

до наказу від _____ 2021 р. № _____

NATIONAL UNIVERSITY
OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

Department of Statistics and Economic Analysis

“ APPROVED ”

Dean of the Economic faculty

_____ A.D. Dibrova

“ ____ ” _____ 2021 p.

“ENDORSED”

at the meeting of the Department
of Statistics and Economic Analysis
Protocol № 15 from “ 20 ” 05 2021
Head of the Department
_____ I. D. Lazaryshyna.

”REVIEWED ”

Guarantor of the educational program

Kuzyk N.P.

WORKING PROGRAM OF EDUCATIONAL DISCIPLINE

Econometrics

Specialty 071 «Accounting and Taxation» _____

Educational program _ Accounting and Taxation _____

Economic Faculty _____

Developers: _ Lesia Voliak, Senior Lecturer of the Department of Statistics and
Economic Analysis, PhD in Economics _____

(посада, науковий ступінь, вчене звання)

1. Description of the discipline

ECONOMETRICS

(назва)

Sphere of knowledge, training direction, specialty, education and qualification level		
Education and qualification level	<i>Bachelor</i>	
Specialty	<i>071 Accounting and Taxation</i>	
Training direction	<i>Accounting and Taxation</i>	
Characterization of discipline		
Type	Mandatory discipline	
Total number of hours	120	
Number of ECTS credits	4	
The number of structural modules	2	
Course project (work) (if your curriculum)	-	
Form of control	Exam	
Indicators of discipline for full-time and distance learning		
	full-time education	distance education
Year of training	3	
Semester	5	
Lectures	<i>30 hours</i>	
Practical, seminars	<i>30 hours</i>	
Laboratory studies	-	
Independent work	<i>60 hours</i>	
Individual tasks	-	
The number of weekly hours for full-time study: classroom	<i>4 hours</i>	

1. Purpose, tasks and competencies of the discipline

The purpose of econometrics is acquisition by the future specialists knowledge of the methods of construction of economically-mathematical models on macro and micro levels, abilities to utilize the proper mathematical vehicle in the decision of economic and administrative tasks and development of creative and analytical skills for economists and managers from a mathematical modeling, including usage of the personal computer for conducting of researches.

Criteria of estimation of student's knowledge. For objective determination of quality of knowledge of students the module-rating system of evaluation of knowledge is utilised. The evaluation system is given more flexible and more objective than previous, that is instrumental in systematic and active independent work of students during all of period of studies, provides a healthy competition between students in studies, instrumental in an exposure and development of capabilities of students. Current control of knowledge of students and mastering by them programmatic material a teacher which conducts employment from a course carries out. He is carried out in the process of conducting of practical and individual employments. During practical employments such controls are used: verbal questioning from themes, certain plans practical employments, conducting of test control, by the evaluation of implementation of individual calculation tasks on the proper subject. Final control is carried out as examination (to the test) at the end of semester. At establishment of estimation effectiveness of current control, mastering of educational material is taken into account. The evaluation of results of capture of educational material a student takes a place taking into account the shown knowledge and carried out it is differentiated in accordance with the accepted Statute about the credit-module system of studies.

Learning course of Econometrics, students should know:

- essence of econometric modeling and its stages;
- methods of testing of economic information;
- methods of evaluation parameters of econometrical model taking into account the features of concrete economic information;
- methods of evaluation of authenticity of models and its parameters;

- methods of evaluation of estimation properties of model;
- methods of econometric prediction taking into account the features of econometrical models.

Students must be able:

- to identify variable models;
- to specify a model;
- to estimate the parameters of econometrical model in time of:
 - a) normally distributed tailings of model;
 - b) heteroskedasticity;
 - c) multicollineation of explaining variables;
 - d) presence of dependence of tailings with explaining variables;
- to determine prognosis properties of model;
- to check up authenticity of model and its parameters;
- to execute a point and interval prognosis on the basis of different econometrical models;
- to determine basic economic descriptions of intercommunication and correctly to interpret them.

