MODEL FOR ANALYZING THE CORRELATION BETWEEN THE LABOR FORCE AND THE GROSS DOMESTIC PRODUCT IN ROMANIA

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Abstract

The labor force in accordance with the provisions of the Cobb Douglas concept, regarding economic activity is based on the production function, ie on the existence of the three factors that can contribute to the development of the activity using the existing labor force. Unfortunately, in Romania the active population is more developed than the offer given by the labor market.

The analysis for the fourth quarter of 2019 and then extended and perhaps some previous ones shows that in Romania the labor force had an oscillating evolution, as some activities were suspended or disappeared, at the same time new ones appeared. areas, so from 1990 to 2019 we can talk about a fairly interesting population in terms of existing workforce.

The article presents some clarifications regarding the definition of the content of statistical indicators that are used in full accordance with the methodology used by the National Institute of Statistics (Eurostat), regarding the monitoring and reporting of the workforce. It is found that during this period the labor force had a somewhat positive evolution, in 2019 being used and ensuring as much as possible a certain concrete evolution of the labor force.

It is then analyzed on the structure of the active population, the employed population, unemployment, employees and other categories of people, there is a whole exposure of situations based on the structure of the workforce, the apparent jobs that were used or not used and so on. far away.

In the analysis of the labor force, an interpretation is made from the point of view of the employment structure by age categories, urban or rural areas, sexes, as well as by some professions that have existed or that exist in our country.

Finally, the simple linear regression model is used to highlight the correlation that exists between the evolution of the Gross Domestic Product and the labor force.

Keywords: Labor force, statistical indicators, evolution, fields of activity, correlations.

JEL Classification: C13, J20

Introduction

In this article, the analysis for the fourth quarter of 2019 began with a total and structural analysis, highlighting that there was a proper employment for the conditions in our country.

Figures and data are presented, mostly in some tables and graphs that are suggestive in terms of employment. Also, the analysis is done on professional groups, thus having the possibility to detach the trends that will exist in the next period.

The analysis is performed at a particular time of Romania's economic evolution, in the sense that there is this pandemic, the coronavirus crisis, which will have special effects on employment in Romania. In this sense, without going into details about unemployment and others, we point out that in our country there is a somewhat reasonable number of unemployed, there was the possibility of filling vacancies that are usually filled at job fairs, but from the point From the perspective of the perspectives, we find that, at this time of 2020, starting with March, the situation is totally different. First of all, to the existing number of unemployed of the almost one million people who have passed into technical unemployment, without the prospect of being able to anticipate whether they will return to the initial form of employment they had, is added over one million three hundred of the thousands of people over four million who worked abroad and returned to the country. Of course, the immediate condition is that of the health crisis caused by the pandemic coronavirus, but we must emphasize that these people, out of the more than four million who returned to the country, are those who worked without agreements, without contracts, without definite possibilities to have the rights that need to be taken into account in the conditions of the European Union. Thus, most of these people were either seasonal workers with limited contracts and no rights, as they should be and as enshrined in the labor code and the international labor code, but who also worked without such agreements. These people, in addition to the negative effect they brought in terms of living resources, had a contribution due to deficiencies in the organization of the Romanian state in the „import" of the corona virus, with effects that are difficult to predict now. Therefore, in the perspective of analyzing the evolution of the labor force, of the employed population, it is much more difficult to decide now, because there is a period of at least one or two years in which Romania will be suffocated by a significant number of people who do not have immediately in correlation with the possibility for the national economy to grant them jobs.

In this article we also made a concrete study, analyzing the evolution of the Gross Domestic Product until 2019 with the evolution of the labor force employed in the same mentioned period. We used simple linear regression which clearly showed the correlation between employment and Gross Domestic Product growth based on this factor, meaning that after using the simple linear regression method and calculating the regression parameters, we could also make an estimate. of the perspective of the evolution of employment, of the number of employees, compared to the increase of the Gross Domestic Product. Of course, this study remains valid even if it is fractured in 2020 in that additional elements have emerged in terms of labor force, the number of people available included or not in unemployment, the absorption capacity of the Romanian economy, the ability to initiate some businesses and more.

