarterly selective statistical survey, having as reference period the middle month of the quarter. For the sizing of the sample, it was considered to obtain some estimates of the main researched characteristics, which would be affected by errors in the limit of +/- 3% and guaranteed with a probability of 95%. The units from the budgetary sector are comprehensively included in the research, with the exception of the local public administration units for which the data at the level of the local communal councils are collected on the basis of a representative sample at county level. For the economic sector, the research includes units with 4 employees and over, which represent 89% of the total number of employees in this sector.

The number of vacancies includes the number of paid, newly created, vacant, or vacant positions, for which the employer takes concrete action to find a suitable candidate for the position and the employer wants to fill it immediately or within a specific period of time. , established by the employer. The specific period of time refers to the maximum period required to fill the vacancy.

Vacancies intended for persons outside the enterprise, but for which persons inside the enterprise may also compete, are considered vacancies, regardless of whether they are fixed-term or indefinite positions, in normal or part-time work.

Data, results and discussions

Analysing the data provided by the National Institute of Statistics related to the evolution of industrial production we find the shock suffered by this economic branch in 2020 with the onset of the pandemic crisis that was combined with the current economic and financial crisis. The devastating effect of the crisis is highlighted by the graphical representation of the evolution of this macroeconomic indicator.

Chart 1. *Monthly evolution of industrial production during January 2015 – February 2021*
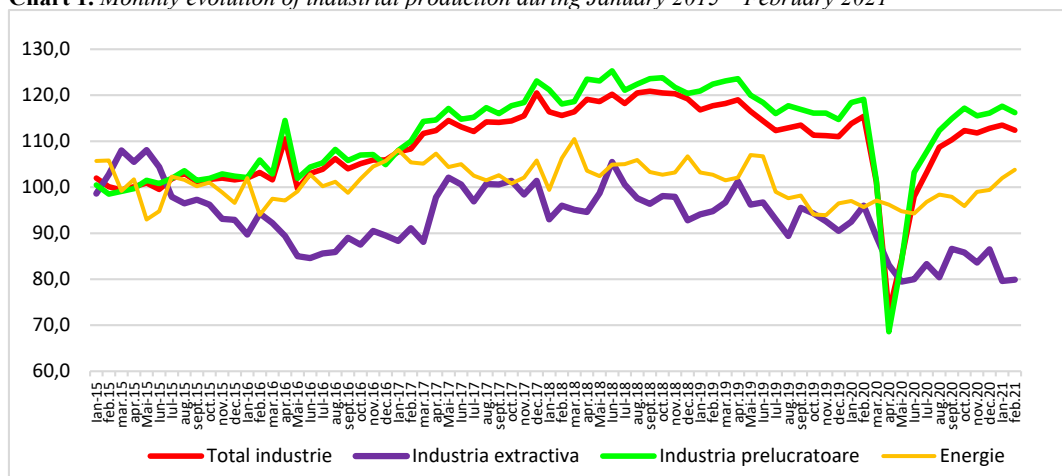
Source: INS communique 93/13 April 2021.

Interpreting the data that formed the basis of the above graph, we find that in February 2021, industrial production increased compared to the previous month by 3.7% as gross series and decreased by 1.0% as a series adjusted according to the number working days and seasonality. Also, the industrial production was lower than the corresponding month of the previous year, both as a gross series by 3.1% and as a series adjusted according to the number of working days and seasonality by 2.6%.

At the same time, in the period in the first two months of 2021, compared to the similar period of 2020, industrial production decreased by 2.3% as gross series and by 1.5% series adjusted according to the number of working days and seasonality.

In February 2021, industrial production (gross series) increased compared to the previous month by 3.7% due to the growth of the manufacturing industry, respectively 6.2%. At the same time, the production and supply of electricity and heat, gas, hot water and air conditioning and the extractive industry decreased by 6.5% and 2.6%, respectively. Also, the industrial production, series adjusted according to the number of working days and seasonality, was lower by 1.0% compared to the previous month. The manufacturing industry decreased by 1.2%, while the production and supply of electricity and heat, gas, hot water and air conditioning and the extractive industry increased by 1.8% and 0.3%, respectively.