Acquisition of competencies:

general competencies (GC):

GC 1. Ability to learn and be ready to learn and apply the acquired knowledge.

GC 2. Ability to analyze and synthesize as a tool for identifying problems and making decisions to solve them based on logical arguments and verified facts

GC 6. Ability to be critical and self-critical.

GZK7. Ability to think flexibly and competently apply the acquired knowledge in professional activities.

GC 8. Ability to communicate in state and foreign languages both orally and in writing.

GC 9. Skills in the use of modern information and communication technologies.

GC 11. Ability to present the results of research

professional (special) competencies (PC):

PC 3. Ability to use mathematical tools to study economic processes, solve applied economic and optimization problems in the field of accounting, auditing and taxation.

2. Curriculum and structure of the discipline for full-time bachelors.

Modul 1

Methods of construction of general linear model

Theme 1. Subject, methods and objectives of discipline

Nature of econometrics. The role of econometric studies in economics. Object, subject, goals, tasks and structure of the course. Place and course importance among basic disciplines for preparation Bachelor in Economics. Relationship of course to related disciplines. The history of occurrence and the course “Econometrics” in the leading educational institutions in the world. Examples of the application of econometric methods for solving economic problems. The main characteristics of the economic system as the object of modeling. The concept of model. The mathematical model, the main stages of the modeling process. Classification of economic-mathematical models. Contemporary methodological foundations of econometric modelling, a priori and a posteriori role of information. The statistical basis of econometric models. Variable and equations in econometric models, macro- and microeconomic data set and the base, their relationship to aggregation. The main types of econometric models and their relationship to other types of mathematical models. Stages of econometric analysis of economic processes and phenomena’s.

Theme 2. Methods of the general linear model

General view of a linear econometric model, its structure and stages of construction. Specification. Prerequisites for using the method of least squares (OLS 1). Properties of estimates, their characteristics.

Correctness of constructing econometric model and test the significance of parameter estimates and the model itself. Statistical criterias for the assessment of

significance. Standard errors and reliability of the forecast. Confidence intervals function of regressions.

Standardized linear econometric model. The economic interpretation of the estimates of the model parameters. Their use in the econometric analysis.

Construction models based on stepwise regression. Simple econometric models. Construction the linear and linear-logarithm production functions. Econometric analysis of production functions, the interpretation of results.

Theme 3. Multicollinearity and its impact on the estimation of the model parameters

The concept of the main principles of the classical correlation econometric analysis. The concept of multicollinearity, methods and characteristics of its identification. Functional and stochastic collinearity. Measurement of multicollinearity. Algorithm of the Farrar-Hlober. Ways to eliminate multicollinearity: exclusion from the analysis the factor, linear transformation of variables, exceptions trend, turn-based correlation and regression, factorial approach and the method of main components.

Theme 4. Generalized least squares

The concept of heteroscedasticity and methods of its study. The impact of heteroscedasticity on the properties of parameter estimates.

Generalized least squares method (Aitken method) estimates of the parameters of the linear econometric models with heteroscedastic residues. Formation the matrix S . The definition of operator estimates and corresponding covariance matrix. Checking the significance and construction of confidence intervals for the model parameters. Numerical example of the implementation the method of Aitken. Construction the prognosis.

Theme 5. Econometric model of the dynamics

Features of the econometric modelling based on time series. Trend model and methods to determine its parameters. The shape of the trend (linear, parabolic, hyperbolic, logical). Interpretation the parameters of the trend model. Graphic representation of the trend. Evaluation of the trend stability. Coefficient of the trend stability. Justification projected estimates of economic phenomena's.

Modul 2

Empirical methods of quantitative analysis based on statistical equations

Theme 6. Empirical methods of quantitative analysis based on statistical equations

The advisability of the use in econometric calculations the statistical equations dependencies. The method of regression analysis and the method of statistical dependence equations. Comparison coefficients is the base of statistical equations dependencies. Calculation parameters of equations dependencies for: simple and curved connection; multiple linear and curvilinear relation. Calculation parameters dependence (one-factor and multifactor), correlation coefficient and index. Forecast calculations.

