ANALYSIS OF THE EFFECT OF THE NUMBER OF EMPLOYEES AND LABOUR PRODUCTIVITY ON ECONOMIC GROWTH

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Abstract

Labour productivity and the number of employees are two indisputable factors for the growth of gross domestic product (economic growth). Labour productivity usually increases, both hourly and per person, from one period of time to another, as a result of improving technology, improving workers, increasing the intensity of economic activity.

The number of employees also has, of course, an increasing influence on the gross domestic product, but we must always correlate the increase in productivity with the change in the number of employees because, on the one hand, the increase in labour productivity also has the effect of reducing the number of employees in one field or another, in one company or another.

In this article, we set out to establish how labour productivity and the number of employees had an effect on the growth of gross domestic product, and therefore on economic growth.

We used statistical indicators, absolute and relative sizes we compared the growth rates from one time period to another, but also the absolute change data from one time period to another to highlight the influence of the number of employees or productivity work on Romania's economic growth in the interval under analysis.

We also used some statistical-econometric models through which we established the parameters, which can then be used in estimating the trend of normal evolution, but also the evolution trend forecast for the following periods.

Keywords: *labour productivity, number of employees, GDP, developments, indicators, models.*

JEL classification: *C13, E20*

Introduction

In this article we started from the definition of economic categories (statistical variables), to understand the content of gross domestic product, hourly or per capita labour productivity, but also the change in the number of employees from one period to another.

We analysed, in turn, the increase in labour productivity per person over a period of time, then the increase in hourly labour productivity over the same period of time and then the change in the number of employees, noting that the change in the number of employees was not always the same tempo with increasing labour productivity.

We emphasize that sometimes, by increasing labour productivity, regardless of the form of expression, the number of employees is reduced as large companies, especially multinationals, when investing to increase production, the return of new fixed assets requires in a precise way the reduction of jobs.

And the digitization, the robotization, which will take place in a pronounced way within the national economy, will also have the effect of reducing the number of employees.

Certainly, there will be some ways in which people will not be made redundant, and this could mean a reduction in the working day, a reduction in the working week, by one or a half days.

It is a matter of strategy that aims, on the one hand, to modernize the economy, especially industry, but also in other branches, while maintaining employment and improving wages to ensure additional income for employees.

We interpreted the evolutions of the three statistical variables in order to highlight the way in which they influenced the growth of the gross domestic product, therefore, as a consequence, the economic growth.

When calculating labour productivity, we referred to the ratio between the gross value added and the number of employees or the number of hours worked in the time period undergoing the research.

Of course, gross value added is a key statistical indicator underlying the calculation of gross domestic product by the production method. The difference between the gross value added and the full value achieved over time is the coverage of expenses, there is an increase in production and, on the other hand, the repeated registrations that are made as a result of the economic circuit that involves repetitions in financial reporting accountant.

Here we could give a short example to understand the difference between gross value added and realized value. Here, for example, a car is made at the specialized factory in Mioveni. But, that car assembles a series of components made by other companies that have this object of activity. For example, tires,

gearboxes, transmission, certain improvements, etc. However, they are reported both as gross value added and as intrinsic value by those who have this object of activity. If they are from import, it represents the cost of import, if they are from domestic production it represents the cost at which these subassemblies used in the completion of the product we mentioned were obtained.

Then, we made some comparisons between the growth rate of labour productivity, the growth rate of gross domestic product and the change in the number of employees to highlight the constantly positive influence of labour productivity on economic growth, as well as the number of employees.

The number of employees must be looked at in a certain qualitative way because as technology improves, fixed assets, yields increase, labour productivity increases and this sometimes has the effect, because there is no adequate retraining, unemployment, ie reduction in employment. employed active persons.

Finally, using some statistical means we made graphical presentations, tabular presentations and we resorted to some analyses using regression models.

Literature review

Economic growth is being pursued with great interest in the current pandemic and financial-economic crisis. Anghelache, C. and others (2013) conducted a study on the general aspects related to the evolution of GDP in Romania. Anghelache, C and others published an article on the correlation between GDP growth rate, inflation rate and unemployment. Anghelache, Anghel, Dumbravă and Ene (2018) analysed the correlation between the employment rate of the population, unemployment and vacancies in the economy. Deschenes, D. and Greenstone, M. (2012) conduct a study on the impact of climate change on economic growth. Krueger and Mueller (2010) presented significant elements related to unemployment insurance. Iacob, Ș.V., Radu I. (2021) addresses issues related to the evolution of the employment and underemployment rate in Romania. Moscarini and Postei Vinay (2012) studied how employers, depending on their size, contribute to job creation during periods of unemployment.

Methodology, data, results and discussions

Within the national economy, two indicators, namely the number of employees and labour productivity, are relevant and contribute to the change in gross domestic product from one period of time to another.

Labour productivity can be calculated as hourly labour productivity by activities of the national economy according to CANE Rev 32- SEC 2010,

and consists in considering the employed population as employees or self-employed engaged in production activity as provided in the system of national accounts.

Hourly labour productivity is calculated per employed person as the ratio of gross value added to the number of employed persons. Hourly labour productivity was calculated as the ratio of gross value added to the number of hours worked. Of course, regardless of the form of labour productivity, it has a positive effect and contributes to the change in gross domestic product.

Hourly labour productivity by activities of the national economy can be analysed and structured, by hourly labour productivity recorded in agriculture, forestry, fishing, industry, construction, services, information and communications, financial intermediation and insurance, as well as real estate transactions. We considered them because in each case the change from one time period to another takes place differently.

At the same time, it is important to analyse the way in which the gross domestic product has evolved and the way in which the employees included in the national economy have evolved.

The average number of employees employed under a contract of employment or employment relationship, for a fixed or indefinite period, including seasonal workers whose employment contract or employment relationship has not been suspended is considered employees in the national economy.

At the same time, the average number of employees is a simple arithmetic average obtained from the sum of the daily workforce of employees working in the national economy. Those who work on days off, public holidays or other non-working days are also considered, as they represent employees who have contributed to the achievement of the results of the national economy.

It is important to keep in mind that within the number of employees the structure can be done on main activities or it can be done simply based on the complex analysis, totally at the level of the national economy.

The average number of employees in the total national economy has experienced an interesting course. In the first period, from 1990 to 2000, there was a large number of employees, considering all persons employed. After the year 2000, when the introduction of the free market economy began to be produced and improved, the number of employees began to decrease. Interestingly, after the year 2000, we encountered a process of some increase in the number of employees in the national economy.

Thus, over the last decade, 2010-2020, the number of employees changed from 4,376,044 to 4,443,554 in 2013, following an increasing course, with small fluctuations between 2013 and 2020, so that in 2015 the number of

employees was 4,611,395, then increased to 4,759,419 in 2016, 4,945,868 in 2017, with successive increases, reaching 5,164,471 in 2019.

From 2019 to 2022, the number of employees decreased as a result of the pandemic crisis and the economic-financial crisis, which the national economy faced. Thus, in 2020 the number of employees decreased to 5,031,767, then fell below 5 million in 2021, a trend that continues in 2022.

By reporting the two statistical variables, labour productivity and the average number of employees, we find that there is an influence, in the sense that by increasing labour productivity, in total and in each branch of the national economy, ensures an increase in production, gross domestic product. On the other hand, the number of employees also contributes, by increasing or decreasing, to the increase of the gross domestic product.

We calculated this variable considering that by increasing labour productivity, even when the number of employees decreased, the gross domestic product increased.

In the analyses we considered the method of calculating the gross domestic product by the production method or the method of gross value added.

The analysis of labour productivity per person labour productivity per person, in lei, for the period 1995 - 2020 is interesting in the sense that it expresses the way in which this productivity increased on the total national economy but also on branches of the national economy.

From this point of view, we find that agriculture has had an important rate of increase in labour productivity per employed person, since 2001, reaching sufficiently large amounts in 2020.

Despite the fact that there have often been some insignificant developments in terms of weather, natural conditions, labour productivity in agriculture has steadily increased (see table and graph for this evolution of labour productivity per person employed). This was due, first of all, to the reintroduction of more mechanized processes, the use of an increasing irrigated area and, last but not least, the application of superior agrotechnical measures, fertilization, pest control by insecticides and herbicides.

Regarding the industry, in this field of activity the productivity of labour increased from 765.8 lei / person in 1995, to 118,048.7 lei / person in 2020. It is found that since 2001 and in this field of activity we have a very substantial increase in labour productivity.

The construction activity, due to its seasonal character, started from a labour productivity per person of 765.8 lei, with successive increases, year by year, reaching in 2020 a productivity of 93,881 lei / person employed in the construction field.

The sphere of services, which also developed a lot in the market economy, had a start of labour productivity in 1995 of 732.7 lei / person, this being increasing with almost explosive values after 2000, when it increased from 6,800, 7 lei / person in 1999, to 9,490.6 lei in 2000 and then with more and more substantial increases, reaching 93,358.1 lei / employed person, in 2020.

We point out that in 2020 there was a decrease in labour productivity in agriculture, as well as in industry, construction but especially in services compared to 2019. These decreases were due to the health crisis related to the economic and financial crisis, which they had devastating effects on the national economy.

Another area that I took into analysis is that of information and telecommunications, which started from a labour productivity of 1,204.6 lei / person, with substantial increases since 1997, then with even higher increases since 2004 when reached 100,241.8 lei, followed by equally substantial increases until 2015 when it was 208,870.3 lei, then successive increases, reaching in 2020 a labour productivity per person of 382,104.9 lei.

Those who worked in the field of financial intermediation and insurance had a sufficiently high and somewhat increasing labour productivity but as steep as in the other fields. Thus, labour productivity was 5,048.4 lei in 1995, reaching 68,423.2 lei in 2004 and then, in 2020, 249,486 lei labour productivity per person.

Real estate transactions have had a very high labour productivity rate from the beginning. Thus, in 1995 there was a labour productivity of 14,490.8 lei which increased very quickly, reaching in 1999 to 95,371.9 lei, with quite consistent increases which, punctuated, represented, in 2014, 1,816,657, 7 lei. In 2020, the labour productivity in the field of real estate transactions was 2,833,464.9 lei.

Here are the main branches that contribute to the formation of gross domestic product have had an increase in labour productivity year by year, which has contributed to the increase of gross domestic product in training and, of course, to its growth in the following periods.

It should also be mentioned an essential field, namely that of hotels and restaurants, as the main service registered in Romania, which started from a labour productivity of 11,195.5 lei in 1999, reaching 64,030.8 lei in 2008, a year before the crisis and then registering even more substantial increases until 2019, when the activity in this field decreased, decreased as a result of the COVID 19 crisis, which led to an unprecedented economic and financial crisis in Romania.

Please note that the employed population includes all persons, both employees and self-employed - engaged in production activities that fall within the limits of production in national accounts.

Labour productivity per employed person was calculated as the ratio between gross value added and the number of employed persons. In turn, hourly labour productivity was calculated as the ratio between the gross values added obtained annually and the total number of hours worked annually.

The two indicators are used to determine the efficiency and return on consumption of fixed assets, as well as the increase in output due to the improvement in the quality of the staff employed.

From the point of view of relative figures, a situation of growth can be presented, both in total and in the fields of activities of the national economy, year by year, reporting labour productivity in year t-1. And they highlight the same evolution, finding that in the field of increasing labour productivity there is a situation that is somewhat positive.