Vegetable production in the main crops in 2020 does not have a good evolution either. Thus, the area cultivated in 2020, compared to 2019, decreased to cereals for grains, oil plants, legumes for grains, potatoes and vegetables and consequently the vegetable

agricultural production decreased in 2020, compared to the previous year, to cereals for grains, oily plants, legumes for grains, and vegetables grown in potatoes.

The data on the cultivated area and the production of the main crops are structured in table number 1.

Table 1. *Cultivated area and production of main crops*

	Cultivated area - thousand ha-		Total production - thousand tons-		Differences (±) Year 2020 compared to 2019	
	2019	2020	2019	2020	- thousand ha -	- thousand tons -
Grain cereals, from which:	**5569**	**5435**	**30412**	**18968**	**-134**	**-11444**
-wheat	2168	2146	10297	6410	-22	-3887
-barley and barley	449	438	1880	1121	-11	-759
-oat	161	103	362	199	-58	-163
-corn grains	2679	2639	17432	10844	-40	-6588
Grain legumes	**116**	**107**	**236**	**122**	**-9**	**-114**
Oily plants, from which:	**1800**	**1736**	**4792**	**3111**	**-64**	**-1681**
-Sunflower	1283	1223	3569	2072	-60	-1497
-soy beans	158	165	416	306	+7	-110
-rape	353	342	798	728	-11	-70
Potatoes	**170**	**166**	**2627**	**2683**	**-4**	**+56**
Vegetables	**228**	**225**	**3530**	**3517**	**-3**	**-13**

Source: INS Communique 80/31 March 2021.

Interpreting the structured data in table number 1 we find that the area cultivated with grain cereals decreased by 2.4% in 2020, and production decreased by 37.6%, compared to the previous year, due to the pronounced drought in the main vegetation periods of crops and lack of irrigation, which led to low yields in most crops. Also, the area cultivated with grain corn in 2020, represented 48.6% of the area cultivated with grain cereals, and the one cultivated with wheat 39.5%. The largest decrease in production was recorded for grain legumes, which was 48.3% lower than in 2019.

The data on the evolution of agriculture and industry over a period of sixteen years, respectively 2005-2020 and their share in the formation of the Gross Domestic Product are structured in table number 2.

Table 2. *Evolution of GDP, agriculture and industry in Romania during 2005-2020*

Year	GDP	Agriculture	Share of agriculture in GDP%	Industry	Share of industry in GDP%
2005	286861,9	14702,4	**5,1**	92691,3	**32,3**
2006	342762,6	17188,8	**5,0**	109926,3	**32,1**
2007	425691,1	17493,4	**4,1**	131201,9	**30,8**
2008	539834,6	24288,8	**4,5**	161562,0	**29,9**
2009	530894,4	22316,1	**4,2**	161459,3	**30,4**
2010	528514,5	28125,1	**5,3**	168228,2	**31,8**
2011	558889,9	28856,8	**5,2**	189152,5	**33,8**
2012	591799,1	23203,9	**3,9**	191610,4	**32,4**
2013	634967,8	29879,2	**4,7**	199818,1	**31,5**
2014	669703,9	29097,9	**4,3**	209835,8	**31,3**
2015	711929,9	26924,8	**3,8**	210784,3	**29,6**
2016	763652,5	27918,6	**3,7**	213383,3	**27,9**
2017	857895,7	30043,9	**3,5**	237941,6	**27,7**
2018	951728,5	35062,9	**3,7**	262810,0	**27,6**
2019	1058190,3	33779,3	**3,2**	256901,3	**24,3**
2020	1053881,4	40425,2	**3,8**	207560,6	**19,7**

Source: INS. Data processed by the authors.

