

Advanced Quantitative Methods in Economics
Fall 2023
CAEN
SYLLABUS

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Course Description: The objective of this course is to introduce a graduate student in economics to the required set of tools for original, quantitative economic research. We will cover the standard techniques for mapping a theoretical model into a set of computer instructions that can approximate its solution. We will discuss the advantages of different techniques and where they fail. Because a quantitative solution is even better if it can describe the world, we will discuss empirical methods, data sources and how to bring the model to the data.

By the conclusion of the course, you should feel comfortable programming in at least one language of your choice, using a statistical package and deploying them on interesting economic questions.

Prerequisites: This course will assume knowledge of graduate-level economics. I will not assume you know how to program, but some familiarity will be helpful: If you are a neophyte, you may have to work harder than others.

Texts: The following texts are strongly recommended.

Dynamic General Equilibrium Modeling [Heer and Maußner \(2009\)](#)

Computational Methods for the Study of Dynamic Economies [Marimon and Scott \(1999\)](#)

Numerical Methods in Economics [Judd \(1998\)](#)

For your library, there are also several books I highly recommend acquiring eventually: ([Press et al., 1992](#); [Adda and Cooper, 2003](#); [Miranda and Fackler, 2004](#))

Problem Sets: I will assign several problem sets during the course. Because of the short time frame of the course, I do not expect you to finish them during the week we are together. It would be a good idea to get started on them early and finish them expeditiously while the material is fresh.

Course Outline:

1. Root finding with an application to Mortensen-Pissarides
 - Newton-type and derivative-free methods
 - The relationship between root finding and optimization
 - First-order conditions as a system of equations
2. Local methods for dynamic models and how to solve a representative agent model.
3. Value function iteration and how to solve a heterogeneous agent model.
 - Endogenous grid points
 - Parameterized expectations
 - Accuracy tests
4. *Time-permitting*, bringing models to data:
 - Micro data and how to look at earnings risk
 - Simulation and how to estimate “deep” parameters
 - Parallel computing with an application to value function iteration

References

- ADDA, J. AND R. W. COOPER (2003): *Dynamic Economics: Quantitative Methods and Applications*, vol. 1 of *MIT Press Books*, The MIT Press.
- HEER, B. AND A. MAUSSNER (2009): *Dynamic General Equilibrium Modeling: Computational Methods and Applications*, Springer, 2nd ed. 2009. 2nd printing ed.
- JUDD, K. L. (1998): *Numerical Methods in Economics*, vol. 1, The MIT Press, 1 ed.
- MARIMON, R. AND A. SCOTT (1999): *Computational Methods for the Study of Dynamic Economies*, OUP Oxford.
- MIRANDA, M. J. AND P. L. FACKLER (2004): *Applied Computational Economics and Finance*, vol. 1, The MIT Press, 1 ed.
- PRESS, W., B. FLANNERY, S. TEUKOLSKY, AND W. VETTERLING (1992): *Numerical Recipes in C: The Art of Scientific Computing*, Cambridge University Press.