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THE CORRELATION-REGRESSION MODELS USAGE AS A WAY TO INCREASE OF LABOR PRODUCTIVITY

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Abstract
The relationships between various factors and labor productivity are analyzed in the article. Analysis of labor productivity in the furniture enterprises Chernivtsi region is held. The correlation and regression analysis are conducted to select the factors that affect the change in labor productivity on the basis of financial reporting. The combination of variables is used for predicting values that can take the dependent variable, and calculated at a given set of values of input variables received. The multifactor regression models for enterprises furniture industry based on correlation analysis are created. The equation for the regression coefficients, which express the dependence of productivity growth factor sign are folding. The substantiated conclusions on the quantitative relationship between the level of labor productivity and organizational-economic factors are made. The similar and distinctive signs in regression models are revealed. The proposed models are appropriate for enterprises of all industries with the similar input parameters.

Keywords: *labor productivity, number of employees, the rate of staff turnover, payroll, allowances and surcharge, correlation-regression models.*

1. INTRODUCTION

The labor productivity is the main criterion of economic efficiency, the first condition for the growth of social production and the complex index of efficiency of the staff. Therefore, there is a need to quantify the influence of individual factors on labor productivity. The various factors and effective signs should be evaluated comprehensively in their interrelation to identify those factors that affect the economic phenomenon and those that do not affect.

The significant contribution was made to the research value of factor-specific analysis of labor productivity by known scientists O. Akilina and L. Illich (Akilina & Ilich, 2010), O. Grishnova (2007), N. Yesinova (2004), M. Sokolik (2010), I. Timosh (2001) and others. The numbers of theoretical and practical issues are unresolved, despite a

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considerable amount of previous research investigation. Questions to identify trends in labor productivity require research in enterprise practice and on this basis the ways of raising labor productivity can be possible.

The further development of labor productivity theoretical propositions and substantiation of practical recommendations based on the analysis of the factors affecting to increase the labor productivity are the main purposes of the article.

2. THE STUDY

We implied the correlation analysis to select the factors that affect the change in labor productivity. The object of this analysis is the enterprise furniture industry in Chernivtsi region. The approach to a representative sample was selected based on the average level of labor productivity in the business for the analyzed period (2006-2010). Therefore, enterprises are divided into three groups: Group C is the enterprises with low labor productivity, Group B is the enterprises with an average level of labor productivity, group A-the enterprise with a high level of labor productivity. The basic companies selected from each group give the continuity of work during the studied period.

The construction of correlation models enables to establish the relationship between the economic indicators that are not functionally linked. The correlation and regression models are constructed using the Microsoft Excel data analysis packet.

A density relation is measured by the absolute value of the correlation coefficient (R). The correlation between two features suggests a causal connection between them when either one of the signs is a partial cause of the other, or both symptoms are associated with common causes.

A zero indicates no linear relationship between variables. A maximum values (R = +1 and R = -1) ratio indicate full (or functional) linear relationship between variables (respectively functional direct link and functional feedback). Intermediate values indicate the following: the higher the absolute value of the index, the closer correlation. The quantifying correlations can help to discard irrelevant links and better outline the direction searches to compare the impact of various factors etc.

The correlation analysis was applied to each group of enterprises furniture industry Chernivtsi region. There were analyzed the following factors: average number of employees, the number of managers, the number of employees who are hired, turnover ratio reception, the employee turnover coefficient, the number of employees having higher education, payroll, the effective fund-time, the fund of additional salary, allowances and bonuses, the cost of production, the volume of industrial output (in comparable prices), the value of fixed assets, the value of intangible assets, administrative expenses, the value of non-current and current assets, labor costs, total costs, average wage.

The factors that are positively or negatively correlated with productive of enterprises in the group C:

1. average number of employees (R= - 0.78);
2. number of management personnel (R= -0.69);
3. number of employees having higher education (R= +0.66);
4. effective fund time (R= -0.7);
5. allowances and bonuses (R= +0.76).

The coefficient of employee turnover (R= +0.39), payroll (R= -0.44), fund of additional salary (R= -0.38), production costs (R= -0,08), the value of fixed assets (R= +0.07), the value of intangible assets (R= +0.02), the value of non-current and current assets (R= +0.11 and R= -0.09, respectively) administrative expenses (R= -0.21), total cost (R= +0.03), the number of employees who are hors (R= -0.53), turnover ratio reception (R= 0.52) and the average wage (R= +0.3) do not slow the density.

