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THEORETICAL FOUNDATIONS OF REGRESSION ANALYSIS IN ECONOMETRICS

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Annotation: This article provides an in-depth analysis of the theoretical foundations of regression analysis in econometrics. Regression analysis is considered an important methodological tool for identifying, evaluating, and forecasting functional and statistical relationships between economic processes. The study theoretically examines simple and multiple regression models, their mathematical expressions, the main assumptions of the classical linear regression model, and parameter estimation methods, particularly the Ordinary Least Squares (OLS) method.

In addition, the article discusses criteria used to evaluate the reliability of regression models, including the coefficient of determination (R^2), t-statistics, the F-test, and the economic interpretation of errors. Problems such as multicollinearity, heteroskedasticity, and autoregression, as well as methods for addressing them, are also analyzed from a scientific perspective.

This research reveals the role and importance of regression analysis in econometrics and substantiates the possibilities of its effective application in economic modeling and decision-making processes.

Keywords: regression analysis, econometrics, linear regression model, multiple regression, Ordinary Least Squares (OLS), coefficient of determination (R^2), t-statistics, F-test, multicollinearity, heteroskedasticity, autoregression, statistical estimation, econometric modeling, forecasting.

In the analysis and forecasting of modern economic systems, the importance of mathematical and statistical methods is continuously increasing. In particular, the need to identify relationships between economic indicators and to evaluate them on a scientific basis has contributed to the development of econometrics. Econometrics integrates economic theory, mathematics, and statistics, allowing real economic processes to be modeled and analyzed.

From this perspective, regression analysis is considered one of the most important and widely used methods in econometrics. It allows researchers to identify causal relationships between economic variables, quantitatively assess the influence of explanatory factors on dependent variables, and forecast future trends. Regression models can range from simple linear forms to complex multiple-factor systems.

The purpose of this article is to study the theoretical foundations of regression analysis in econometrics and to provide a scientific explanation of its main concepts, models, and estimation methods. In addition, the role and practical significance of regression analysis in economic research are also discussed.

In econometrics, regression analysis serves as an important methodological tool for identifying and analyzing quantitative relationships between economic processes. This method allows researchers to determine the functional relationship between a dependent variable and independent factors influencing it, expressing these relationships in the form of mathematical models. Regression analysis is widely used for in-depth analysis of economic phenomena, identification of causal relationships, and the development of scientifically based forecasts.

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The simple linear regression model is the most basic form of regression analysis and describes the relationship between two variables. In this model, the influence of one independent variable on a dependent variable is evaluated. One of the key parameters of the model, the regression coefficient, indicates the average change in the dependent variable resulting from a one-unit change in the independent variable.

However, real economic processes are usually influenced by multiple factors. Therefore, multiple regression models are often applied. These models include several independent variables, allowing researchers to determine the individual effect of each factor on the dependent variable. As a result, multiple regression provides a more accurate representation of complex economic processes.

To estimate the parameters of regression models, the most widely used method is the **Ordinary Least Squares (OLS)** technique. The essence of this method is to minimize the sum of the squared differences between observed actual values and theoretical values predicted by the model. The estimates obtained using this approach are statistically efficient and reliable, which explains their wide application in empirical research.

For regression analysis to produce reliable results, several assumptions of the **classical linear regression model** must be satisfied. In particular, the expected value of the error term should be equal to zero, the variance of the errors should remain constant, the errors should not be correlated with each other, and there should be no strong linear relationship between independent variables. Violation of these assumptions negatively affects the reliability and validity of the model results.

The quality of a regression model is evaluated using several statistical indicators, such as the coefficient of determination, t-statistics, and the F-test. The coefficient of determination shows the extent to which the model explains the variation in the dependent variable. The t-statistic is used to determine the statistical significance of individual parameters, while the F-test evaluates the overall significance of the regression model.

At the same time, several problems may arise in regression analysis. Multicollinearity occurs when strong correlations exist among independent variables, which can lead to inaccurate parameter estimates. Heteroskedasticity refers to the situation where the variance of the error term is not constant, reducing the efficiency of estimation results. Autocorrelation mainly occurs when analyzing time series data and indicates the presence of correlation among error terms.

