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THE COURSE «ECONOMETRICS (ADVANCED COURSE FOR FINANCE)» OVERVIEW

Russian-Armenian (Slavonic) University
Lida Mnatsakanyan, Senior lecturer

BASIC INFORMATION

TITLE OF THE COURSE	ECONOMETRICS (ADVANCED COURSE FOR FINANCE)
TEACHERS	**Lida A. Mnatsakanyan,** Senior lecturer
YEAR OF THE COURSE	**1st**
SEMESTER OF THE COURSE	**2st**
LANGUAGE	Russian, English
NUMBER OF ECTS CREDITS	**4**

LEARNING OUTCOMES

The purpose of this course is

1. to familiarize students with the basic methods of processing primary data;
2. to formulate the equations of dependence.

LEARNING OUTCOMES

- To carry out collection, preparation and preliminary data analysis;
- Ability to formulate economic hypotheses in terms of econometric models;
- Ability to use econometric computer package to estimate an econometric model;
- Ability to evaluate the quality of the obtained econometric models;
- Define basic concepts in time series econometrics;
- Ability to work with time series models;
- Ability to report the results of their works.

SYLLABUS OF THE COURSE

WEEK	TOPIC
1	Introduction. Linear regression model with non-stochastic regressors
2	Model of multiple regression by non-stochastic regressors
3	Stochastic regressors. The method of instrumental variables, two-step OLS
4	Maximum likelihood method in econometrics. Binary choice models.
5-6	Time series models
7-8	Vector autoregression (VAR) and structural vector autoregression (SVAR) models
9	Panel data
10-18	Work in the R (R studio) program

TEACHING METHODOLOGY

- Course is designed for 18 weeks, during each week students will have 1 lectures (duration of 1 lecture is 90 minutes). The last 15 minutes of the lecture are devoted to various practical tasks.

- Course consists of lectures (all the lectures are in the form of slide show) and case study. There are also supposed homework assignments to be solved individually.

WEEK 1. Introduction. Linear regression model with non-stochastic regressor

- Econometrics. Problems and methods of applied econometrics. Application of econometrics in applied research. Data types in econometric analysis: spatial samples, time series, panel data. Regression functions and the main tasks of statistical analysis of linear coupling. Least squares method (OLS). Derivation of OLS estimates of coefficients. The quality of the coefficient of determination R^2. Relation of R^2 to correlation coefficient. Prerequisites of the classical linear model of linear regression with non-stochastic regressors. Gauss-Markov theorem for linear regression. Unbiased estimate of the variance of the unobserved errors. Unbiased estimate of random error variance. Standard errors of coefficient estimates. Interpretation of coefficients.

WEEK 2. Model of multiple regression by non-stochastic regressors

- Background of the classical linear model of multiple regression with non-stochastic explanatory variables. Formulation of the Gauss-Markov theorem for multiple regression, statistical properties of OLS estimates. Unbiased estimate of the variance of the unobserved errors. The standard error of the regression. Coefficients R^2 and adjusted R^2. Standard errors of coefficient estimates. Hypothesis testing with F-statistics. Confidence interval. Checking the significance of the equation using F-statistics. Checking the significance of a group of variables using F-statistics: parsimonious vs. overparameterized regressions. Comparison of linear and logarithmic models.

WEEK 2. Model of multiple regression by non-stochastic regressors

- Generalized least squares method. Heteroscedasticity. Consequences of heteroscedasticity. Detection is heteroscedastic. Elimination of heteroskedasticity; weighted least squares method. Standard errors are in the form of White.

WEEK 3 (Part 1). Stochastic regressors. The method of instrumental variables, two-step OLS

- Background of the classical linear model of multiple regression with stochastic explanatory variables. Properties of OLS estimates of regression coefficients with stochastic explanatory variables in the case of finite samples.

