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Economics 518B
Seminar on Applied Econometrics II: Time Series Techniques and Applications
TTh 1:00-2:30, Seigle Hall 103
Class Website: http://artsci.wustl.edu/~morley/Courses/Econ518B.html

Syllabus

Course Description

This is a survey course on time series econometric techniques, with applications in macroeconomics, international finance, and finance. Topics include ARMA models, the Box-Jenkins methodology, and forecasting; VARs and impulse response functions; time trends, unit roots, and structural breaks; spurious regressions; trend/cycle decomposition methods, including Kalman filtering; spurious cycles; cointegration; ARCH models of volatility, and Markov-switching models. Following the bulk of the applied literature, we will mostly, but not exclusively, work with the classical framework in the time domain. While there is a textbook, a lot of emphasis will be put on readings from economics journals.

Objectives

An important objective of this course is to survey the core literature in applied time series econometrics. However, the primary objective is to stimulate interest in the time series approach, with the ultimate aim of providing students with the necessary tools to conduct original research in the area. To that end, the course requires a research project rather than any written exams.

Prerequisites

A good grasp of basic mathematical statistics and linear algebra is necessary for the course. The mathematical appendix in the Hamilton textbook provides a good summary of useful mathematical and statistical tools. I will assume everyone has taken the first year econometrics sequence.

Requirements

There will be a series of homework assignments that will involve generating and interpreting computer output from EViews and GAUSS. There will also be a major research project. There are no exams for the class.

The research project will have three stages. In the first stage, you will make an appointment and meet with me in order to propose a topic. While original research that applies the time series techniques discussed in the course would be acceptable, it is expected that you will take an existing empirical study and extend it by changing, or at the very least updating, the data used in the original study. (In time series analysis, replication is often harder than it sounds.) Potential source papers are denoted with asterisks in the reading list below. Other papers will be allowed, but must be cleared by me first. I will allow you to work in pairs, if you choose. However, if you do, you must make it clear to me how you plan to "divvy up" the work in an equitable manner. The second stage of the project will be an in-class presentation. The presentations will be sometime around the middle of the semester. Therefore, it is not expected that you will report on any final results. Instead, you should try to motivate why their project is interesting and teach some of the details of its implementation in a way that engages others in the class. For the final stage, you will submit a 6-10 page paper that motivates the issue, presents in detail the implementation of the econometric techniques, and summarizes the results.

Textbooks

There is one required text for the course:

Time Series Analysis, by James D. Hamilton, Princeton University Press, 1994.

There is also a very useful optional text that is mentioned in the reading list:

State-Space Models with Regime Switching, by Chang-Jin Kim and Charles R. Nelson, MIT Press, 1999.

Other texts that you may find useful are the following:

Time Series Models, Second Edition, by Andrew C. Harvey, MIT Press, 1993.

Applied Econometric Time Series, Second Edition, by Walter Enders, Wiley, 2004.

Time Series Models for Business and Economic Forecasting, by Philip Hans Franses, Cambridge, 1998.

Econometric Theory and Methods, by Russell Davidson and James G. MacKinnon, Oxford University Press, 2004.

Bayesian Econometrics, by Gary Koop, Wiley, 2003.

Outline

I. Stationary Time Series Analysis

Stochastic Difference Equations, ARMA Models, Forecasting, Maximum Likelihood Estimation, Prediction Error Decomposition, State-Space Form, Kalman Filter, Spectral Analysis, Measures of Persistence, Inference

- Hamilton 1-6, 13
- Kim and Nelson 2-3
- Diebold, F.X., 1998, The Past, Present, and Future of Macroeconomic Forecasting, *Journal of Economic Perspectives* 12, 175-192. RP

