

Educational Institution  
“Belarus State Economic University”

**APPROVED**

Rector of Educational Institution  
«Belarus State Economic University»

  
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24.12 2025.  
Reg. No 6840-25 /academic

**METHODOLOGY OF QUANTITATIVE ANALYSIS  
IN ECONOMIC RESEARCH**

The curriculum of the educational institution for the specialties  
7-06-0311-01 «Economics», 7-06-0311-02 «World Economics»,  
7-06-0411-01 «Accounting, Analysis and Audit»,  
7-06-0411-02 «Finance, Taxation and Credit»,  
7-06-0412-04 «Marketing»

The curriculum is based on the General/In-depth Higher Education Standard (Education Standards) OCBO 7-06-0311-01-2023, 7-06-0311-02-2023, 7-06-0411-01-2023, 7-06-0411-02-2023, 7-06-0413-01-2023 and education plans for the specialties «Economics», «World economics», «Accounting, Analysis and Audit», «Finance, Taxation and Credit», «Marketing».

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**RECOMMENDED FOR APPROVAL:**

Mathematical Methods in Economy Department of the educational institution “Belarus State Economic University” (Protocol №. 5 dated 21.11, 2025);

Statistics Department of the educational institution “Belarus State Economic University” (Protocol №. 3, dated October 9<sup>th</sup>, 2025);

Scientific and Methodological Council of the educational institution “Belarus State Economic University”  
(Protocol №. 3 dated 23.12.2025)

## EXPLANATORY NOTE

The curriculum for the course “Methodology of Quantitative Analysis in Economic Research” is aimed at developing skills in using quantitative methods to make management decisions based on data analysis to identify existing relationships and patterns and determine possible development options for the economic system.

The aim of this course is to develop systematized knowledge and practical skills in applying quantitative analysis to solve applied problems in economics and management, as well as to conduct independent scientific research.

Achieving this objective requires addressing the following **tasks**:

- study of the fundamental tenets of systems analysis theory in economics;
- introduction to key concepts and methods of quantitative analysis;
- developing skills and abilities in applying quantitative methods of analysis and forecasting in economic research;
- mastering tools for collecting, processing, and visualizing data, including the use of analysis software;
- study of models used in economics and their quantitative interpretation;
- developing skills for critically evaluating the results of quantitative analysis and interpreting them in the context of economic problems.

The following **competencies** are developed by studying the course “Methodology of Quantitative Analysis in Economic Research”:

**universal:**

solving research and innovation problems using information and communication technologies;

**specialized:**

creating, processing, and analyzing databases to solve practical business problems under conditions of uncertainty.

After studying this course, the master’s student should **know**:

- the fundamental principles, key concepts, and methods of systems analysis in economics, which form the basis for the development and use of quantitative calculation methods;
- the basics of using software for quantitative data analysis;
- quantitative methods and models used to analyze economic data;

**Be able to:**

- justify the choice of quantitative methods of analysis and forecasting and use them to solve various classes of economic problems.

**Possess skills to:**

- perform calculations for various classes of economic problems using the computational capabilities of MS Excel;
- use the methodology of applying quantitative methods to solve applied problems;
- use the results to develop and make management decisions.

As part of the educational process in this academic discipline, the master’s student must acquire not only theoretical and practical knowledge, skills, and abilities in the specialty, but also develop their value-based, personal, and spiritual potential, and develop the qualities of a patriot and citizen prepared to actively participate in the economic, industrial, socio-cultural, and public life of the country.

The “Methodology of Quantitative Analysis in Economic Research” course in the Economics major is part of the “Innovative Development,” “Statistical and Instrumental Methods in Economics,” “Business Analysis,” and “Economic Decision-Making Mechanisms” modules. For the “Global Economy” major, it is part of the “Research Methods of Analysis in Economics” module. For the “Accounting, Analysis, and Audit” major, it is part of the “Accounting and Analytical Tools in Economics” module.

