

# Macroeconomics with (some) Heterogeneity

## Syllabus

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The attempt to understand the origins and consequences of inequality has a long history. While political philosophers like Rousseau (1754) provided a philosophical perspective on the origins of natural and ethical inequality, economists took their time to dive deeper in field. However, with the provision of relevant data along with the backdrop of steep rise in inequality, this field is taking a center stage in present day economics research. As there is a close relationship between economic inequality and policy implemented by the state, macroeconomists also have begun to take inequality seriously. Although there has been an intense growth in the academic literature associated with this field, many policy-oriented researchers lack proper tools to delve in this field. This course tries to bridge this gap to some extent and attempts to provide a brief but an intense overview of the macroeconomics literature which deals with inequality. As this literature is vast, this course will act as a building block for other courses which will come in the future.

This course paves a way to questions like,

- how progressive should income taxation should be?
- should government impose capital income taxation or not? If yes, what is the optimal level of capital taxation?
- Why are we witnessing high levels of income and wealth inequality? Which steps government can take to curb this inequality and what are the trade-offs associated with these steps?

**Dates:** May 4 - 8, 2020.

**Time:** 09:00 – 10:15, 10:30 – 11:45, 13:00 - 14:15, 14:30 – 15:45

**Prerequisite:** Some programming experience in either MATLAB, R, Python, Julia, FORTRAN or C++ is required to do practical exercises. However, if you don't know any of these languages I will recommend to start using either R, Julia or Python. R the is easiest to learn but Julia is very fast.

**Intended audience:** Policy oriented researchers and early stage PhD students.

**Rules:** I will provide all listed papers and slides sequentially. This means that before each lecture, the associated slides and papers will be provided. There are no required assignments for the course. However, I will provide some exercises for people who might be interested in learning more.

## Day 1

### **Lecture 1: Introduction to Quantitative Macroeconomics and Micro-Datasets**

We will start with discussing the interpretation of quantitative macroeconomics. What are the different ways of doing quantitative macroeconomics research? How can micro-data help us to discipline our models? After this discussion we will move onto the dynamic programming problems and ergodic distribution.

#### **Readings:**

- Heckman (2001) “Micro Data, Heterogeneity, and the Evaluation of Public Policy: Nobel Lecture” Journal of Political Economy
- Todd and Wolpin (2006) “Assessing the Impact of a School Subsidy Program in Mexico: Using a Social Experiment to Validate a Dynamic Behavioral Model of Child Schooling and Fertility ” American Economic Review [**only to see the application of quantitative macroeconomics principles**]
- Blundell (2017) “What have we learned from structural models?” American Economic Review P&P

### **Lecture 2: Dynamic Programming: Theory and Applications**

We will continue our discussion of dynamic programming. We will learn how to implement value function iteration under no uncertainty as well as under uncertainty. For practical purposes I will implement the value function iteration for a simple growth model. And then I will provide a code for another model in MATLAB which will be missing important lines. You will have to fill in the code to get it running.

#### **Readings:**

- Ljungqvist and Sargent (2004), Chapter 2 – 4

## Day 2

### Lecture 3: Aggregation Results

We will look into several aggregation results. Specific focus will be on Gorman's result. It will help us understand the conditions under which aggregate equilibrium quantities and prices do not depend on the distribution of these quantities at the individual level. For example, in order to determine the aggregate consumption we only need to know aggregate income and not how the income is distributed. We will extend this discussion to the concept of recursive competitive equilibrium.

#### Readings:

- Gorman (1961) "On a class of preference fields" *Metroeconomica*
- Constantinides (1982) "Inter-temporal asset pricing with heterogeneous consumers and without demand aggregation" *Journal of Business*
- Caselli and Ventura (2000) "A representative consumer theory of distribution" *American Economic Review*

### Lecture 4: Complete Markets

We will establish the relationship between complete markets and the presence of a representative agent. The starting setting will be a pure exchange infinite horizon economy with stochastic endowments. Two market structures will be discussed: one in which all securities are traded at time 0 and another in which sequential trading structure is imposed. We will establish that both structure lead to the same consumption allocations.