Comparing the figures recorded in the field of the average number of employees by categories and total activity, we find that this increase had a different meaning from one period of time to another. Thus, it has increased and decreased from time to time, starting in 1990 with 3,486,066 employees, a number that has increased or decreased depending on the evolution of the national economy, reaching 5,031 in 2020 767 employees. We point out that in 2020 there will be a decrease in the number of employees, by over 130,000 compared to 2019 because this is the moment when the health crisis started, which then led to the economic-financial crisis with special effects.

In general terms, comparing the increase in labour productivity, both hourly and per person, with the increase in gross domestic product (economic growth), we find that both indicators generally have the same trend, clearly showing that labour productivity is a qualitative factor of production growth in all branches of the national economy and, consequently, the growth of gross domestic product.

In this sense, we will make a statistical-econometric analysis that can highlight the influence of labour productivity and the number of employees on the evolution of the national economy, highlighted by the most complex indicator of results, namely Gross Domestic Product. Thus, the data related to the evolution of the three macroeconomic indicators under analysis are structured in table number 1.

Evolution of GDP, labour productivity and number of employees in the period 2005-2020

Table 1

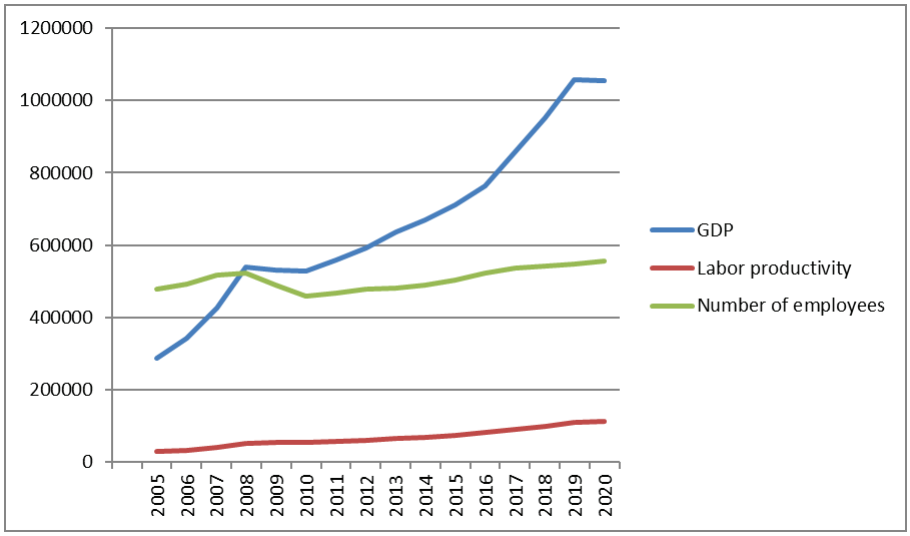
Year	GDP Millions of lei	Labour productivity lei / person	Number of employees
2005	286862	27774	4790430
2006	342763	32634	4910090
2007	425691	39987	5162970
2008	539835	51740	5232700
2009	530894	53530	4879480
2010	528515	54058	4580990
2011	558890	57649	4660460
2012	591799	60109	4777150
2013	634968	65351	4801100
2014	669704	68600	4900680
2015	711930	73340	5041190
2016	763653	81248	5223770
2017	857896	89982	5362350
2018	951729	99562	5426270
2019	1058190	110706	5481140
2020	1053881	113199	5567430

Source: http://statistici.insse.ro:8077/tempo-online. Data processed by the authors.

In order to better highlight the evolution of the indicators subject to analysis, graph number 1 was drawn up.

Evolution of GDP, labour productivity and number of employees in the period 2005-2020

Chart 1



Interpreting the data presented in table number 1 and drawing graphically, we find that in the period under analysis, 2005-2020, labour productivity had a slightly upward trend, and the evolution of Gross Domestic Product and the number of employees registered some oscillations marked by economic and financial crises statements for the periods 2008-2010 and 2019-present, respectively.

Table 2 shows the matrix of correlation coefficients between the variables under analysis.