For the “Finance, Taxation, and Credit” major, it is part of the “Finance and Investment in the Global Economy” and “Innovations in Banking” modules of the educational institution component. The following academic disciplines are required for studying this course: “Microeconomic Analysis and Policy” and “Macroeconomic Analysis and Policy.” The academic disciplines for which this course is important are: “Econometrics of Time Series of Financial Assets”, “Nonparametric Statistics”, “Time Series Models”.

The curriculum is for master students studying in the English language.

The curriculum is offered full-time.

According to the university’s curriculum, the following is allocated for the study of this discipline:

Total number of class hours – 102.

For full-time study:

Classroom hours – 36 hours, including 18 hours of lectures and 18 hours of seminars (practical).

Workload – 3 credits. Classroom time distribution by courses and semesters:

Semester 1 – 18 hours of lectures, 18 hours of seminars (practical).

Independent student work – 66 hours.

Classroom time distribution by courses and semesters:

Introductory session – 4 hours of lectures;

Session 1 – 4 hours of seminar (practical) classes.

Independent student work – 94 hours.

Workload – 3 credits.

Midterm assessment – credit.

## COURSE CONTENT

### **Introduction**

The concept and meaning of the terms “method,” “methodology,” and “technique.” Quantitative methods of analysis and forecasting in economic research, their overview and classification. The main stages of quantitative analysis in economic research. A systems approach to quantitative research of economic processes.

### **Topic 1. Methods of data organization**

Classification of data types. Quantitative data: discrete and continuous. Qualitative data: ordinal and nominal. Data presentation methods: tables and graphs. Basic rules for the presentation of data. Frequency table and histogram. Discriminative statistics. Measures of the central tendency: average value, mode, median. Problems of using measures of the central tendency. Quartiles and percentiles. The concept of variation (variability) Absolute and relative indicators of variation, their advantages, disadvantages. Indicators of asymmetry and excess. Random variables: discrete and continuous. Distribution forms of discrete and continuous random variables. The normal distribution of a continuous random variable. Normal distribution parameters. The use of various types of distribution in the analysis of processes in business. Selection of the distribution law according to available data.

### **Topic 2. Methodology of sample surveys**

Selective observation: concept, essence, advantages and disadvantages. General and sample aggregate. The formation of a sample for decision-making in business. Probabilistic and improbability samples. Types and methods of selecting units in a sample. Estimation of the parameters of the general population (average / share) based on the results of a sample survey. Confidence probability. Significance level Sampling error. Confidence interval for the average / share in the population. Determination of the initial sample size. Testing statistical hypotheses. The concept and formulation of the statistical hypothesis. Zero and alternative hypotheses. Choosing the appropriate hypothesis test method (statistical criterion). Bilateral and unilateral hypothesis testing (bilateral and unilateral tests). Stages of testing statistical hypotheses. Testing statistical hypotheses regarding average values: Student t-test for independent samples, for paired (dependent) samples, one-sample student t-test. Interpretation of hypothesis test results. Errors of the first and second kind.

### **Topic 3. Correlation and regression**

The concept of correlation. Graphic method for evaluating the connection (dispersion diagrams). Correlation coefficient: calculation formula and interpretation of the value. Types of relationships between phenomena and processes. Linear and nonlinear dependencies. The essence of regression analysis. Pairwise linear regression model. Checking the quality of the regression equation. Hypothesis testing regarding the

coefficients of the linear regression equation. T-student test. Interpretation of regression coefficients. Checking the overall quality of the regression equation. Determination coefficient R<sup>2</sup>. Fisher F-test. Multiple Regression Model Estimation of the quality of the multiple regression equation. The concept of multicollinearity. Identification of multicollinearity and methods for its elimination. Multiple correlation coefficient and multiple determination coefficient. Prediction based on regression models. Dummy variables Use of correlation analysis to assess the tightness of communication in time series. Models with dichotomous variables. The need to use qualitative dummy variables in regression analysis. Ways to introduce dummy variables into a regression model. Check regression homogeneity of the sample (Chow criterion). Regression models with quantitative and qualitative variables (ANCOVA models). Nonparametric indicators of measuring the tightness of communication (Spearman rank correlation coefficient, Kendal rank correlation coefficient, association coefficient, contingency coefficient, Pearson mutual conjugation coefficient, Fechner coefficient).