The factors that significantly affect the labor productivity of the enterprises in group B:

1. number of management personnel (R= -0.64);
2. coefficient of employee turnover (R= -0.77);
3. number of employees having higher education (R= +0.6);
4. allowances and bonuses (R= +0.61);
5. administrative expenses (R= +0.61);
6. average wage (R= +0.69).

Thus, the additional salary fund and the wage costs do not show close link with labor productivity (R= +0.31 and R=+0.24 accordingly).

So the fund of close correlation with labor productivity has the following factors as:

a) average number of employees (R = -0.29),
b) payroll (R = 0.3),
c) effective fund-time (R = -0.29),
d) award (R = -0.3),
e) cost of production (R = +0.37),
f) the value of fixed assets (R = 0.13),
g) the value of intangible assets (R = 0.13),
h) the value of non-current and current assets (R = 0.06 and R = 0.3 respectively),
i) total cost (R = 0.29),
j) number of employees who are hors (R = -0.58),
k) ratio of employee turnover (R = -0.52).

The factors that are positively or negatively correlated with productive for groups A:

1. number of management personnel (R = -0.62);
2. number of employees having higher education (R = +0.62);
3. allowances and bonuses (R = +0.61);
4. average wage (R = +0.6).

We can make a conclusion that despite the fact that the allowances and bonuses are positively correlated with labor productivity (R = +0.61), in general, the additional salary fund for this group of enterprises is ineffective because it does not affect the figure resulted (R = +0.021). Also, this analysis suggests that administrative expenses and labor costs are not the optimal structure as well as not closely related with labor productivity (R = -0.07 and R = -0.09, respectively). It does not demonstrate the connection of:

a) employees average number density (R = - 0.46),
b) coefficient of employee turnover (R = +0.22),
c) payroll (R = -0.21),
d) effective fund-time (R = -0.46),
e) the value of fixed assets (R = -0.25),
f) the value of intangible assets (R = -0.45),
g) the value of non-current and current assets (R = -0.36 and R = -0. 43, respectively),
h) total cost (R = -0.33),
i) the number of employees who are hors (R = -0.14),
j) turnover ratio reception (R = -0.15).

The next stage of our research is to conduct regression analysis. The combination of variables obtained in the course of regression analysis is used to predict values that can take the dependent variable, which is calculated for a given set of input variables value. The regression coefficients are calculated in the generated tables that allow an equation expressing the dependence of labor productivity growth factor features.

The functional dependence of the resulting regression analysis we got the form:

$$y_C = 44.608 - 0.886 \cdot x_1 + 0.745 \cdot x_2 - 0.004 \cdot x_3 - \\ - 2.024 \cdot x_4 + 0.0009 \cdot x_5$$

where:

y_c - level of labor productivity, thousand UAH;

x_1 - number of management personnel, persons;

x_2 - number of employees having higher education, persons;

x_3 - allowances and bonuses, thousand UAH;

x_4 - average number of employees, persons;

x_5 - effective fund-time, man per hours.

It should compare the model results with the actual performance of productivity in order to estimate the accuracy of the construction (chart 1).

The multifactor regression model for group enterprises to companies with an average level of labor productivity is:

$$y_B = 10.845 - 2.634x_1 + 3.082x_2 - 0.197x_3 - \\ - 2.415x_4 + 0.042x_5 - 1.312x_6$$

where: y_B is a level of labor productivity, thousand UAH;

x_1 - number of management personnel, persons;
x_2 - number of employees having higher education, persons;
x_3 - allowances and bonuses, in thousand UAH;
x_4 - average wages, in thousand UAH;
x_5 - administrative expenses, thousand UAH;
x_6 - coefficient of employee turnover.

