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ECONOMETRICS PANEL DATA MODEL OF THE DEPENDENCE OF EU COUNTRIES ON THE AVERAGE ANNUAL NUMBER OF PEOPLE EMPLOYED IN SCIENCE AND TECHNOLOGY AND ITS ANALYSIS

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The key policy areas of the EU are investment in research, development, education and skills, as they are necessary for the growth of the knowledge-based economy. With the help of econometric modeling, the dependence of GDP growth on one of the essential factors (innovation-oriented human capital) is determined.

Keywords: innovative economy; economic growth; regression model; analysis.

ЭКОНОМЕТРИЧЕСКАЯ МОДЕЛЬ ПАНЕЛЬНЫХ ДАННЫХ ЗАВИСИМОСТИ СТРАН ЕС ОТ СРЕДНЕГОДОВОЙ ЧИСЛЕННОСТИ ЗАНЯТЫХ В НАУЧНО-ТЕХНИЧЕСКОЙ СФЕРЕ И ЕЕ АНАЛИЗ

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Ключевыми направлениями политики ЕС являются инвестиции в исследования, разработки, образование и навыки, поскольку они необходимы для роста экономики, основанной на знаниях. С помощью эконометрического моделирования определена зависимость роста ВВП от одного из существенных факторов – инновационно-ориентированного человеческого капитала.

Ключевые слова: инновационная экономика; экономический рост; регрессионная модель; анализ.

Consider one of the factors – the average annual number of people employed in science and technology, expressed in thousands of people and study its impact on GDP at purchasing power parity (PPP) at constant (2017) prices.

In 2019, the European Union included 28 countries, in the following 2020, the UK ceased its membership in the European Union. Therefore, a sample of n = 28 was selected for the period of 2019. Since the range of data is very large, the data was normalized as logarithms of the original ones.

Using the Microsoft Excel Analysis ToolPak, the following regression model is built:

$$lnY = -1{,}428 + 1{,}013 \cdot lnX.$$

The explanatory variable is X – the average annual number of people employed in science and technology, thousands of people in the EU.

The coefficient at X shows how many percent Y will change with an increase of X by 1 %, an increase in the number of people employed in science and technology by 1 % will lead to an increase in GDP by 1.013 %.

The strength, tightness and direction of the correlation relationship can be judged by the value of the correlation coefficient r_i, which is equal to 0.988.

According to the value of the correlation coefficient, it can be concluded that there is a strong correlation between the variables under consideration in the model. Positive correlations mean that high values of one variable are associated with a high value of another, which corresponds to the model.

The quality of the created regression equation is indicated by the coefficient of determination, $R^2 = 0.975$, which shows a good consistency of the regression equation with statistical data.

To test the significance of the coefficient of determination, a null hypothesis is put forward about the equality of the coefficient of determination to zero, as well as an alternative one: the coefficient of determination is greater than zero. Acceptance of the null hypothesis means that the coefficient is statistically insignificant, acceptance of the alternative hypothesis means that the coefficient is significant, and our model is adequate.

To do this, we compare the *F*-statistics with the critical point *F* distribution with degrees of freedom 1 and 26 and a significance level of 0.05 based on our data. As a result, we get *F* critical = 4,225, *F*-statistics = 1026,6. *F*-statistics is greater than the critical point *F* of the distribution, therefore this means acceptance of the hypothesis $H1$, which indicates the significance of the coefficient of determination.

The next step is to check the statistical significance of the regression coefficients.

After calculations, we get t-statistics = 32,041; *t* critical= 2.056.

Since the value of *t*-statistics modulo exceeds its critical value, the estimation of the regression coefficient is considered *significant*. This means that the number of people employed in science and technology significantly affects the level of GDP.

An important prerequisite for building a qualitative regression model using the Least Squares method is the independence of the values of random deviations from the values of deviations in all other observations. The absence of dependence guarantees the absence of correlation between neighboring deviations, that is, $cov(e_{i-1},e_i) = 0$. In practice, to analyze the correlation of deviations, instead of the correlation coefficient, the associated Durbin–Watson statistic are used, calculated by the formula:

$$DW = \frac{\sum (e_i - e_{i-1})^2}{\sum e_i^2}.$$

This *DW* value should be approximately equal to 2 to indicate the absence of autocorrelation, that is, the value should be in the interval between *DU* and (4-*DU*). To determine the values of the boundaries of this interval, a table of critical points of the Durbin–Watson distribution is used. For the data under study, we get: *DW* = 1.643236; *DU* = 1.47589; 4-*DU* = 2.52411, which means that the statistics fall into the interval we need, from which we can conclude that there is no autocorrelation of the residuals and the constructed model can be considered satisfactory.

