1 Course Description

This course introduces some of the most important econometric techniques and tools in formulation, estimation and testing of dynamic models involving economic time series. It will focus on practical applications in both asset pricing finance and macroeconomics. One of the aims of the course is to give students a chance to pursue a small project and conduct simple empirical research.

2 Administrative Information

Lectures: Monday - Friday, 11:00 am - 12:15 pm, Science Sciences Building, Room 119.

   Course website: Duke Blackboard (https://courses.duke.edu/)
   Contact information: kai.li@duke.edu
   Office location: Social Sciences Building, Room 325L
   Office Hours: My office hours will be Monday, 2-3:30pm in Soc Sci 325L. We can also talk straight after class, or by appointment.

Textbook: There are no required textbooks. The exams will be based on self-contained lecture slides/notes and problem sets. However, I recommend the following books and I will provide suggested readings of related chapters in them.

   • [SW]: Stock and Watson (2011), Introduction to Econometrics, 3rd-edition, Addison-Wesley (highly recommended. this book is very good and an excellent reference for any future empirical work. We will mainly use Part IV in this course.);

   • [WE]: Enders, Walter (2010), Applied Econometric Time Series, 3rd-edition, Wiley (optional. this book has a lot of applications and examples.);

   • [JH]: Hamilton, James (1994), Time Series Analysis, Princeton University Press (optional but quite important, a standard graduate textbook in time series econometrics);

   • [FH]: Hayashi, Fumio (2000), Econometrics, Princeton University Press (optional. this book is a required textbook for Duke econ first-year Ph.D. students. it will be useful for OLS and GMM estimation in this class.).
Grading: There will be approximately weekly assignments, two in-class 30-minute quizzes on May 31 and June 14, and a final exam (time and place TBA). They will count toward the grade as follows.

- Assignments 25%
- 2 in-class quizzes 20%
- Final exam 55%

Software: To solve the empirical exercises without particular indication in the problem sets, you can use any software packages, for instance, Matlab, Stata, or EViews, and so on. However, you are encouraged to use Matlab to write code from scratch. And you can even solve the problem with both Matlab and another software language, and then double-check whether you Matlab code is correct or not. For some exercises, I may explicitly require you to use Matlab exclusively. That is how you can get most benefits from these exercises.

3 Syllabus

I will post lecture slides, and problem sets to blackboard. These will be mentioned in class or email reminder as they become available. The list of topics is as follows. You can find the suggested chapters to read after each topic. Note: The abbreviated notations and chapter numbers correspond to the books and editions as listed in the "textbook" section. It works fine if you use earlier editions, however, please be aware that the chapter numbers may be slightly different. One star means "hard" and two stars means "very hard" — you can skip what we have not covered in class and problem sets. The coverage and schedule are subject to minor changes.

1. Introduction of Time Series Econometrics. Review of basic statistics and econometrics. (May 18 - May 20)
   - Statistics review. SW 2
   - Review of asymptotic distribution theory: convergence in probability and in distribution, LLN, CLT, Slutsky and CMT. SW 3 17.2; FH 2* 
   - Review of OLS, hypotheses tests and conditional homoskedasticity. SW 4, 17; FH 1*

2. Stationary ARMA processes. (May 23 - May 27)
   - Covariance-stationarity, MA, AR and ARMA processes. SW 14.2, 14.3, 14.4; JH 3, 10**
   - Autocorrelation and partial autocorrelation functions, Box-Jenkins model selection. WE 2.5, 2.6, 2.7, 2.8
   - Forecasting. JH 4*
• HAC robust standard errors. SW 15.4

3. An introduction to GMM and MLE estimations. (May 31 - June 2)
   • GMM estimation: exactly identified and overidentified models, asymptotic properties and distribution, efficient GMM and tests of overidentifying restrictions. FH 3★; JH 14★
   • MLE: asymptotic properties, its relationship with GMM. FH 1.5; JH 5★, 14.4★
   • An application to estimating ARMA models. JH 5★

4. Vector autoregressions (VARs). (June 6 - June 10)
   • Estimation and identification, Impulse responses, variance decomposition, Bivariate Granger Causality. SW 16.1; JH 11★★
   • Macroeconomic applications.

5. State-space models and the Kalman filter. (June 13 & June 14)
   • JH 13★★

6. Non-stationarity. (June 15 - June 17)
   • Deterministic and stochastic trends, and unit root tests. SW 14.6; JH 15★, 16★★, 17★★

7. Cointegration. (June 20 & June 21)
   • SW 16.4; JH 19★★, 20★★

8. ARCH, GARCH models and realized volatility with financial applications. (June 22 & June 23)
   • SW 16.5; JH 21★★

9. Regime switching models with macroeconomic applications. (June 24, an optional topic if time permits)
   • JH 22★★

10. Review and catching up (June 27)