

## **Research Seminar: Macroeconomics**

### **Aim of the course:**

The goal of this course is twofold. At first, students are introduced to using state of the art computational techniques for quantitative macroeconomic research. We learn about the programming language Fortran and how to solve standard dynamic programming problems in that language. We then use the techniques learned to study some standard macroeconomic models as well as models of life-cycle decision making and financial investment. While the first part of the course covers models with a representative agent, the focus of the second lies on heterogeneous agent models, specifically the life cycle model with idiosyncratic labor productivity shocks and (potentially) investment risk. In the more standard macro part, we investigate the efficiency and redistribution consequences of fiscal policy (like taxation and public debt). We will learn how such policies redistribute between different generations, how they may improve risk sharing when markets are incomplete and how they can trigger distortions and therefore hurt the aggregate economy. When studying life cycle decision making, we learn how we can model important dimensions of household decision making in uncertain environments, like savings and labor supply decisions, labor force participation of second earners, financial investment decisions along the life, the choice to buy annuities or contributing to tax favored retirement accounts. Ideally at the end of the course, students will be able to develop their own ideas and conduct their own research project using the acquired techniques.

### **Outline:**

The course will consist of a series of lectures and a do-it-yourself part. The teaching sequence is divided into three units:

1. In the first unit, students learn how to program in Fortran and acquire some basic skills in applying numerical methods. Fortran is a free, fast and easy to learn programming language that is used quite frequently in modern quantitative macroeconomic research.
2. Unit 2 is concerned with solution techniques to dynamic programming problems and how to apply them to macroeconomic models with a representative agent.
3. In Unit 3 is devoted to models of life cycle decision making.

### **Grading:**

At the end of units one and two, students are given homework tasks that they have to solve themselves using Fortran. Working in groups is explicitly encouraged. Ideally students will form groups of two people. After unit 3 students should be ready to start their own little research project. I will be available for consultation, to give ideas and to assess the feasibility of the project. Towards the end of the semester, students have to submit their project in the form of a program they wrote and a couple of pages of writing about how they solved things and what they found.

Grades are based on students' participation in the course as well as the project they submit.

**Prerequisites:**

Students who attend this course should know about basic macroeconomics. Knowledge of heterogeneous agent models will be helpful, but not a prerequisite. It is not required to already have programming skills. Yet, students should know how to use a computer. In addition, they should bring along the willingness to learn programming (which requires that they will program a lot themselves). Ideally, if available, students should bring their own computer to class. This is however not a requirement.

**Course materials:**

There will be ample course material on how to program in Fortran, which compilers to use, numerical techniques, etc. In addition to a couple of chapters on these topics, there will be Fortran codes available for everything we do. There is no book, but lecture notes will be provided in pdf format. All information about how to use Fortran, a toolbox and all the program codes are available through the website

[www.ce-fortran.com](http://www.ce-fortran.com)