Literature review

Agrawala and Matsab (2013) studied a number of issues regarding the risk of unemployment. Anghel and Radu (2020) analyzed the main elements that characterize vacancies on the labor market in Romania. Anghel, Marinescu, Burea, Olteanu and Samson (2018), as well as Anghelache, Avram, Burea, Petre (Olteanu) (2018) analyzed the correlation between the natural movement of the population and the labor force in Romania. A similar topic is studied by Anghelache, C., Marinescu, R. T., Soare, D.V. (2015). Anghelache, Anghel, Căpușneanu and Topor (2019) used the econometric instrumentation to analyze the correlation between the Gross Domestic Product and the economic aggregates. Bijak, Kupiszewska, Kupiszewski, Saczuk and Kicinger (2007) made projections on population and labor force, by 2050, for 27 states in Europe. Donangelo (2014), as well as Klein and Ventura (2009) focused on the effects of labor mobility. Maestas, Mullen and Powell (2016) analyzed the correlation between population aging, labor force and economic growth. Saraceno and Keck (2010) referred to intergenerational strategies and policies in Europe.

Some methodological clarifications

For the more efficient assimilation of some aspects of this study, we present some methodological clarifications, taken from the methodology developed and used by the National Institute of Statistics. Thus, the data source is the Statistical Survey on Household Labor Force (AMIGO) which is carried out quarterly, in accordance with Council and European Parliament Regulation no. 577/1998 on the organization of a selective statistical survey on the labor force in the European Community.

The economically active population includes all persons who provide the labor force available for the production of goods and services during the

reference period, including the employed population and the unemployed.

The activity rate represents the share of the active population in age group x in the total population in the same age group x.

The activity rate of the working age population represents the share of the active population aged 15-64 in the total population aged 15-64.

The employed population includes all persons aged 15 and over who have carried out an economic activity producing goods or services for at least one hour during the reference period (one week), in order to obtain income in the form of wages, payment in kind or other benefits.

Since 2011, self-employed and unpaid family workers working in agriculture are considered employed persons only if they are the owners of agricultural production (not necessarily land) obtained and meet one of the following conditions: agricultural production is intended, at least in part, the sale or exchange in kind (barter) and agricultural production is intended solely for its own consumption if it represents a substantial part of the total consumption of the household.

In addition to persons who have a job and worked during the reference week, regardless of professional status, are considered employed persons and those who fall into the following categories: persons who during the reference week have performed any paid work or income earners, even if they were in compulsory schooling, retired or receiving a pension, were registered with the National Agency for Employment (ANOFM), receiving or not receiving unemployment benefits, paid apprentices and trainees, who work full or part time and members of the armed forces.

The employed population is classified according to professional status in:

- Employee - is considered the person who carries out his activity on the basis of an employment contract in an economic or social unit - regardless of its form of ownership - or to private persons, in exchange for a remuneration in the form of salary, money or nature, in the form of a commission, etc. „Employment contract" means any other type of employment agreement (concluded in written or verbal form).

- Employer - is the person who exercises his occupation (profession) in his own unit (enterprise, agency, workshop, shop, office, farm, etc.), for whose activity he has employees one or more employees.

- Self-employed - is the person who carries out his activity in his own unit or in an individual business, without hiring any employee, being helped or not by unpaid family members.

- Unpaid family worker - is the person who carries out his activity in a family economic unit run by a family member or a relative, for whom he does

not receive remuneration in the form of salary or payment in kind. The peasant (agricultural) household is considered such a unit.

- Member of an agricultural company or a non-agricultural cooperative - is considered the person who worked either as an owner of agricultural land in an agricultural company established under Law 36/1991, or as a member of a craft, consumer or credit cooperative.

The employment rate represents the share of the employed population in age group x in the total population in the same age group x.

The employment rate of the working age population represents the share of the employed population aged 15-64 in the total population aged 15-64.

The unemployed, according to the international definition (ILO), are people aged 15-74 who simultaneously meet the following three conditions: they do not have a job, are available to start work in the next two weeks and have been actively looking for a job at any time during the last four weeks.

The unemployment rate represents the share of the unemployed in the active population.

Data, results and discussions

In the fourth quarter of 2019, the employment rate of the population aged 20-64 was 71.1%, with 1.1 percentage points above the national target of 70% set in the context of the Europe 2020 Strategy.

In the fourth quarter of 2019, the active population of Romania was 9008 thousand people, of which 8654 thousand people were employed and 354 thousand people were unemployed.

The study on the participation of the population in the labor force, by sex, age and environment is based on the data in table number 1.

