Analysis of correlation between labor productivity and determinants of its in Romania

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Abstract: - This paper aims to treat problems of the main labor productivity growth in Romania, trying to highlight the link between labor productivity and a series of economic indicators. We believe that during the current period, deeply marked by the global crisis, labor productivity growth can contribute to the recovery of our country. Labour productivity manifestation as an expression of development of productive forces, is characterized by multiple technical aspects and correlations. They stress the mutual influence of the dynamic elements of production forces, highlighting a number of technical reports: the subject of work and means of labor, of technology and means of working system, the various elements of technique and the interaction between technical and manpower at work.

Key-Words: - labor productivity, average net salary, technical endowment of labor, linear regression

1 Introduction

Work is the active and transformative element of the production process, the amount and effectiveness resulting in the production. The importance of strong labor productivity growth is enhanced by numerous key processes and phenomena of economic development. Labour productivity manifestation as an expression of development of productive forces, is characterized by multiple technical aspects and correlations. They stress the mutual influence of the dynamic elements of production forces, highlighting a number of technical reports: the subject of work and means of labor, of technology and means of working system, the various elements of technique and the interaction between technical and manpower at work.

Labor productivity analysis is an essential component of developing a system of indicators that reflect many of its quantitative aspects and illustrates the factors that influence labour productivity. Thus, productivity is a complex economic indicator, which acts as a law increasing the overall development of society.

As far as the calculation of labour productivity is involved at the enterprise level, it is being used the following formula:

\[ I_{lw} = \frac{\sum q_0 p_0 t_0}{\sum q_1 p_0 t_1} = \frac{\sum q_0 p_0 t_0}{\sum q_1 p_0 t_1} \]  

where: \( I_{lw} \) is productivity index,
\( q_{0,1} \) - is the production base year, respectively this year
\( p_0 \) - is the base period prices expressed in the production
\( t_{0,1} \) - is working to achieve production consumption in the base year, respectively this year

This method of calculating the productivity index can be used throughout the industry, because consider the value of being so embedded in its structure and changes.

In its most general indicator of labor productivity could be expressed as the value added by an employee within an hour of work, the formula is:

\[ w = \frac{VAE}{M} \]
where: \( W \) is labor productivity per worker  
\( N_k \) number of persons employed or hours worked.

Regardless of the definition, labor productivity has great economic and social importance and is a central problem of scientific research. The theme is very broad and complex that they must achieve deeper by analyzing specific issues related to the companies or branches, but the general trends exhibited throughout the economy. This paper aims to treat key issues of labor productivity growth in Romania, trying to highlight the link between labor productivity and a series of economic indicators. We believe that during the current, deeply marked by the global crisis, labor productivity growth can contribute to the recovery of our country.

2 Developments in labor productivity

The evolution of labor productivity has a very similar trend phases of business cycles. Such development is driven by the fact that labor productivity indicates the efficiency of the whole work, i.e., the usability of the labor force and production capacity.

In times of revival and boom there is an increased use of production capacities and labor. Economic crises have generally opposite effect in the sense that in these times, part of the production potential is not used.

Also, labor productivity per worker record and she swings it depends largely on the degree of technical endowment of labor. Between labor productivity per worker and cyclical nature of production there is some connection, but this link is weaker than in the general labor productivity. This is how and why in some cases evolving production and productivity in different meaning.

In the chart below, we present the evolution of comparative labor productivity per employee, hourly labor productivity and output in Romania for 10 years, including the period of economic crisis. Please, leave two blank lines between successive sections as here.

Fig.1. Developments in production and labor productivity

Developments in production and productivity differentiated zones, on the one hand and the evolution of labor productivity per employee, on the other hand, are caused by objective processes and not single events.

In periods of economic boom due to increased production of favorable circumstances, become profitable use of production capacity even weaker. This develops small and medium whose endowment is less technical and using labour with lower qualification grade. Thus increasing productivity per employee is not generally in line with global production, on the contrary, sometimes stagnating.

In periods of recession and economic crisis there is a tendency to restrict the production and falling prices (due to stocks becoming more products). Thus, there is massive layoffs especially unskilled workers, and will last on the market than those companies with superior technical facilities and lower production costs. Under these conditions the overall production is reduced, but increases employee productivity.

The issue raises labor productivity a new problem: that of employment.

Labour productivity growth per employee and hourly labor productivity growth particularly emphasized process involves a labor-intensive, with negative effects on long-term health and life of employees.

With globalization, health threats include labor worldwide. To counter these risks, the individual countries and the European and global, have established programs to anticipate new risks and to improve the health of the workforce.

