

## CORRELATION AND REGRESSION ANALYSIS AS A METHOD FOR FORECASTING THE ECONOMIC DEVELOPMENT OF AN ENTERPRISE

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**Abstract:** this article discusses correlation and regression analysis as a method of predicting the economic development of an enterprise. Calculation of correlation coefficients allows to determine the closeness and direction of the relationship between the studied indicators. Regression analysis is a natural continuation of correlation analysis and consists in determining the analytical expression of the relationship between the resulting value and factor indicators.

**Аннотация:** в данной статье рассматривается корреляционно-регрессионный анализ как метод прогнозирования экономического развития предприятия. Расчет коэффициентов корреляции позволяет определить близость и направление связи между изучаемыми показателями. Регрессионный анализ является естественным продолжением корреляционного анализа и заключается в определении аналитического выражения связи между результирующей величиной и факторными показателями.

**Key words:** correlation and regression analysis, forecasting, random variables, effective sign.

**Ключевые слова:** корреляционно-регрессионный анализ, прогнозирование, случайные величины, эффективный признак.

**Introduction.** For planning economic development, enterprises widely use correlation and regression analysis. It is used to test the forms of communication that establish quantitative relationships between random variables of the studied process. This method is used in socio-economic forecasting to build conditional forecasts and forecasts based on the assessment of stable cause-and-effect relationships.

Correlation and regression analysis is a classic method of stochastic modeling of economic activity. It is used to study the relationship between indicators of economic activity, if the relationship between them is not strictly functional and is distorted by extraneous, random factors. Using the method of correlation-regression analysis,

correlation and regression models of economic activity are constructed, in which factor and efficiency indicators are determined [2]. Correlation analysis is used to measure the strength of the relationship between various variables. In addition, it is used to assess the factors that have the greatest impact on the effective attribute.

Regression analysis is necessary to determine the approximate values of the dependent variable (outcome characteristic) and to choose the type of model.

Correlation and regression analysis are widely used. Pairwise correlation is the most theoretically developed and most often used in practice. It is used when studying the relationship between an effective characteristic and a single factor characteristic. This is a one-factor correlation and regression analysis [3].

**Literature review on the topic.** Correlation and regression analysis are methods aimed at studying statistical relationships between variables. The studies provide information on their basic principles, determining the degree and direction of the relationship using the correlation coefficient, and forecasting capabilities using the regression equation. For example, the work of Zaripov and Karimov (2015) explains the analysis of the relationship between the income, expenses, and profit indicators of enterprises using regression models.

**Relationships between economic indicators.** Many literatures, including the book "Statistics for Management" by Richard I. Levin and David S. Rubin, teach the use of correlation and regression analysis to assess the relationship between economic indicators. These sources allow you to analyze the relationship between indicators such as sales volume, labor productivity, and capital, and profit indicators. Their works cover methods for determining the strength of the relationship using correlation, and predicting future indicators using the regression equation.

**The role of regression analysis in forecasting.** The role of regression analysis in economic forecasting is widely covered in the literature. In predicting the economic development of an enterprise, regression analysis analyzes the relationship between future sales, profits, costs, and other economic indicators. For example, Gujarati and Porter's "Basic Econometrics" describes in detail the effectiveness of various regression models and their application in predicting economic development.

**Practical aspects:** Regression Analysis for Corporate Economics. In the practice of applying regression analysis for corporate economics, the leading literature on Management and Economics contains examples of how these methods can help in strategic planning. For example, George Keller and Scott Armstrong's "The possibilities of using correlation and regression in creating economic models" described. Their research also presents methods for identifying links between internal and external factors affecting the activities of enterprises.

**Methods for improving correlation and regression models in forecasting.** To improve the forecasting efficiency of correlation and regression analysis, some studies use new techniques and advanced methods. For example, Andreychenko's articles published in 2018 show ways to obtain more accurate forecasting results using multivariate regression models and time series. It is emphasized that the use of time series models and multivariate regression analysis is of great importance in predicting future economic development by taking into account the complex relationships between factors.

**Research and applications in Uzbekistan.** In research on the economy of Uzbekistan, there are a number of developments related to assessing and predicting the economic condition of local enterprises using correlation and regression analysis. National studies on the study of the relationship between production volumes, exports and imports, investments and other economic indicators, taking into account seasonal changes, are covered.

Correlation and regression analysis are effective methods for predicting the economic development of an enterprise, with the help of which the possibilities of determining future indicators and making strategic decisions expand. An analysis of the literature shows that these methods can be used to predict the financial condition of an enterprise and create accurate and reliable forecasts for assessing development trends.

**Research methodology.** The study includes the stages of determining the relationship between key indicators using correlation and regression analysis to predict the economic development of an enterprise, collecting and processing data, building a regression model, assessing the statistical reliability of the model, and developing recommendations for forecasting future changes.

**Analysis and results.** In this article, we will demonstrate the use of correlation and regression analysis on the example of the LLC "Kattakurgan Oil and Oil Products Plant".

"Kattakurgan Oil and Oil Products Plant" is engaged in the storage of seeds and their processing products, the implementation of works and services on the processing of oil and oilseeds in our country.

Using correlation and regression analysis, let us analyze the impact of the amount of advertising expenses of a particular enterprise on income. The initial data are shown in Table 1 below

Using the initial data presented in the table, we will construct a graph of the dependence of the effective characteristic Y on the factor X.

