Heterogeneity and Macroeconomics

Aggregate implications of (partially) uninsurable income risk

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Description

Economic agents differ in many respects: skill, employment status, consumption levels, wealth etc. This has important implications in many areas, e.g. optimal tax policy, welfare effects of business cycles, optimal unemployment insurance system. In this course, we will learn how to solve dynamic models in which agents differ (exogenously) in either their stochastic labor productivity or employment/unemployment status and insurance markets against these shocks are absent (incomplete financial markets). Agents can, however, self-insure against income shocks by saving or borrowing. We will derive equilibria of economies in which these heterogenous agents interact. In these equilibria, agents differ (endogenously) with respect to consumption and wealth.

These models cannot be solved analytically. They have to be solved numerically. Since one learns these techniques best by applying them, we will have two practice sessions in which we solve these models on the computer.

Prerequisites

You have to be familiar with the standard intertemporal consumption model under uncertainty. Solutions are either based on the consumption Euler equation or on the value function. You must know the former. Ideally, you also know the latter. Nicola Fuchs-Schündeln's course is the perfect preparation since my course complements hers.

You do not have to have a lot of experience in using Matlab / Octave. However, you should be able to do basic operations (creating variables, simple operations, storing results, etc.) in these languages. For those who have never used either language, you can find an introductory course to Matlab here.

Computer languages and course software

There are roughly three categories of languages. Mathematica and Maple are mainly used for symbolic algebra. Not many macroeconomists work with them, Chris Caroll being a notable exception. These two languages are considered to be slow for most macro purposes. The second level languages are Matlab, Octave, R and Gauss. Matlab and Octave are very similar. Octave being free

but Matlab having stonger graphical capabilities. Finance people and econometricians seem to prefer Gauss or R. They are all pretty similar and not too difficult to learn.
The compiled languages Fortran and C++ are the most difficult to learn but are the fastest and give the user most control. I have no experience with C++, though. Matlab (and Octave) is good for vector and matrix operations. However, if your code involves loops, Fortran or C++ are several times faster.

I will give you code that is written in Matlab. Octave is the open source equivalent to Matlab. Matlab code can be run (mostly) without modifications in Octave. You can obtain Octave from here. Octave is a command level program. If you add this graphical user interface the look and feel will be very similar to Matlab.

Further resources

- Books
  - Heer and Maussner (2008) is a wonderful book for students, in particular for heterogenous agent models.
  - The Bible aka Judd (1998) is an advanced book but an absolute must for serious research.
  - Miranda and Fackler (2002) is also aimed at students. It has a nice matlab toolbox that makes many things easier.
  - Adda and Cooper (2003) develop the models and then discuss computational issues. This book includes some econometrics as well.
- Websites
  - Victor Rios-Rull one of the giants, excellent course materials.
  - Makato has excellent lecture notes.
  - Collard's course page has wonderful lecture notes and matlab codes, perfect complement to Ken Judd's book.
  - Wouter is one of the fathers of heterogenous agent models and my teacher: lecture notes, data and codes
  - Chris Carroll excellent macro lecture notes; Mathematica and matlab codes.
  - Numerical recipes the master source for codes for Fortran and C++.
  - Repec source codes for many economic models, all languages.

COURSE OUTLINE

1 Endowment economy w/o aggregate uncertainty

Main reference: Huggett (1993)
Textbook: Heer & Maussner (2008) ch. 7.1-7.3.1; Ljungqvist & Sargent (2004) ch.17.2

1. The model
   (a) Value functions
   (b) Equilibrium definition
2. Numerical solution concepts
   (a) Markov processes and invariant distributions
   (b) Discretization
   (c) Endogenous grid points method; Carroll (2006)

Further readings:

- Stokey, Lucas, & Prescott (1989) and/or Ljungqvist & Sargent (2004) for background to proofs.
- Imrohoroglu (1992) similar model to measure welfare effects of inflation when money is a store of value.
- Barillas & Fernández-Villaverde (2007) on endogenous grid point methods in presence of more than one control.
- Clausen & Strub (2011) and Fella (2011) on endogenous grid point methods in presence of discrete choices.

2 Production economy w/o aggregate uncertainty

Main reference: Aiyagari (1994)
Textbook: Heer & Maussner (2008) ch. 7.3.2; Ljungqvist & Sargent (2004) ch.17.3

New features

1. Firms's capital demand in the model
2. Numerical: discretizing an AR(1) process, Tauchen (1986); Tauchen & Hussey (1991); Floden (2008); Kopecky & Suen (2010)

Further readings, among many others:

- Castaneda, Diaz-Gimenez, & Rios-Rull (2003) on wealth distribution in U.S.
- Conesa & Krueger (2006) on optimal progressivity of income taxation.
- Cagetti & De Nardi (2006) on entrepreneurship and wealth distribution.
- Conesa, Kitao, & Krueger (2009) on capital income taxation.
- interesting (working) paper on consequences of financial crises Guerrieri & Lorenzoni (2011)

3 Production economy w/ aggregate uncertainty

Main reference: Krusell & Smith (1998)
Textbook: Heer & Maussner (2008) ch. 8.3.2; Ljungqvist & Sargent (2004) ch.17.14

New numerical concepts and tools

1. Forecasting functions
2. Simulating a model

Further readings, among many others:

- Den Haan, Judd, & Juillard (2010) special issue of JEDC on Krusell-Smith includes many methods and codes in matlab or fortran.
- Gomes & Michaelides (2008) and Guvenen (2009) on asset pricing implications of incomplete markets.
- Benhabib, Bisin, & Zhu (2011) on capital income risk.

4 Models with default (if we get that far)

Reference: Livshits, MacGee, & Tertilt (2007)
New issues

1. pricing function
2. default function
3. pooling vs. no-pooling equilibria

Further readings, among many others:

- Dubey, Geanakoplos, & Shubik (2005) on default in general equilibrium

- Chatterjee, Corbae, Nakajima, & Rios-Rull (2007) on existence of equilibrium
- Athreya (2002) an early model with pooling contracts.
- Mankart (2010) on importance of multiple assets.
- Mankart & Rodano (2010) on default and entrepreneurship.
- Arellano (2008) on sovereign default.

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