WEEK 3 (Part 2). Stochastic regressors. The method of instrumental variables, two-step OLS

- Consequences of correlation of explanatory variables and random errors. The problem of endogeneity. Examples of situations leading to endogeneity: measurement errors, causality, not including a significant variable in the model. The instrumental variable method. The two-step OLS. The testing of hypotheses.

WEEK 4. Maximum likelihood method in econometrics. Binary choice models.

- Maximum likelihood method (MMP). MMP on the example of linear regression model. Properties of ml estimators. Three ways to test linear constraints: Wald test (Wald test), Lagrange multiplier test (LM test), likelihood ratio test (Likelihood ratio test, LR test). Binary choice models.

WEEK 5. Time series models

- Time series (OF). Definitions and examples. Stationarity and nonstationarity. Unit roots. Processes AR (p), MA (q), ARMA (p, q). Definitions, properties, autocorrelation functions (ACF) and partial autocorrelation functions (PACF). Random walk. The integrated process of the order of the Process is an ARIMA (p,k,q). Testing of stationarity. Dickey-fuller test (for single root). Advanced Dickey-fuller test. Some other methods of stationarity testing.

WEEK 6. Time series models

- Autocorrelation of random errors. Consequences of autocorrelation. First-order autocorrelation testing: the Durbin - Watson test. Forecasting in terms of the autocorrelation of the random errors.

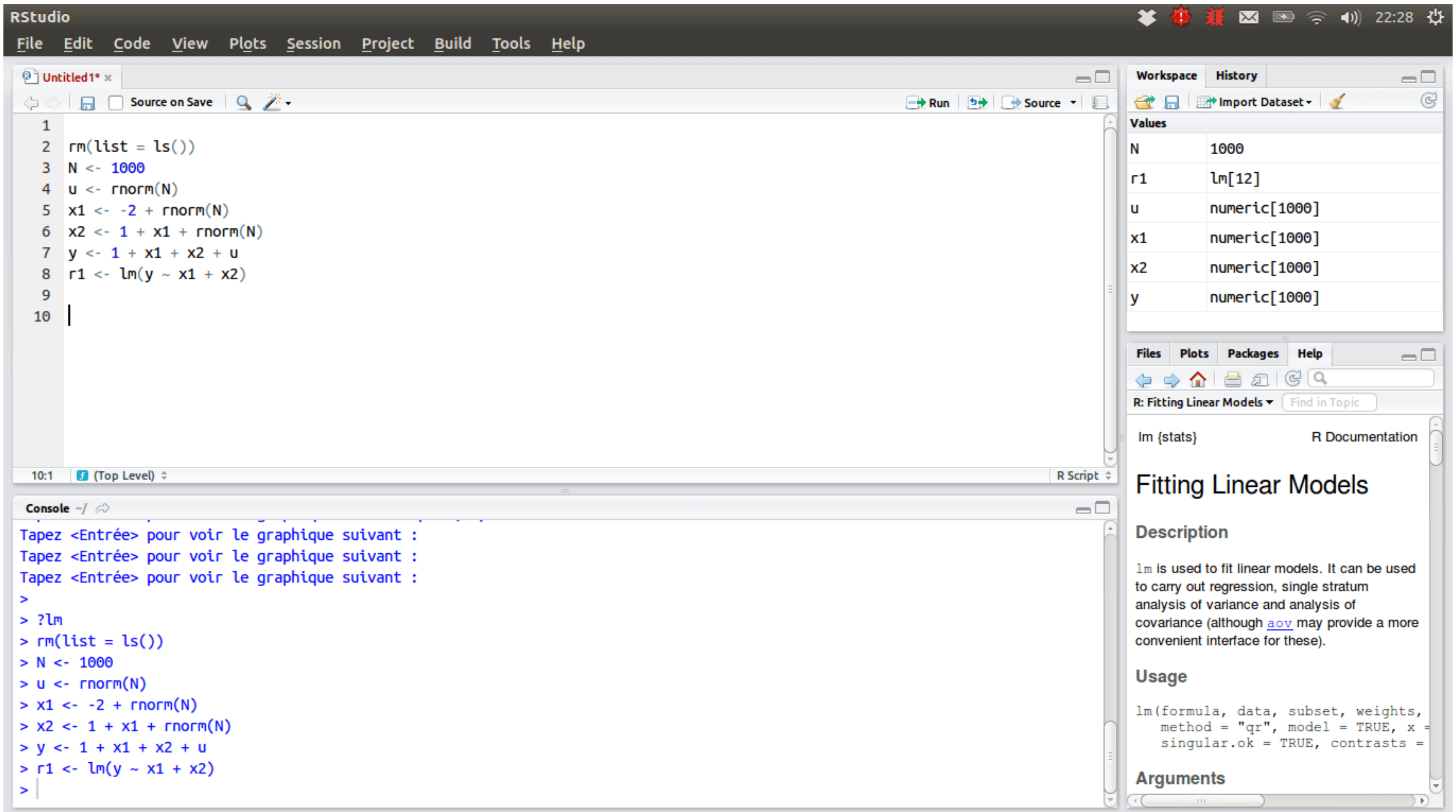
WEEK 7 - 8. Vector autoregression (VAR) and structural vector autoregression (SVAR) models