#### **Topic 4. Time series analysis and forecasting**

Approaches to the analysis of time series. The basic components of a time series. Types of time series for the presence of individual basic components. Methods for evaluating time series components. A time series model that includes trend and seasonality. Methods for identifying the main trend (trend). Estimation of trend equation parameters. Autocorrelation. Methods for detecting, measuring and eliminating autocorrelation. Seasonality index and methods for its calculation. Seasonal adjustment. Time Series Forecasting Methods. Forecasting time series with trend and seasonal components. Building ARIMA time series



## INFORMATORY-METHODOLOGICAL PART

### Basic coursebooks

1. Damodar, N. Basic econometrics : Student solutions manual for use with Basic econometrics [Electronic resource] / N. Damodar // PDF Drive. – Mode of access : <https://www.pdfdrive.com/basic-econometrics-student-solutions-manual-for-use-with-basic-econometrics-e184135351.html>. – Date of access : 02.05.2025.
2. Белько, И. В. Количественные методы анализа в АПК [Текст]: учеб. пособие для студентов второй ступени (магистратура) учреждений высшего образования по специальности «Экономика (магистратура)» / И. В. Белько [и др.]; Минсельхозпрод РБ, УО «БГАТУ». – Минск : БГАТУ, 2020. – 232 с.
3. Хацкевич, Г. А. Эконометрика: учебник / Г. А. Хацкевич, Т. В. Русилко. – Минск : РИВШ, 2021. – 452 с.

### Supplementary Coursebooks

1. Dougherty, C. Introduction to Econometrics (4<sup>th</sup> edition) [Electronic resource] / C. Dougherty // Academia.edu. – 2011. – Mode of access : [https://www.academia.edu/33062577/Dougherty\\_Intro\\_to\\_Econometrics\\_4th\\_ed\\_small/](https://www.academia.edu/33062577/Dougherty_Intro_to_Econometrics_4th_ed_small/). – Date of access : 07.05.2025.
2. Greene, W. H. Econometric Analysis [Electronic resource] / W. H. Greene // PDF Drive. – 2018. – Mode of access: <https://www.pdfdrive.com/econometric-analysis-e187763948.html>. – Date of access : 13.05.2025.
3. Wooldridge, J. Introductory econometrics. A modern approach [Electronic resource] / J. M. Wooldridge // PGF Drive. – 2016. – Mode of access : <https://www.pdfdrive.com/introductory-econometrics-a-modern-approach-e158283770.html>. – Date of access : 04.05.2025.
4. Белько, И. В. Эконометрика. Практикум : учеб. пособие для студентов вузов по экономическим специальностям / И. В. Белько, Е. А. Криштапович. – Минск : Издательство Гревцова, 2011. – 223 с.
5. Валентинов, В. А. Эконометрика : учебник для студентов вузов, обучающихся по специальности «Математические методы в экономике» / В. А. Валентинов. – 2-е изд. – Москва : Дашков и К, 2010. – 446 с.
6. Доугерти, К. Введение в эконометрику = Introduction to econometrics : учебник для студентов экономических специальностей вузов / К. Доугерти; [пер. с англ.: О.О. Замков, Е.Н. Лукаш, О.Ю. Шибалкин]. – Москва : ИНФРА-М, 2010. – 466 с.
7. Дэвидсон, Р. Теория и методы эконометрики: учебник для студентов, обучающихся по эконом. направлениям и специальностям, а также для студентов бакалавриата, магистратуры, аспирантов,

преподавателей эконом. фак. вузов / Рассел Дэвидсон, Джеймс Г. Мак-Киннон ; пер. с англ. под науч. ред. Е. И. Андреевой ; Рос. акад. нар. хоз-ва и гос. службы при Президенте Рос. Федерации. – Москва : Издат. дом "Дело" РАНХиГС, 2018. – 936 с.

