Time Series and Panel Data Analysis Syllabus

Sergey Gelman and Pavel Katyshev

September 10, 2012

Lecturers	
Sergey V. Gelman sgelman@hse.ru	Pavel K. Katyshev pkatish@nes.ru
Class Teachers	
Marina Turuntseva m.turuntseva@gmail.com	Sergey Vedernikov goryinyich@inbox.ru

1 Course description

Time Series and Panel Data Analysis (intermediate level) is a one-semester course designed for fourth year ICEF students. The main objective of the course is to prepare the students to do their own applied work, in particular on their bachelor's diploma. The course is divided into two parts: the first part — Time Series theory and methods — is taught by Sergey Gelman, and the second part — Panel Data Analysis — is taught by Pavel K. Katyshev. The prerequisites of the course are Statistics and Econometrics. The knowledge of economic theory and computer-based information systems is necessary as well. The course is taught mainly in English, some of the classes may be taught in Russian.

2 Teaching methods

The following methods and forms of study are used in the course:

- Lectures
- Practices and in computer lab class (the main problems in home assignments are discussed)
- Self-study in computer lab (doing home assignments using Excel and Econometric Views, working with economic data, doing research on the web)
- Self-study with literature

3 Assessment

1. Midterm exam at the end of the first part of the course (about 90 minutes)
2. Essay (4-5 pages)
3. Written final exam (about 120 minutes)

Grade determination

This course includes one control work, one essay and one written final exam. The main form of control is the written exam at the end of the semester; it contributes 40% of the final grade. The final grade is also partly determined by the midterm control work (30% of the final grade), the home assignments (10% of the final grade), and the essay (20% of the final grade).

4 Main Readings

4.1 Time Series Analysis

1. Enders W. *Applied Econometric Time Series*. 2nd ed., John Wiley and Sons, Inc., 2004 (***WE***)
2. Christoffersen, P. F. *Elements of Financial Risk Management*. Academic Press, London 2003 (***PC***)
3. Diebold, F.X. *Elements of forecasting*, Thomson South-Western, Canada 2006 (***FD***).
4. James D. Hamilton. *Time Series Analysis*. Princeton University press, 1994.
5. Kantorovich G. G. *Lecture notes for the course "Time Series Analysis" (in Russian)*. Ekonomicheskij zhurnal VShE, 2002.

4.2 Panel Data Analysis

1. Johnston J. and DiNardo, J. *Econometric Methods*. 4th Ed. McGraw-Hill 1997. (***JD***)
2. Angrist, J. and Prischke, J. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton Univ Press, 2009. (***AP***)
3. Frees, E. W. *Longitudinal and Panel Data*. Cambridge U. P., 2004. (***FR***)
4. Wooldrige J. M. *Econometric Analysis of Cross Section and Panel Data*. The MIT Press, 2002. (***WOO***)
5. Cameron C.A and Trivedi P.K. *Microeconometrics: methods and applications*. Cambridge U.P., 2005. (***CA***)

4.3 Additional Readings

Time Series Analysis

1. Tsay, R., *Analysis of Financial Time Series*, John Wiley and Sons, 2002
2. Maddala, G.S. And Kim In-Moo. *Unit Roots, Cointegration, and Structural Change*. Cambridge University Press, 1998
3. P. J. Brockwell, R. A. Davis, *Introduction to Time Series and Forecasting*. Springer, 1996
4. J. Johnston, J. DiNardo. *Econometric Methods*. McGraw-Hill, 1997.
5. W. Charemza, D. Deadman. *New Directions in Econometric Practice*. Edward Elgar Publishing Limited, 1997.
6. R. I. D. Harris. *Using Cointegration Analysis in Econometric Modeling*. Prentice Hall, 1995

Panel Data Analysis

1. Ruud P.A. *An Introduction to Classical Econometric Theory*. Oxford U.P., 2000.
2. Hsiao, C. *Analysis of Panel Data* (Econometric Society Monograph). Cambridge U.P. , 1986.
3. Nerlove, M. *Essays in Panel Data Econometrics*. Cambridge U. P., 2002.