Population participation in the labor force, by sex and environment, in the fourth quarter of 2019

Table 1

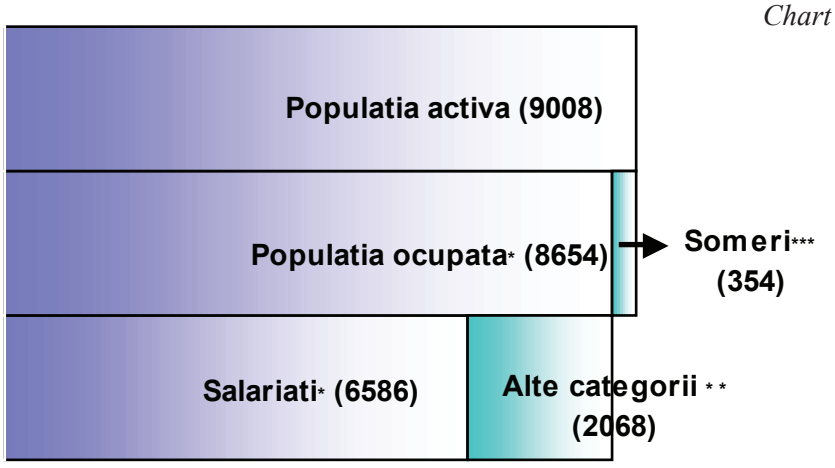
	Total	Male	Female	Urban	Rural
	- thousands of people -				
Active population	**9008**	**5195**	**3813**	**4952**	**4056**
from which:					
Employed population	8654	4963	3691	4803	3851
unemployed	354	232	122	149	205
	- percent -				
Activity rate	**68,8**	**78,8**	**58,5**	**69,9**	**67,5**
20-64 years	73,8	84,5	62,9	74,4	73,0
15-24 years	29,9	37,3	22,2	21,0	37,6
25-54 years	84,1	93,3	74,3	87,0	80,2
55-64 years	49,5	63,2	37,0	45,6	55,0
Occupancy rate	**66,0**	**75,2**	**56,6**	**67,8**	**63,9**
20-64 years	71,1	80,9	61,0	72,3	69,5
15-24 years	24,4	30,3	18,3	17,0	30,8
25-54 years	81,6	90,1	72,5	85,0	77,0
55-64 years	48,1	61,1	36,2	44,5	53,3
Unemployment rate	**3,9**	**4,5**	**3,2**	**3,0**	**5,1**
15-24 years	18,5	19,0	17,7	18,9	18,3
25 years and over	2,9	3,3	2,3	2,3	3,6

Source: National Institute of Statistics, Press release no. 82 / 27.03.2020

The graph number 1 summarizes and presents the structure of the population by the following categories: active, employed, unemployed, employees and other categories involved in the activity.

Population categories in the fourth quarter of 2019 (thousand people)

Chart 1



Source: National Institute of Statistics, Press release no. 82 / 27.03.2020

The employment rate of the working age population between 15 and 64 years was, in the fourth quarter of 2019, 66.0%, down from the previous quarter by 0.7 percentage points. The employment rate was higher for men (75.2% compared to 56.6% for women) and for people in urban areas (67.8% compared to 63.9% in rural areas).

It is important that the employment rate of young people aged 15 to 24 was 24.4%.

Evolution of the employment rate of the population aged 15 and over, by age groups (%)

Table 2

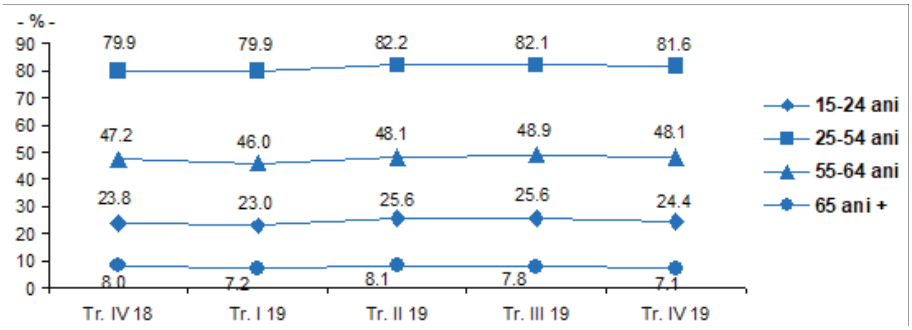
	Quarter IV 18	Quarter I 19	Quarter II 19	Quarter III 19	Quarter IV 19
15-24 years	23,8	23,0	25,6	25,6	24,4
25-54 years	79,9	79,9	82,2	82,1	81,6
55-64 years	47,2	46,0	48,1	48,9	48,1
65 years and over	8,0	7,2	8,1	7,8	7,1

Source: National Institute of Statistics, Press release no. 82 / 27.03.2020

It is also found that constantly, throughout the year 2019, the employed population in the age group 65 years and over, was between 7.1% in the fourth quarter of 2019 and 8.1% in the second quarter of 2019, out of the total employed population.