Sense of equations parameters by different dependencies. Calculation of stability coefficient for evaluation the reliability of the equations of dependencies parameters. Determination the proportion of influence factors on the resultant variable. Plotting one-factor and multiple dependencies. Justification projected estimations of economic phenomena's.

Theme 7. Construction an econometric model with the autocollinearity remains

The concept of autocorrelation. The nature and consequences of autocorrelation in econometric models. Check for autocorrelation. Durbin-Watson criterion.

Estimation of model parameters with autocollinearity remains by such methods: Aitken, transform the input data, Kochrena - Orkatta, Durbin. The feasibility and effectiveness of the use these methods. Using an econometric model to calculate the prediction of the dependent variable with autocorrelation residuals.

Theme 8. Methods of instrumental variables

Causes of correlation appearance between explanatory variables and residues. Estimation of model parameters using instrumental variables. Determination instrumental variables using different operators values: Wald operator evaluation, features of evaluation by the method of Bartlett, operator evaluation Durbin. Measurement errors of variables.

Theme 9. Distributed lag models

The concept of lag and lagged variables. Determination of the log coefficient. Building mutual correlation function and its graph. Building a distributed lag econometric models. Parameter estimation with lagged values of factors and indicators, correction and prediction.

Theme 10. Econometric models on the basis of system structural equations

General view of the structural form model based on simultaneous equations. Combined shape of model. Record model based on a recursive model. Identified and unidentified equations system. Parameters estimation of model that consists in a system of recursive equations, 1 OLS. The indirect method of least squares (NOLS) and two-step method of least squares (2 OLS). Forecast and general confidence intervals.

Theme 11. Econometric modeling based on nonlinear regression

Nonlinear model. Quasi-linear model. The production Cobb-Douglas function. Building equations system to estimate the parameters of the production function. Characterization of the model parameters. Checking the adequacy of the model and its parameters significance. Precision assessment of prognosis and confidence interval prediction.

Names of Modules and Themes	Quantity of Hours													
	Full-time							Заочна форма						
	weeks	Total	including					Total	including					
			L	Pr.	Lab	Ind.	I.W.		L	Pr.	Lab	Ind.	I.W.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Module 1 Methods of construction of general linear model														
Theme 1. Subject, methods and objectives of discipline	1	8	2	2			4							
Theme 2. Methods of the general linear model	2	9	2	2			5							
Theme 3. Multicollinearity and its impact on the estimation of the model parameters	3-4	13	4	4			5							
Theme 4. Generalized least squares	5-6	13	4	4			5							

Theme 5. Econometric model of the dynamics	7	10	2	2			6						
Total for module 1		53	14	14			25						
Module 2 Empirical methods of quantitative analysis based on statistical equations													
Theme 6. Empirical methods of quantitative analysis based on statistical equations	8	10	2	2			6						
Theme 7. Construction an econometric model with the autocollinearity remains	9-10	14	4	4			6						
Theme 8. Methods of instrumental variables	11-12	14	4	4			6						
Theme 9. Distributed lag models	13	10	2	2			6						
Theme 10. Econometric models on the basis of system structural equations	14	10	2	2			6						
Theme 11. Econometric modeling based on nonlinear regression	15	9	2	2			5						
Total for module 2		67	16	16			35						
Total sum		120	30	30			60						

3. Themes of seminars

№	Name of Themes	Quantity of hours
1		
2		
...		

4. Topics of practical classes

№ 3/II	Name of Themes	Quantity of hours
1.	Subject, methods and objectives of discipline	2
2.	Methods of the general linear model	2
3.	Multicollinearity and its impact on the estimation of the model parameters	4
4.	Generalized least squares	4
5.	Econometric model of the dynamics	2

6.	Empirical methods of quantitative analysis based on statistical equations	2
7.	Construction an econometric model with the autocollinearity remains	4
8.	Methods of instrumental variables	4
9.	Distributed lag models	2
10.	Econometric models on the basis of system structural equations	2
11.	Econometric modeling based on nonlinear regression	2
	Разом	30

12. Topics of lab classes

№ з/п	Name of Themes	Quantity of hours
1		
2		
...		

