HE4016 Quantitative Macroeconomics Syllabus

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1 Course Descriptions

The purpose of this course is to equip you with quantitative tools commonly used in the modern macroeconomic research. First, we we will learn some useful numerical methods, which are widely implemented in answering quantitative macro questions, such as function approximation, integration and differentiation, numerical optimization etc. The rest of the courses will in general be divided into two broad topics: business cycles and neoclassical economic growth. We will study a class of dynamic stochastic general equilibrium(DSGE) models to address business-cycle related issues. We will also learn how to perform some numerical calibration and simulation by using DYNARE. When we move to the neoclassical economic growth part, we will learn some basic dynamic programming and value iteration methods, which will enable us to perform quantitative analysis in deterministic and stochastic economies with homogenous or heterogenous agents.

This is a demanding course and I expect you to be engaged continuously. The prerequisites are HE 202 or HE2002. It helps if you have had previous programming experience but it is not a pre-requisite. This course requires degree of mathematical maturity associated with the concepts of sets, functions, derivatives, integrals, Taylor series, optimization, ordinary differential equations, and other material covered in basic mathematical economics.

2 Computer Skills

It helps if you have had previous programming experience but it is not a pre-requisite. However, in order to solve the assignments in this class it is definitely a requisite to learn how to program. However, this is not a computer science course; instead, what we learn in this class are tools and algorithms that, making use of some programming language, help us to solve modern macroeconomic models with heterogeneous agents. That is, I cannot teach you how to declare variables, generate random numbers, call intrinsic functions, link external subroutines, etc., but I am assuming that you can learn those things fast by

yourselves from internet or your experienced classmates.

Matlab is very popular in economics. It is particularly useful if you are used to think in vector-matrix operations. This application has a large amount of toolkits available to solve representative-agent business cycle models via (log- and) linearizations around steady states (see Uhligs toolkit, Dynare, etc.) that you may find useful. To do serious data work when you are fishing for facts, Stata is a good application that allows you to upload and manipulate many large data sets at once. SAS or Eviews may work fine as well.

3 Grading and Requirement

Learning is way more important than testing. The purpose of exams is to give you a chance to review the course materials and train your skills to solve real economic problems. Your overall performance will be evaluated based upon several assignments, class presentations and one final exam. I strongly encourage you to work in a group of 2 or 3, and submit your homework, make class presentations as a group. Class presentation may contain a presentation of your homework or some assigned readings, or your own project.

Homework 25%

Class Presentation 25%

Final Exam, TBA, 50%

4 Texts and Requirement

There will be no required text. However, the following textbooks may be useful for certain parts of the courses. To understand lecture notes and the assigned readings is critical for succeeding in the courses.

- Burkhard Heer and Alfred Maussner, Dynamic General Equilibrium Modeling, Springer Press, 2005
- DYNARE User Guide
- Romer, D. (1996), Advanced Macroeconomics, McGraw-Hill.
- Ljungqvist, L. and T.Sargent (2000), Recursive Macroeconomic Theory, MIT Press.

- Stokey, N. and R. Lucas with E. Prescott (1989), Recursive Methods in Economic Dynamics, Harvard University Press.
- Kenneth Judd, Numerical Methods in Economics, MIT Press, 1998

5 Course Outline

(1) Numerical Methods in Economics:

- Function approximation
- Numerical Integration and Differentiation
- Solve Non-linear Equations
- Numerical Optimization

(2) Quantitative analysis for Dynamic Stochastic General Equilibrium(DSGE) Models:

- Real business cycle (RBC) models
  - Solution Method–Log Linearization
  - Calibration and Simulation
- Simulation in DYNARE
- Examples (will be illustrated in DYNARE)
  - Asset pricing in production economies
  - New Keynesian DSGE model
  - News driven business cycles

(3) Dynamic Programming and Value Function Iteration Methods

- Discrete time dynamic programming
- Value function iteration (VFI): Discretization
- Euler Equation methods
- Representative Agent Model in Deterministic and Stochastic Economies

(4) Heterogenous Agent Model

- Heterogenous Agent Model in complete market
- Heterogenous Agent Model in incomplete market

6 References

[To be added later...]