ECON 690: Advanced Topics in Time Series Econometrics

Professor Mohitosh Kejriwal

Spring 2018

Lectures: Mondays and Wednesdays, 4:30-6:00pm in Rawls 3058

Office: KRAN 371

Office Hours: Tuesdays and Thursdays, 10:30-11:30am and by appointment

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Course Overview: This course covers the models and statistical techniques used in the analysis of nonstationary time series econometrics. It is designed for students interested in conducting theoretical and/or applied research in the econometric analysis of time series. The course has two specific objectives. The first is to equip students with the main statistical tools required for conducting state-of-the-art empirical research using time series data. The second objective is to lay out the econometric theory of time series analysis, with an emphasis on recent developments. Upon finishing the course, students will be able to understand the empirical and theoretical time series literature as exposed in the leading journals, as well as gain familiarity with a number of areas currently of interest in the field. Knowledge of a matrix oriented programming language (such as MATLAB or GAUSS) is essential. It is important to emphasize that not all methods covered are available in common software packages yet and hence their implementation will require the students to develop their own program codes.

Prerequisites: ECON 670-673 or equivalent.

Course Format: The lectures will primarily involve discussion of journal articles and working papers. For instance, the discussion of a methodological paper will include the shortcomings of existing methods, assumptions and mechanics of the new method and why it works, and simulation/empirical evidence to corroborate its usefulness in applications. For each topic, I will first present a set of papers that cover the main issues and methods while two students will be in charge of leading the discussion in the final lecture on that topic based on a list of topics I will provide. The students will roughly present once every two weeks and will have the option to prepare slides or use "chalk and talk", depending on their preference.

Grading: There will be **no exams**. The evaluation for the course will be based on assignments (40%), class presentations (20%) and a research project (40%). The assignments will primarily include replication of simulation and/or empirical results from published papers. The research project can be either theoretical or empirical and should include a statement

of the problem and why it is important, a survey of the relevant literature and a description of the findings. It is especially important to clearly discuss the contribution relative to existing studies. If proposing a new method, adequate simulation evidence should be provided while if the project is purely empirical which, say, entails application of a recently developed technique to an empirical question, a detailed discussion of the econometric issues involved should be included.

Course Website: All material related to the course will be available through Blackboard. You will need to log in with your username and password.

Textbooks and Lecture Notes: The main textbook for the course is Hamilton, J.D. (1994), *Time Series Analysis,* Princeton University Press. Two other books that are more application oriented are: (1) Enders, W. (2010), *Applied Econometric Time Series,* Third Edition, Wiley. (2) Lütkepohl, H. & Krätzig, M. (2004), *Applied Time Series Econometrics,* Cambridge University Press. I will additionally provide a set of lecture notes for each topic covered in class.

Other Suggested References:

1. Brockwell, P.J. & Davis, R.A., *Time Series: Theory and Methods,* Springer.
2. Davidson, J., *Stochastic Limit Theory,* Oxford University Press.
3. Davidson, R. & MacKinnon, J.G., *Econometric Theory and Methods,* Oxford University Press.
4. Harvey, A.C., *Forecasting, Structural Time Series Models and the Kalman Filter,* Cambridge University Press.
5. Lütkepohl, H., *New Introduction to Multiple Time Series Analysis,* Springer.
6. Tsay, R.S., *Analysis of Financial Time Series*, Third Edition, Wiley.
7. White, H., *Asymptotic Theory for Econometricians,* Academic Press.

Emergency: In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances.

Course Outline and Suggested Readings [* denotes primary reading]

Topic 1: Unit Roots and Trends

- Comparison of difference stationary and trend stationary processes, the functional central limit theorem, unit root testing, GLS detrending and robust inference in models with trends.