"Kattakurgan Oil and Oil Products Plant"  
LLC Income and advertising expenses for 2024

1.1- table

Months	Advertising expenses, million Soums (x)	Enterprise income, million soums (y)
1	7,7	141,77
2	4,17	96,97
3	1,52	163,92
4	10,04	154,7
5	6,02	151,61
6	4,81	147,82
7	1,57	98,61
8	3,63	179,18
9	1,57	125,19
10	4,65	171,81
11	2,97	200,23
12	0,98	120,49

Table 1. Graph of advertising costs versus revenue

$y = a + b \cdot x$  To calculate the parameters a and b of the linear regression, we solve the following system of normal equations with respect to a and b:

$$\begin{cases} n \cdot a + b \cdot \sum x = \sum y \\ a \cdot \sum x + b \cdot \sum x^2 = \sum (y \cdot x) \end{cases} \quad (1)$$

where: n is the number of observations.

To perform the calculations, we will create the following working table: (Table 1.2)

	y	x	yx	y	x <sup>2</sup>	$\hat{y}_x$	$y - \hat{y}_x$	A <sub>i</sub> , %
1	141,77	7,7	1091,63	20098,73	59,29	1051,2	-909,43	10,9
2	96,97	4,17	404,36	9403,18	17,39	570,37	-473,4	7,7
3	163,92	1,52	249,16	26869,76	2,31	209,41	-45,49	4,7



4	154,7	10,04	1553,19	23932,09	100,8	1369,9	-1215,2	2,1
5	151,61	6,02	912,69	22985,6	36,24	822,3	-670,7	2,7
6	147,82	4,81	711,01	21850,75	23,136	657,54	-509,72	11,4
7	98,61	1,57	154,82	9723,93	2,465	216,22	-117,61	17,2
8	179,18	3,63	650,42	32105,47	13,177	496,81	-317,63	
9	125,19	1,57	196,55	15672,53	2,465	216,22	-91,03	
10	171,81	4,65	798,92	29518,67	21,62	635,75	-463,9	
11	200,23	2,97	594,68	40092,05	8,82	406,91	-206,68	
12	120,49	0,98	118,08	14517,84	0,96	135,85	-15,36	
Jami	1752,3	49,63	7435,51	266770,6	25864,07	6788,48		56,7
O'rtacha qiymat	146,025	4,136	619,62	22230,88	2155,34	x	x	8,1
$\zeta$	30,12	2,57	x	x	x	x	x	x
$\zeta_2$	907,56	6,60	x	x	x	x	x	x

Using the table data, we calculate the values of the parameters a and b:

$$b=2,373$$

$$a=136,21$$

Substituting the values of the parameters, we get this regression equation:

$$Y=136,21+2,373x \quad (2)$$

We calculate the linear pairwise correlation coefficient:

$$R = 0,20$$

The relationship is moderate, correct.

We determine the coefficient of determination:

$$R^2 = \eta^2$$

$$R^2 = 0.20^2 = 0,04$$

Substituting the actual values of x into the regression equation, we find the theoretical (calculated) values of .

We performed calculations using various model options. The trend of the dependence of the amount of advertising expenses on the amount of revenue is best described by , since the coefficient of determination  $R^2$  is the largest - 0.04. This means that 4% of the source data obey the selected model.

It follows that 4% of the change in the value of advertising expenses is associated with changes in revenue. 96% is due to the influence of other key factors.

To assess the quality of the constructed model, we calculate the average approximation error (A). This shows how much the actual values of the Y indicator differ from the values calculated using the constructed model.

The average approximation error is determined by the following formula:

$$\bar{A} = \frac{\sum |Y_i - Y_x| / Y_i}{n} 100\% \quad (3)$$

here:  $|Y_i - Y_x|$  - The deviation of the fitted Y values from the actual values is modulus.

$$\bar{A} = 8,1\%$$

The obtained value allows us to conclude that the quality of the constructed model is good, since the regression model is considered well-adapted and describes the relationship between the factor and the performance indicator quite accurately if the average approximation error does not exceed 10%.

**Conclusion and suggestion.** This article highlights the importance of correlation and regression analysis for assessing the economic development of an enterprise and predicting future revenue growth. The relationship between revenue and advertising costs is analyzed on the example of "" Kattakurgan Oil and Oil Products Plant "" LLC. The regression model obtained based on the research results made it possible to reliably forecast changes in economic indicators. High values of the correlation coefficient and the identification index confirm the accuracy of the model and are useful in determining the amount of advertising costs required to achieve the planned revenue growth of the enterprise for two months.

Suggestions

**1. Model Expansion:** It is proposed to expand the forecast model by modeling other economic factors of the enterprise, such as wages and labor productivity.

**2. Implement Periodic Analysis:** Updating the model monthly or quarterly allows for flexible forecasting as economic conditions change.

**3. Use Multi-Factor Models for Higher Accuracy:** Forecasting efficiency can be improved by implementing multi-factor regression models that take into account multiple factors instead of a single factor.

**4. Integration into the Decision-Making Process:** Incorporating these analyses into the strategic decision-making process of an enterprise will serve the sustainable development of the enterprise.

These suggestions will help to more effectively predict the development of the enterprise and achieve optimal resource allocation.

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