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Economic Analysis of Business Processes Using Correlation-Regression Models

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Abstract: This article discusses the theoretical foundations and practical application of correlation and regression models in the economic analysis of business processes. If the degree of dependence between variables is determined through correlation analysis, then regression models are used to predict certain economic indicators. The article analyzes how these models help in making business decisions, their advantages and limitations. The topic is also explained more clearly through a simple real-life regression example.

Key words: correlation, regression analysis, business processes, economic analysis, statistics, model building, dependence, forecasting, decision making, sales analysis.

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In the modern economy, the ability to accurately, predict and analyze is of great importance for the effective management of business processes. Such capabilities are mainly implemented through statistical modeling methods. In particular, correlation-regression models are widely used to determine the relationship and cause-and-effect relationships in business processes. The essence of these models, their significance in analysis and practical application are highlighted.

A correlation-regression model is a way of expressing the relationship between the phenomena under study through reliable quantitative relationships between the resulting characteristic and important factors.

A correlation-regression model is a regression equation that expresses the relationship between the phenomena under study through reliable quantitative relationships between the resulting characteristic and important factors. Its determination and regression coefficients are essentially fully consistent with the scientific theory of the socio-economic nature of the relationship and have a reliable interval probability.

A number of recommendations have been developed by the theory and practice of statistics for constructing correlation-regression models:

- the characteristics taken as a factor should be in a causal relationship with the resulting characteristic;
- the characteristics taken as a factor should not be a structural element of the resulting characteristic or its function;
- the characteristics taken as factors should not repeat each other, that is, they should not be collinear (the correlation coefficient should not be less than 0.8);
- it is advisable to take factor characteristics for the set unit to which the resulting characteristic belongs;
- the number of factors included in the regression equation should be less than the number of set units *m* and *n*. Usually, for multivariate regression equations $\frac{m}{n} \geq 11$ and for the principal components method $\frac{m}{n} \geq 7$ are recommended.

The mathematical form of the regression equation should fully correspond to the nature of the relationship.

The mathematical expression of the regression equation should fully correspond to the nature of the relationship between factors and outcomes in real conditions. If there is an additive relationship between factors and outcomes, and the outcome occurs even in the absence of any factor, the equation should be in the form $Y_{1\ldots k} = a_0 + \sum_{j=1}^{k} a_j x_j$, and if the outcome cannot occur without any factor, the equation should be in the form $Y_{x_j} = a_0 \prod_{j=1}^{k} a_j x_j$.

Using a regression model to determine the future consists in putting the expected values of the factor units into the equation for prediction. Using a correlation-regression model to determine the future consists in putting the expected values of the factor units into the regression equation for prediction and calculating the human indicators of the outcome characteristic or the confidence interval within which they lie with a given probability. It is incorrect to put into the equation human values that differ significantly from the value that the factor has in the information that served as the basis for calculating the equation, since at other qualitative levels of the factor, the equation parameters may have different values.

The probability of a point forecast of the future is small. The forecast (prospect level) determined by substituting the expected values of the factors into the regression equation is called a point forecast (prospect assessment). The probability of such a forecast assessment being implemented is very small. Therefore, the forecast assessment should be carried out together with the determination of its average error or, with a sufficiently high probability, the confidence interval (interval) of the forecast. The average error of the position of the regression line in the original set when the value of the factor sign is equal to X_k is determined by the following formula:

$$M_{y\bar{x}} = \delta_{xy} \sqrt{\frac{1}{n} + \frac{(x_k - \bar{x})^2}{\sum_{i=1}^{n} (x_i - \bar{x})^2}}$$

where $M_{y\bar{x}}$-the average error of the position of the regression line in the original set when $x = x_k$; *n* - sample size; x_k- the expected value of the factor;

$\delta_{residue}$- the estimate of the mean square difference of the resulting sign of the regression line in the main set with the number of degrees of freedom, i.e.:

$$\delta_{residue} = \sqrt{\frac{\sum_{i=1}^{n} (y_i - y_{x_i})^2}{n - m}}$$

m - the number of equation parameters (coefficients).

To determine the reliable limits of the regression line's forecast, its average error should be multiplied by the critical (table) value of the *t*-Student criterion, determined by the number of degrees of freedom n-m and a reliable probability of 0.95 ($\alpha = 0{,}05$), $\Delta_{forecast} = t_{table} * M_{y\bar{x}}$.

After the data obtained on the basis of business processes at the enterprise are forecasted for future periods, strategies for the development of the enterprise are developed. It identifies the capabilities and "bottlenecks" of the enterprise, and important issues are resolved in the future to attract the necessary resources and improve business processes.

Conclusion

The correlation-regression model is a reliable quantitative representation of the relationship between the phenomena under study by the relationship between the resulting characteristic and the characteristics of the important factor.

Factor analysis methods allow us to overcome the limitations of correlation-regression analysis (taking into account many factors despite the fact that the set consists of few units, some characteristics are collinear). These methods combine the interconnected characteristics into common factors, and their number is consistent with the number of units in the set.

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