

Belarusian State Economic University

APPROVE

Belarusian State Economic University  
Rector



V. Yu. Shutilin

“ 22 ” 11 2019

Registration № УД-4187-19

## QUANTITATIVE METHODS OF ANALYSIS IN BUSINESS

The higher education curriculum (training program)  
on an academic discipline

for the specialties 1-25 80 10 “Statistics and analysis”, 1-25 80 02 “World economy”, 1-25 80 03 “Finance, taxation and credit”, 1-25 80 05 “Accounting, analysis and audit”, 1-25 80 07 “Commodity research and examination of goods”, 1-25 80 09 “Commerce”, 1-26 80 03 “Marketing”, 1-26 80 06 “Logistics”

## **COMPILERS:**

*Agabekova N.V.*, head of the Statistics Department of the educational institution “Belarusian State Economic University”, Doctor of Economics;

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## **REVIEWERS:**

*Bondarenko N.N.*, ass. prof. of the Finance and Real Estate Management Department of educational institution “Institute of Business (BSU)”, Candidate of Economics;

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## **RECOMMENED FOR APPROVAL:**

Statistics Department of the educational institution “Belarusian State Economic University”  
(Protocol № 11 from May 16, 2019)

Scientific and methodological Council of the educational institution “Belarusian State Economic University”  
(Protocol № 2 from 20.11. 2019).

## EXPLANATORY NOTE

The process of development of the information society puts forward new requirements for business entities. In modern conditions, the reasonable adoption of managerial decisions involves a preliminary quantitative analysis of the data to identify the existing relationships, patterns, assess the factors that led to this state of affairs, as well as determine possible options for the development of events in the future. This kind of analysis requires the use of statistical tools and often involves complex mathematical calculations. Thus, modern managers and specialist managers at various levels should have certain skills of statistical analysis, which will allow them to extract from the available data the necessary information for making logical and reasoned management decisions in business. In these conditions, the use of software products, and in particular, the Excel computer program, which is a component of the office suite of Microsoft Office applications, installed everywhere, will allow you to quickly and efficiently conduct comprehensive data analysis to ensure decision-making in business.

The purpose of teaching the discipline "Quantitative Methods of Analysis in Business": the formation of practical skills in data analysis using statistical tools in Excel to ensure informed decisions in business in the face of uncertainty.

The objectives of teaching the discipline "Quantitative methods of analysis in business":

- the formation of knowledge about the place and role of quantitative data analysis methods in the process of making managerial decisions;
- familiarization with the main statistical (quantitative) methods of data analysis;
- sequential development of data processing procedures in a computer program Excel.

As a result of studying the discipline "Quantitative methods of analysis in business" the following competencies are formed:  
SC-2. Independently study new methods of economic design, research, production organization.

SC-4. To be able to create, process and analyze databases to solve practical business problems in the face of uncertainty.

As a result of studying the discipline, undergraduates *should know*: main methods of quantitative analysis used in the framework of managerial decision-making in business.

***should be able to:***

- conduct a preliminary analysis of the data on the basis of summary statistical tables and diagrams, the values of indicators of descriptive statistics and variations, as well as the characteristics of their distribution;
- use the results of sample surveys to justify the adoption of managerial decisions in business;
- identify the relationship between the main economic indicators;
- conduct a regression analysis of real data with subsequent analysis of the quality of the results;
- to carry out forecasting of time series taking into account their features (the presence of

individual components of the time series).

***should possess:***

skills of quantitative data analysis using statistical tools based on the computer program Excel.

102 hours are allocated for the study of a discipline in full-time education, including classroom 36 hours, of which 18 hours are lectures and 18 hours are laboratory classes. In extramural studies - 8 class hours, including 4 hours of lectures and 4 hours of laboratory classes. The distribution of classroom hours by topic is presented in the educational and methodological maps of the curriculum.

The form of current control - credit.

The structure of the program and the methodology for teaching the discipline take into account the new results of economic research and the latest achievements in the field of pedagogy and information technology, orienting students to the acquisition of relevant professional competencies.

# **CONTENT OF EDUCATIONAL MATERIAL**

## **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  $R^2$ . 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 models.