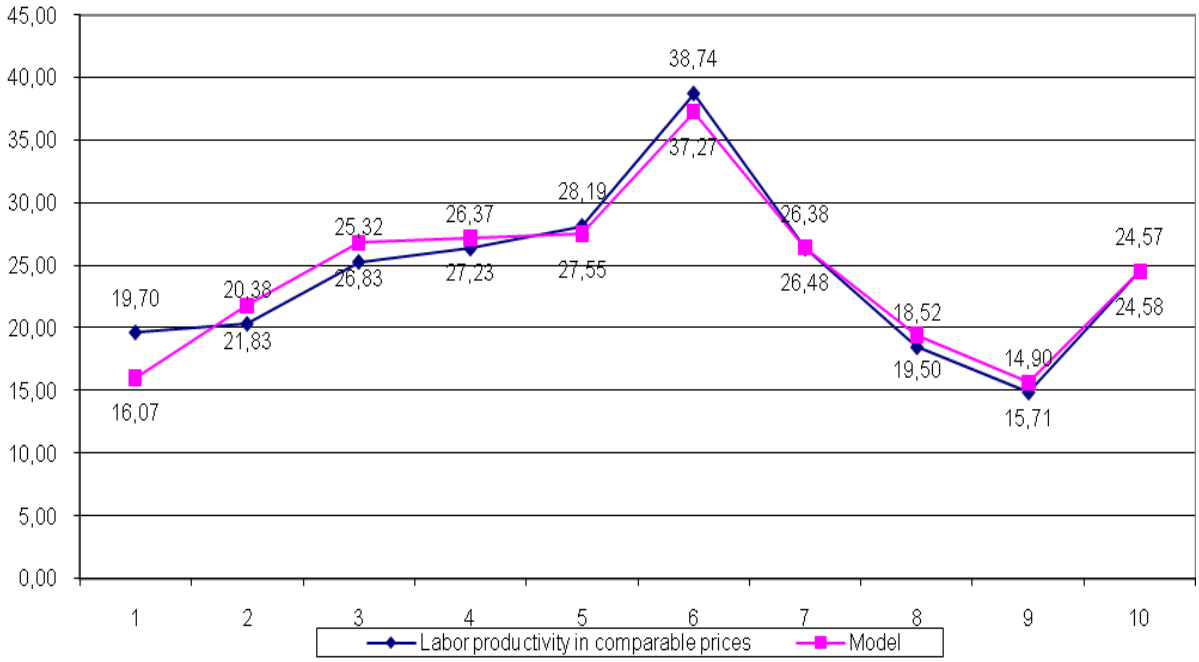

Chart 1 Graphical interpretation of the comparison of actual labor productivity and performance model for enterprise in group C (Source: Compiled by the author O. Petrashchak)

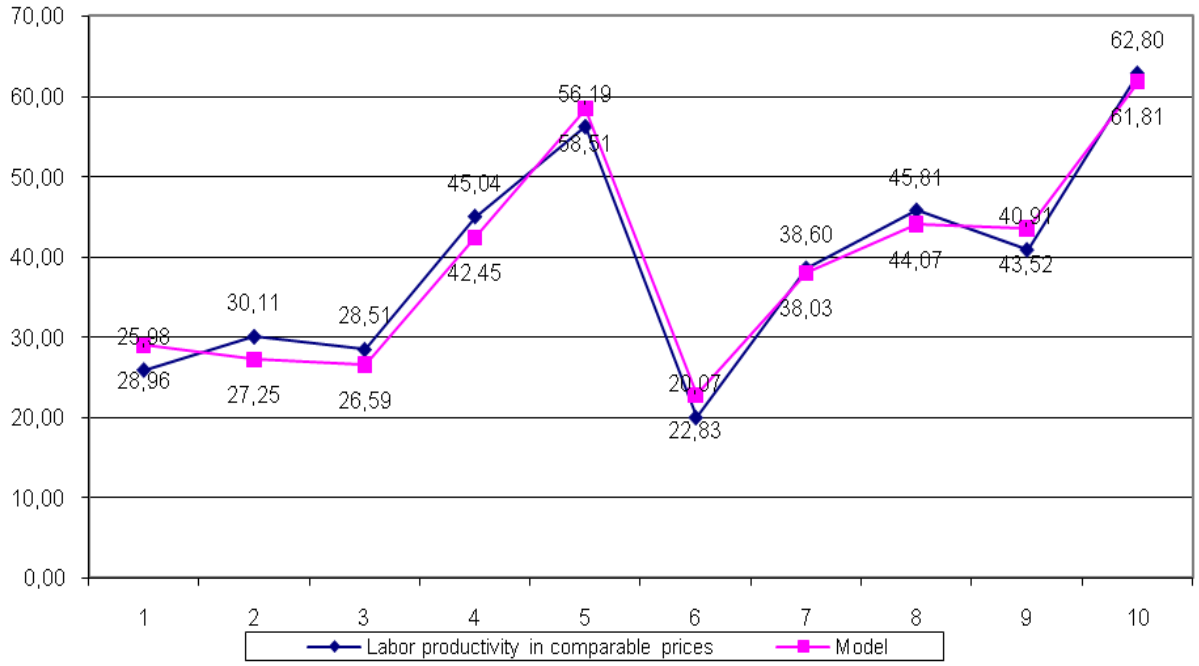

Chart 2 Graphical interpretation of the comparison of actual labor productivity and performance model for of enterprises group B (Source: Compiled by the author O. Petrashchak)

