George Mason University
Department of Economics
Economics 895-006
Time Series Econometrics

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Syllabus and Reading List

The purpose of this course is to help you develop basic time series econometric skills. The focus is primarily applied, as opposed to theoretical. As such, it is important that you are (or become) familiar with an appropriate statistical software (STATA, MATLAB, E-views, R, etc). While the course will not require any specific statistical software, my preference is STATA, as it is highly adaptable to a variety of environments. (STATA also has an immense, and growing, library of commands, which is housed at Boston College.)

It is important to point out that, while the primary focus is applied, a great deal of understanding takes place at the theoretical level. When necessary, therefore, we will discuss the underlying theory behind some of the most popular time series techniques. To that end, you need to be familiar with: a basic understanding of differential equations (at a fundamental level, time series involves the estimation of difference equations with a stochastic component), a basic understanding of linear algebra (which make understanding of multivariate time series much easier to follow), and basic knowledge of trigonometry that will be very helpful for understanding analysis in the frequency domain (important for understanding filtering techniques, as well as spectral regressions).

Grade Requirements

Time series is best learned by "doing." Therefore, there will be three small projects. We will also have a final exam, as per Mason requirements. Each project is worth 25 percent of the final grade, and the final exam counts for the remaining 25 percent of the grade. You can work in groups of not more than 4 in the projects, however, you must turn in your homework individually. The projects will be in the format of a mini-paper (about 3 to 5 pages): an introduction, a discussion of what you are doing, a conclusion, and the supporting tables as well as the code you wrote to generate the tables.

Basic References:

Enders, Walter. 2010. Applied Econometric Analysis. Wiley (most important textbook. **required!**)

Becketti, Sean. 2013. Introduction to Time Series Using STATA. STATA Press Publication. College Station, Texas. (Required especially for those who have never used STATA.)

Hamilton, James. Time Series Analysis. 1994. Princeton University Press. (A classic! highly recommended)

Lütkepohl, Helmut. 2005. New Introduction to Multiple Time Series Analysis. Springer (more theoretical, but highly recommended.)

Topics:

Topic 1: Difference equations. Homogeneous difference equations. Particular solutions. Lag operator.
Application: A dynamic Cobb-Web model of price determination.

Topic 2: Stationarity. Modeling stationary processes. Autocorrelation function. Box-Jenkins methodology.
Application: Simulating an ARMA process

Topic 3: Non-stationarity. Difference between deterministic and stochastic trend. Unit roots. Other forms of non-stationarity. Dickey-Fuller tests. Filtering: Moving averages, Baxter-King, Christiano-Fitzgerald, Hodrick-Prescott.
Application: Modeling nominal exchange rates

Topic 4: Multivariate systems. Transfer function. Constructing an impulse response function.
Application: What drives public interest in Austrian Economics?

Topic 5: Introduction to VARs. Identification problem. Granger causality. Cholesky decomposition and ordering. Structural VARs. Short-run and long-run restrictions. Examples.
Application: Is there evidence for (or against) the Austrian Business Cycle Theory?

Topic 6: Cointegration. Engle-Granger Error correction set up and speed of adjustment. Dynamic inferences.
Application: Estimation of dynamic money demand
Application: Estimation of long-run Purchasing Power Parity

Topic 7: Introduction to analysis in the frequency domain. Fourier Theorem. Spectral distribution. Understanding the periodogram.
Application: Modeling international political relations in the frequency domain

Topic 8: Temporal aggregation/sampling problems. Illustrations and applications.
Application: Evaluating gravity equations

Topic 9: (Time permitting) Dynamic implications of global games and contagion.
Application: Modeling bank runs from Diamond-Dybvig to coordination games

Additional References (The list below is partial. It will be updated by January 2019):

Advanced textbooks:

Amemiya, Takeshi. 1985. Advanced Econometrics. Cambridge, MA: Harvard University Press.

Harvey, Andrew C. 1990. Forecasting, Structural Time Series Models, and the Kalman Filter. Cambridge, UK: Cambridge University Press.

Priestly, Maurice B. 1981. Spectral Analysis and Time Series: Multivariate Series, Prediction and Control. Waltham, MA: Academic Press.

Stationarity tests and unit roots:

Campbell, John Y. and Pierre Perron. 1991. "Pitfalls and Opportunities: What Macroeconomists Should Know About Unit Roots," NBER Macroeconomics Annual 1991, Volume 6 (Editors: Olivier Blanchard and Stanley Fischer.), MIT Press. http://www.nber.org/chapters/c10983

Kwiatkowski, Denis, Peter C.B. Phillips, Peter Schmidt, and Yongcheol Shin. 1992. "Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root?" *Journal of Econometrics*, Vol. 54, pp. 159-178.

Phillips, Peter C.B. 1987. "Time Series Regression with a Unit Root," *Econometrica*, 55, 277-301.

Elliott, Graham, Thomas J. Rothenberg, and James H. Stock. 1996. "Efficient Tests for an Autoregressive Unit Root." *Econometrica* 64 (4): 813–36.