Interpreting the data presented in table number 2, we find that the share of agriculture in the formation of the Gross Domestic Product was decreasing, reaching in 2020 to be only 3.8%, while in 2005 it was 5.1%. Also, in terms of industry, the decrease in the share of Gross Domestic Product is much more pronounced. Thus, if in 2005 the industry participated with a percentage of 32.3%, in 2020 it was only 19.7%. For a better visualization of the evolution of the three macroeconomic indicators, graph number 2 was drawn up.
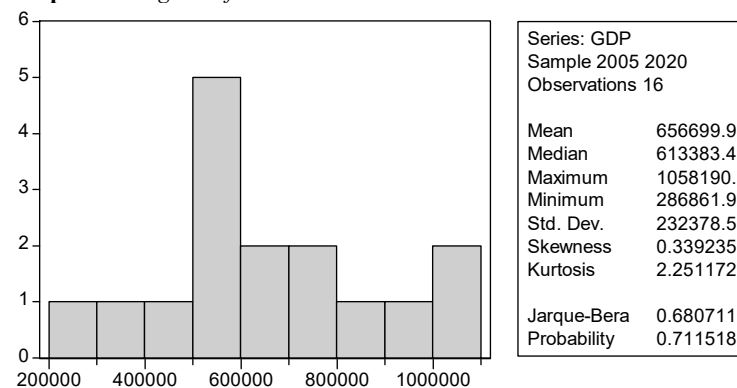
Chart 2. *Evolution of GDP, agriculture and industry in Romania in the period 2005-2020*
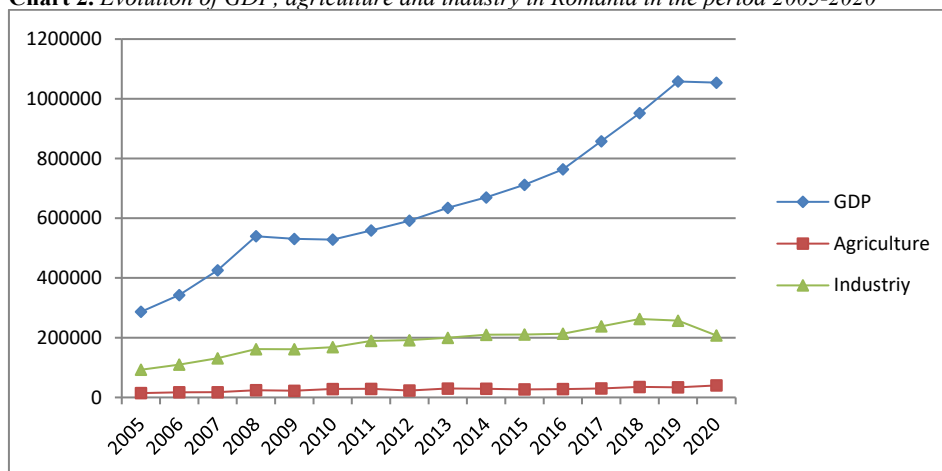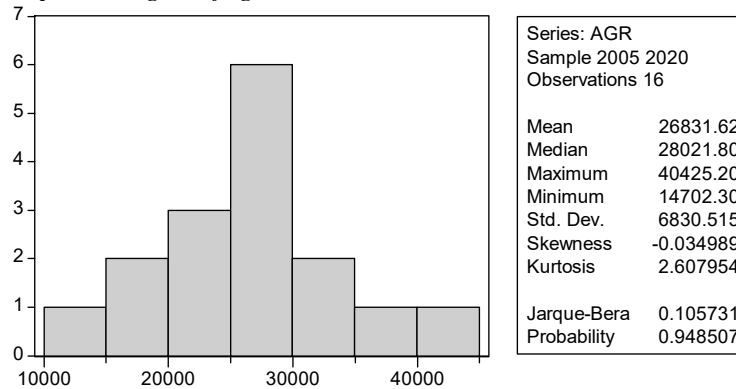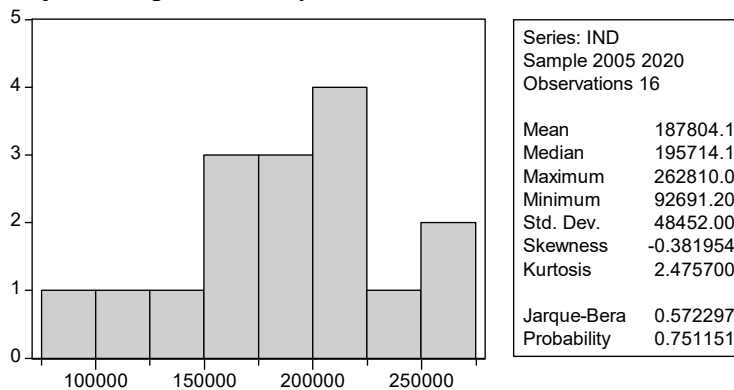

We find that in Romania in the period 2005-2020 the Gross Domestic Product had a positive trend with small changes of meaning during the financial crisis of 2008-2010 and the pandemic combined with the economic-financial one we are going through. As far as industry is concerned, it has been severely affected by the effects of the health crisis, with major declines in recent years under analysis, while agriculture has seen a more pronounced evolution.