References:

1. *Hamilton, Ch 17.
2. *Nelson, C.R. & Plosser, C.I. (1982), Trends and Random Walks in Macroeconomic Time Series, Journal of Monetary Economics 139-162.
3. *Campbell, J. Y. & Perron, P. (1991), Pitfalls and Opportunities: What Macroeconomists should know about Unit Roots, NBER Macroeconomic Annual 6, 141-201.
4. *Elliott, G., Rothenberg, T.J. & Stock, J.H., (1996), Efficient Tests for an Autoregressive Unit Root, Econometrica 64, 813-836.
5. *Ng, S. & Perron, P. (2001), Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power, Econometrica 6, 1519-1554.
6. Davidson, J. (1994), *Stochastic Limit Theory,* Oxford University Press.
7. Enders, Ch 4.
8. Lütkepohl & Krätzig, Ch 2.
9. Dickey, D.A. & Fuller, W.A. (1979), Distribution of the Estimators for Autoregressive Time Series With a Unit Root, Journal of the American Statistical Association 74, 427-431.
10. Phillips, P.C.B., Perron, P. (1988), Testing for a unit root in time series regression, Biometrika 75, 335-346.
11. Stock, J.H. (1994), Unit Roots, Structural Breaks and Trends, Handbook of Econometrics vol IV, chapter 46.

Topic 2: Cointegration Analysis

- Spurious Regression, cointegrated time series, estimation of the cointegrating vector, tests for cointegration and cointegrating rank.

References:

1. *Hamilton, Ch 18-20.
2. *Engle, Robert F. & Granger, C.W.J. (1987), Co-Integration and Error Correction: Representation, Estimation and Testing, Econometrica 55, 251-276.
3. Enders, Ch 6.
4. Lütkepohl & Krätzig, Ch 3-4.

5. Elliott, G. (1998), The Robustness of Efficient Cointegration Estimators when Regressors Almost Have Unit Roots, Econometrica 66, 149-158.

6. Haug, A. (1996), Tests for Cointegration: A Monte Carlo Comparison, Journal of Econometrics 71, 89-115.

7. Jansson, M and Moreira, M. (2006), Optimal Inference in Regression Models with Nearly Integrated Regressors, Econometrica 74, 681-714.

8. King, R. G., Plosser, C.I., Stock, J.H. & Watson, M.W. (1991), Stochastic Trends and Economic Fluctuations, American Economic Review 81, 819-840.

9. Watson, M (1994), Vector Autoregressions and Cointegration, Handbook of Econometrics vol IV, chapter 47.

Topic 3: Structural Breaks

- Detection and estimation of structural breaks in time series data, interplay between structural change and unit roots, bubble detection in financial time series.

References:

1. *Bai, J. & Perron, P. (1998), Estimating and Testing Linear Models with Multiple Structural Changes, Econometrica 66, 47-78.

2. *Hansen, B. (2001), The New Econometrics of Structural Change: Dating Changes in U.S. Labor Productivity, Journal of Economic Perspectives 15, 117-128.

3. *Perron, P. (2006), Dealing with structural breaks, in Palgrave Handbook of Econometrics, Palgrave Macmillan, 278-352.

4. *Stock, J.H. & Watson, M.W. (1996), Evidence on Structural Instability in Macroeconomic Time Series Relations, Journal of Business & Economic Statistics 14, 11-30.

5. Andrews, D.W.K. (1993), Tests for parameter instability and structural change with unknown change point, Econometrica 61, 821-856.

6. Bai, J. (1997), Estimation of a change point in multiple regression models, Review of Economics and Statistics 79, 551-563.

7. Bai, J., Lumsdaine, R.L. & Stock, J.H. (1998), Testing for and Dating Common Breaks in Multivariate Time Series, Review of Economic Studies 63, 395-432.

8. Enders, Ch 4.

Topic 4: Predictive Regression

- Tools for forecast evaluation, predictive regression bias, forecast combination, regularization methods such as LASSO, principal components and bagging.

References:

1. *Ng, S (2013), Variable selection in predictive regressions, Handbook of Economic Forecasting.

2. *Stock, J.H. & Watson, M.W. (2006), Forecasting with Many Predictors, in Handbook of Economic Forecasting.

3. *West, K.D. (2006), Forecast Evaluation, Handbook of Economic Forecasting.

4. Clark, T. & McCracken, M. (2013), Advances in Forecast Evaluation, Handbook of Economic Forecasting.

5. Hastie et al. (2009), The elements of statistical learning - data mining, inference and prediction. Springer Series in Statistics

6. Inoue, A. & Kilian, L. (2008), How useful is bagging in forecasting economic time series? A case study of US consumer price inflation, Journal of the American Statistical Association 103, 511-522.

7. Stambaugh, R. (1999), Predictive Regressions, Journal of Financial Economics 54, 375-421.

8. Lettau, M. and Van Nieuwerburgh, S. (2008), Reconciling the Return Predictability Evidence, Review of Financial Studies 21, 1607-1652.