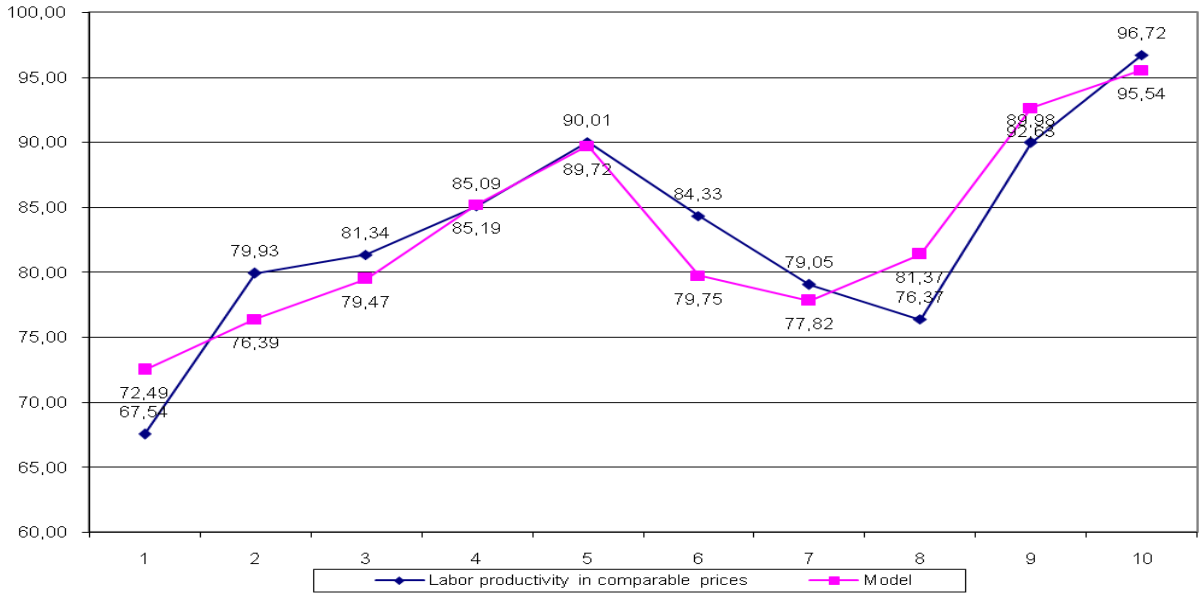

Chart 3 Graphical interpretation comparison of actual labor productivity and performance model for of enterprises in group A (Source: Compiled by the author O. Petrashchak)

The results comparison of an econometric model of the actual labor productivity is presented in the chart 2.

The multifactor econometric model for of enterprises in group A obtained from the regression analysis is as follows:

$$y_A = 66.125 - 0.882 \cdot x_1 + 0.621 \cdot x_2 + \\ + 0.042 \cdot x_3 + 2.185 \cdot x_4$$

where:

y_A - level of labor productivity, thousand UAH;

x_1 - number of management personnel, persons;

x_2 - number of employees having higher education, persons;

x_3 - allowances and bonuses, thousand UAH;

x_4 - average wages, thousand UAH;

We should compare the model results with the actual labor productivity in order to estimate the construction accuracy (chart 3).

3. CONCLUSIONS

Thus, regression models constructed for companies' furniture industry have similar symptoms as well as some significant differences. The number of management personnel in all models demonstrates the opposite effect on labor productivity and the number of employees who have higher education shows the direct. The value of allowances and bonus payments in the model for of enterprises group A has a direct connection to the resultant figure, and models for business groups B and C has reverse that allows to conclude the ineffectiveness of these payments on the last business groups. The average wages directly influences labor productivity in business models for group A, while in group B business models are inversely, and for group C enterprise it is not generally correlated with the dependent variable, which shows the above conclusion. The coefficient of employee turnover shows feedback from the dependent variable in the model for of enterprises group, and direct for administrative costs. The average number of employees in the model for enterprise group C negatively affects level of labor productivity, which is associated with high rates of reception and turnover, and positively is fund-time effective. Thus, the analysis of labor productivity in the furniture business Chernivtsi region is based on a comparison of information obtained during the measurement and evaluation of the productivity levels and is the basis for further search of reserves growth in labor productivity.

Since it is conclusion in the market economy, it is the main precondition for the creation of competitive products, increase in internal market and the possibility of decent representation national products in the world market.

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