13. Control questions, sets of tests to determine the level of knowledge acquisition by students.

1. Object, method and task of the course of “Econometrics”.
2. Role and place of econometric models in the economic systems management.
3. Forming of observation aggregate.
4. Notion of observations homogeneity.
5. Exactness of economic information.
6. Choice of variables and structure of connections.
7. Accidental constituent of econometrical model.
8. Evaluation of model’s parameters by a least-squares method.
9. Coefficient of correlation, verification of hypothesis about meaningfulness of correlation coefficient.
10. Index of correlation.
11. Verification of model on adequacy by Fisher’s a criterion.
12. Concept of multicollinearity.
13. Features of multicollinearity.
14. Farrar-Glober algorithm for multicollinearity determination.
15. Sence of the phenomenon heteroscedasticity.

16. Methods of determination heteroscedasticity
17. Definition of matrix S
18. Method of smallest squares (Eitken method)
19. Forecasting
20. Concept of autocorrelation
21. The consequences of autocorrelation remains
22. Check of autocorrelation
23. Evaluation of model parameters with autocorrelation residues
24. Forecasting methods in dynamic models
25. Properties of model estimates within stochastic variable
26. Method of tool variable
27. Definitions of tool variable
28. Errors of measurement variables
29. Methods with time lag. Methods of evaluation
30. Eitken's method
31. Iterative method
32. Instrumental Variables
33. Two-stage procedure

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENT SCIENCES OF UKRAINE			
"Bachelor"	Statistics and Economic Analysis department	Ticket number <u>1</u> the discipline "Econometrics"	Approved Chief of Department of Statistics and Economic Analysis (signature) prof. I.D.Lazarysnyna 2021p.

Examination task

I. Theoretical question

Explain the essence of the random component of the econometric model

II. Problem

Check the linear econometric model $Y = 0,9 + 0,56x + u$ on adequacy if:
 $\sum(\hat{y}_i - \bar{y})^2 = 11,5$; $\sum(y_i - \hat{y}_i)^2 = 5,7$; $n=12$; $P=0,95$. Make appropriate conclusions.

III. Test

1. Define acceptance of hypothesis H_0 for F criterion about the adequacy the model

- a. if $F_{\text{calculated}} > F_{\text{table}}$
- b. if $F_{\text{calculated}} = F_{\text{table}}$
- c. if $F_{\text{calculated}} < F_{\text{table}}$

2. The main tasks of the correlation analysis:

- a. quantitative assessment of the tightness of connection
- b. mathematical modeling of the dependence of the effective attribute on the factors
- c. qualitative assessment of the tightness of connection

3. An assessment of the significance of the model parameters can be

- a. F-criterion
- b. determination factor
- c. Student's criterion
- d. correlation coefficient

4. Multikollinearity means:

- a. Existence of linear dependence or correlation between two or more independent variables
- b. Presence of tailings of econometric model
- c. Not possibility of prognosis of effective index
- d. Not possibility of establishment of degree of freedom is for dispersion of tailings
- e. Being of fictitious factors is in a model

5. In an econometric investigation forecast of effective index is:

- a. the first stage
- b. the final stage
- c. the second stage
- d. not used

6. The sum of tailings in correctly built model is evened:

- a. It is not possible to define
- b. 0
- c. 100%
- d. To any value from 0 to
- e. To any value from -1 to 1

