New Economic School

APPLIED TIME SERIES ECONOMETRICS

Module 2, 2010–2011

Professor: Stanislav Anatolyev

The course is devoted to the modern applied time series analysis. First we will discuss principles of time series modeling and review various model selection procedures. After that we will study popular models of conditional mean dynamics such as linear autoregressions and vector autoregressions as well as nonlinear structures like threshold, smooth transition and regime switching models. We will also explore such issues as stationarity, integratedness, unit roots and cointegration, and get acquainted with the notion of Brownian motion. Then we will turn to modeling conditional variance and, more generally, volatility. We will also review modeling and forecasting more complex conditional objects. Finally, we will study methods of dealing with structural instability.

ORGANIZATION

The course presumes the use of publications in applied time series and computer work. The home assignment, or “mini-project” (50% of the grade) is an empirical analysis of a time series of own choice (with instructor’s approval). The exam (50% of the grade) will contain questions on a published applied time series paper handed out in advance. Both components, as well as minimal 70% attendance, are obligatory for getting a credit.

LITERATURE

There is a “Reader” available at the NES library which contains illustrative applied papers for reading at the rate about 2 per week. These papers primarily teach the methodology of research. Other, more technical, recommended literature is:

- «Эконометрический ликбез: прогнозирование временных рядов», *Квантиль*, №1, сентябрь 2006 г., стр. 3-62. «Эконометрический ликбез: волатильность», *Квантиль*, №8, июль 2010 г., стр. 1-122. Доступно на http://quantile.ru/
- Franses, P. and D. van Dijk. *Nonlinear Time Series Models in Empirical Finance*, Cambridge, 2000
- Hamilton, J. *Time Series Analysis*, Princeton, 1994
- Enders, W. *Applied Econometric Time Series*, John Wiley, 2nd edition, 2004

I. Modeling methodology and model selection

- Structural and non-structural time series modeling.
- Object of dynamic modeling: conditional mean, conditional variance, conditional quantile, conditional direction, conditional density.
- Model selection: diagnostic testing, information criteria and prediction criteria.
- General-to-specific and specific-to-general methodologies. Data mining.

II. Modeling conditional mean

- Stationary AR models: properties, estimation, inference, forecasting.
- Stochastic and deterministic trends, unit root testing. Brownian motion, FCLT.
- Nonlinear autoregressions: threshold autoregressions, smooth transition autoregressions, Markov switching models, state-space models.
- Stationary VAR models: properties, estimation, analysis and forecasting.
- VAR models with elements of nonlinearity.
- Spurious regression and cointegration.

III. Modeling conditional variance

- The class of ARCH models: properties, estimation, inference and forecasting.
- Extensions: IGARCH, ARCH-t. Time-varying risk and ARCH-in-mean.
- Multivariate GARCH. Copulas.
- Other models for financial volatility: stochastic volatility, diffusion models.
- Other measures of financial volatility: implied volatility, realized volatility.

IV. Other topics on modeling and forecasting

- High frequency data models: ACD, UHF–GARCH.
- Modeling and forecasting conditional density. ARCD and GARCHSK models.
- Modeling and forecasting direction-of-change. Directional predictability.
- Modeling and forecasting conditional quantiles. Value-at-risk. CAViaR model.

V. Structural instability

- Identification, estimation and testing for structural breaks.
- Retrospection and monitoring for structural stability.