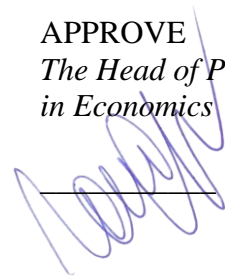Ministry of Education and Science of Russian Federation
Federal State Autonomous Educational Institution of
Higher Professional Education
"SIBERIAN FEDERAL UNIVERSITY'

APPROVE
The Head of Postgraduate School
in Economics

_____ E.V. Zander

DISCIPLINE PROGRAM

Discipline 2.1.5 Application of econometric methods in scientific research

Group of Branches of Science 5.2 Economics

Branch of Science 5.2.3 Regional and Sectoral Economy (Environmental Economics)

Krasnoyarsk 2024

DISCIPLINE PROGRAM

is compiled in accordance with the federal state requirements

Group of branches of science / branch of science
5.2 Economics / 5.2.3 Regional and Sectoral Economy (Environmental Economics)
The program was compiled   by Pyzev A.I.

Head of department (developer)   Zander E.V.

25.03.2024

The discipline program was discussed at a meeting of the department (graduating)
          of
social and economic planning
25.03.2024   Protocol No. 7

Head of department (graduating) Zander E.V.

1. Course Description

1.1 Course overview

Course covers main topics of advanced applied econometrics: hypotheses testing, basic regression extensions, univariate and multivariate time series modeling, non-parametric regressions, limited dependent variables models, panel data analysis. Course give both theoretical insights into modern econometric techniques and practical experience of its application.

1.2. Special features of the course

Course gives a special attention to the topics of modern applied econometrics, which are crucially important for delivering profound analysis of Environmental and Resource Economics problems. Widespread free and opencode statistical software (gretl, R) will be used for seminar sessions.

1.3. Course aim

To provide students with the opportunity to apply modern methodology to formulate econometric models, to test their performance and use them for interpretation, analysis and forecasting.

1.4. Course objectives

1. To give a comprehensive overview of econometric modeling techniques at postgraduate level.
2. To establish a cause-consequence relationship between real economic data and economic theories with main focus on environmental and natural resource economics issues.
3. To train skills of practical application of econometric modeling using open and free software.

1.5. Learning outcomes of the course

After completing the course, PhD student will be able to:
- formulate econometric models and give correct specification based on restrictions yielding from data source features;
- produce estimates for models parameters and test model performance using appropriate measures and techniques;
- use econometric models for problem solving, decision- and policy-making both for theoretical and practical tasks.

2. The Volume of the Discipline (Module)

Type of Learning Activity	Total, credits (Academic hours)	Semester
		2
Total complexity of the discipline	2 (72)	2 (72)
Contact activities with the professor:	0,5 (18)	0,5 (18)
Lectures	0,25 (9)	0,25 (9)
Seminars	0,25 (9)	0,25 (9)
including: seminars	-	-
workshops	0,25 (9)	0,25 (9)
Other types of contact activities	-	-
Independent study of postgraduate students:	1,5 (54)	1,5 (54)
Study of the theoretical course	1,5 (54)	1,5 (54)
Preparation of an essay, report etc.	-	-
Preparation for current control	-	-
Preparation for intermediate control	-	-
Type of intermediate certification (credit/exam)	Credit	Credit

3. The Content of the Discipline (Module)

3.1 Sections of the discipline and types of classes (thematic lesson plan).

Item No.	Topic	week no.	Learning Activities (lecture, lab, assessements and other)	Hours	Homework and Reading
1	Introduction to theoretical econometrics. The value of econometrics for economic analysis	1	Lecture "Introduction to theoretical econometrics. The value of econometrics for economic analysis"	2	Lecture 1 Verbeek, Ch. 1, 2
2	Basic regression model. Ordinal least squares. Model performance assessment	2	Lecture "Basic regression model. Ordinal least squares. Model performance assessment"	2	Lecture 2 Verbeek, Ch. 2
		3	Seminar "Basic regression model estimation"	2	Lecture 2 (Task)
3	Hypothesis testing. Regression extension: heteroscedasitcity, multicollinearity, generalized least squares	4	Lecture "Hypothesis testing. Regression extension: heteroscedasitcity, multicollinearity, generalized least squares»	2	Lecture 3 Verbeek, Ch. 3
		5	Seminar "Heteroscedasticity and	2	Lecture 3 (Task)