Although productivity in Romania, overall, recorded an upward trend, is still well below the average EU countries, being the last places. Since 2005, we managed to beat the main competitor of our country, Bulgaria, which in recent years show a lower productivity than in Romania.
Fig. 2 Evolution of labor productivity in different EU countries

In the above figure is shown the comparative labor productivity in different EU countries, most of them from Eastern Europe, Romania's main competitor.

3. Correlations of labor productivity
3.1 Factors of influence of productivity

Intensive use of labour depends on action co-complex of factors that influence in a greater or lesser extent, the use of work required to produce goods. By analyzing these factors can create technical assumptions, economic and organizational productivity increase. The starting point for analysis of factors influencing labour productivity is based on scientific classification. Research intensity action involves various factors analysis of quantitative and qualitative aspects of the influence of each factor. To determine as true contribution of each factor must be like-all aims realization of their classification.

In terms of economic and social character, the production process involves combining two elements, namely labour and employment resources. Thus, improving labour productivity growth requires two elements giving rise to two categories of factors: technical and material factors - which refers to the degree of development of means of labour, ethnic progress, the degree of quality raw materials, capacity utilization production, etc., factors related to workforce development - such as the welfare, compensation of employees, job security, level of training of employees, labour discipline, etc.

Among the factors that determine productivity and its level is a causal link. Thus, several factors act directly on labor productivity, materializing their influence either through a reduction of labor per unit of product, either through an increase in product quality, such as degree of technical endowment of labor the use of resources, higher raw material UTI marketing standards, qualification of workers, etc. However, there are factors that influence productivity indirectly through direct factors contributing to increase or enhance their effectiveness. Action indirect factors must be considered separate factors not directly, as it occurs and ends with them.

Effect of action to improve labor productivity factors vary in time and space. Thus, an overview of factors acting on productivity as they relate to specific manufacturing process and scope are uneven. Emerges from this point of view two types of factors influence labor productivity: factors at the enterprise or industry, and factors in the economy.

In this paper we want to focus research on the correlation between labor productivity in Romania and the main influencing factors: technical progress, raising labor skills, compensation of employees.

3.2 The correlation between productivity and living standards of population

Rational use of material resources and time working is an important lever in improving work efficiency. Thus, wage growth boosts employee productivity, which in turn allows growth of the working people welfare. Between labor productivity and the dynamics of living standards (measured as GDP per capita) is formed certain correlations objectives.

Fig. 3
The relationship between index and index of labor productivity per capita consumption is in a direct proportion to the evolution of the share of gross capital formation in GDP and inversely proportional to the number of employees share in the total population.

This dependence is explained by the fact that while productivity is expressed as the ratio between gross value added and number of employees, consumption per capita is the ratio of final consumption (which is part of GDP) and population.

Providing a growing rate of gross capital productivity would increase at a rate higher than per capita consumption increase.

A special place in labor productivity correlation analysis with the standard of living is studying the relationship between labor productivity growth and average income of employees. Faster growth in labor productivity to increase revenue per employee is a clear objective of development of society.

In our country, analyzing labor productivity growth rates and growth rates of net average wage in recent years, it is found (Fig. 4) wage increases above productivity increases, a situation favored by foreign loans, which affects the economy long term. [21]

We will analyze below, the correlation between labor productivity, average wage index and GDP per capita index, using the regression model.

3.3 The correlation between productivity and technical endowment of labor

The interaction between ethnic progress and the production process is an important factor of growth of labor efficiency, making use of resources and raising top quality products.

Technical development of an enterprise, providing it with means of work performance is expressed by increasing fixed capital. The economy, the dynamics of endowment assets is expressed in gross fixed capital formation.

According to statistics, the whole economy of our country, gross fixed capital formation had the following evolution (Fig.5):

The evolution of labor productivity is the effect-molded with the action of several factors on which it. To highlight their influence is first necessary to consider each action separately.

Important to note is that between the dynamic fixed endowment funds (IFBCF) and labor productivity (Iw), the entire Romanian economy is very strong correlation (Table 1).

<table>
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<tr>
<th>Corelatie</th>
<th>Iw/pers</th>
<th>IFBCF</th>
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<tbody>
<tr>
<td>Iw/pers</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>IFBCF</td>
<td>0.862372</td>
<td>1</td>
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</tbody>
</table>

Thus, the simple correlation coefficient is over 86%, indicating a high degree of dependence between the two indicators. This dependence can be revealed using suggestive graphical expression (Fig.6).