II. Structural Analysis

VAR Models, Granger Causality, Identification, IRFs

- Hamilton 10-11
- Sims, C.A., 1972, Money, Income, and Causality, *American Economic Review* 62, 540-552. RP
- Sims, C.A., 1980, Macroeconomics and Reality, *Econometrica* 48, 1-48.
- Cooley, T.F. and S.F. LeRoy, 1985, Atheoretical Macroeconometrics: A Critique, *Journal of Monetary Economics* 16, 283-308.
- Blanchard, O.J. and D. Quah, 1989, The Dynamic Effects of Aggregate Demand and Supply Disturbances, *American Economic Review* 79, 655-673.
- Eichenbaum, M. and C.L. Evans, 1995, Some Empirical Evidence on the Effects of Shocks to Monetary Policy on Exchange Rates, *Quarterly Journal of Economics* 110, 975-1009.
- Faust, J. and E.M. Leeper, 1997, When do long-run identifying restrictions give reliable results? *Journal of Business and Economic Statistics* 15, 345-353.
- Rudebusch, G.D., 1998, Do Measures of Monetary Policy in VARs Make Sense? *International Economic Review* 39, 907-931.
- Faust, J. 1998, The robustness of identified VAR conclusions about money, *Carnegie-Rochester Conference Series on Public Policy* 49, 207-244.
- Christiano, L.J., M. Eichenbaum, and C. Evans, 1999, Monetary Policy Shocks: What Have We Learned And to What End? In Handbook of Macroeconomics 1, 65-148.
- *Kilian, L., 1999, Finite-Sample Properties of Percentile and Percentile-t Bootstrap Confidence Intervals for Impulse Responses, *Review of Economics and Statistics* 81, 652-660.
- Stock, J. and M. Watson, 2002, Vector Autoregressions, *Journal of Economic Perspectives* 15, 101-115. RP
- *Canova, F. and G. De Nicolo, 2002, Monetary Disturbances Matter for Business Fluctuations in the G-7, *Journal of Monetary Economics* 49, 1131-1159.
- Uhlig, H., 2005, What are the effects of monetary policy on output? Results from an agnostic identification procedure, *Journal of Monetary Economics* 52, 381-419.
- *Jordà, O., 2005, Estimation and Inference of Impulse Responses by Local Projections, *American Economic Review* 95, 161-182.
- *King, T.B. and J. Morley, 2007, In Search of the Natural Rate of Unemployment, *Journal of Monetary Economics* 54, 550-564. RP
- Kim, C.-J., J. Morley, and J. Piger, 2007, Bayesian Counterfactual Analysis of the Sources of the Great Moderation, *Journal of Applied Econometrics*.

III. Unit Roots and Structural Breaks

Unit Roots, Structural Breaks, Trend/Cycle Decomposition, Spurious Regressions, Cointegration

- Hamilton 15-20
- Granger, C.W.J. and P. Newbold, 1974, Spurious Regressions in Econometrics, *Journal of Econometrics* 2, 111-120.
- Nelson, C.R. and H. Kang, 1981, Spurious Periodicity in Inappropriately Detrended Time Series, *Econometrica* 49, 741-751.
- Beveridge, S. and C.R. Nelson, 1981, A New Approach to Decomposition of Economic Time Series into Permanent and Transitory Components with Particular Attention to Measurement of the "Business Cycle", *Journal of Monetary Economics* 7, 151-174.
- Nelson, C.R. and C.I. Plosser, 1982, Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications, *Journal of Monetary Economics* 10, 139-162. RP
- Watson, M., 1986, Univariate Detrending Methods with Stochastic Trends, *Journal of Monetary Economics* 18, 49-75. RP
- Clark, P., 1987, The Cyclical Component of U.S. Economic Activity, *Quarterly Journal of Economics* 102, 797-814.
- Stock, J. and M. Watson, 1988, Variable Trends in Economic Time Series, *Journal of Economic Perspectives* 2, 147-174. RP
- Cochrane, J., 1988, How Big Is the Random Walk in GNP? *Journal of Political Economy* 96, 893-920.
- Perron, P., 1989, The Great Crash, The Oil Price Shock, and the Unit Root Hypothesis, *Econometrica* 57, 1361-1401.
- Campbell, J. and Pierre Perron, 1991, Pitfalls and Opportunities: What Macroeconomists Should Know About Unit Roots, *NBER Macroeconomic Annual 1991*. RP
- *King, R.G., C.I. Plosser, J.H. Stock, and M.W. Watson, 1991, Stochastic Trends and Economic Fluctuations, *American Economic Review* 81, 819-840.
- Kwiatkowski, D., P. Phillips, P. Schmidt, and Y. Shin, 1992, Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root, *Journal of Econometrics* 54, 159-178.
- *Zivot, E. and D.W.K. Andrews, 1992, Further Evidence on the Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis, *Journal of Business and Economic Statistics* 10, 251-270.
- Harvey, A.C. and A. Jaeger, 1993, Detrending, Stylized Facts and the Business Cycle, *Journal of Applied Econometrics* 8, 231-247.
- Stock, J.H. and M.W. Watson, 1993, A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems, *Econometrica* 61, 783-820.
- *Leybourne, S.J. and B.P.M. McCabe, 1994, A Consistent Test for a Unit Root, *Journal of Business and Economic Statistics* 12, 157-166.
- Cochrane, J.H., 1994, Permanent and Transitory Components of GNP and Stock Prices, *Quarterly Journal of Economics* 104, 241-263. RP (hw6)
- *Cogley, T. and J.M. Nason, 1995, Effects of the Hodrick-Prescott Filter on Trend and Difference Stationary Time Series: Implications for Business Cycle Research, *Journal of Economic Dynamics & Control* 19, 253-278. RP
- Gregory, A.W., A.C. Head, and J. Raynauld, 1997, Measuring World Business Cycles, *International Economic Review* 38, 677-701.