7. It is necessary for application of least-squares method, that dispersion of tailings:
- a. Equaled a zero
 - b. It was permanent
 - c. It was a positive size
 - d. It was in scopes from 0 to 1
8. The main signs of multicollinearity of factors are:
- a. Presence of high values of pairs coefficients of correlation
 - b. A presence of small values of estimation of model parameters at the high level of coefficient of determination and F-criterion
 - c. A substantial change of estimations of model parameters at additional introduction to it of explanatory variable
 - d. The considerable approaching of coefficient of correlation to unit
9. Importance of parameters of equalization of regression is estimated with a help
- a. χ^2 -criterion
 - b. Dispersion
 - c. t-criterion
 - d. Standard deviation
 - e. The least-squares method
10. The estimation of model importance can be:
- a. Coefficient of determination
 - b. Standard deviation
 - c. Dispersion
 - d. Coefficient of correlation
 - e. F-criterion

11. Methods of education

Practical	Visual	Verbal	Working with book	Video- method
Experiments, exercises, training and productive work	Illustrations, demonstration, observation of students	Explanation, explanation, narration, conversation, instruction, lecture, discussion, debate	Reading	Viewing, Training, Exercises under the supervision of "electronic teacher" control

12. Control forms

Control measures include current and final evaluation of student knowledge. Current control is carried out during practice and in the process of self-study in the following areas: rapid surveys, tests, tasks "right-wrong" problem.

Current control		Rating of Academic Affairs R _{HP}	Rating of additional work R _{ДП}	Fine rating R _{ШТТ}	Final certification (exam or test)	Total quantity of marks
Module 1	Module 2					
0-100	0-100	0-70	0-20	0-5	0-30	0-100

13. Distribution of points received by students. Assessment of student knowledge is on a 100-point scale and is translated into national assessments according to table. 1 "Regulations on examinations and tests in NULES of Ukraine" (order of entry into force of 27.12.2019 № 1371)

Student rating, points	National assessment based on the results of the compilation	
	exams	tests
90-100	Excellent	Passed
74-89	Good	
60-73	Satisfactorily	
0-59	Unsatisfactorily	Not passed

To determine the rating of the student (listener) for mastering the discipline R_{дис} (up to 100 points), the obtained rating for certification (up to 30 points) is added to the rating of the student (listener) for the educational work of the R_{HP} (up to 70 points):
 $R_{\text{дис}} = R_{\text{HP}} + R_{\text{AT}}$.

11. Methodical support

1. Regulations.
2. Complex teaching of the discipline.
3. Methodological guidelines for independent study courses.
4. Methodological guidelines for writing a term paper.
5. Elearn <https://elearn.nubip.edu.ua/course/view.php?id=1744>

12. Recommended literature

Legislation and regulations

1. [Закон України "Про державну статистику"](#) Закон введено в дію з дня прийняття (згідно з Постановою Верховної Ради України від 17 вересня 1992 року N 2615-XII) Із змінами і доповненнями, внесеними Законами України від 13 липня 2000 року N 1922-III (Законом України від 13 липня 2000 року N 1922-III цей Закон викладено в новій редакції), від 15 грудня 2005 року N 3205-IV, від 5 березня 2009 року N 1070-VI, від 1 червня 2010 року N 2289-VI (зміни, внесені Законом України від 1 червня 2010 року N 2289-VI, вводяться в дію з 31 липня 2010 року), від 2 грудня 2010 року N 2756-VI, від 13 січня 2011 року N 2938-VI

2. Наказ Державної служби статистики "Про затвердження форм державних статистичних спостережень у галузі сільського та рибного господарства" від 17.07.2012 р. №301

3. Наказ Державної служби статистики "Про затвердження Положення про Реєстр статистичних одиниць у сільському господарстві, мисливстві, лісовому і рибному господарстві – Реєстр АГРО" 02.07.2011 №278

Tutorials

1. Ачкасов А. Є. Конспект лекцій з курсу «Економіко-математичне моделювання» / А. Є. Ачкасов, О. О. Воронков. – Х.: ХНАМГ, 2011. – 204 с.

2. Доля В.Т. Економетрія: навч. посібник / В.Т. Доля; Харк. нац. акад. міськ. госп-ва. – Х.: ХНАМГ, 2010. – 171 с.