To address these problems, econometricians apply special diagnostic tests and correction methods. These include statistical tests for detecting multicollinearity, heteroskedasticity, and autocorrelation, as well as various transformation techniques and advanced econometric modeling approaches.

Overall, regression analysis plays a significant role in econometrics for modeling economic processes, analyzing relationships between variables, and forecasting future development trends. It provides a scientific basis for economic decision-making.

This article examined the theoretical foundations of regression analysis in econometrics in detail. Regression analysis allows researchers to identify relationships between economic variables, evaluate their influence, and forecast future trends. Simple and multiple regression models, the Ordinary Least Squares method, the coefficient of determination, t-statistics, and the F-test are important tools for ensuring the accuracy and reliability of econometric models.

In addition, the article discussed major problems that may arise in regression analysis, including multicollinearity, heteroskedasticity, and autoregression. Detecting and correcting these problems improves the reliability of economic modeling results.

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Overall, regression analysis is important not only from a theoretical perspective but also for practical economic research. It contributes significantly to improving the quality of economic decision-making and forecasting processes.

Recommendations:

1. Greater attention should be given to **multiple regression models** in order to reflect the complexity of real economic processes.
2. Reliable and updated data sources should be used to improve the quality of econometric models and minimize statistical errors.
3. Special diagnostic tests and transformation methods should be applied to detect and correct problems such as **multicollinearity, heteroskedasticity, and autocorrelation**.
4. Regression analysis should be applied more widely in **macro- and microeconomic decision-making**, including the analysis of investment, employment, and pricing policies.
5. In the context of the modern digital economy, regression analysis should be integrated with **digital and computerized methods**, such as statistical software packages and machine learning techniques, in order to increase model accuracy and analytical efficiency.

References:

1. Raxmonqulova, N. O. (2025). THE IMPORTANCE OF EFFICIENT USE OF RESOURCES. *Shokh Articles Library*, *1*(2).
2. Qudratova, G. M. (2025). METHODOLOGY FOR ASSESSING THE COMPETITIVENESS OF EDUCATIONAL SERVICES IN HIGHER EDUCATION INSTITUTIONS. *SHOKH LIBRARY*, *1*(13).
3. Sodiqova, N. T. (2025). WAYS TO ENHANCE COMPANY COMPETITIVENESS. *Ethiopian International Journal of Multidisciplinary Research*, *12*(01), 145-150.
4. Supievna, B. M. (2025). FOREIGN EXPERIENCE IN ECONOMIC DIVERSIFICATION. *SHOKH LIBRARY*.
5. Azimov, B. F. (2026). STRATEGIC DIRECTIONS FOR ORGANIZATIONAL–INSTITUTIONAL AND FINANCIAL–ECONOMIC TRANSFORMATION OF THE NATIONAL INNOVATION SYSTEM: EVIDENCE FROM UZBEKISTAN. *Shokh Articles Library*, *1*(1), 1350-1354.
6. Shadiyev, A. X. (2025). A MODERN APPROACH TO THE METHODOLOGY OF TEACHING ECONOMIC DISCIPLINES. *Ethiopian International Journal of Multidisciplinary Research*, *12*(01), 134-139.
7. Bahodirovich, K. B. (2026). LONGEVITY DERIVATIVES: CONCEPT AND PRINCIPLES. *Shokh Articles Library*, *1*(1).
8. Jumayeva, Z. B. (2025). MARKETING STRATEGY AND ITS IMPACT ON EXPORT-ORIENTED ENTERPRISE PERFORMANCE. *SHOKH LIBRARY*, *1*(13).
9. Jumayeva, Z. Q. (2025). FOREIGN MODELS OF FINANCING INNOVATION ACTIVITIES AND THEIR APPLICATION IN UZBEKISTAN. *SHOKH LIBRARY*, *1*(13).
10. Abidovna, A. S. (2025). Issues of export of services in higher education institutions: the case of Bukhara region. *Multidisciplinary Journal of Science and Technology*, *5*(6), 1916-1922.
11. Hakimovich, T. M. (2026). INDUSTRY STRUCTURE OF THE BUKHARA REGION INDUSTRY AND PRIORITY DIRECTIONS FOR ITS IMPROVEMENT. *Shokh Articles Library*, *1*(1), 429-433.

