Advanced Techniques in Macroeconomics I

2017-2018 Academic Year
Master of Research in Economics, Finance and Management

1. Description of the subject

- Advanced Techniques in Macroeconomics I
- Total credits: 6 ECTS
- Type of subject: Optative
- Department of Economics and Business
- Teaching team: Davide Debortoli

Code: 31804
Workload: 150 hours
Term: 1st
2. Teaching guide

- **Introduction**

  In order to answer relevant theoretical and quantitative economic questions, it is often necessary to rely on complex models that cannot be solved with paper and pencil. In this course we discuss the techniques for solving this kind of models on the computer. Each technique will be applied to workhorse models in different fields of macroeconomics, like economic growth and fluctuations, international finance (sovereign defaults), corporate finance (financing decisions with borrowing limits) and public policy (optimal taxation and debt policies).

- **Contents**

  1. **Introduction: numerical mathematics (weeks 1 and 2)**
     

  2. **Solution of non-linear deterministic models (weeks 3 and 4)**
     
     Technique: Root-finding algorithms.
     
     Applications: The Ramsey growth model.
     
     Deterministic models with financial frictions.

  3. **Solution of stochastic models by linear (or higher order) approximations (weeks 5 and 6)**
     
     Technique: Perturbation methods.
     
     Applications: Medium-scale DSGE models.
     
     Regime-switching models.
     
     Models with Occasionally Binding Constraints (the Zero Lower Bound on Interest Rate)
     
     Optimal fiscal and monetary policy.

  4. **Solutions of models by Value Function Iteration (weeks 7 and 8)**
     
     Technique: Value Function Iteration.
     
     Applications: Models with sovereign default.
     
     Firms’ pricing behavior with fixed costs.

  5. **Solution of stochastic models by Projection Methods (weeks 9 and 10)**
     
     Techniques: Projections methods.
     
     Applications: Heterogeneous agents models.
     
     Optimal fiscal policy models.
Teaching methodology

Approach and general organization of the subject

The focus of the course will be on the numerical solution of macroeconomic models, as a complement to the theoretical aspects covered in other courses (e.g. Topics in Macroeconomics, International Economics, Topics in Corporate Finance). Previous knowledge of specific models is not required, as they will be described in class, or specific notes will be distributed. However, students should be familiar with general concepts of dynamic models, as taught for example in Macroeconomics or Advanced Macroeconomics courses.

For each topic covered, lectures will be divided into the following parts: (i) theoretical description of the numerical technique; (ii) application of the technique to a standard growth model. (iii) application of the technique to specific models (see list above) (iv) discussion of homeworks’ solutions.

Students will have to learn how to write computer programs to implement the techniques discussed in class. The programming language used in the course will be MATLAB. No previous knowledge of numerical techniques is required, but a basic knowledge of MATLAB (or another programming language) would be very helpful.

Training activities

Lectures, proposed readings, study and development of computer programs.

Assessment and Grading System

The grade of the course will be determined on the following basis:

- (50%) Final project that involves either replicating an interesting paper in the literature, or solving a new model and writing a short paper about it. The project should be finalized by the end of December.
- (25%) A short final exam, about the theoretical concepts covered during lectures.
- (25%) A series of homeworks, requiring to write computer programs to solve standard problems and models. Homeworks could be performed in small groups (max. 3 people, one solution per group).

Textbook and References

The main reference for the numerical techniques covered in class is the book


Other (more advanced) valuable resources are:

Advanced Techniques in Macroeconomics I


The main references for **numerical methods for macroeconomic models** are


References for specific applications are:


