ECON E724 Joon Y. Park
Economics Department Spring 2012

Topics in Financial Econometrics

The objective of this course is to prepare the Ph.D. students for their dissertation research in the area of time series and financial econometrics, both theoretical and empirical. The course consists of two parts. Part I introduces the basic theory of stochastic processes and continuous time models used extensively in quantitative financial economics and financial econometrics. Part II provides in-depth studies of some selected topics that are related to my previous and current research in financial econometrics. The lectures on Part I will be based on various lecture notes and textbooks in stochastic processes, and the lectures on Part II will mainly use research papers and my research notes.

The requirement of the course is to pass one midterm exam and the final take-home exam. The dates for the midterm will be set as we move along, and the final take-home exam will be given on the last day of the classes. There will be weekly homework problem sets on the material that we will cover in Part I. The course grade will be based on problem sets, midterm exam and final take-home exam. Submitting all problem sets and passing the midterm and take-home final exams will be sufficient to complete the course requirement.

To best understand the lectures and start meaningful research after the course, the students should have a good understanding of the material covered in the standard econometrics sequence offered for the first year economics Ph.D. students. In particular, basic knowledge in measure-theoretic probability is necessary. Though not essential, the materials covered in the second year Ph.D. econometrics course will be very helpful to follow this course. Finally, students are expected to have a motivation to learn some basic finance theory and practice.

Lectures will be given on Tuesdays at 9:30am-12:00pm in Wylie Hall Rm 111. I will have office hours in my office (Rm 215, Wylie Hall) on Tuesdays at 2:00-4:00pm. Students who wish to meet me outside my office hours may email me to make an appointment. My email address is joon@indiana.edu. Problem sessions will be given on Thursdays at 9:30am-10:30am by Jihyun Kim. His email address is kimjihy@indiana.edu.

Required Lecture Notes and Textbook

An Introduction to Stochastic Processes in Continuous Time, Lecture Note, by Harry van Zanten, 2004.

Dynamic Asset Pricing Theory, 3rd edition, by D. Duffie, Princeton University Press, 2001.

Reference Textbooks

Stochastic Process Theory

Probability with Martingales, by D. Williams, Cambridge University Press, 1991.

Elementary Stochastic Calculus, by T. Mikosch, World Scientific, 1998.

Brownian Motion and Stochastic Calculus, 2nd edition, by I. Karatzas and S.E. Shreve, Springer, 1991.

Stochastic Differential Equations, 4th edition, by B. Oksendal, Springer, 1995.

Continuous Martingales and Brownian Motion, 3rd edition, by D. Revuz and M. Yor, Springer, 1999.

Lévy Processes and Stochastic Calculus, 2nd edition, by D. Applebaum, Cambridge University Press, 2009.

Finance and Financial Engineering

Options, Futures, and Other Derivatives, 5th edition, by J.C. Hull, Prentice Hall, 2002.

An Introduction to the Mathematics of Financial Derivatives, 2nd edition, by S. N. Neftci, Academic Press, 2000.

Arbitrage Theory in Continuous Time, by Thomas Björk, Oxford University Press, 1998.

Asset Pricing, Revised edition, by John H. Cochrane, Princeton University Press, 2005.

Financial Econometrics

Financial Econometrics, by C. Gourieroux and J. Jasiak, Princeton University Press, 2001.

The Econometrics of Financial Markets, by J.Y. Campbell, A.W. Lo and A.C. MacKinlay, Princeton University Press, 1996.

Empirical Dynamic Asset Pricing: Model Specification and Econometric Assesment, by Kenneth J. Singleton, Princeton University Press, 2006.

Part I: Stochastic Processes and Continuous Time Models

In this part, I will give lectures on the basic notions and tools that the students need to understand continuous time models. The details are given below.

1. *Introduction to Stochastic Processes*

   Introduction and basic concepts, filtration and stopping times, Brownian motion

2. *Martingales*

   Introduction, Useful results on discrete-time and continuous-time martingales

3. *Markov Processes*

   Introduction, Useful tools and facts for markov processes

4. *Ito Integral and Stochastic Calculus*

Ito integral, Quadratic variance and covariation, Stochastic calculus

5. *Diffusion Models*

   Introduction, Commonly used diffusion models, Approximations, Other important facts

6. *Other Important Concepts and Tools*

   Girsanov theorem, Time change, Local times

7. *Basic Continuous Time Finance*

   No arbitrage pricing, Black-Scholes option pricing formula, Consumption CAPM

Part II: Selected Research Topics

In this part, I will provide in-depth studies of some selected topics that are related to my previous and current research in theoretical and applied time series, and financial econometrics. The following topics will be discussed. The reading list will be distributed at the end of the first part.

1. *Asymptotics for Continuous Time Models*

   Basic asymptotics for continuous time processes, Asymptotic theory for diffusion models

2. *Regressions at High Frequency*

   Continuous time regression models, Asymptotics for high frequency regressions, Estimation and testing for continuous time asset pricing models using high frequency regressions

3. *Panels at High Frequency*

   Continuous time panels, Asymptotics for high frequency panels, Estimation and testing for continuous time asset pricing models using high frequency panels