The following graphs show the histograms of the evolution of the three macroeconomic indicators studied.

Graph 3. *Histogram of GDP evolution*

Series: GDP	
Sample 2005 2020	
Observations 16	
Mean	656699.9
Median	613383.4
Maximum	1058190.
Minimum	286861.9
Std. Dev.	232378.5
Skewness	0.339235
Kurtosis	2.251172
Jarque-Bera	0.680711
Probability	0.711518

Graph 4. *Histogram of agricultural evolution*

	Series: AGR Sample 2005 2020 Observations 16	
	Mean	26831.62
	Median	28021.80
	Maximum	40425.20
	Minimum	14702.30
	Std. Dev.	6830.515
	Skewness	-0.034989
	Kurtosis	2.607954
	Jarque-Bera	0.105731
	Probability	0.948507

Graph 5. Histogram of industry evolution

	Series: IND Sample 2005 2020 Observations 16	
	Mean	187804.1
	Median	195714.1
	Maximum	262810.0
	Minimum	92691.20
	Std. Dev.	48452.00
	Skewness	-0.381954
	Kurtosis	2.475700
	Jarque-Bera	0.572297
	Probability	0.751151

Interpreting the results presented in graphs 3,4 and 5 we find that the distributions of the three macroeconomic indicators studied between 2005 and 2020 are somewhat symmetrical aspect confirmed by the Skewness test and somewhat slower considering the values of the Kurtosis test which are less than 3.

In the same order of ideas, considering that there are linear correlations between variables, we will further proceed to a statistical-econometric analysis using in this sense the multiple linear regressions, which has the following form:

$$GDP = a + b \cdot AGR + c \cdot IND + \varepsilon \tag{1}$$

where:
GDP (Gross Domestic Product) is the dependent variable;
AGR (agriculture) is the independent variable;
IND (industry) is the independent variable
a , b and c are the regression parameters;
ε represents the residual variable.

To estimate the regression parameters and to test the significance of the model we used the statistical-econometric analysis program EViews, and the results are presented in figure number 1.

Figure 1. *Results of the analysis of the dependence of GDP on agriculture and industry*

Dependent Variable: GDP				
Method: Least Squares				
Sample: 2005 2020				
Included observations: 16				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-235027.9	87207.95	-2.695028	0.0184
AGR	17.58325	5.833930	3.013963	0.0100
IND	2.236056	0.822438	2.718816	0.0176
R-squared	0.894755	Mean dependent var		656699.9
Adjusted R-squared	0.878563	S.D. dependent var		232378.5
S.E. of regression	80978.69	Akaike info criterion		25.60912
Sum squared resid	8.52E+10	Schwarz criterion		25.75398
Log likelihood	-201.8730	F-statistic		55.26063
Durbin-Watson stat	0.914190	Prob(F-statistic)		0.000000

Interpreting the results obtained and structured in figure number 1 we can say that the model is a good one and can be used in estimating the evolution of GDP.

The values recorded by the significantly estimated parameters are non-zero, and the F-statistic and t-Statistic tests have higher values than the tabulated ones.

Also, the value of 0.89 recorded by R-squared, close to the unitary one, indicates that the factorial variables have a strong influence on the evolution of the resultant characteristic. Thus, using the results from figure number 1, we can estimate the theoretical values of the dependent variable, according to the relation:

$$\widehat{GDP} = -235027.9 + 17.58325 \cdot \widehat{AGR} + 2.236056 \cdot \widehat{IND} + \varepsilon \tag{2}$$

The high value of the free term coefficient indicates that there are other factors that influence the formation and growth of the Gross Domestic Product.

Next we will analyse the evolution of vacancies and the number of employees and the influence they have on the formation of the Gross Domestic Product.

The pandemic crisis also affected the labour market, the average annual number of vacancies in 2020 being 37.7 thousand, decreasing by 16.1 thousand vacancies compared to the previous year, and the average annual rate of jobs job vacancies was 0.77%, down 0.32% from the previous year.

The data are presented in the following graph.