- Vector autoregression (VAR) models with stationary variables. Estimation of vector autoregression models. Impulse response functions, Structural vector autoregression (VAR) models.

WEEK 9. Panel data

- Advantages of using panel data in regression analysis. Model of mixed (pooled) regression. Individual and temporary effects. Linear regression model on panel data. Fixed effects model (FE)/ random effects Model (RE). Model selection: effects tests, Hausmann test to compare FE and RE models. Measures of quality of fit.

WEEK 10 - 18. Work in the R (R studio) program



LABOUR MARKET RELEVANCE

- The course structure is built in the connection with the practice, so knowledge got from each topic can be used not only for solving theoretical issues, but also can be applied in the real economy. The course will be the most useful for the students who are going to continue their career as a researcher, analyst etc. in different financial institution.

ASSESSMENT AND GRADING

The weights presented below combine into final grade for the course.

There ***are two types*** of assessment in this course:

- Current control (30%);
- Final exam (70%).

Current control considers:

Home assignments are the form of current control and their weight is 0,2 (20%);

Test. At the end of the 9th week, students write a test. It has weight 0,8 (80%) and this is also a form of current control.

So, together (1 and 2) they form midterm grade for the 9 weeks of the course. Final exam consists of case study.

ASSESSMENT AND GRADING

- There is only **one re-take** for the final exam.
- The maximum number of points for each type of work and for the whole course is **100** points, the minimum is **40** points.
- The mark for the course is set on the basis of the following scale:

Points	From 88 to 100	From 74 to 87	From 64 to 73	From 63 to 54	From 40 to 54	From 20 to 39	Less than 20
Grade	A (excellent)	B (very good)	C (good)	D (fair)	E (satisfactory)	F (not satisfactory)	FX (not satisfactory)

REFERENCES

- William Greene ***"Econometric analysis"*** // fifth edition, Pearson Education, 2003
- Dougherty K. ***Introduction to econometrics: a textbook.*** 3rd ed. Infra-M, 2009.
- Enders, ***Applied Econometric Time Series***, Wiley Series in Probability and Statistics (abbr. E)
- Favero, Carlo A. ***Applied macroeconometrics***. Oxford University Press on Demand, 2001. (abbr. F1)
- Favero, Carlo A. Lecture notes: ***VAR models in Macro and Finance*** (abbr. F2)
- Magnus J. R., J. P. Katyshev, A. Peresetsky And "***Econometrics. Initial course***": Textbook-6th ed., Rev. and DOP .- M.: Case, 2004
- Ayvazyan, S. A., and D. Fantazzini. ***Econometrics-2: advanced course with applications in Finance*** Moscow, 2014
- Hamilton, James, ***Time Series Analysis***, Princeton University Press (abbr. JH), (advanced book)
- Stock and Watson, ***Introduction to Econometrics***, Addison Wesley (abbr. SW)
- Martin V., Hurn S., Harris D. (2013) ***Economic Modelling with Time Series: Specification, Estimation and Testing***, Cambridge University Press, 887p.