			multicollinearity testing"		
4	Limited dependent variable models. Censored dependent variable models	6	Lecture "Limited dependent variable models. Censored dependent variable models"	2	Lecture 4 Verbeek, Ch. 5
		7	Seminar "Limited dependent variable models: logit and probit. Censored dependent variable models: tobit"	2	Lecture 4 (Task)
5	Univariate time series modeling. Stationarity and unit-root testing	8	Lecture "Univariate time series modeling. Stationarity and unit-root testing"	2	Lecture 5 Verbeek, Ch. 6
		9	Seminar "Univariate time series modeling. Stationarity and unit-root testing"	2	Lecture 5 (Task)
6	Multivariate time series modeling. Vector autoregression. Distributed lag model	10-11	Lecture "Multivariate time series modeling. Vector autoregression. Distributed lag model"	4	Lecture 6 Verbeek, Ch. 8, 9
		12-13	Seminar "Multivariate time series modeling. Vector autoregression"	4	Lecture 6 (Task)
7	Panel data analysis. Fixed and random effects models	14-15	Lecture "Panel data analysis. Fixed and random effects models"	4	Lecture 7 Verbeek, Ch. 10
		16-17	Seminar "Panel data analysis. Fixed and random effects models"	4	Lecture 7 (Task)

3.2 Lecture-type classes

Lecture 1. Introduction to theoretical econometrics. The value of econometrics for economic analysis

Subject of econometrics: how to measure economic indicators?
The history of econometrics.
Basic knowledge of modern theoretical econometrics.

Lecture 2. Basic regression model. Ordinal least squares. Model performance assessment

Ordinary least squares as an algebraic tool
  − Ordinary least squares

Lecture 3. Hypothesis testing. Regression extension: heteroskedasticity, multicollinearity, generalized least squares

Testing for Heteroskedasticity
- Testing Equality of Two Unknown Variances
- Testing for Multiplicative Heteroskedasticity
- The Breusch–Pagan
- The White Test
- Which Test?
- llustration: Explaining Labour Demand

Autocorrelation
- First Order Autocorrelation
- Unknown ρ

Testing for First Order Autocorrelation
- Asymptotic Tests
- The Durbin–Watson Test

Illustration: The Demand for Ice Cream

Alternative Autocorrelation Patterns
- Higher Order Autocorrelation
- Moving Average Errors

What to do When you Find Autocorrelation?
- Misspecification
- Heteroskedasticity-and-autocorrelation-consistent

Standard Errors for OLS
   Illustration: Risk Premia in Foreign Exchange Markets
- Notation
- Tests for Risk Premia in the One-month Market
- Tests for Risk Premia Using Overlapping Samples

Lecture 4. Limited dependent variable models. Censored dependent variable models

Binary Choice Models
- Using Linear Regression?
- Introducing Binary Choice Models
- An Underlying Latent Model Estimation
- Goodness-of-fit
- Illustration: the Impact of Unemployment Benefits on Recipiency
- Specification Tests in Binary Choice Models
- Relaxing Some Assumptions in Binary Choice Models

Multi-response Models
- Ordered Response Models

- About Normalization
- Illustration: Willingness to Pay for Natural Areas
- Multinomial Models

Models for Count Data
- The Poisson and Negative Binomial Models
- Illustration: Patents and R&D Expenditures

Tobit Models
- The Standard Tobit Model Estimation
- Illustration: Expenditures on Alcohol and Tobacco
- Specification Tests in the Tobit Model

Extensions of Tobit Models
- The Tobit II Model
- Estimation
- Further Extensions
- Illustration: Expenditures on Alcohol and Tobacco (Part 2)

Sample Selection Bias
- The Nature of the Selection Problem
- Semi-parametric Estimation of the Sample Selection Model

Estimating Treatment Effects

Duration Models
- Hazard Rates and Survival Functions
- Samples and Model Estimation
- Illustration: Duration of Bank Relationships

Lecture 5. Univariate time series modeling. Stationarity and unit-root testing

Introduction
- Some Examples
- Stationarity and the Autocorrelation Function

General ARMA Processes
- Formulating ARMA Processes
- Invertibility of Lag Polynomials
- Common Roots

Stationarity and Unit Roots

Testing for Unit Roots
- Testing for Unit Roots in a First Order Autoregressive
- Model
- Testing for Unit Roots in Higher Order Autoregressive
- Models

- Extensions
- Illustration: Annual Price/Earnings Ratio

Illustration: Long-run Purchasing Power Parity (Part 1)

Estimation of ARMA Models
- Least Squares
- Maximum Likelihood

Choosing a Model
- The Autocorrelation Function
- The Partial Autocorrelation Function
- Diagnostic Checking
- Criteria for Model Selection
- Illustration: Modelling the Price/Earnings Ratio

Predicting with ARMA Models
- The Optimal Predictor
- Prediction Accuracy

Illustration: The Expectations Theory of the Term Structure

Autoregressive Conditional Heteroskedasticity
- ARCH and GARCH Models
- Estimation and Prediction
- Illustration: Volatility in Daily Exchange Rates

What about Multivariate Models?

