ECON 615: Monte Carlo Simulation Methods and Design

COURSE AIMS & OBJECTIVES, KEY SKILLS AND LEARNING OUTCOMES

Course Aims & Objectives: The purpose of this course is to provide students with an introduction to Monte Carlo methods as used in Econometrics. Most research papers use Monte Carlo, and we aim to understand its foundations, use, and limitations. We mainly use the Ox language to understand and create Monte Carlo experiments.

There are no prerequisite modules required before taking this course.

Key Skills: By the end of this course, students should have some knowledge and understanding of:

- Basic pseudo random number generation, sampling from statistical distributions
- Basic principles of numerical computation
- Uses and limitations of Monte Carlo experiments
- Statistical properties of Monte Carlo experiments
- Using PcNaive to design experiments for Econometrics
- Understand the output from PcNaive
- Bootstrapping

Desired Outcomes: By the end of this course, students should be able to:

- Interpret Monte Carlo results
- Implement advanced experiments using PcNaive
- Implement basic experiments in the Ox language, and use parallelization effectively
- Understand basic principles and limitations of the bootstrap
- Present, interpret and analyse information in numerical form
- Understand some of the basic principles of Monte Carlo estimation

COURSE STRUCTURE

Econ 615 is a 10 credits course and therefore students are expected to input approximately 100 hours of study into the course. The total number of contact hours on Econ 615 is 15 hours. This leaves 85 hours for private study. Course Delivery comes in the form of Lectures with 15 hours delivered over the first 3 weeks of the term (10 hours of lectures and 5 hours of tutorials). There will be optional clinics on the last day of the course.

During your private study you should strike a balance between reading the course material (which is the primary source of information) and the recommended textbooks, thinking critically about how these fit in to the body of knowledge on the subject and about how our level of knowledge can be improved, performing exercises, completing coursework and revising for examinations. You can expect to perform well on this course only if you work consistently through the year.

COURSE CONVENOR
Dr Jurgen A DOORNIK

LECTURERS CONTACT INFORMATION (Including Office Hours)
Email: jurgen@doornik.com

Available by appointment (please email to arrange a convenient time)

COURSEWORK ASSESSMENT
The CWA mark will be calculated as 100% coursework. The coursework will be assigned at the end of the course

The coursework will be delivered to students at the end of week 6 of each term and is due for submission at the end of week 10, allowing students 4 weeks for completion.

Coursework must be submitted electronically through the Moodle site for this course.

FEEDBACK ON COURSEWORK:
The coursework will be marked and returned to students within 4 weeks of the submission deadline. Feedback will consist of marker's notes appended to the pdf of your coursework.

MARKING CRITERIA AND PENALTIES
Marking criteria can be found in the Economics Undergraduate Handbook and the general course information paper. An electronic copy of this can be found via the Current Student page of the university website then follow the Academic Regulations link
https://gap.lancs.ac.uk/ASQ/QAE/MARP/Documents/UG-Assess-Regs.pdf

FINAL MARK INFORMATION
This course is assessed 100% by means of coursework. The final mark is the average of the marks obtained in the two pieces of coursework.

COURSE TEXT AND RECOMMENDED READING
Recommended readings:

book chapters and online material.

For the tutorials you will also need:

Access to the OxMetrics system for PcNaive and the Ox statistical programming language. We will also take a brief look at aspects of R, Python, and GNU Octave

Students will also find the following texts useful as further reading.

- Doornik, J.A. (2006). The Role of Simulation in Econometrics. Chapter 22 in *Palgrave Handbooks of Econometrics*: Vol. 1 Econometric Theory.
- Doornik, J.A. and Hendry, D.F. (2001). *Interactive Monte Carlo Experimentation in Econometrics Using PcNaive*, London: Timberlake Consultants Press.
- Hendry, D.F. (1984), Monte Carlo Experimentation in Econometrics. *Handbook of Econometrics*, Volume II, online at www.sciencedirect.com/science/handbooks /15734412.

<u>Note</u> Copies of the lecture slides will be made available on the course web pages. Additional material associated with these lectures and course announcements will also be placed on this website.

COURSE OUTLINE/LECTURE SCHEDULE

***Lecture and tutorial 1:* Random numbers**

Pseudo random number generation, some experiments using PcNaive

***Lecture and tutorial 2: Introduction to* Monte Carlo**

Introduction to Monte Carlo experiments in Econometrics; PcNaive

***Lecture and tutorial 3:* Implementing Monte Carlo**

Designing and implementing Monte Carlo experiments in PcNaive and Ox; parallel computation

***Lecture and tutorial 4:* Replicating and extending Monte Carlo experiments**

Extending the scope of experiments, replication of some published experiments.

***Lecture and tutorial 5:* Advanced topics and conclusions**

Further uses of Monte Carlo methods, including the bootstrap.