COURSE ASSIGNMENT 1

Homework

Task 1. The following information is available about the x and y variables

X	1	3	1	3	7
Y	2	2	6	4	6

the regression equation will look like this:

Task 2. The following regression equation was estimated from 30 observations (in parentheses standard deviations of coefficient estimates are indicated):

$$\widehat{y_i} = \underset{(1,0)}{1,5} - \underset{(0,4)}{0,9} \cdot x_i^{(1)} + \underset{(0,01)}{0,04} \cdot x_i^{(2)} + \underset{(0,02)}{0,09} \cdot x_i^{(3)} + \underset{(0,6)}{2,0} \cdot x_i^{(4)},\ R^2 = 0,59$$

Check (at a significance level of 5%) the hypothesis that all coefficients at both equations are zero at the same time.

COURSE ASSIGNMENT 2

Practical tasks in R (RStudio)

1. Find the length of the circle with a radius of 8. Assign the result to the *len* variable. Display them on the screen.
2. Create the matrix A_mat that contains a sequence from 40 to 2 with a difference of -2 and has 4 rows and 5 columns. Data must be counted by rows
3. Import the data set from the rus_data.csv file to R. Display the objects structure. Delete the column "time" and convert the data back to the *ts* object.
4. Import the data set from gas.csv. Convert the data to *ts* object.
5. Create a new variable dlempl = 100 (log (templ_manift) - log (empl_manift-1)), where templ_manift is the first column in the rus_data.csv. Use the function *diff ()* to do this
6. Draw the graph for dlempl using the function *autoplot ()*
7. Draw the graphs of ACF and PACF for dlempl.

COURSE ASSIGNMENT 3

Test

TASK 1. A researcher is studying the effectiveness of a new drug for altitude sickness, which people face when they are at high altitude. He collected data about 2,000 climbers, half of whom, while at altitude, took the new medicine, and the other half did not. For each of the climbers, as a result of a comprehensive survey, the level of health was measured on a special 10-point scale (1-very bad, 10-very good).

After some simple calculations, the researcher obtained the following results:

- For climbers who took the medicine, the average health level is 4 points, with a sample variance of 2.
- For climbers who did not take the medicine, the average health level is 7 points, with a sample variance of 2.

In addition to calculating averages, our researcher wants to evaluate the regression:

$$y_i = a_1 + a_2 x_i + e_i$$

where $\mathbf{x_i}$ is a dummy variable equal to 1 if the i-th climber took the medicine, and equal to 0 otherwise, $\mathbf{y_i}$ is the health level of the i-th climber.

COURSE ASSIGNMENT 3

Question 1.1. Consider three options for implementing the drug experiment. *Option 1:* each climber participating in the experiment independently decides whether to take the medicine or not. *Option 2:* climbers participate in a lottery that randomly determines who will take the medicine and who will not. *Option 3:* female climbers take the medicine, but male climbers do not. *In which of the cases, the regressor in the equation to be exogenous?*

Question 1.2. *Which of the options described in the previous question is preferable if the goal of the researcher is to obtain a consistent assessment of the effectiveness of the drug?*

Question 1.3. *Using OLS method the coefficient score for* $\mathbf{a}_1$ *will be*

1)4
2)7
3)9
4)11
5)15

Question 1.4. *Using OLS method the coefficient score for* $\mathbf{a}_2$ *will be*

1) *-2*
2) *-3*
3) *-5*
4) *-6*
5) *-12*

THANKS FOR ATTENTION

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