Advanced Macroeconomics II

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Course Time: Thursday, 1:30-5:00

1 Syllabus

1.1 Summary

This course prepares studies in the methods of modern macroeconomic research on business cycle fluctuations and frictions, with special emphasis on the labor market and unemployment.

This course can be divided into three chunks. The first chunk focuses on time series and recursive methods, in particular dynamic programming. The second chunk analyzes real business cycle models and various extensions. These include investment-specific productivity shocks, heterogeneous agents, and New Keynesian models, which provide a role for monetary policy shocks in aggregate fluctuations. These models fit into the class called dynamic stochastic general equilibrium models (DSGE). We will focus heavily on calibration and simulation of these models. There are a number of algorithms useful for simulation: dynamic programming methods, which are the most general; Euler-equation based methods, which are valid when the first order conditions are sufficient; and perturbation methods, which consider a Taylor approximation around the steady state. Due to time limitations (as well as that of my own expertise), we will not discuss estimation of DSGE models. However, if interested, I can point you to several resources at the end of the course.

The third chunk of the course focuses on frictional labor markets, and especially the interactions of frictions in labor markets, good markets, and credit markets. This is the one chunk of the course that closely follows a text. These models can explain much more amplification and propagation of business cycles than possible under standard real business cycle or New Keynesian models. They also provide a much more reasonable model of the labor market, and can be used to study many applications beyond the business cycle: shop-

ping time, heterogeneity in the labor market, on-the-job search, unemployment insurance, interaction between unemployment, and precautionary savings, etc.

Unfortunately, due to time constraints, the course will not be able to focus too much on the New Monetarist literature, which develops rich models of exchange and liquidity of various assets (money, bonds, capital, credit, and so forth). Compared to the New Keynesian literature, it concentrates on issues of liquidity, financial intermediation, and the essentiality of money; but places much less emphasis on business cycles. To partially remedy this, you will write referee reports and present papers from a list which draws heavily from this literature. Indeed, by now search-and-matching unemployment is well integrated into the DSGE literature, and there is also heavy interaction between labor market frictions and New Monetarist economics. What remains scarce, however, is a unified treatment of these branches.

1.2 Textbook

Course lectures will draw on a number of different texts, alongside the lecture notes and papers. The most import two textbooks are the following:

Lucas, Robert E. and Stokey, Nancy L. *Recursive methods in economic dynamics*

Petrosky-Nadeau, Nicolas and Wasmer, Etienne. *Labor, credit, and goods markets: the macroeconomics of search and unemployment*

The first text, often abbreviated SLP, presents the major theory on dynamic programming, and the second covers unemployment in frictional labor markets. However, the following texts are also very useful:

Stachurski, John. *Economic dynamics: theory and computation.* (Contains extensive Python applications).

Ljungqvist, Lars and Sargent, Thomas. *Recursive macroeconomic theory.*

Hamilton, James. *Times series analysis.*

McCandless, George. *The ABCs of RBCS.*

Gali, Jordi. *Monetary policy, inflation, and the business cycle.*

Judd, Ken. *Numerical Methods in economic dynamics.*

Stachurski's text (EDTC) covers similar material as SLP but with somewhat different presentation and Python applications. The text by Ljunqvist and Sargent is similar in spirit to SLP but emphasizes more economic applications. The text by Hamilton is the standard reference on time series analysis. McCandless' text offers very practical guidelines on solving real business cycle models. Gali's text covers applications related to the New Keynesian models, but is rather terse. Finally, Judd's text offers a broad exposition to numerical issues in computation.

1.3 How to study for this course

Lectures are dense, and the course covers an ambitious amount of material. To better digest the material, I suggest the following rule. You will receive the lecture material several days prior to lecture. Review the lecture as much as possible *before* class. You will be able to follow the lecture more effectively as a result. Next, review the lecture a day (or at most two) after class as you work on the homework. Going through the material three times, in conjunction with the homework, should promote retention of material. Finally, discussing and working through problems with classmates is an excellent way to solidify your understanding.

1.4 Computation and Python

This course will make heavy use of the open-source programming language Python and will often reference the lectures and examples from Quantecon: https://lectures.quantecon.org/py. I strongly suggest you work through the QuantEcon lectures 'Introduction to Python' through 'Data and Empirics' prior to the start of the course. These lectures will familiarize you with the basic Python objects, syntax, libraries for scientific computing (especially NumPy, Scipy, and Matplotlib), data manipulation and regression, and good coding practice.

I strongly recommend you install Python from https://www.anaconda.com/download/, which includes some of the most important libraries. A guide to setting up the Python environment is available on https://lectures.quantecon.org/py/getting_started.html. There are also instructions on updating Anaconda and installing new packages.