Below is a graph (Fig. 1): the X axis is the natural logarithm of the average annual number of people employed in science and technology in the *EU* (thous. people), the *Y* axis is the natural logarithm of GDP at PPP (billions o dollars), the regression line is shown, and the points of the country are indicated.

The model considered for the European Union is not suitable for studying the relationship between the GDP of the Republic of Belarus and the average annual number of people employed in science and technology, since this factor has little effect on the GDP of Belarus, and statistical data do not correspond well with the model.

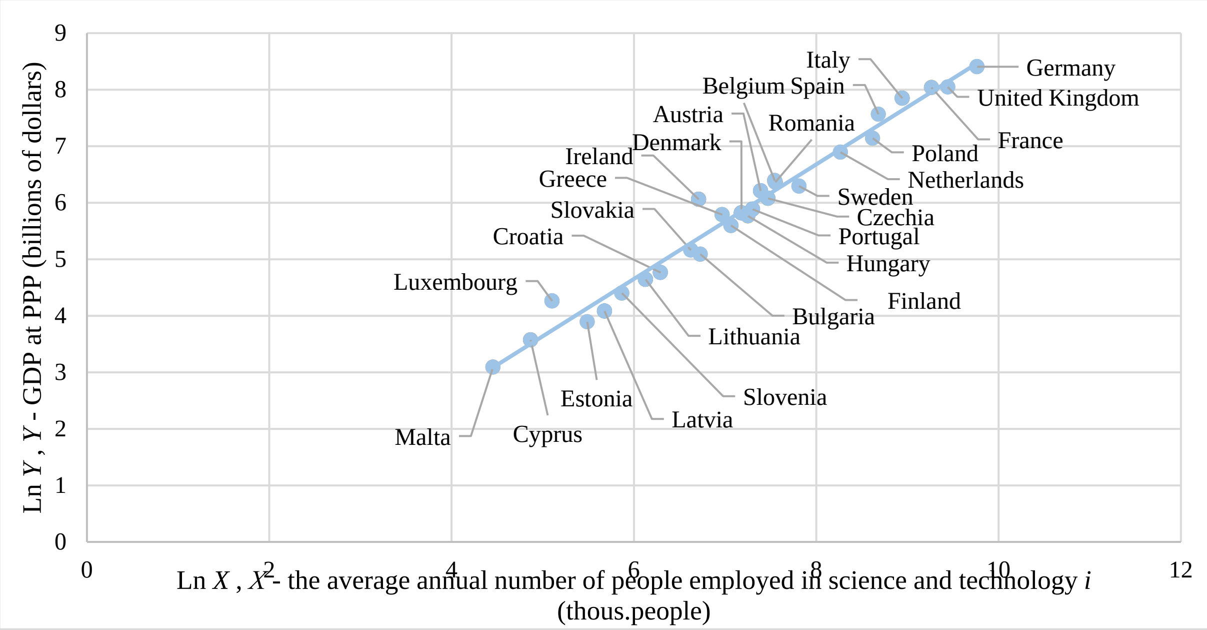

Figure 1 – **Graph showing points of countries and regression line**

Note – Source: Author's development based on data from Eurostat.

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THE ROLE AND PROBLEMS OF THE DIGITAL ECONOMY DURING COVID-19

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The COVID-19 outbreak has been a huge challenge for many industries, many of which have been hit hard, but the digital economy has played a big role during the pandemic, it has also found some problems. Based on some data, this paper analyzes the important role of digital economy such as online sales and online teaching, discusses the problem such as digital divide caused by the rapid development of digital economy, and puts forward corresponding countermeasures and suggestions.

Keywords: COVID-19: digital economy; countermeasures; digital divide.

РОЛЬ И ПРОБЛЕМЫ ЦИФРОВОЙ ЭКОНОМИКИ ВО ВРЕМЯ COVID-19

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