A Short Course on Applied Time Series Econometrics for Macroeconomics and Finance

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Time: 1:00-4:00PM

1 Course Objectives

Over the past few decades, there has been a remarkable surge in macroeconometric research aimed at estimating various macroeconomic and finance models. The majority of empirical investigations in the fields of macroeconomics and finance heavily rely on time-series econometric techniques, which have been further enhanced by recent developments in machine learning models. The objective of this course is to provide an introduction to a subset of these econometric methods: forecasting and state space models. These models are widely used in both academic and policy contexts. Classroom activities will primarily involve intuitive explanations and practical examples that utilize computer applications in R. The main focus will revolve around using data to address real-world challenges through the application of both time-series and machine learning models.

2 Prerequisites

I assume that all of you have completed at least one semester of mathematical statistics and are comfortable with algebraic manipulations and basic statistical concepts. If you haven't mastered these prerequisite skills, be prepared to invest additional time. Hamilton's mathematical appendix offers a useful summary of relevant mathematical and statistical tools.

3 Useful Textbooks in Time Series Econometrics

In addition to the following textbooks, we will also use a few research papers for each topic.

- Time Series for Macroeconomics and Finance, by John Cochrane, unpublished lecture notes, updated 2005. Available from Cochrane's web site.

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

- Applied Bayesian Econometrics for Central Bankers by Andrew Blake and Haroon Mumtaz.

- An Introduction to Statistical Learning (ISLR) by James, G., Witten, D., Hastie, T., & Tibshirani.

4 Assessment

There will be an empirical assignment based on the models taught in the class.

5 Software Information

We will be using the econometric/statistics software R in this class. R is an open-source software widely used in the industry and academia. Detailed information about R can be found at https://www.r-project.org/. There will be regular demonstrations of empirical examples using R in class. Make sure to download a copy of the software as soon as possible.

6 Our Road Map

1. *Lecture 1 (May 6)*

    (a) Forecasting Models

    (b) Linear Model Selection and Regularization

    (c) Tree Based Methods including Random Forest Models

2. *Lecture 2 (May 7)*

    (a) State Space Models: Kim and Nelson, Chapters 3 and 8; Blake and Mumtaz, Chapter 3

3. *Lecture 3 (May 8)*

    (a) Empirical Applications