#### Readings:

- Ljungqvist and Sargent (2004) Chapter 8

## Day 3

### Lecture 5: Consumption Insurance

We will study the implications of complete markets model in terms of consumption insurance and discuss how it departs from what we see in the data. From here we will move on to a partial risk sharing model, bond market economy etc. This discussion will provide a launching pad for introducing incomplete markets model.

#### Readings:

- Friedman (1957) "A theory of the consumption function"
- Cochrane (1991) "A simple test of consumption insurance" *Journal of Political Economy*
- Hall (1978) "Stochastic implications of the life cycle-permanent income hypothesis: Theory and evidence" *Journal of Political Economy*

- Mace (1991) “Full insurance in the presence of aggregate uncertainty” *Journal of Political Economy*
- Blundell and Preston (1998) “Consumption inequality and income uncertainty” *Quarterly Journal of Economics*

### **Lecture 6: Precautionary Savings**

In the previous class you will learn that under permanent income hypothesis, and in the absence of borrowing constraints, the mean preserving spreads of income have no effect on savings. This lecture will break that result in various ways. Further, we will learn about income fluctuations problem which will become the basis of the Bewley-Huggett-Aiyagari model.

#### **Readings:**

- Kimball et al. (1990) “Precautionary savings in the small and in the large” *Econometrica*
- Chetty and Szeidl (2007) “Consumption commitments and risk preferences” *Quarterly Journal of Economics*
- Sandmo (1970) “The effect of uncertainty on saving decisions” *Review of Economic Studies*

## **Day 4**

### **Lecture 7: Exogenously Incomplete Markets**

We are going to discuss the Bewley-Huggett-Aiyagari model in detail. The discussion will revolve around the definition of a stationary recursive competitive equilibrium. We will talk about existence and uniqueness of an equilibrium. I will illustrate that the solution of this model is not standard. We will design an algorithm for the solution of this model and in the next two classes we will learn how to implement it.

#### **Readings:**

- Aiyagari (1993) “Uninsured idiosyncratic risk and aggregate saving” Working paper 502, FRB Minneapolis
- Aiyagari (1994) “Uninsured idiosyncratic risk and aggregate saving” *Quarterly Journal of Economics*
- Huggett (1993) “The risk-free rate in heterogeneous agent incomplete-insurance economies” *Journal of Economic Dynamics and Control*

### **Lecture 8: Solution of Aiyagari Model**

We are going to learn about the income process with the backdrop of the Aiyagari model. Specifically we will learn how to identify an income process and discretize

it computationally. For discretization we will learn two methods: Tauchen and Rouwenhorst. An assignment will be given in the class which will facilitate the understanding of this topic.

**Readings:**

- Tauchen (1986) “Finite state Markov chain approximations to univariate and vector autoregressions” *Economics Letters*
- Tauchen and Hussey (1991) “Quadrature based methods for obtaining approximate solutions to nonlinear asset pricing models” *Econometrica*
- Kopecky and Suen (2010) “Finite state Markov chain approximation to highly persistent processes” *Review of Economic Dynamics*

**Day 5**

**Lecture 9 & 10: Solution of Aiyagari Model**

We will implement the solution of the Aiyagari model, and try to replicate his results in the QJE paper. An assignment will be given for the afternoon.

**References**

- AIYAGARI, S. R. (1994): “Uninsured idiosyncratic risk and aggregate saving,” *The Quarterly Journal of Economics*, 109, 659–684.
- BLUNDELL, R. (2017): “What have we learned from structural models?” *American Economic Review*, 107, 287–92.
- BLUNDELL, R. AND I. PRESTON (1998): “Consumption inequality and income uncertainty,” *The Quarterly Journal of Economics*, 113, 603–640.
- CASELLI, F. AND J. VENTURA (2000): “A representative consumer theory of distribution,” *American Economic Review*, 90, 909–926.
- CHETTY, R. AND A. SZEIDL (2007): “Consumption commitments and risk preferences,” *The Quarterly Journal of Economics*, 122, 831–877.
- COCHRANE, J. H. (1991): “A simple test of consumption insurance,” *Journal of political economy*, 99, 957–976.
- CONSTANTINIDES, G. M. (1982): “Intertemporal asset pricing with heterogeneous consumers and without demand aggregation,” *Journal of business*, 253–267.
- FRIEDMAN, M. (1957): “The permanent income hypothesis,” in *A theory of the consumption function*, Princeton University Press, 20–37.