Matrix of correlation coefficients between variables

Table 2

	GDP	LP	NE
GDP	1.000000	0.998836	0.750727
LP	0.998836	1.000000	0.736413
NE	0.750727	0.736413	1.000000

The analysis of the structured d ata in table number 2 shows that there is a strong correlation between the Gross Domestic Product and the two independent variables, the correlation coefficients registering values of 0.99 and 0.75, respectively, values close to the upper limit of the range [-1 ,1].

Under these conditions the multiple linear regression equation has the following form:

$$GDP = a + b \cdot LP + c \cdot NE + \varepsilon \quad (1)$$

where: GDP (Gross Domestic Product) is the dependent variable;
LP (labour productivity) is the independent variable;
NE (number of employees) is the independent variable;
$a, b \text{ and } c$ are the regression parameters;
ε represents the residual variable.

Using the statistical-econometric analysis program EViews we used to estimate the parameters and test the significance of the chosen model, the results being presented in the following figure:

Analysis results

Figure 1

Dependent Variable: GDP
Method: Least Squares
Sample: 2005 2020
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-60288.82	59560.22	-1.012233	0.3299
LP	8.750519	0.157222	55.65705	0.0000
NE	0.025074	0.013243	1.893298	0.0808
R-squared	0.998176	Mean dependent var		656700.0
Adjusted R-squared	0.997896	S.D. dependent var		232378.5
S.E. of regression	10660.04	Akaike info criterion		21.55375
Sum squared resid	1.48E+09	Schwarz criterion		21.69861
Log likelihood	-169.4300	F-statistic		3557.483
Durbin-Watson stat	1.577883	Prob(F-statistic)		0.000000

Interpreting the results presented in figure number 1 we find that the statistical tests *F-statistic* and *t-Statistic* are confirmed by the values higher than those tabulated, and the model used is valid and can be used in macroeconomic forecasts. Thus the multiple linear regression equation has the following form:

$$\widehat{GDP} = -60288{,}82 + 8{,}75 \cdot \widehat{LP} + 0{,}02 \cdot \widehat{NE} + \varepsilon \quad (2)$$

Turning our attention to the values of the regression parameters, we find that labor productivity has a much stronger influence on the resultant characteristic, the value of 8.75 being two orders of magnitude higher than that of the number of employees, respectively 0.02. At the same time, the value of the *R-squared* correlation coefficient of 0.99 indicates a strong influence of the factorial variables on the evolution of GDP in the case of the chosen model.

Conclusions

The study of this article draws a series of conclusions, especially theoretical, which must be taken into account by those who establish the strategy of economic evolution of Romania, but also practical, revealing the concrete effect of increasing labour productivity on economic growth and influence, the correlation that exists between the three statistical variables, the gross domestic product, labour productivity, per person or hourly, and the number of employees.

It is clear that measures must be taken to increase and improve the capital used in terms of quality, while improving and retraining the workforce in order to be able to use much more advanced fixed assets.

We consider that digitization, robotics and other improved procedures and mean increase yields, increase the knowledge of the staff serving this fixed capital, so that we can achieve economic development based on modern means. This will certainly have the effect of increasing labour productivity and thus increasing gross domestic product, and thus economic growth.

Another conclusion is that not in all branches of the national economy labour productivity has increased at the same rate, which means either maintaining fixed capital assets not exactly improved or, if you will, business management is not at the accepted level and, perhaps, reconversion was not done on time or on a permanent basis. This professional retraining can be done in two ways (cases). People who leave the job from certain positions, who no longer offer jobs, need to convert, through additional knowledge, to other areas of activity in which there are or will be created vacancies.

The second way is that of the management of commercial, national or multinational companies to ensure the rhythmic improvement through courses, specializations, etc., so that the personnel used can cope with the requirements imposed by the use of much improved fixed assets.

And one last conclusion is that the periods of crisis (2008 - 2010 and the one triggered in 2018) must be taken into account, for the reorganization of the economy, so as to avoid entering a process of destabilization which then has full effects negative effects on the growth of the national economy.

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