Evolution of the employment rate of the population aged 15 and over, by age groups

Chart 2



Source: National Institute of Statistics, Press release no. 82 / 27.03.2020

The unemployment rate in the fourth quarter of 2019 was 3.9%, up 0.1% from the previous quarter. Regarding the unemployment rate, we must specify that the analysis is performed for the entire year 2019, the situation

being positive. At the time of the study for this article (April 2020) the situation in the first quarter of 2020 was not taken into account. We make this clarification because currently the unemployed population and the number of registered unemployed have increased significantly. This increase is based on the increase of the unemployment rate and of the unemployed population as a result of immigration (over one million people) and of the technical unemployment that can materialize in unemployment.

Unemployment rate by age groups, sexes and averages, in the fourth quarter of 2019 (%)

Table 3

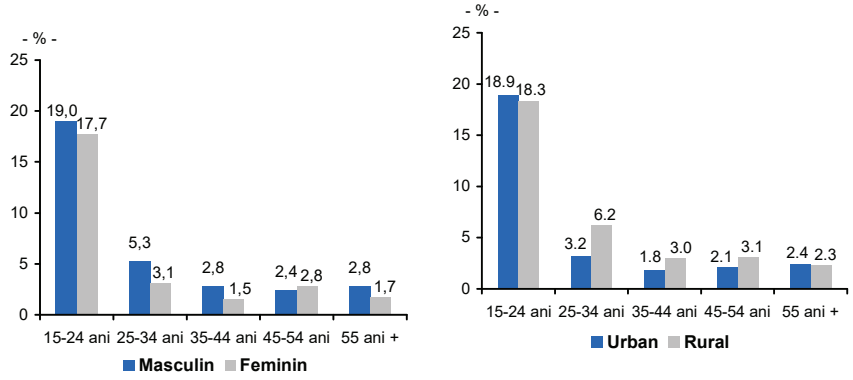
	Male	Female	Urban	Rural
15-24 years	19,0	17,7	18,9	18,3
25-34 years	5,3	3,1	3,2	6,2
35-44 years	2,8	1,5	1,8	3,0
45-54 years	2,4	2,8	2,1	3,1
55 years and over	2,8	1,7	2,4	2,3

Source: National Institute of Statistics, Press release no. 82 / 27.03.2020

Table number 3 and graph number 3 show the unemployment rate by age groups, sexes and averages.

Unemployment rate by age groups, sexes and averages, in the fourth quarter of 2019

Chart 3



Source: National Institute of Statistics, Press release no. 82 / 27.03.2020

By sex, the gap between the two unemployment rates was 1.3%, ie 4.5% for men compared to 3.2% for women, and for residential areas, 2.1%, ie 5.1% in rural areas, compared to 3.0% in urban areas.

By age groups, the unemployment rate reached the highest level, namely 18.5% among young people aged between 15 and 24 years.
In order to highlight the correlation that exists between the evolution of the Gross Domestic Product and the labor force, in the following a statistical-econometric analysis was performed using a simple linear regression model. Thus, the data series regarding the evolution of the two statistical variables considered are structured in table number 4.