- GORMAN, W. M. (1961): “On a class of preference fields,” *Metroeconomica*, 13, 53–56.
- HALL, R. E. (1978): “Stochastic implications of the life cycle-permanent income hypothesis: theory and evidence,” *Journal of political economy*, 86, 971–987.
- HECKMAN, J. J. (2001): “Micro data, heterogeneity, and the evaluation of public policy: Nobel lecture,” *Journal of political Economy*, 109, 673–748.
- HUGGETT, M. (1993): “The risk-free rate in heterogeneous-agent incomplete-insurance economies,” *Journal of economic Dynamics and Control*, 17, 953–969.
- KIMBALL, M. S. ET AL. (1990): “Precautionary Saving in the Small and in the Large,” *Econometrica*, 58, 53–73.
- KOPECKY, K. A. AND R. M. SUEN (2010): “Finite state Markov-chain approximations to highly persistent processes,” *Review of Economic Dynamics*, 13, 701–714.
- LJUNGQVIST, L. AND T. J. SARGENT (2004): “Recursive Macroeconomic Theory, volume 1 of MIT Press Books,” .
- MACE, B. J. (1991): “Full insurance in the presence of aggregate uncertainty,” *Journal of Political Economy*, 99, 928–956.
- SANDMO, A. (1970): “The effect of uncertainty on saving decisions,” *The Review of Economic Studies*, 37, 353–360.
- TAUCHEN, G. (1986): “Finite state markov-chain approximations to univariate and vector autoregressions,” *Economics letters*, 20, 177–181.
- TAUCHEN, G. AND R. HUSSEY (1991): “Quadrature-based methods for obtaining approximate solutions to nonlinear asset pricing models,” *Econometrica: Journal of the Econometric Society*, 371–396.
- TODD, P. E. AND K. I. WOLPIN (2006): “Assessing the impact of a school subsidy program in Mexico: Using a social experiment to validate a dynamic behavioral model of child schooling and fertility,” *American economic review*, 96, 1384–1417.

Topics in Macroeconomics III. b. Heterogeneous firms, heterogeneous projects and bank runs. 5. Finance, firm dynamics and the business cycle: theory and applications a. Apply the theory to the 2007-2009 financial crisis b. Finance, firm dynamics and secular stagnation. Syllabus. Note: this is preliminary. New papers may be added before the course starts.Â Fluctuations in an Economy with Production Heterogeneity,â€ Journal of Political Economy, 121, no. 6 (2013): 1055-1107. â€¢ Christiano, Lawrence J., Roberto Motto, and Massimo Rostagno. 2014. "Risk Shocks." This article reviews macroeconomic models with heterogeneous households. A key question for the relevance of these models concerns the degree to which markets are complete. This is because the existence of complete markets imposes restrictions on (i) how much heterogeneity matters for aggregate phenomena and (ii) the types of cross-sectional distributions that can be obtained.Â @inproceedings{Guvener2011MacroeconomicsWH, title={Macroeconomics with Heterogeneity: A Practical Guide}, author={Fatih Guvener}, year={2011} }. Fatih Guvener. Published 2011. Economics. This article reviews macroeconomic models with heterogeneous households. Syllabus of the course Advanced Macroeconomics (Macroeconomics-3). Program 080100.68 â€˜Economicsâ€™™, Masterâ€™™s programs in â€˜Economics: Research Programâ€™™, â€˜Applied Economicsâ€™™ and â€˜Statistical Analysis of Economic and Social Processesâ€™™. The Government of the Russian Federation.Â Yet, this requires from students certain facility with linear algebra and some basic game theory. The course also assumes studentsâ€™™ familiarity with introductory macroeconomics topics but this is not compulsory.Â The course syllabus is designed for the instructors, teaching assistants and students of the Education Program 080100.68 â€˜Economicsâ€™™ following Masterâ€™™s programs in â€˜Economics: research programâ€™™, â€˜Applied Economicsâ€™™ and â€˜Statistical Analysis of Economic and Social Processesâ€™™.