Lecture 6. Multivariate time series modeling. Vector autoregression. Distributed lag model

Dynamic Models with Stationary Variables

Models with Nonstationary Variables
- Spurious Regressions
- Cointegration
- Cointegration and Error-correction Mechanisms

Illustration: Long-run Purchasing Power Parity (Part 2)

Vector Autoregressive Models

Cointegration: the Multivariate Case
- Cointegration in a VAR
- Example: Cointegration in a Bivariate VAR
- Testing for Cointegration
- Illustration: Long-run Purchasing Power Parity (Part 3)
- Illustration: Money Demand and Inflation

Lecture 7. Panel data analysis. Fixed and random effects models

Advantages of Panel Data
  – Efficiency of Parameter Estimators
  – Identification of Parameters
The Static Linear Model
  – The Fixed Effects Model
  – The Random Effects Model
  – Fixed Effects or Random Effects?
  – Goodness-of-fit
  – Alternative Instrumental Variables Estimators
  – Robust Inference
  – Testing for Heteroskedasticity and Autocorrelation
Illustration: Explaining Individual Wages
Dynamic Linear Models
  – An Autoregressive Panel Data Model
  – Dynamic Models with Exogenous Variables
Illustration: Wage Elasticities of Labour Demonstationarity, Unit Roots and
Cointegration
  – Panel Data Unit Root Tests
  – Panel Data Cointegration Tests
Models with Limited Dependent Variables
  – Binary Choice Models
  – The Fixed Effects Logit Model
  – The Random Effects Probit Model
  – Tobit Models
  – Dynamics and the Problem of Initial Conditions
  – Semi-parametric Alternatives
Incomplete Panels and Selection Bias
  – Estimation with Randomly Missing Data
  – Selection Bias and Some Simple Tests
  – Estimation with Nonrandomly Missing Data

3.3 Seminar-type classes

Prerequisites
Good level of advanced mathematics is of a great importance while studying
Econometrics.

Core knowledge of Econometrics at Master's level is required to study the "Applied Econometrics" course.

Course materials
During the self-studying according to practical lessons students should read, make notes of the publications proposed by the teacher, and be ready to discuss given topics, write essays.

Required feedbacks
Student should provide his contact data to the lecturer in order to get the necessary instructions for learning the course

Assessment
At each seminar students make personal class assignments (67% of score). The final examination will be given at the end of the course (33% of score).

Attendance Policy and Required Course Participation
Students are expected to attend every lecture and seminar taking careful notes, complete all assigned readings and class assignments.

3.4 List of educational and methodological support for independent work of graduate students in the discipline (module)

Independent work on the discipline is organized in the following forms:
1. Independent study of theoretical material on topics and sections of the discipline. When preparing for seminars, it is necessary to use lecture notes, demonstration materials, recommended literature of the main and additional lists, which includes scientific works by leading specialists, scientists and practitioners (monographs, textbooks, textbooks). The forms of the SibFU Scientific Library are used for the selection of literature (https://bik.sfu-kras.ru /), Krasnoyarsk Regional Scientific Library (https://www.kraslib.ru /), EBS of university partners, Internet resources.

4. List of Basic and Additional Educational References Necessary for Mastering the Discipline (Module)

4.1 Main references

1.   Verbeek, Marno A guide to modern econometrics / Publisher Chichester, England ; Hoboken, NJ : John Wiley & Sons, 2008 / ISBN 978-0-470-51769-7.

2. Christopher Dougherty Introduction to econometrics / Publisher Oxford ; New York : Oxford University Press, 2002 / ISBN 0198776438

5. List of Internet Resources Required for Mastering the Discipline (Module)

Postgraduate students are provided with free access to educational and methodological documents and Internet resources. All students have open access to the database of the Electronic Catalog and the full-text database of intra-university publications (http://lib.sfu-kras.ru/); to resources of the Virtual Reading Rooms (http://lib.sfu-kras.ru/eresources/virtual.php); to educational-methodical complex of the discipline (http://lib.sfu-kras.ru/ecollections/umkd.php); to video lectures and educational films of the university (http://tube.sfu-kras.ru/); to educational and methodical materials of institutes.