Methodical cart for the academic discipline «**Quantitative methods of analysis in business**»  
for part-time education

Number of topic	Name of section, topic	The number of classroom hours							else	The form of knowledge control
		lectures	practical classes	seminars	laboratory classes	Number of hours CAW				
						L	Pr	Lab		
1	2	3	4	5	6	7	8	9	10	11
1	Methods of data organization	1			-				[1,2,3 ch. 5, ch. 12]	Laboratory test №1
2	Methodology of sample surveys	1			-				[1,2,3 ch. 7, 4,5]	Laboratory test №2
3	Correlation and regression	1			2				[1,2,3 ch. 9, 4,5]	Laboratory test №3
4	Time series analysis and forecasting	1			2				[1,2,3 ch. 10, 4,5]	Laboratory test №4
	<b>Total hours</b>	<b>4</b>			<b>4</b>					<b>Credit</b>



## **INFORMATION - METHODOICAL PART**

### **Guidelines for the organization of independent work of students in the discipline "Quantitative methods of analysis in business"**

An important step in mastering the knowledge of a discipline is the independent work of students. We recommend a time budget for independent work on average 2 hours for a 2-hour classroom lesson.

The main areas of independent work of students are:

- initially a detailed familiarization with the curriculum;
- familiarization with the list of recommended literature on the discipline as a whole and its sections, its presence in the library and other available sources, the study of the necessary literature on the topic, the selection of additional literature;
- study and expansion of the lecture material of the teacher due to special literature, consultations;
- preparation for laboratory studies according to specially developed plans with the study of special statistical packages of applied programs;
- preparation for the implementation of diagnostic forms of control (survey, tests, tests, etc.);
- preparation for the credit.

## References

### 1. Main:

1. The theory of statistics with elements of econometrics: a textbook for academic undergraduate studies: a textbook for students of higher educational institutions studying in economic areas and specialties. In 2 vol. Vol. 2 / V.V. Kovalev [and others]; ed. by V.V. Kovalev; Saint-Petersburg SU. – M.:Urait, 2015. – 347 p.

2. Econometrics: a textbook for students of higher educational institutions studying in economic areas and specialties / [I.I. Eliseeva and others]; ed. by I.I. Eliseeva; Saint-Petersburg SEU – M.: Urait, 2017. – 449 p.

3. Theory of statistics: textbook /L.I. Karpenko [and others]; ed. by L.I. Karpenko. – Minsk: BSEU. – 591 p.

4. Kosorukov, O.A. Methods of quantitative analysis in business: textbook / O.A. Kosorukov – M.: Infra-M, 2005. – 368 p.

5. Makarova, N.V. Statistics in Excel / N.V. Makarova, V.Ya. Trofimetz. – M.: Finances and Statistics, 2002. – 368 p.

### 2. Additional:

6. Borovikov, V. Statistica. Art of data analysis with PC: for professionals. / V. Borovikov. – S. Pb. : Piter. –2003. – 443 p.

7. Nasledov, A. SPSS-19: professional statistical data analysis. / A. Nasledov. – S. Pb. : Piter. –2011. – 400 p.

8. Aivazian, S.A. Multidimensional statistical methods. Practice book: textbook / S.A. Aivazian, V.S. Mkhitarian. – M.: UNITI, 1998. – 1022 p.

9. Soshnikova, L.A. Multidimensional statistical methods. Practice book: textbook / L.A. Soshnikova. – Minsk : BSEU, 2015. – 215 p.

10. Carlberg, K. Business-analysis with Excel: tr. from En. / K. Carlberg. – Kiev : Dialektika, 1997. – 448 p.

11. Sigel, E. Practical business-statistics / - M. E. Sigel – M.: Publishing house “Williams”, 2002. – 1056 p.

12. Fundamentals of statistics with elements of probability theory for economists: a guide for solving problems / Nivorizhkina L.I., Morozova Z.A., Gerasimova I.A., Zhitnikov I.V. – Rostov-on-Don : Feniks, 1999. – 320 p,

13. Richard Thomas Quantitative methods of business analysis / Tr. from En. – Moscow : Publisher “Delo i Servis”, 1999. – 432 p.

## Protocol

for the coordination of the training program on the academic discipline  
with other disciplines of the specialty

Title of the discipline coordination with which is required	Department title	Offers on changes in training program contents of academic discipline	The decision made by the Department which developed the training program (with the indication of date and number of the protocol)
Business Analysis	Department of Accounting, Analysis, Audit in branches of the national economy	<i>HEM</i>	<i>Промокон №11 от 16.05.2019</i>

**Additions and changes to the training program  
for higher education establishment  
For the academic year 20\_\_/20\_\_**

Number	Additions and changes	Reason

The program is revised and approved at the meeting of the Statistics Department  
(protocol № \_\_, \_\_\_\_\_)

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

N.V. Agabekova

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Dean of Faculty of Digital Economy

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D.A. Marushko