Evolution of Gross Domestic Product and labor force during 1991-2018

Table 4

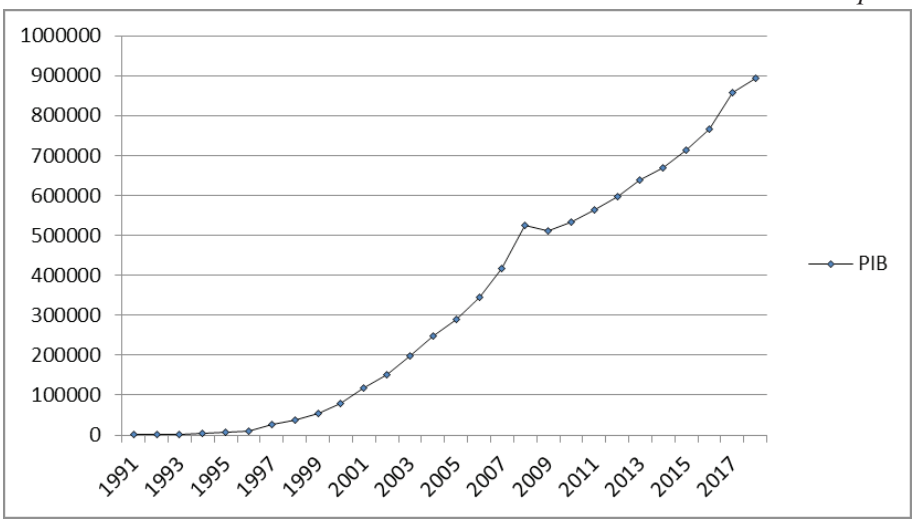
YEAR	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
GDP (million lei)	220,4	602,9	2.003,60	4.977,30	7.213,50	10.891,90	25.292,60	37.379,80	55.191,40	80.377,30
Number of Employees (thousands of people)	10786	10548	10062	10011	9493	9379	9023	8813	8420	10508
YEAR	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
GDP (million lei)	116.768,70	151.475,10	197.564,80	247.368,00	288.954,60	344.650,60	416.006,80	524.388,70	510.522,80	533.881,10
Number of Employees (thousands of people)	10440	9234	9223	9158	9267,2	9330,7	9364,8	9365,9	8952	8713
YEAR	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**		
GDP (million lei)	565.097,20	596.681,50	637.583,10	668.590,10	712.587,80	765.135,40	856.726,60	894.422,60		
Number of Employees (thousands of people)	8528	8605	8549	8614	8535	8449	8671	8896		

Source: National Institute of Statistics

The graphs numbers 4 and 6 show the evolution of the Gross Domestic Product in Romania in the period between 1991 and 2018.

Evolution of Gross Domestic Product during 1991-2018

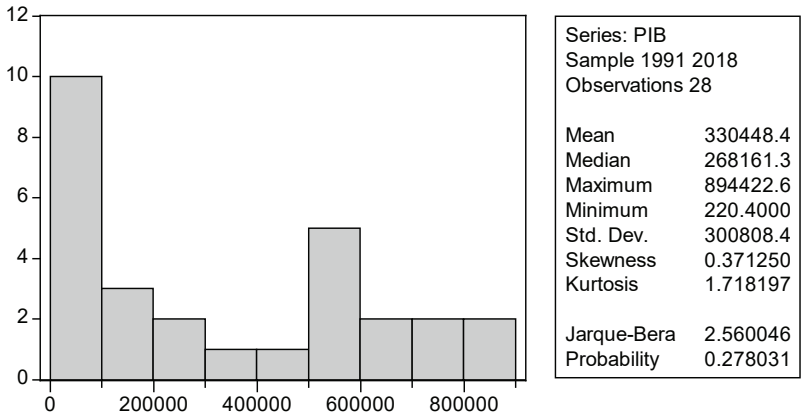
Graph 4



Interpreting the evolution of the Gross Domestic Product in the period between 1991 and 2018 from the graphic representation above, we find that in the period of twenty-eight years subject to analysis, there were increases, reaching in 2018 a maximum of 894,422 , 6 million RON, value also confirmed by the histogram presented in graph number 5.