- *Canova, F., 1998, Detrending and Business Cycle Facts, *Journal of Monetary Economics* 41, 475-512.
- Bai, J. and P. Perron, 1998, Estimating and Testing Linear Models with Multiple Structural Changes, *Econometrica* 66, 47-78.
- *Diebold, F.X. and C. Chen, 1998, Testing Structural Stability with Endogenous Breakpoint: A Size Comparison of Analytic and Bootstrap Procedures, Journal of Econometrics 70, 221-241.
- *Ireland, P.N., 1999, Does the Time-Consistency Problem Explain the Behavior of Inflation in the United States? Journal of Monetary Economics 44, 279-291.
- *Engel, C. and C.-J. Kim, 1999, The Long-Run U.S./U.K. Real Exchange Rate, Journal of Money, Credit, and Banking 31, 335-356.
- Murray, C.J. and C.R. Nelson, 2000, The Uncertain Trend in U.S. GDP, *Journal of Monetary Economics* 46, 79-96.
- Hansen, B.E., 2001, The New Econometrics of Structural Change: Dating Breaks in U.S. Labor Productivity, *Journal of Economic Perspectives* 15, 117-128. RP
- Engel, C. and J. Morley, 2001, The Adjustment of Prices and the Adjustment of the Exchange Rate, NBER Working Paper 8550.
- Stock, J. and M. Watson, 2002, Has the Business Cycle Changed and Why? *NBER Macroeconomics Annual 2002*, 159-218.
- Morley, J.C., C.R. Nelson, and E. Zivot, 2003, Why Are the Beveridge-Nelson and Unobserved Components Decompositions of GDP So Different? *Review of Economics and Statistics* 85, 235-243. RP
- *Murray, C.J., 2003, Cyclical Properties of Baxter-King Filtered Time Series, *Review of Economics and Statistics* 85, 472-476. RP
- *Kose, M.A., C. Otrok, and C.H. Whiteman, 2003, International Business Cycles: World, Region, and Country-Specific Factors, *American Economic Review* 93, 1216-1239.
- Ahmed, S., A. Levin and BA Wilson, 2004, Recent U.S. macroeconomic stability: Good policy, good practices, or good luck? *Review of Economics and Statistics,* 86, 824-832.
- Kim, C.-J., J.C. Morley, and C.R. Nelson, 2005, The Structural Break in the Equity Premium, *Journal of Business and Economic Statistics* 23, 181-191.
- Anderson, H.M., C.N. Low, and R. Snyder, 2006, Single Source of Error State Space Approach to the Beveridge Nelson Decomposition, *Economic Letters* 91, 104-109.
- *Levin, A.T. and J.M. Piger, 2006, Is Inflation Persistence Intrinsic in Industrial Economies? Working Paper.
- Morley, J., 2007, The Slow Adjustment of Aggregate Consumption to Permanent Income, *Journal of Money, Credit, and Banking* 39, 615-637.
- Morley, J., 2007, The Two Interpretations of the Beveridge-Nelson Decomposition, Working Paper.
- Oh, K.H. and E. Zivot, The Clark Model with Correlated Components, Working Paper.
- *Sinclair, T., 2008, The Relationships between Permanent and Transitory Movements in U.S. Output and the Unemployment Rate, *Journal of Money, Credit, and Banking*, forthcoming.

IV. Nonlinearity

ARCH, Markov switching, Threshold Models, Time-Varying Parameters, Gibbs sampling, Particle Filtering, Identification through Heteroskedasticity