3. Економетрика: Підручник/Черняк О.І.; Комашко О.В.; Ставицький А.В.; Баженова О.В.; За ред. О.І. Черняка. – Київ: Видавничо-поліграфічний центр "Київський університет", 2010. - 359 с.

4. Економетрія. Частина 1 : навчальний посібник / [Азарова А. О., Сачанюк-Кавецька Н. В., Роїк О. М., Міронова Ю. В.] – Вінниця : ВНТУ, 2011. – 97 с.

5. Диха М. В., Мороз В. С. Економетрія :навчальний посібник. Київ : Центр учбової літератури, 2019. 206 с

6. Карімов Г. І. Моделювання та прогнозування в управлінні : навч. посіб. Кам'янське : ДДТУ, 2018. 163 с.
7. Козьменко О. В. Економіко-математичні методи та моделі (економетрика) : навч. посіб. Суми : Університетська книга, 2018. 406 с.
8. Козьменко О.В. Економіко-математичні методи та моделі (економетрика): навчальний посібник / О.В. Козьменко. – Суми: Університетська книга, 2014. – 406.
9. Кузьмичов А. І. Економетрія. Моделювання засобами MS Excel: [навчальний посібник] / А. І. Кузьмичов. – К. : ЦУЛ, 2011. – 214 с.
10. Наконечний С. І., Терещенко Т.О., Романюк Т. П. Економетрія: Підручник. вид. 3-тє, доп. та перероб. к.: КНЕУ, 2004. 520 с.
11. Руська Р. В. Економетрика : навчальний посібник / Р. В. Руська. – Тернопіль : Тайп, 2012. – 224с.
12. Wooldridge, Jeffrey M. (2015): Introductory Econometrics: A Modern Approach, 6th edition, Southwestern.

Supplementary

1. Дубров А.М., Мхитарян В.С., Трошин Л.И. Многомерные статистические методы: Учебник. – М.: Финансы и статистика, 2003. – 352 с.
2. Дуброва Т.А. Прогнозирование социально–экономических процессов. Статистические методы и модели: учеб. пособие / Т.А. Дуброва. – М.: Маркет ДС, 2007. – 192 с.
3. Магнус Я.Р., Катышев П.К., Пересецкий А.А. Эконометрика. Начальный курс: Учебник. -3-е изд., перераб. и доп. – М.: Дело, 2000.- 400 с.
4. Методы математической статистики в обработке экономической информации: учеб. пособие / Т.Т. Цымбаленко, А.Н. Баудаков, О.С. Цымбаленко и др.; под ред. проф. Т.Т. Цымбаленко. – М.: Финансы и статистика; Ставрополь: АРГУС, 2007. – 200 с.
5. Палий И.А. Прикладная статистика: Учебное пособие. – М.: Издательско–торговая корпорация "Дашков и К", 2008. – 224 с.
6. Прикладна економетрика : навч. посіб. : у двох частинах. Частина1 : / Л. С. Гур'янова та ін. Харків : ХНЕУ ім. С. Кузнеця, 2016. 235 с.

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8. Greene, W.H. (2008). *Econometric Analysis*. 6th edition, Prentice-Hall.
9. Stock, J.H., and Watson, M.W. (2007). *Introduction to Econometrics*. Addison-Wesley.
10. Wooldridge, J.M. (2009). *Introductory Econometrics*. 4th edition, South-Western.

Information Resources

1. Верховна Рада України <http://zakon.rada.gov.ua/>
2. Міністерство фінансів України <http://www.minfin.gov.ua>
3. Кабінет Міністрів України <http://www.kmu.gov.ua/control/>
4. Газета «Все про бухгалтерський облік» <http://www.vobu.com.ua>
5. Газета «Урядовий кур'єр» <http://www.ukurier.gov.ua/>
6. Журнал «Вісник податкової служби України» <http://www.visnuk.com.ua>
7. Міністерство фінансів України <http://www.minfin.gov.ua>
8. Нормативні акти України - законодавство для практиків
<http://www.nau.kiev.ua>
9. Офіційний вісник України <http://www.gdo.kiev.ua>