Gross Domestic Product Histogram

Graph 5

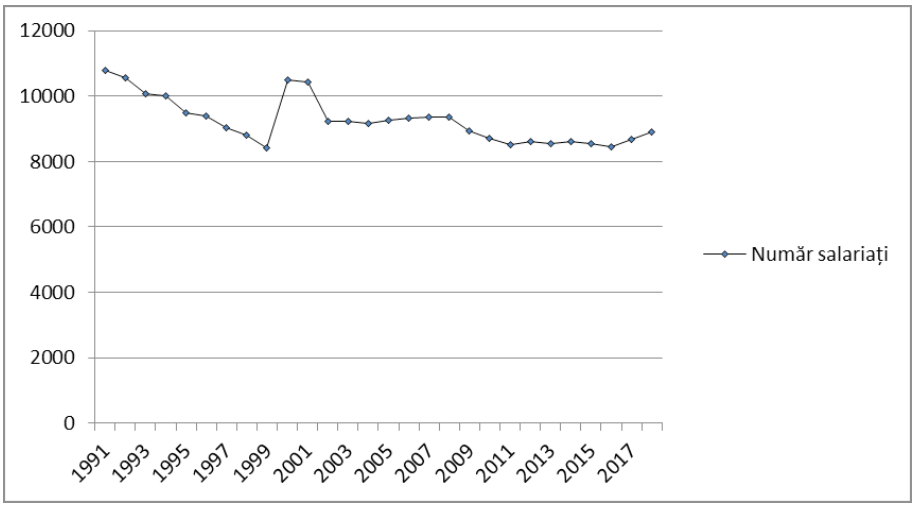


According to graph number 5 we can say that the distribution of GDP values in the period under analysis is slower considering the result of the Kurtosis test, whose value of 1.71 is below the threshold of 3 and at the same time the distribution is not perfectly symmetrical having considering the value of 0.37 significantly non-zero of the Skewness test.

Graphs numbers 6 and 7 show the evolution of the number of employees in Romania in the period between 1991 and 2018

Evolution of the number of employees in the period 1991-2018

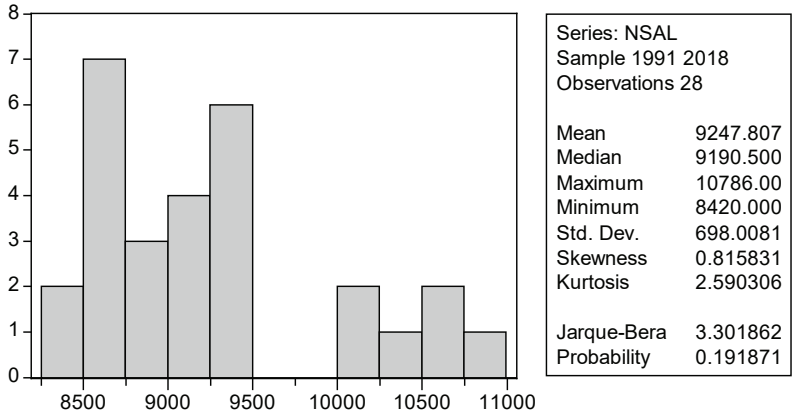
Chart 6



Interpreting the evolution of the number of employees in Romania during the period under analysis, we find from the above graphical representation that there were small fluctuations, but the number of employees remained at a relatively constant value, which results from the data presented in chart number 7 (histogram), where the median value of 9,247.8 thousand people is quite close to the extreme points (maximum of 10,786 thousand people and minimum of 8,420 thousand people).

Histogram of the number of employees

Graph 7

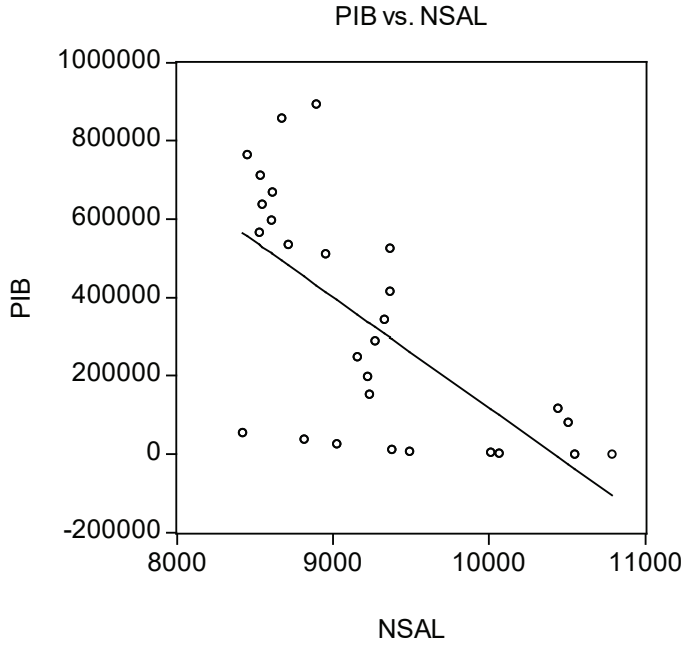


We can also say that the distribution of values of the number of employees in the period under analysis is slower given the result of the Kurtosis test, whose value of 2.59 is below the threshold of 3 and at the same time the distribution is not perfectly symmetrical taking into account view value of 0.81 significantly different from zero of the Skewness test.