- Hamilton 21-22
- Kim and Nelson 3-5, 7-10
- Engle, R.F., D.M. Lilien, and R.P. Robbins, 1987, Estimating Time Varying Risk Premia in the Term Structure: the ARCH-M Model, *Econometrica* 55, 391-408.
- Hamilton, J.D., 1989, A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle, *Econometrica* 57, 357-384. RP
- Turner, C.M., R. Startz, and C.R. Nelson, 1989, A Markov Model of Heteroskedasticity, Risk, and Learning in the Stock Market, *Journal of Financial Economics* 25, 3-22.
- *Engel, C.R. and J.D. Hamilton, 1990, Long Swings in the Dollar: Are They in the Data and Do Markets Know It?" *American Economic Review* 80, 689-713.
- *Lam, P.-S., 1990, The Hamilton Model with a General Autoregressive Component, *Journal of Monetary Economics* 26, 409-432.
- *Campbell, J.Y. and L. Hentschel, 1992, No News Is Good News: An Asymmetric Model of Changing Volatility in Stock Returns, *Journal of Financial Economics* 31 281-318.
- *Beaudry, P. and G. Koop, 1993, Do Recessions Permanently Change Output? *Journal of Monetary Economics* 31, 149-163.
- Kim, C.-J., 1994, Dynamic Linear Models with Markov-Switching, *Journal of Econometrics* 60, 1-22.
- *Hamilton, J.D. and R. Susmel, 1994, Autoregressive Conditional Heteroskedasticity and Changes in Regime, *Journal of Econometrics* 64, 307-333.
- Ramsey, J.B. and P. Rothman, 1996, Time Irreversibility and Business Cycle Asymmetry, *Journal of Money, Credit, and Banking* 28, 1-21.
- *Obstfeld, M. and A.M. Taylor, 1997, Nonlinear Aspects of Goods-Market Arbitrage and Adjustment: Heckscher's Commodity Points Revisited, *Journal of the Japanese and International Economies* 11, 441-479.
- *Kim, C.-J. and C.R. Nelson, 1999, Friedman's Plucking Model of Business Cycle Fluctuations: Tests and Estimates of Permanent and Transitory Components, *Journal of Money, Credit, and Banking* 31, 317-334.
- *van Dijk, D. and P.H. Franses, 1999, Modeling Multiple Regimes in the Business Cycle, *Macroeconomic Dynamics* 3, 311-340.
- *Cogley, T. and T.J. Sargent, 2001, Evolving Post-World War II Inflation Dynamics, *NBER Macroeconomics Annual 2001*. RP
- Kim, C.-J., J.C. Morley, and C.R. Nelson, 2001, Does an Intertemporal Tradeoff Between Risk and Return Explain Mean Reversion in Stock Prices? *Journal of Empirical Finance* 8, 403-426.
- van Dijk, D., T. Teräsvirta, and P.H. Franses, 2002, Smooth transition autoregressive models – A survey of recent developments, *Econometric Reviews* 21, 1-47.
- *Clarida, R.H. and M.P. Taylor, 2003, Nonlinear Permanent-Temporary Decomposition in Macroeconomics and Finance, *Economic Journal* 113, C125-C139.
- Rigobon, R., 2003, Identification through Heteroskedasticity, *Review of Economics and Statistics* 85, 777-792.

- *Clements, M.P. and H.-M. Krolzig, 2003, Business cycle asymmetries: Characterization and testing based on Markov-switching autoregressions, *Journal of Business and Economic Statistics* 21, 196-211.
- Kim, C.-J., J.C. Morley, and C.R. Nelson, 2004, Is There a Positive Relationship between Stock Market Volatility and the Equity Premium, *Journal of Money, Credit, and Banking* 36, 339-360.
- *Gravelle, T., M. Kichian, and J. Morley, 2005, Detecting Shift-Contagion in Currency and Bond Markets, *Journal of International Economics* 68, 409-423. RP
- *Lo, M.C. and J. Piger, 2005, Is the Response of Output to Monetary Policy Asymmetric? Evidence from a Regime-Switching Coefficients Model, *Journal of Money, Credit, and Banking* 37, 865-886. RP
- Kim, C.-J., J. Morley, and J. Piger, 2005, Nonlinearity and the Permanent Effects of Recessions, *Journal of Applied Econometrics* 20, 291-309. RP
- *Diebold, F.X. and C. Li, 2006, Forecasting the Term Structure of Government Bond Yields, *Journal of Econometrics* 130, 337-364. RP
- Koop, G.M. and S. M. Potter, 2006, Forecasting and estimating multiple change-point models with an unknown number of change-points, forthcoming in *Review of Economic Studies*.
- *Ma, J., C.R. Nelson, and R. Startz, 2007, Spurious Inference in the GARCH(1,1) Model When It Is Weakly Identified, *Studies in Nonlinear Dynamics & Econometrics* 11, 1-27. RP
- Piger, J., 2007, Econometrics: Models of Regime Changes, prepared for Springer *Encyclopedia of Complexity and System Science*.
- Morley, J., 2007, Macroeconomics, Nonlinear Time Series in, prepared for Springer *Encyclopedia of Complexity and System Science*. RP
- Morley, J. and J. Piger, 2008, Trend/Cycle Decomposition of Regime-Switching Processes, *Journal of Econometrics*, forthcoming.
- Sinclair, T.M., 2008, Asymmetry in the Business Cycle: A New Unobserved Components Model, Working Paper.
- *Kim, C.-J., J. Piger, and R. Startz, 2008, Estimation of Markov Regime-Switching Regression Models with Endogenous Switching, Journal of Econometrics 143, 263-273.

RP denotes that the article is available in the course reading package. * denotes paper is appropriate for replication project.