8. Ежеманская, С. Н. Эконометрика : учеб. пособие / С. Н. Ежеманская, Е. В. Бекушева, Н. Н. Джиева. – Красноярск : Сибирский федеральный университет, 2021. – 104 с.

9. Картаев, Ф. Введение в эконометрику : учебник / Ф. Картаев. – М. : Экономический факультет МГУ им. М. В. Ломоносова, 2019. – 472 с.

10. Новиков, А. И. Эконометрика : учеб. пособие для студентов, обучающихся по направлению 521600 «Экономика» и экономическим специальностям / А. И. Новиков. – 2-е изд. испр. и доп. – Москва : ИНФРА-М, 2011. – 144 с.

11. Рожков И. М., Эконометрика. Продвинутый курс для начинающих исследователей : учеб. пособие / И. М. Рожков, И. А. Ларионова, Н. А. Исаева. – Москва : МИСиС, 2020. – 268 с.

12. Харин, Ю. С. Эконометрическое моделирование : учеб. пособие / Ю. С. Харин, В. И. Малюгин, А. Ю. Харин. – Мн. : БГУ, 2003. – 313 с.

13. Хацкевич, Г. А. Эконометрика : УМК для студ. эконом. спец. / Г. А. Хацкевич, А. Б. Гедранович. – Минск : Изд-во МИУ, 2007. – 272 с.

## **List of questions for the credit**

1. Classification of quantitative methods of analysis and forecasting in economic research.
2. Classification of data types: quantitative and qualitative data.
3. Basic methods of data presentation: tables and graphs.
4. Measures of central tendency: mean, mode, median.
5. The concept of variation (variability). Absolute and relative variation indicators, their advantages and disadvantages.
6. Indicators of asymmetry and kurtosis.
7. Distribution forms of discrete and continuous random variables.
8. Normal distribution of a continuous random variable.
9. Representation of the original data system as a matrix of pairwise comparisons of features and its content.
10. Content and properties of an ideal matrix of pairwise comparisons of features.
11. Determining the degree of inconsistency of a matrix of pairwise comparisons of features.
12. Approximate methods for finding the priority vector of a matrix of pairwise comparisons of features.
13. Algorithm for finding the maximum eigenvalue of a pairwise comparison matrix based on the determined eigenvector.
14. The maximum eigenvalue of an inversely symmetric matrix and its use in measuring the expert judgment consistency index.
15. Construction of an ideal pairwise comparison matrix based on the known weights of the compared features.
16. The method of pairwise comparisons of features when establishing their significance or decision-making priority.
17. Prerequisites and rules for constructing a hierarchical comparison structure. Pairwise comparison matrices of criteria, actions, and results.
18. Using linear algebra methods to establish the main quantitative characteristics of feature priority in their hierarchical structure.
19. Using a psychological scale of nine-point comparison scores when constructing a pairwise comparison matrix of features.
20. Particular and general (integrated) economic indicators. Methods for forming integrated indicators based on a set of particular indicators.
21. Standardization of individual indicators in a data table in quantitative analysis of integrated economic indicators.
22. Polar coordinate system (radar diagram) for graphical interpretation of comparative assessment of objects based on integrated indicators.
23. Rating assessment of economic entities based on general indicators.
24. Harrington's desirability function, its interpretation, and use in quantitative analysis to identify integral indicators.
25. Identifying integral (general) indicators using the area method.
26. Sampling: concept, essence, advantages, and disadvantages.