The correlation between the Gross Domestic Product and the number of employees is presented in graph number 8.

Correlation between GDP and number of employees

Chart 8



According to the graphical representation above, we can say that the point cloud related to the values recorded by the two indicators studied describes a line, which allows us to continue the statistical-econometric study, using a simple linear regression model, such as:

$$PIB = a + b \cdot NSAL + \varepsilon \quad (1)$$

where: PIB is the dependent variable;
$NSAL$ is the independent variable;
a and b are the regression parameters;
ε represents the residual variable.

To estimate the parameters *a* and *b*, respectively $\hat{a}$ and $\hat{b}$, we will use the least squares method. In the same vein, to test the significance of the model, the authors used the statistical-econometric analysis program EViews, and the results are presented in Figure 1.

The results of the analysis of the dependence of GDP on the evolution of the number of employees

Figure 1

Dependent Variable: PIB
Method: Least Squares
Sample: 1991 2018
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2949772.	590692.4	4.993753	0.0000
NSAL	-283.2373	63.69905	-4.446491	0.0001
R-squared	0.431958	Mean dependent var		330448.4
Adjusted R-squared	0.410110	S.D. dependent var		300808.4
S.E. of regression	231033.7	Akaike info criterion		27.60726
Sum squared resid	1.39E+12	Schwarz criterion		27.70242
Log likelihood	-384.5017	F-statistic		19.77128
Durbin-Watson stat	0.454546	Prob(F-statistic)		0.000145

Interpreting the results of the analysis summarized in figure number 1, we can say that the model is a good one, given that the values of the coefficients are significantly different from zero. In the same order of ideas, the model is confirmed by statistical tests, ie *F-statistic* = 19.77, having a higher value than the tabulated one and also the same situation is confirmed by the *t-Statistic* test, with higher values than the tabulated ones. and with almost zero probability of error.

Regarding the value of 0.43 recorded by *R-squared* confirms that there are other factors that influence the evolution of Gross Domestic Product, but the model is confirmed and we can write the equation that allows us to calculate the forecast values of this macroeconomic indicator, under form:

$$\widehat{PIB} = 2.949.772 - 283{,}2373 \cdot \widehat{NSAL} + \varepsilon \quad (2)$$

The influence of other factors on the evolution of the Gross Domestic Product is also confirmed by the high value of the free time coefficient (2,949,772), and the plus sign of the value of this coefficient indicates that the influence of other factors not taken into account is positive.

Conclusions

This article is based on a study that stops, in a justified way, on December 31, 2019, because it was the intention of the authors to highlight the evolution of employment, thus increasing the number of employees and reducing the as much as possible of the unemployment rate. I said until December 31, 2019 because until then there were normal conditions of evolution that were maintained and perpetuated for a period of time.

Furthermore, the issue starting with March 2020 must be the subject of another study, although we anticipate that after the resettlement of the Romanian economy after the economic and financial crisis that will follow

this pandemic caused by the coronavirus crisis, the correlation is maintained and will eventually have to be reset to its parameters. We make a brief remark here that the reset of the world economy, the reset within the European Union and the reset, including internally, of the Romanian economy may need the introduction of other statistical variables in the study to reveal the perspectives closer to reality. which will develop in the immediate future.

A first conclusion that emerges is that without measures, without a program of the government's economic development as a whole, we can speak neither of sustainable economic growth nor of employment as it appears in the labor market. Romania had economic growth until 2019 inclusive, based on consumption and less on investments.

At the time of writing, the consumption growth criterion for 2020 is also declining because the market has narrowed and investment has been delayed for the time being. Therefore, the conclusion that emerges from this is that in the resumption and full alignment of the evolution of the national economy must resort to investments in priority areas, to resume activity, to refinance the development of agriculture, even by providing special facilities. . An important role must be played by the European Union, to which Romania must apply for additional subsidies to encourage and develop the Romanian economy, which is one of the main countries with this field of activity best developed, due to the natural conditions of Romania has.

Another conclusion of employment is to analyze more specifically the possibility under the European Union directive on the free movement of persons, so that those who leave and find employment in other European markets do so on the basis of employment. commitments, of certain contracts, which ensure them both the prospect of entering unemployment when necessary, and the prospect of obtaining the rights required by the time segment in which they worked in these countries to retire.

One last conclusion is that it must be verified now at the moment, to more actively correlate the training of the labor force with the conditions offered by the Romanian labor market.

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