# CORRELATION FOR NONLINEAR DEPENDENCIES

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**Annotation**: This article presents ideas and considerations about correlation for nonlinear dependencies.

The quality of a nonlinear correlation dependence can be assessed using a correlation index:

$$R = \sqrt{\left(1 - \frac{\sigma^2_{ocm}}{\sigma^2_y}\right)}, \qquad (1)$$

Here: $\sigma^2_y$ - general variance of the resulting attribute;

$\sigma^2_{ocm}$ - $\hat{y}_x = f(x)$ residual variance given by the regression equation. The correlation index can also be written in the following form:

$$R = \sqrt{1 - \frac{\sum (y - \hat{y}_x)^2}{\sum (y - \bar{y})^2}}. \qquad (2)$$

Correlation index for nonlinear forms of relations [0; 1] varies within. The closer its value is together, the stronger the correlation between the variables being studied. If we square the correlation index, the resulting value is called the determination index.

$$R^2 = \frac{\sum (\hat{y}_x - \bar{y})^2}{\sum (y - \bar{y})^2}. \qquad (3)$$

The detection index indicates what ratio of the total variance of the resulting attribute explained by the regression model is the variance of that attribute.
In addition to the correlation and determination indices, the coefficients of elasticity allow us to estimate the closeness of the relationship between the variables x and u.
The overall elasticity coefficient indicates the percentage change in the resultant sign when the factor sign changes by 1%.

$$\bar{Э} = f'(x)\frac{\bar{x}}{\bar{y}}. \qquad (4)$$

There are generalization (average) and point coefficients of elasticity. Total elasticity coefficient $\bar{x}$ is calculated for the average value of and shows how many percent it changes relative to its average level, increasing by 1% relative to the average level of.

Point coefficient of elasticity $x = x_0$ is calculated for a certain value and $x_0$ with an increase of 1% from the level $y(x_0)$ indicates the percentage change relative to the level and the formulas for calculating the coefficients of elasticity vary depending on the type of relationship between and. The basic formulas are given in Table 1.

Table 1

Formulas for calculating the coefficients of elasticity

| $y = f(x)$ function view | Elasticity coefficient |
|---|---|
| Linear: $y = b_0 + b_1 \cdot x$ | $Э(x_0) = \frac{b_1 \cdot x_0}{b_0 + b_1 \cdot x_0}$ |
| Parabola: $y = a + b \cdot x + c \cdot x_2$ | $Э(x_0) = \frac{(a + 2c + bx_0) \cdot x_0}{a + b \cdot x_0 + c \cdot x_0^2}$ |
| Equilateral hyperbola: $y = a + b / x$ | $Э(x_0) = \frac{-b}{a \cdot x_0 + b}$ |
| Level: $y = a \cdot x^b$ | $Э(x_0) = b$ |
| Indicator: $y = a \cdot b^x$ | $Э(x_0) = x_0 \cdot \ln b$ |

Only $\left(y = a \cdot x^b\right)$ is a constant value (equal to the parameter in this case) that does not depend on the coefficient of elasticity for the indicator functions. Therefore, power functions are widely used in econometric research. The parameter in such functions has a clear economic interpretation - it shows the percentage change in the result with a 1% increase in the factor.

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