Hands-On Heterogeneous Agent Macroeconomics Using the Econ-ARK/HARK Toolkit

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Because Representative Agent ('RA') models were of little use in understanding much of what happened in the Great Recession, policymakers including Larry Summers (2011), Fed Chair Janet Yellen (2016), former IMF Chief Economist Olivier Blanchard (2016), ECB Governing Board Member Benoit Coeure (2013), and Bank of England Chief Economist Andy Haldane (2016) have suggested that incorporation of heterogeneity (for example, across borrowers and lenders) must be an essential part of the agenda in developing new and better models. In confirmation of that intuition, a number of recent papers, most notably Kaplan, Moll, and Violante (2016) and Krueger, Mitman, and Perri (2016), have developed models that are otherwise standard but include a realistic description of microeconomic heterogeneity, and have shown that such models can generate much more sensible macroeconomic implications than RA models.

The aim of this course is to provide a thorough and hands-on introduction to the construction of models with 'serious' heterogeneity (that is, heterogeneity that matches the microeconomic facts that theory suggests *should* matter); how and why such heterogeneous agent ('HA') models have implications that differ from those of RA models; and how existing HA models can be adapted to new questions. (By hands-on, we mean that students with their own laptops will be able to execute the code themselves; it is preferred, but not required, to bring a laptop on which you are able to install new software).

The course will have two main components: Lectures explaining the theory and conceptual mechanics of how the models work; and hands-on demonstrations of live working versions of such models using the open-source Econ-ARK/HARK toolkit.

Students should bring a laptop on which they have permissions to install new software. Prior to class, students who anticipate continuing to use the Econ-ARK toolkit over the longer run should probably install the anaconda stack, which is a distribution of python that includes a robust set of extra tools that are useful for doing computational work. A good guide to installing anaconda is here.

This syllabus contains required and recommended readings for some topics. Required readings are indicated by a ⋆.

1 Motivation and Preliminaries

1.1 Motivation

Day 1
Lecture 1
minutes 90

The introduction and conclusion to last year's NBER Macro Annual paper by Ahn, Kaplan, Moll, Winberry, and Wolf provide a compact and well written discussion of the state and progress of HA macro.

Parts of the discussion of that paper by Carroll and Crawley (2017) put the relationship of HA to RA models in a broader context.

Handout:

NBER-Macro-Annual-Heterogeneity-Discuss

Readings:

* Ahn, Kaplan, Moll, Winberry, and Wolf (2017), Introduction, Conclusion
* Carroll and Crawley (2017), Sections 1, 2, and 4

Summers (1991)

Romer (2016)

1.2 Refresher on Consumption Theory

Resource: Lecture Notes on Consumption

1.2.1 The Infinite Horizon Perfect Foresight Model

Handouts:

- Consumption Under Perfect Foresight and CRRA Utility
- The Certainty Equivalent Consumption Function

1.2.2 Consumption with General Uncertainty

Handout: A Tractable Model of Buffer Stock Saving

Carroll (2016)

1.2.3 Habits

Handouts: Consumption Models with Habit Formation

2 Computational Tools

Day 1, Lect 2
minutes 45
CDC

2.1 Vision for the Econ-ARK Project

Intro-To-Econ-ARK

2.2 Intro to Heterogeneous Agents Resources and Toolkit (HARK)

Intro-To-HARK

3 Hands-On Exercises

Here we will explain how to begin using the Econ-ARK toolkit for heterogeneous agent macro modeling, and will guide students through the use of the toolkit to do solve increasingly sophisticated models, starting with partial equilibrium perfect foresight models and ending with some exercises using a full general equilibrium micro-macro model with idiosyncratic and aggregate risks.

3.1 Getting Started

Day 1
Lecture 2
minutes 45
MNW

3.1.1 **Perfect Foresight** *from A Gentle Introduction*

3.1.2 Installing Ananconda and Setup

3.2 Adding 'Serious' Income Uncertainty

Day 2, Lect 3
minutes 90

3.2.1 **Realistic Income Shocks** *from A Gentle Introduction*

3.2.2 Nondurables During the Great Recession

Is it plausible to argue that the collapse in C during the Great Recession was caused by an increase in uncertainty?

3.3 'Serious' HA Macro: The Distribution of Wealth and the MPC

Exercises with a full-fledged HA macro model, exploring the relationship between macro and micro theory and data

4 The Future

Day 2, Lect 4
minutes 60
CDC

The near-term and longer-term future of the Econ-ARK toolkit, and of macroeconomics.

4.1 Of Econ-ARK/HARK

- Tools Being Added Now

4.2 Of Macroeconomics

The term 'HA' is omitted because our view is that most future macroeconomics will be HA macroeconomics!

- Monetary and Fiscal Policy
  - Fiscal Policy
  - Monetary Policy
- Macroprudential Policy
  - Mortgages
  - Financial markets

5 Hands-On Exercises

Day 2, Lect 4
minutes 30
MNW

5.1 Preparation for Exercises

5.2 Exercises

Day 2, Lect 5
minutes 45
MNW, CDC

References

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