27. Probability and non-probability samples. Types and methods of selecting units for a sample population.
28. Estimating population parameters (mean/proportion) based on sample survey results.
29. Testing statistical hypotheses.
30. Testing statistical hypotheses regarding mean values: Student's t-test for independent samples, for paired (dependent) samples, and the one-sample Student's t-test.
31. The concept of correlation. Graphical method for assessing relationships (scatterplots). Correlation coefficient: calculation formula and interpretation of the value.
31. Content of econometric methods and models of analysis in economic research.
32. Types of relationships between phenomena and processes. The essence of regression analysis.
33. The paired linear regression model: construction algorithm, statistical and economic analysis, point and interval forecasting.
34. Calculation of the parameters of the multiple linear regression model and their economic interpretation.
35. Conducting point and interval forecasting of the analyzed economic indicators within the classical linear multiple regression model.
36. Construction of regression equations with dummy variables and their economic interpretation.
37. A class of economic problems solved within the framework of nonlinear regression models. Economic interpretation of nonlinear relationships.
38. Nonparametric indicators for measuring the strength of a relationship (Spearman's rank correlation coefficient, Kendall's concordance coefficient, association coefficient, contingency coefficient, Pearson's contingency coefficient, Fechner coefficient).
39. The concept and types of time series. Basic components of a time series.
40. Methods for estimating time series components. Trend-seasonal time series models.
41. Methods for identifying the main trend.
42. Estimating the parameters of the trend equation.
43. Seasonality index and methods for its calculation. Seasonality adjustment.
44. Time series forecasting methods.
45. Forecasting time series with trend and seasonal components.
46. Construction of ARIMA time series models and their use for forecasting economic indicators.
47. The main purpose and algorithm for using the quality function structuring (QFD) method.
48. Formation of a QFD matrix and interpretation of its elements.
49. Calculating the absolute and relative importance of product technical characteristics based on the QFD matrix.

50. Determining the highest priority strategies in a company's management system using the QFD method.

### **Organization of the independent study for master students**

Independent study for master students is an important step in acquiring competencies in the academic discipline.

Full-time students are allocated 66 hours of independent work, while part-time students are allocated 94 hours.

Students' independent work includes all topics covered in the "Course Content" section.

The following forms of independent work are used in the course:

- independent work in the form of solving individual problems in the classroom during practical classes under the supervision of the instructor, in accordance with the class schedule;

- in-depth study of sections, topics, individual questions, and concepts;

- preparation for seminars;

- working with educational, reference, analytical and other literature and materials;

- preparation for midterm assessment.

### **Checking the acquired knowledge**

Assessment of the quality of knowledge acquisition is carried out through ongoing and midterm assessments.

*Ongoing assessment* activities are conducted throughout the semester and include the following forms of monitoring

express - questionnaire during classes

studying tasks

other means

Current assessments for each academic discipline are conducted at least three times per semester.

The results of the current assessments for a semester are assessed as "pass" or "fail" and are reflected in the current assessment report for that discipline.

Requirements for students to take midterm assessments.

Students are admitted to midterm assessments for a given course subject to successful completion of the current assessment (current monitoring activities) for the course covered by the current semester's curriculum.

Midterm assessments are held as a credit.

### **Methodic of grading for the discipline**

In accordance with the Regulation on the rating system for assessing the knowledge, skills and abilities of BSEU students.

**PROTOCOL OF THE CURRICULUM COORDINATION  
WITH OTHER ACADEMIC DISCIPLINES OF THE SPECIALTY**

Name of the discipline that requires coordination	Name of the department	Proposals for changes in the curriculum content of a higher education institution on the academic discipline	Decision taken by the department that developed the curriculum (indicating the date and number of the protocol)
1	2	3	4

ADDITIONS AND CHANGES TO THE CURRICULUM ON THE  
DISCIPLINE «METHODODOLOGY OF QUANTITATIVE ANALYSIS IN  
ECONOMIC RESEARCH»,

(Registration \_\_\_ dated \_\_\_\_ . \_\_\_\_ . \_\_\_\_ )  
for \_\_\_\_ / \_\_\_\_ academic year

№	Additions and changes	Explanatory notes

The curriculum was revised and approved at the meeting of the Department  
of Statistics

(Prot. N\_\_ dated \_\_\_\_\_ 20\_\_)

Head of Department \_\_\_\_\_

S.Y. Vysotsky

APPROVED

Dean of the Faculty of Digital Economy \_\_\_\_\_

S.V. Majorovskaya