Chart 6. *Average annual rate and average annual number of vacancies*
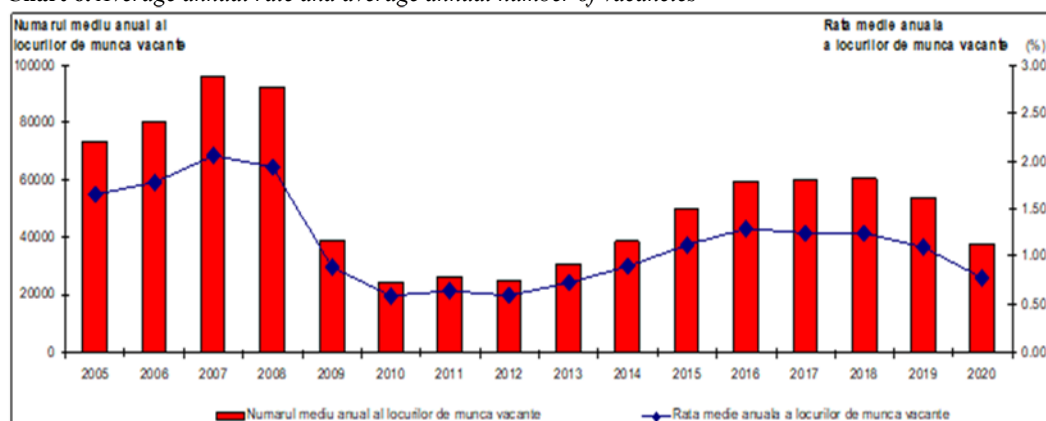
Source: INS communique 79/30 March 2021.

Interpreting the data presented in graph number 6, we find that in 2020, the highest average annual vacancy rates were registered in public administration and other service activities, in health and social assistance, respectively in entertainment activities, cultural and recreational, while the manufacturing industry concentrated almost a fifth of the average annual number of vacancies.

At the same time, the lowest value of the average annual vacancy rate was recorded in hotels and restaurants, and the average annual number of vacancies was the lowest in real estate transactions.

All the aspects presented above highlight the delicate situation in which Romania was in the context of the current economic and financial crisis and represent an alarm signal regarding the economic situation that is further deteriorating.

The data regarding the evolution of the Gross Domestic Product and the number of employees in Romania in the period 2005-2020 are structured in table number 3.

Table 3. *Evolution of GDP and number of employees in Romania during 2005-2020*

Year	GDP	Number of employees
2005	286861,9	4790431
2006	342762,6	4910088
2007	425691,1	5162967
2008	539834,6	5232694
2009	530894,4	4879480
2010	528514,5	4580989
2011	558889,9	4660461
2012	591799,1	4777152
2013	634967,8	4801104
2014	669703,9	4900684
2015	711929,9	5041186
2016	763652,5	5223767
2017	857895,7	5362346
2018	951728,5	5426272
2019	1058190,3	5481143
2020	1053881,4	5567428

**Source:** INS. Data processed by the authors.

For a better visualization of the evolution of the two macroeconomic indicators, graph number 7 was sketched.

**Chart 7.** *Evolution of GDP and number of employees in Romania during 2005-2020*
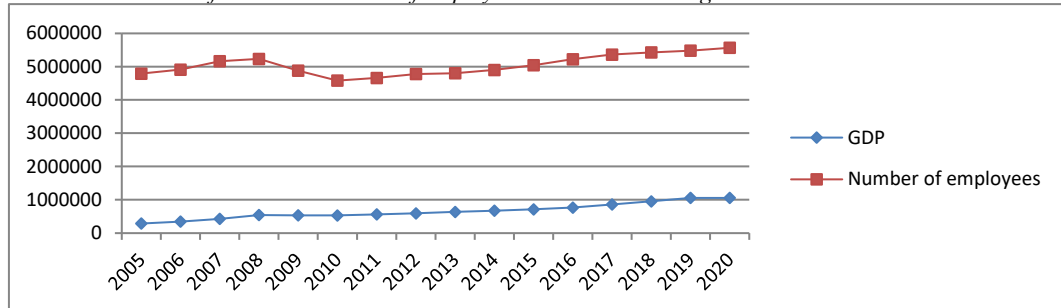
Interpreting the data structured in table number 3 and represented in graph number 7 we find that the evolutions of the two indicators follow somewhat the same trend in the sense that both Gross Domestic Product and the number of employees are influenced by economic crises, moments when the evolution trend changes