Internet resources necessary for mastering the discipline:
1. American Economic Journal: Applied Economics (www.aeaweb.org/aej/app/index.php);
2. American Economic Review (www.aeaweb.org/aer/index.php);
3. Brookings Papers on Economic Activity (www.brookings.edu/about/programs/economics);
4. Economic Policy, CEPR & CES & MSH (http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1468-0327);
5. Economic Studies Program, The Brookings Institution (www.brookings.edu/about/programs/economics);
6. European Economic Review (www.journals.elsevier.com/european-economic-review);
7. Experimental Economics (http://link.springer.com/journal/10683);
8. Journal of Business & Economic Statistics (www.tandfonline.com/toc/UBES20/current#.UwV9kuKVtzo);
9. Journal of Development Economics (www.journals.elsevier.com/journal-of-development-economics);
10. Journal of Economic Growth (http://link.springer.com/journal/10887);
11. Journal of Economic Literature (www.aeaweb.org/journal/);
12. Journal of Economic Perspectives (www.aeaweb.org/jep/);
13. Journal of Economic Surveys (http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1467-6419);
14. Journal of Finance (www.afajof.org/view/publishedArticles.html);
15. Journal of Financial Economics (www.journals.elsevier.com/journal-of-financial-economics);
16. Journal of Labor Economics (www.press.uchicago.edu/ucp/journals/journal/jole.html);
17. Journal of Law and Economics (www.press.uchicago.edu/ucp/journals/journal/jle.html);

18. Journal of Monetary Economics (www.journals.elsevier.com/journal-of-monetary-economics);
19. Journal of Political Economy (www.press.uchicago.edu/ucp/journals/journal/jpe.html);
20. Journal of the European Economic Association (http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1542-4774);
21. Quarterly Journal of Economics (http://qje.oxfordjournals.org/);
22. Review of Economic Studies (http://restud.oxfordjournals.org/);
23. Review of Economics and Statistics (www.mitpressjournals.org/loi/rest);
24. Review of Financial Studies (http://rfs.oxfordjournals.org/);
25. TERRA ECONOMICUS (http://sfedu.ru/evjur/);
26. World Bank Economic Review (http://wber.oxfordjournals.org/)
27. EastView: http://www.ebiblioteka.ru;
28. eLIBRARY.RU: http://elibrary.ru;
29. «ibooks.ru»: http://ibooks.ru;
30. Elsevier: (https://www.elsevier.com/);
31. POLPRED.COM Обзор СМИ: http://www.polpred.com;
32. Cambridge University Press: http://www.journals.cambridge.org;
33. DOAJ: http://www.doaj.org;
34. EBSCO Publishing: http://search.ebscohost.com;
35. Henry Stewart Talks: www.hstalks.com;
36. IEEE/IEL Database: http://ieeexplore.ieee.org;
37. Oxford Russia Fund eContent library: http://lib.myilibrary.com;
38. ProQuest: http://search.proquest.com/;
39. Sage: http://online.sagepub.com;
40. Scopus: http://www.scopus.com;
41. Springer: http://www.springerlink.com;
42. Web of Science: http://isiknowledge.com.

6. Methodological guidelines for graduate students on the development of the discipline (module)

№ п/п	Discipline section	Scope of work, credits (hours)	Characteristics of the types of independent work implemented in the discipline
1	Construction of econometric models of spatial data	1,5 (54)	1. Independent study of theoretical material (reading educational literature from the list of basic and additional literature specified in clause 6.) 2. Search for statistical information. 3. Execution of the calculation task.
2	Construction of econometric models of time series	1,5 (54)	1. Independent study of theoretical material (reading educational literature from the list of basic and additional literature specified in clause 6) 2. Search for statistical information.

		3. Execution of the calculation task.

The verification of independent work on the study of theoretical material is carried out by the teacher in the form of a written test.

Collectively, based on the results of training in the discipline "Application of econometric methods in scientific research", a credit is awarded based on the results of a written test and an independent calculation task for building an econometric model.

The overall score consists of 100 points, where:

- 50 points can be scored as much as possible as a result of completing a written test;

- 50 points can be scored as much as possible based on the results of completing and submitting to the teacher an independent written calculation assignment based on the results of building an econometric model.

