University of Pennsylvania **Economics 722, Spring 2019**

Advanced Time-Series Econometrics – Part 1

Instructor : Frank Schorfheide, Room 621, PCPE

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Office Hours: by Appointment

Scheduled Class Time and Organization: We will meet twice a week Tuesdays and Thursdays from 1:30p - 3:00p in Room 203 PCPE.

Course Description:

The course is designed as a sequel to Economics 706. Broadly speaking, we will study econometric models and methods that are useful to conduct substantive empirical research in macroeconomics. It focuses on Bayesian analysis of vector autoregressions (VARs) and dynamic stochastic general equilibrium (DSGE) models.

Prerequisites: Economics 705 and 706 or equivalent graduate level econometrics.

Courseware: You can access the course materials via CANVAS. You can log-in from *http://upenn.instructure.com/*.

Course Requirements:

This is a research course! The goal is to lead students toward the current frontier in macroeconometrics and time series analysis.

- **Class Participation and Problem Sets [50%]**: There will be four problem sets, assigned during the semester. Moreover, you are expected to carefully study the assigned readings and participate in classroom discussions.

- **Research Paper [50%]**: with strong econometric component (theoretical or empirical), related to one of the topics covered in class. A two page outline is due on Monday, April 1. The completed paper is due on on August 31. NO EXCEPTIONS!

  The paper does not have to constitute an original piece of research. For instance, it could be a replication of an existing empirical or Monte Carlo study; it could deviate from an existing study by using a different data set, e.g., data from a different country; it could be a Monte Carlo study that compares existing estimators or test procedures that have not been compared previously or it assesses these procedures under certain forms of misspecification (robustness analysis). The paper could also cover a topic in the area of theoretical econometrics.

- **Econometrics Workshop [extra credit]**: You are expected to attend the econometrics workshop, which takes place on Mondays from 4:30-6:00.

Students who participate in class and submit decent solutions to all problem sets will receive a B- or a B at the end of the course. To convert the B grade into an A grade, students must submit a research paper by August 31.

Course Readings: the following books are recommended:

Herbst, Edward and Frank Schorfheide (2015): *Bayesian Estimation of DSGE Models*, Princeton University Press.

Geweke, J., G. Koop, and H. van Dijk (2011, eds.): *Oxford Handbook of Bayesian Econometrics,* Oxford University Press.

In addition I will provide lecture notes and refer to a long list of published articles and working papers in our lectures.

Course Outline

- **Introduction to Bayesian Inference:** linear regression model, point estimation, interval estimation, model selection and averaging, importance sampling. Irregular cases: partial identification and unit roots.
- **Reduced-Form VARs:** direct sampling from posterior, Minnesota prior, data-driven hyperparameter selection, forecasting, extensions.
- **Structural VARs:** short-run and long-run identification schemes, sign restrictions, external instruments, implementation of Bayesian inference.
- **DSGE Models:** Introduction, structure of DSGE models, solving linear and nonlinear rational expectation systems, likelihood evaluation.
- **Metropolis-Hastings Algorithm:** Convergence results and applications to DSGE models, Hamiltonian MCMC.
- **Sequential Monte Carlo Methods:** Convergence results and applications to DSGE model estimation, particle filters, particle MCMC, SMC^2
- **DSGE Model Evaluation:** Posterior odds comparisons, computation of marginal data densities, prior and posterior predictive checks