The installation also provides several different graphics user interfaces for using Python. Spyder is a MATLAB style IDE, and is more intuitive if you are used to Matlab. There is also a notebook interface via a Jupyter notebook. This interface is similar to that of Mathematica and integrates code, outbook, and text in executable chunks.

One of most useful packages is quantecon. It supports various tools related to Markov processes, solving discrete dynamic programs, and optimization methods.

1.5 Mathematical typesetting

People usually do not write research in economics using Microsoft Word or similar software. Researchers generally use LaTeXto typeset. Check out *The Not So Short Introduction to LaTeX*. You can install the language through Miktex. You also need a LaTeXeditor. I generally recommend TexStudio, but you can check out this article on the most popular editors. I encourage you to type up your homeworks and the referee report in TeX, and to prepare the presentation using the document class beamer.

1.6 Referee report, presentation, and connection to the final exam

Close, critical reading and presenting to one's peers are important skills in economics. Accordingly, in the 13th week of the course, you will present (either in a pair or 3 people tops) a summary and critique of a major research paper. I will provide a list of possible papers, but I will also consider requests outside the list if it complements the course material well. I also ask that you write a detailed referee report to me in person. This can be very similar to the presentation but should be more detailed. In general, the structure of the referee report is

- Summary (includes statement of research problem, methodology, and relation to literature)
- Major revisions (what are the major areas in which the paper can be improved?)
- Minor revisions (in what minor ways can the paper be improved? This includes issues of flow, presentation, and auxiliary results).

The referee reports and presentations will cover major extensions and work related to the themes of the course that were not feasible due to time constraints. To encourage you to closely follow each others' work, a significant chunk of the final exam will ask about conceptual issues and findings in the presentations. To aid you in preparation, you will each receive a copy of the slides submitted.

I emphasize that in order to adequately assess the paper in the context of the literature, you will need to reference several background papers and concurrent work in the referee report. This will take time and explains why the combination of these two assignments is worth 20% of the course grade. More importantly, this exercise will help hone your abilities as scholars.

1.7 Course outline

Week 1 (2/28): Introduction and Time Series(ARMA's, VAR's, Filtering). Suggested readings: Hamilton, Chapters 1-3; Ljungqvist and Sargent, Chapter 1; Quantecon lectures 'Tools and Techniques'

Week 2 (3/7): Dynamic programming and stochastic dynamic programming. Suggested readings: SLP Chapters 3-5, Ljungqvist and Sargent Chapters 3-4; Quantecon lectures 'Dynamic programming

Week 3 (3/14): Basic real business cycle model. Suggested reading: King and Rebelo (1999), 'Resuscitating Real Business Cycles'

Week 4 (3/21): Solution of RBC model and extensions (investment-specific productivity shocks). Suggested reading: Greenwood, Hercowitz and Krusell (1998,'The role of investment-specific technological change in the business cycle')

Week 5 (3/28): Heterogeneous agents: Aiyagari (1994) and Krusell-Smith (1998)

Week 6 (4/4): Midterm

Week 6 (4/11): The basic New Keynesian model: derivation, log linearization, solution, and evidence on price stickiness

Week 8 (4/18): Determinacy and optimal monetary policy; the financial accelerator model. Suggested reading: Clarida, Gali, and Gertler (1999); Bernanke, Gertler, and Gilchrist (1999)

Week 9 (4/25): Benchmark unemployment model and business cycle properties. Suggested reading: LCGM Chapters 1 and 2.

Week 10 (5/2): Credit and labor market frictions. Suggested reading: LCGM Chapters 5 and 6.

Week 11 (5/9): Credit, labor, and goods market frictions. Suggesed reading: LCGM Chapters 7 and 8

Week 12 (5/16): In-class presentations

Week 13 (5/23): In-class presentations

Week 14 (5/30): Final exam

1.8 Exams and Grading Policy

The final grade for the course will be determined as follows:

Problem Sets 25%

Presentation 10%

Referee report 10%

Attendance/Participation 5%

Midterm 20%

Final Exam 30%

The grade is comprised of problem sets, midterm, the final exam, an in-class presentation and referee report on a paper, and attendance and participation points. Note that a full 50% of the course is not based on exams. This is designed so that you focus more on practicing the material, connecting the theory and the programming, and learning to work with others. It is important to develop skills beyond those which readily lend themselves to testing.

Homework questions involve a mix of analytical/numeric problems to be done by hand and computational problems. The latter may involve replicating results or simulating a model. Some of these will require a lot of time, so start early and work patiently.

1.9 Qualifying examination

In a time to be determined following the final exam, there will be a qualifying examination. This exam will balance technical applications with conceptual issues. It will be straightforward provided you work diligently throughout the course. I will provide more information during the course.

1.10 Course Policies and Guidelines

All electronic equipment should be away during exams. Phones must be silent or off. Only in the event of a documented emergency can you miss an exam, in which case I will prepare a separate version.