The credit is given to a graduate student if he has collectively scored at least 60 points based on the results of all types of written work.

7. List of information technologies used in the implementation of the educational process on the discipline (module) (if necessary)

7.1. List of required software.

Microsoft® Windows XP (Microsoft® Vista Business Russian Upgrade Academic OPEN No Level) License certificate - 43158512 from 07.12.2007, unlimited;

– ESET NOD32 - Software license, serial number EAV-0220436634, valid from 04/19/2018 to 04/26/2019;

– Acrobat 8.0 Pro Russian Version Win Full Educ - License certificate CE0712341 from 06.12.2007, unlimited.

7.2. List of necessary information reference systems.

The e-library system (the scientific library of SibFU: http://bik.sfu-kras.ru/) provides the possibility of individual access for each student from any point where there is access to the Internet.

1. E-library system "Lan": http://e.lanbook.com
2. E-library system "INFRA-M": http://www.znanium.com
3. Scientific e-library CyberLeninka: https://cyberleninka.ru/
4. E-library of dissertations RSL: http://dvs.rsl.ru (access to full text), http://diss.rsl.ru (directory access)
5. Scientific e-library (eLIBRARY.RU): http://elibrary.ru
6. E-library LitRes: Library:
7. E-library of Grebennikov Publishing House http://grebennikon.ru
8. E-library of the Russian State University of Oil and Gas. I. M. Gubkina: http://elib.gubkin.ru

Information reference systems:

1. Federal State Statistics Service: https://rosstat.gov.ru/
2. IAS "Statistics":: http://www.ias-stat.ru
3. Unified Interdepartmental Statistical Information System (UniSIS): https://www.fedstat.ru/
4. State Archive of Krasnoyarsk Krai: http://красноярские-архивы.рф
5. Open budget project»: http://openbudget.karelia.ru/
6. "SBIS"*: https://sbis.ru/
7. *«SPARK»:* https://www.spark-interfax.ru/
8. *Transparent Business - A Project of the Federal Tax Service of Russia* https://pb.nalog.ru/
9. Unified portal of the budget system of the Russian Federation: http://budget.gov.ru/
10. Krasnoyarsk Krai. Official web-site: http://www.krskstate.ru/
11. Information reference system "Kodeks".
12. Information reference system "Kodeks-Server".
13. Legal reference system "Garant".
14. Legal reference system "Consultant Plus"

Postgraduate students are provided with the conditions and opportunities to work online with foreign and domestic licensed information databases on the profile of SibFU educational programs.

– Cambridge University Press: http://www.journals.cambridge.org ;
– EBSCO Publishing: http://search.ebscohost.com ;
– Oxford Journals: http://www.oxfordjournals.org ;
– Oxford Russia Fund eContent library: http://lib.myilibrary.com ;
– Science/AAAS: http://www.sciencemag.org ;
– Scopus: http://www.scopus.com ;
– Springer: http://www.springerlink.com;
– Web of Science: http://isiknowledge.com

8. Material and technical base necessary for the implementation of the educational process on the discipline (module)

– 6 classrooms with software and hardware complex with SANACO LAB 300 software for 16 seats: PANASONIC PT-F200NT projector; interactive whiteboard Interwrite; interactive plasma panel Smartboard - Svobodny pr., 79, building № 3 3rd floor and Maerchaka st. 3; 6, 7 floor
– 3 seminar rooms with rear projection smart boards - Svobodny pr., 79, building № 3, 3rd floor and Maerchaka st. 3; 6, 7 floor
– 4 computer labs equipped with Kraftway computers with direct projection boards. Projector EPSON EMP-X5 - Svobodny pr., 79, building № 3, 3rd floor and Maerchaka st. 3; 6, 7 floor
– 6 mobile carts (class AquaCartMC116, special software for teamwork, Windowos XP, optical mouse, cart safe, project)

- 6 lecture classroom complexes equipped with: Epson EMP-X5 multimedia projector, remote control, Audio-Technica ATW-702/701P dual radio system; Management console #1 HP TFT7600 RKM with LCD monitor and keyboard; Installation power amplifier Electro-Voice PA2250T; Acoustic system for background sounding Electro-Voice EVID 4.2T. Speaker; Computer Kraftway Credo model KS35 - in / counter. Intel CRAPHICS Media Accelerator 950. Up to 224 MB c/control. 10/100/100) - Svobodny pr., 79, building № 3, 3rd floor and Maerchaka st. 3; 6, 7 floor