Graph 8. *Histogram of the evolution of the number of employees*
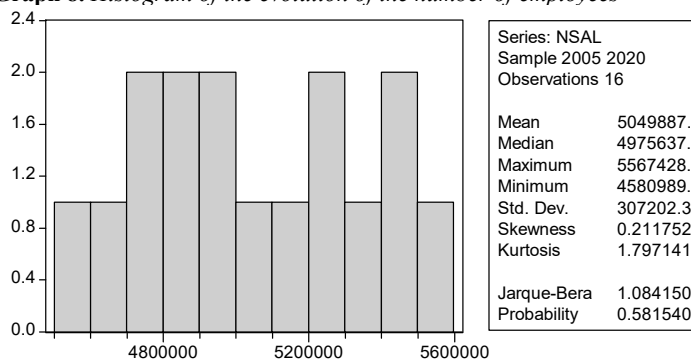
Interpreting the results presented in graph number 7 we find that the distribution of the number of employees between 2005 and 2020 is symmetrical aspect confirmed by the Skewness test and slightly slower considering the value of the Kurtosis test which is less than 3.

Chart 8. *Correlation between GDP and number of employees*
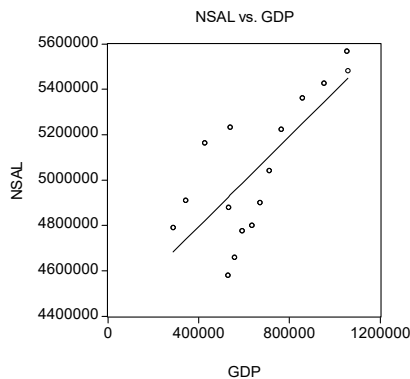
Interpreting the results presented graphically above, we find that the point cloud related to the values recorded by the two macroeconomic indicators studied describes straight, which allows us to continue the study, making a statistical-econometric analysis, using a simple linear regression model, which has the following form:

$$GDP = a + b \cdot NSAL + \varepsilon \qquad (3)$$

Where:

GDP (Gross Domestic Product) is the dependent variable;

NSAL (number of employees) is the independent variable;

a and *b* are the regression parameters;

ε represents the residual variable.

To estimate the regression parameters and to test the significance of the model we used the statistical-econometric analysis program EViews, and the results are presented in figure number 2.

Figure 2. *Results of the analysis of the dependence of GDP on the number of employees*

Dependent Variable: GDP				
Method: Least Squares				
Sample: 2005 2020				
Included observations: 16				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-2211023.	675593.5	-3.272712	0.0056
NSAL	0.567879	0.133552	4.252103	0.0008
R-squared	0.563596	Mean dependent var		656699.9
Adjusted R-squared	0.532425	S.D. dependent var		232378.5
S.E. of regression	158899.2	Akaike info criterion		26.90640
Sum squared resid	3.53E+11	Schwarz criterion		27.00297
Log likelihood	-213.2512	F-statistic		18.08038
Durbin-Watson stat	0.262803	Prob(F-statistic)		0.000805

Interpreting the results obtained and structured in figure number 2 we can say that the model is a good one and can be used to estimate the evolution of GDP. The values recorded by the estimated parameters are significantly different from zero, and the F-statistic and t-Statistic tests have higher values than the tabulated ones. Thus, using the results from figure number 2, we can estimate the theoretical values of the dependent variable, according to the relation:

$$\widehat{GDP} = -2211023 + 0.567879 \cdot \widehat{NSAL} + \varepsilon \qquad (4)$$

The high value of the free term coefficient indicates that there are other factors that influence the formation and growth of the Gross Domestic Product.

Conclusions

From the study on the evolution of the macroeconomic activity trend we find that first of all the pandemic and economic-financial crisis has a destructive role in the sense that it stimulates indicators with negative effect on economic growth such as unemployment, inflation, internal and external debt, real incomes, sources financing of the economy by each economic subject or as a whole by the national economy.

A second conclusion is that this crisis will expose its effect it will transfer its effect on some areas that will suffer a lot in the next period.

At the same time, it must be borne in mind that this pandemic and economic-financial crisis will extend over time, and may lead to additional negative effects on the Romanian economy. Of course, this is not a particular situation only for our country it is a situation that is encountered in all the member states of the European Union and of the world.

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