Stationary VARs:

Sims, Chris A. 1980. "Macroeconomics and Reality," *Econometrica*, 48, 1-48.

Sims, Chris A. 1992. "Interpreting the Macroeconomic Time Series Facts: The Effects of Monetary Policy," *European Economic Review*.

Stock, James and Mark Watson (2001), "Vector Autoregressions", *Journal of Economic Perspectives*, 15(4).

Canova, Favio. 1995. "The Economics of VAR Models," chapter 3 in Hoover, K.D. (ed.) *Macroeconometrics: Developments, Tensions, and Prospects*, Kluwer.

Structural VARs:

Blanchard, O.J. and D. Quah, 1989. "The Dynamic Effects of Aggregate Demand and Supply Disturbances," *American Economic Review*, Vol. 79, pp. 655-673.

Bernanke, B. 1986. "Alternative Explanations of the Money-Income Correlation," *Carnegie Rochester Conference Series on Public Policy*, 25, 49-99.

Gali, Jordi. 1992. "How Well Does the ISLM Model Fit Postwar Data?" *Quarterly Journal of Economics* Vol. 107, pp. 709-735.

Cohen, Mark and Will Luther. 2014. An Empirical Analysis of the Austrian Business Cycle Theory. *Atlantic Economic Journal*, 42(2): 153-169.

Cointegration:

Engle, Robert F. and Granger, Clive W. J. (1987). "Co-integration and error correction: Representation, estimation and testing". Econometrica. 55 (2): 251–276.

Campbell, John Y. and Pierre Perron. 1991. "Pitfalls and Opportunities: What Macroeconomists Should Know About Unit Roots," NBER Macroeconomics Annual 1991, Volume 6 (Editors: Olivier Blanchard and Stanley Fischer.), MIT Press. http://www.nber.org/chapters/c10983

Temporal aggregation problems:

Amemiya, Takeshi, and Roland Y. Wu. 1972. "The Effect of Aggregation on Prediction in the Autoregressive Model." *Journal of the American Statistical Association* 67 (339): 638–32.

Breitung, Jorg, and Norman R. Swanson. 2002. "Temporal Aggregation and Spurious Instantaneous Causality in Multiple Time Series Models." *Journal of Time Series Analysis* 23 (6): 651–65.

Du, Yingxin, Jiandong Ju, Carlos D. Ramirez, and Xi Yao. 2017. "Bilateral Trade and Shocks in Political Relations: Evidence from China and Some of Its Major Trading Partners, 1990–2013." *Journal of International Economics* 108:211–25.

Lütkepohl, Helmut. 1987. Forecasting Aggregated Vector ARMA Processes. Berlin, Germany: Springer.

Marcellino, Massimiliano. 1999. "Some Consequences of Temporal Aggregation in Empirical Analysis." *Journal of Business and Economic Statistics* 17 (1): 129–36.

Rossana, Robert J., and John J. Seater. 1995. "Temporal Aggregation and Economic Time Series." *Journal of Business and Economic Statistics* 13 (4): 441–51.

Schwert, G. William. 1989. "Tests for unit roots: A Monte Carlo investigation." *Journal of Business and Economic Statistics* 2 (1): 147-159.

Sims, Christopher A. 1971. "Discrete Approximations to Continuous Time Distributed Lags in Econometrics." *Econometrica* 39 (3): 545–63.

Telser, Lester G. 1967. "Discrete Samples and Moving Sums in Stationary Stochastic Processes." *Journal of the American Statistical Association* 62 (318): 484–99.

Tiao, George C. 1972. "Asymptotic Behaviour of Temporal Aggregates of Time Series." *Biometrika* 59 (3): 525–31.

Wei, W. W. S. 1982. “The Effects of Systematic Sampling and Temporal Aggregation on Causality—A Cautionary Note.” *Journal of the American Statistical Association* 77 (378): 316–19.

Filtering and stochastic detrending:

Baxter, Marianne and Robert G. King. 1999. “Measuring business cycles: Approximate band-pass filters for economic time series. *Review of Economics and Statistics*, 81 (4), pp. 575-593.

Canova, Fabio. 1998. “Detrending and Business Cycle Facts.” *Journal of Monetary Economics* 41 (3): 475–512.

de Jong, Robert M., and Neslihan Sakarya. 2016. “The Econometrics of the Hodrick-Prescott Filter.” *Review of Economics and Statistics* 98 (2): 310–17.

Hodrick, Robert, and Edward C. Prescott. 1997. "Postwar U.S. Business Cycles: An Empirical Investigation." *Journal of Money, Credit, and Banking* 29 (1): 1–16.

King, Robert G., and Sergio Rebelo. 1993. “Low Frequency Filtering and Real Business Cycles.” *Journal of Economic Dynamics and Control* 17:207–31.

Nelson, Charles R. and Charles I. Plosser. 1982. “Trends and random walks in macroeconomic time series: Some evidence and implications.” *Journal of Monetary Economics* 10 (2): 139-62.

Ravn, Morten and Harald Uhlig (2002). "On adjusting the Hodrick–Prescott filter for the frequency of observations". *Review of Economics and Statistics* 84 (2): 371-76.