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Journal: https://www.academicpublishers.org/journals/index.php/ijai

12. Naimova, N. A. (2026). THE EVOLUTION OF GREEN ECONOMY AND SUSTAINABLE DEVELOPMENT CONCEPTS. *Shokh Articles Library*, *1*(1), 1051-1054.
13. Bobojonova, M. J. (2026). THE PRACTICE OF ATTRACTING INVESTMENTS IN GREEN TECHNOLOGIES: FOREIGN EXPERIENCE AND IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT. *Shokh Articles Library*, *1*(1), 1023-1026.
14. Ibodulloyevich, I. E. (2025). DEVELOPMENT DIRECTIONS OF INNOVATIVE ENTREPRENEURSHIP IN UZBEKISTAN. *SHOKH LIBRARY*.
15. Djurayeva, M. S. (2026). THE ROLE OF DIGITAL TECHNOLOGIES IN EMPLOYING YOUNG SPECIALISTS. *Shokh Articles Library*, *1*(1), 925-927.
16. Ibragimov, A. T. (2026). THE INTERRELATIONSHIP BETWEEN INVESTMENT AND INNOVATION AND ITS IMPACT ON ECONOMIC GROWTH. *Shokh Articles Library*, *1*(1), 932-934.
17. Raximova, L. A. (2025). FOREIGN DIRECT INVESTMENT AND REGIONAL ECONOMIC DEVELOPMENT: OPPORTUNITIES AND CHALLENGES. *SHOKH LIBRARY*.
18. Umarova, H. U. (2026). THE INTERACTION OF STATE AND MARKET MECHANISMS IN THE FORMATION OF AN INNOVATIVE ECONOMY. *Shokh Articles Library*, *1*(1), 1016-1019.
19. Gafarova D.T. DEVELOPMENT OF THE SERVICES SECTOR IN THE REPUBLIC OF UZBEKISTAN: INNOVATIVE SERVICES, INTEGRATION WITH PRODUCTION, AND EXPORT OF SERVICES. (2026). *International Journal of Artificial Intelligence*, *6*(01), 1027-1031. https://www.academicpublishers.org/journals/index.php/ijai/article/view/10073
20. Jurayev, J. N. (2026). THE NECESSITY AND RELEVANCE OF STUDYING SECTORAL ECONOMICS: CURRENT PROBLEMS AND SOLUTIONS. *Shokh Articles Library*, *1*(1), 1020-1022.
21. Aslanova, D. F. (2025). DEVELOPMENT FACTORS AND PROBLEMS OF ECOTOURISM: A SCIENTIFIC ANALYSIS. *SHOKH LIBRARY*, *1*(13).
22. Djurayevna, Y. N. (2026). THE ROLE OF LARGE INDUSTRIAL ENTERPRISES IN THE DEVELOPMENT OF BUKHARA REGION BASED ON THE GROWTH POLE (POLARIZATION) THEORY. *Shokh Articles Library*, *1*(1), 1035-1037.
23. Khamzayevna, R. S. (2026). MECHANISMS FOR IMPLEMENTING INNOVATIONS BASED ON PUBLIC–PRIVATE PARTNERSHIPS. *Shokh Articles Library*, *1*(1), 938-940.
24. Tolibjonovna, B. N. (2026). REGIONAL INDUSTRIAL ZONES AND INVESTMENT ATTRACTIVENESS: AN EMPIRICAL STUDY WITH POLICY LESSONS FROM UZBEKISTAN. *Shokh Articles Library*, *1*(1), 935-937.
25. Raxmatullayevich, J. B. (2026). THE ROLE OF BANKING CRISES IN ECONOMIC RECESSION. *Shokh Articles Library*, *1*(1).
26. Ismatov F.I. “PROSPECTS FOR THE DEVELOPMENT OF TRANSPORT AND LOGISTICS CENTERS IN THE REGIONAL ECONOMY” (2025) *Journal of Multidisciplinary Sciences and Innovations*, 4(11), pp. 2308–2312. doi:10.55640/.
27. Zokirovich, T. Z. (2025). INTELLECTUAL POTENTIAL AND ITS DEVELOPMENT IN THE CONTEXT OF ECONOMIC GROWTH. *SHOKH LIBRARY*, *1*(13).