Such a ratio is formed due to the action of several factors crucial role back Improving the
production, application of modern technological processes, providing a rhythmic activity, allowing more efficient use of production capacity. Technical progress and better use of fixed capital underlying productivity growth.

Linear dependence between labor productivity and gross fixed capital formation is expressed by the equation:

\[ I_P = \alpha + b \cdot I_{FCF} \]  

(3)

To determine the parameters of this formula (the coefficients \( a \) and \( b \)) apply the method of least squares, that:

\[ \sum (I_P - \alpha - b \cdot I_{FCF})^2 \]  

is minimal. (4)

Setting aside the partial derivatives with respect to \( a \) and \( b \), we obtain the following system:

\[
\begin{align*}
\alpha + b \cdot \sum I_{FCF} &= \sum I_P \\
\alpha \cdot \sum I_{FCF} + b \cdot \sum I_P &= \sum I_{FCF} \cdot I_P
\end{align*}
\]  

(5)

Considering a sample of statistical data (between 2000-2010) and solving equations system formats (5), based on these data the following results:

\[ I_P = 46.86 + 0.5656 \cdot I_{FCF} \]  

(6)

Regression coefficient \( b = 0.5656 \) shows how changes in labor productivity index increased by one index of gross fixed capital formation. Analysis of correlation between productivity and technical equipment necessary work that has implications for treating technical progress on labor use as work product transmits the value of production consumed by it. Also the value of inputs of a certain amount of work increases with labor efficiency.

### 4 Problem Solution

The correlation between labor productivity and living standards of the population was tested using linear regression. The proposed regression model, consider a sample of data over a period of 10 years, 2000-2010. Independent variable is the labor productivity index, calculated as the ratio between the gross value added and number of employees. Independent variables are average wage index and the index of GDP / capita. Regression model equation is as follows:

\[ I_P = \alpha_1 \cdot I_{wage} + \alpha_2 \cdot I_{GDP/capita} + \varepsilon \]  

(7)

Simple correlation coefficient between the index of labor productivity \( I_P \) and wage growth \( I_{wage} \) net average is about 86.6%, indicating a close link between these indicators.

The first table of the overall regression statistics is:

<table>
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<tr>
<th>Regression Statistics</th>
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<tr>
<td>Multiple R</td>
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<tr>
<td>R Square</td>
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<tr>
<td>Adjusted R</td>
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<td>Square</td>
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<td>Standard Error</td>
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<tr>
<td>Observations</td>
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We note that approximately 90% of the variation in labor productivity is explained due to variation of the two independent variables considered. Function regression coefficients were determined:

\[ I_P = 0.861 \cdot I_{wage} + 1.718 \cdot I_{GDP/capita} - 16.7 \]  

(5)

Function coefficients are found from the regression analysis, the average net wage growth is significantly positive influence on labor productivity index, which means that the average wage increase has the effect of increasing labor productivity. Standard of living of the population has positive influence on productivity, but the same intensity as wage growth.

Analysis can be deepened by considering a regression model whose independent variable is labor productivity and independent variables are complemented by gross fixed capital formation index and education levels of employees.

### 4 Conclusion

Labour productivity is the expression of efficiency, yield of the way human labor is consumed to produce a certain volume of goods and to provide certain services.

Labour productivity growth is a general economic law, economic and social progress, reflecting a double process: on the one hand increasing the amount of goods and services produced per unit of effort, on the other hand reducing expenditure per unit of product or service. Ensuring conditions for the steady increase of work efficiency is the essential condition of our country's rapid development of economy, increasing production and consumption per capita in the developed countries.

Labour productivity under the influence of various conditions in which production takes place,
increasing their complexity with the evolution of production.

Consequently, labor productivity reflects the synthetic action of several factors converging technical, economic and social, quantitative and qualitative, direct and indirect, etc.

In the present paper we analyzed only a few of the most important, highlighting the correlation between labor productivity and the evolution of these factors.

Applying various statistical and mathematical methods to determine accurate levels and changes in labor productivity, quantitative expression (with algebraic equations) the relationship between work efficiency and the factors that influence the correlations are formed are essential steps that contribute to discovery and enhancement of important reserve of labor efficiency.

Quantitative analysis that supports a growing extent on the use of the mathematical, qualitative content analysis complements economic phenomena.

References:
[12] Lala - Popa Ion, Miculeac Melania Elena, Economic and financial analysis. Theoretical concepts and practical applications, Editura UniversităŃii de Vest, Timişoara, 2010