4.4 Internet Resources and Databases

1. *Econometric Views 4.0 User's Guide*. Quantitative Micro Software, LLC.

5 Course Outline

5.1 Time Series Analysis

Stochastic processes: main properties Stochastic process. Time series as a discrete stochastic process. Stationarity. Main characteristics of stochastic processes (mean, autocovariation and autocorrelation functions). Stationary stochastic processes. Stationarity as the main characteristic of stochastic component of time series. Lag operator.
WE, Chapter 1

Autoregressive-moving average models ARMA (p,q) Moving average models $MA(q)$. Condition of invertibility. Autoregressive models $AR(p)$. Yule-Walker equations. Stationarity conditions. Autoregressive-moving average models $ARMA(p,q)$.
WE, Chapter 2

Coefficient estimation in $ARMA(p,q)$ processes. Box-Jenkins methodology Coefficients estimation in autoregressive models. Coefficient estimation in $ARMA(p,q)$ processes. Goodness of fit in time series models. AIC information criterion. BIC information criterion. Q-statistics. Box-Jenkins methodology to identification of stationary time series models.
WE, Chapter2

Properties of forecasts Forecasting, trend and seasonality in Box-Jenkins model.
WE, Chapter 2

Modeling volatility using GARCH The notion of conditional volatility. Properties, diagnostics, and estimation of $GARCH$.
WE, Chapter 3

Vector autoregression and impulse-response functions. Causality Intervention analysis and transfer function. VAR analysis. Impulse-response function.
WE, Chapter 5

5.2 Panel Data Analysis

Introduction to Panel Data Definition of panel data. Types of panels. Brief History. Benefits and drawbacks of longitudinal data. Causal inference using panels. Exploratory analysis of panels. Basic models: fixed effects, random effects, between and pooled estimators. Traditional vs. modern approaches to panel data.
FR, Chapter 1. ***AP***, Chapter 5. ***JD***, Chapter 12.

The Pooled OLS Estimator Pooled panel data as a system of equations. Assumptions. Consistency of pooled OLS. Examples. Pooled OLS, FGLS, and WLS. Estimation using STATA.
WOO, Chapter 7

The Random Effects Estimator Assumptions. Comparison to pooled OLS. Random effects in the context of the unobserved effects model. Random effects as feasible GLS and as a combination of the within and between estimators. Conditions for the consistency of random effects. Panel-Robust Sandwich Standard Errors. Tests for pooling. Examples. Estimation using STATA (xtreg command).
WOO, Chapter 10.1-10.4

The Fixed Effects Estimator Fixed effects in the context of the unobserved effects model. Advantages and disadvantages over other estimators. The two-period case. Consistency of fixed effects. Examples. Estimation using STATA (xtreg command). Fixed or random effects? The Wu-Hausman Test.
WOO, Chapter 10.5-10.7

GMM estimation of panel models Moment conditions and identification. One and two-step GMM. Tests of overidentifying restrictions. Redundant and weak instruments.

Examples. Random and fixed effects panel GMM. Dynamic Panel Models. Arellano-Bond estimator. STATA xtabond command.
CA, Chapter 22

6 Distribution of Hours

No	Topic title	Total (hours)		Contact hours	Self-study
		Lectures	Classes		
PART I. Time Series Analysis					
1	Stochastic processes	16	2	2	12
2	Autoregressive-moving average models	20	4	4	12
3	Coefficient estimation in $ARMA(p,q)$ process. Box-Jenkins.	20	4	4	12
4	Properties of forecasts	18	4	4	10
5	Modeling volatility using $GARCH$	20	4	4	12
6	Vector auto-regression and impulse-response functions. Causality.	16	2	2	12
PART II. Panel Data Section					
7	Introduction to Panel Data	14	2	2	10
8	Pooled OLS	20	2	2	16
9	Random Effects	24	4	4	16
10	Fixed Effects	24	4	4	16
11	Advanced Topics	24	4	4	16
	Total	216	36	36	144