Skills required to perform two-factor econometric analysis

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Abstract: In this article, the author provides information on the selection of factors, the implementation of correlation and regression analysis. The construction of an econometric model is shown step by step. Information is also provided on the stage of generating a regression equation using correlation coefficients and a system of normal equations.

Keywords: factor, endogenous, exogenous, correlation, linear and nonlinear relationships, regression, least squares method, econometric model.

Introduction: Students can be taught to perform two-factor econometric analysis using several steps. Specifically:

Stage 1. Selection of factors. They learn to classify statistical data and work with economic factors. Statistical classification is understood as the processing of collected data from the point of view of the goals and objectives of scientific research. One of the most common methods of processing and analyzing statistical observation data is grouping. In statistics, grouping refers to the division of units of a set into the same groups and subgroups according to their most important characteristics.

Stage 2. Working with factors. Data obtained as a result of statistical observations for the purpose of studying economic processes are signs that represent a certain aspect (edge) of the process, which are divided into resulting and influencing factors in the process of change. If a change in one sign also changes the second sign, then the first sign is called a factor sign, and the second sign is called a resulting sign, and these show the interrelation of factors and are expressed as follows:

$$y = f(x_1, x_2, \dots x_n).$$

Here, y is the outcome variable, and xi are the factor

variables.

Variables are divided into dependent and independent variables. Whether they are dependent or independent is determined based on the results of correlation analysis.

Factors have their own qualitative and quantitative aspects. Signs that are expressed in numbers are called quantitative signs, signs that are not expressed in numbers, that is, expressed in words, expressing the qualitative side of factor and resultant signs are called attributive signs. Factors must be quantitatively measurable. If factors consist of qualitative indicators that cannot be measured quantitatively, they must be quantified (for example, a resultant sign - the quality of soil that affects productivity - a factor sign should be converted into a value, not a score).

In the study of economic processes, the factors studied are divided into endogenous and exogenous factors. In economic processes expressed by a system of equations, the resulting characteristics ui, that is, dependent variables, are called endogenous factors. Exogenous variables are previously defined variables that affect endogenous variables but are not dependent on them, usually denoted as x.

Stage 3. Correlational connection.

The concepts of types, shape, and density of correlations are presented with the participation of 3 students.

The relationship between factors is divided into 2 types: functional relationship and correlation relationship.

Depending on the direction of the change, bonds are divided into two types: direct bonds and inverse bonds.

Depending on the form of analytical expressions, connections are divided into two types: linear and nonlinear connections.

In functional relationships, each value of one variable corresponds to exactly one value of another variable.

Correlation analysis is based on determining correlation coefficients and assessing their significance and reliability..

The correlation coefficient (r) ranges from –1 to +1. If there is no relationship between the factors, then there is a direct relationship - if there is an inverse relationship, then there is a functional relationship.

The level of bond density is usually interpreted as follows. If

$0,2$ up to – weak connection;

$0,2 \div 0,4$ – Weaker than average density binding;

$0,4 \div 0,6$ – average connection;

$0,6 \div 0,8$ – higher than average bonding;

$0,8 \div 0,99$ – Students provide information about close contact.

Steps to establish teacher-student relationships.

Stage 4. Correlation task.

Students, divided into two groups, are given tasks on direct and inverse correlation. Based on the distributed tasks, they are divided according to the density of the connection and analyzed. Through this presented task, the groups complete the tasks.

Table 1.

Year	1-y.	2-y.	3-yil	4-y.	5-y.	6-y.	7-y.
Y	1,6	3,2	5,5	8,6	11,4	14,9	22,0
X	5,4	7,9	17,4	23,9	38,8	60,3	91,5

Task 1

$$: r_{xy} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

The first group determines the correlation coefficient using the formula for calculating the linear correlation coefficient..

Task 2: The second group also determines the nonlinear correlation coefficient based on Table 1.

Stage 5. Regression task.

Students will construct a regression equation using the normal equation using the "Least Squares" method based on Table 1.

$$\sum_{i=1}^{n}(y_i - \hat{y}_{x_i})^2 \to \min \quad \text{"Least squares" method}$$

system of normal equations:

$$\begin{cases} n \cdot a + b \cdot \sum_{i=1}^{n} x_i = \sum_{i=1}^{n} y_i, \\ a \cdot \sum_{i=1}^{n} x_i + b \sum_{i=1}^{n} x_i^2 = \sum_{i=1}^{n} x_i \cdot y_i. \end{cases} \tag{3.8}$$

From this system of equations, a and b can be found..

$$b = \frac{n \cdot (\sum x_i y_i) - (\sum x_i) \cdot (\sum y_i)}{n(\sum x_i^2) - (\sum x_i)^2}.$$

A regression equation is constructed based on the calculated values.

$$y = a + bx + e$$

Econometric analysis. Analysis of a two-factor regression equation shows that an increase in the x-exogenous (influencing) factor by one unit leads to an increase in the y-endogenous (resultant factor) by b units. If there is no factor x affecting the y-resultant factor, the resulting factor will be equal to a (free margin). Therefore, the obtained correlation and regression coefficients are analyzed economically. After the economic analysis, the students' knowledge is assessed. The values calculated by the students are checked in the Excel program with the active participation of the students. The skills of the students who calculate the correlation coefficient and construct linear two-factor regression equations are assessed.

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