

# Macroeconomics - II

## Course Description

This course deals with a set of tools, models and methods that leads us to the contemporary macroeconomics discourse. The topics covered in this course forms the foundation for standard workhorse models used in a variety of applications including more advanced as well as applied macroeconomics, policy formulation as well as various other areas of economics like finance, environment etc.

## Course Outline

### 1 Introduction

Broad overview of contemporary macroeconomic theory, confronting macroeconomic data with a simple neoclassical growth model, alternative approaches to macroeconomics and macroeconometrics.

### 2 Dynamic Macroeconomics Toolkit

#### 2.1 Modelling time: Deterministic dynamical systems

Introduction to dynamic models in economics, continuous and discrete time, notion of equilibrium, solutions, qualitative analysis, phase diagrams, linearization of nonlinear systems, local and global stability, local and global determinacy, various types of dynamical possibilities in continuous and discrete time.

Linear first order autonomous difference equations, system of difference equations, nonlinear system of difference equations, linearization using Taylor's series, local stability analysis.

Linear first order differential equations, system of differential equations, nonlinear system of differential equations, linearization using Taylor's series, local stability analysis (Routh-Hurwitz criterion).

#### 2.2 Optimal control theory / Dynamic optimization

##### Pontygarin's Maximum Principle

Setting up a general optimal control problem: state and control variable, Solution using Pontryagin's Maximum Principle (in continuous time): Free-endpoint vs. fixed endpoint problems, finite and infinite horizon, problems using discounting (current-valued Hamiltonian), economic applications.

##### Dynamic Programming

Deterministic finite and infinite horizon problems, value functions, Bellman equation and policy functions, existence and uniqueness of value functions, solving by sequential method vs. dynamic programming using value function iteration.

#### 2.3 Stochastic Processes and Models

Simple stochastic processes: white noise, random walk and AR processes, stationarity, mean reversion and impulse response functions, Markov process, Markov chains, stochastic dynamic programming, optimal stopping problems, stochastic difference equations.

## 2.4 Using MATLAB for symbolic and numerical computation

Computer Algebra Systems, Setting up MATLAB, simple numerical and symbolic computations using MATLAB.

## 3 Simple Aggregate Models

Dynamic models of output and inflation, introduction to expectations: adaptive vs. rational expectations, general solution to rational expectations (using lag operators and the method of undetermined coefficients), Cagan's model under adaptive and rational expectations, policy effectiveness/ineffectiveness, Lucas critique, problems with traditional aggregate models and rise of microfoundations in modern macroeconomics, fundamental solutions, rational bubbles and sunspots, learning under rational expectations.

## 4 Contingent Markets and Asset Pricing

Introduction to uncertainty and financial assets, complete vs. incomplete markets, Arrow-Debreu securities, time 0 vs. sequential trading, Arrow-Debreu Equilibrium with complete markets, insurance, introduction to asset pricing under complete and incomplete markets, equity premium and risk-free rate puzzle, capital asset pricing model (CAPM), efficient markets hypothesis (EMH), limits of arbitrage.

## 5 Optimal Growth (Dynamic General Equilibrium) Models

### 5.1 Optimal growth with single dynasty under infinite horizon (Ramsey-Cass-Koopmans Model)

Decentralized market equilibrium and the social planner's problem, efficiency of decentralized market equilibrium and the welfare theorems, introducing government and Ricardian equivalence.

### 5.2 Overlapping generations

Decentralized market equilibrium, comparison with social planner's problem, inefficiency of decentralized market equilibrium, golden rule of capital accumulation, pension - fully funded vs. pay-as-you-go (PAYG) system.

### 5.3 Monetary models

Models of money as a medium of exchange and as store of value, fragility of OLG money, money in the utility function (MIUF) models, cash-in-advance (CIA) models, search in money market.

## 6 Real Business Cycles & Introduction to DSGE

Basic stochastic growth model, labor-leisure choice, Arrow-Debreu competitive equilibrium vs. Recursive competitive equilibrium, Brock-Mirman Model, Hansen models, moving from theory to data, calibration techniques.

## 7 Search and Matching in Labor Market

Diamond-Mortensen-Pissarides model: matching function, job creation, Beveridge curve, wage determination and equilibrium unemployment.

## Readings

- Adda, Jérôme and Russell Cooper (2003). *Dynamic Economics*. Cambridge, Massachusetts: MIT Press.
- Bénassy, Jean-Pascal (2011). *Macroeconomic Theory*. New York: Oxford University Press.
- Brock, William and Leonard Mirman (1972). "Optimal economic growth and uncertainty: The discounted case". In: *Journal of Economic Theory* 4.3, pp. 479–513.
- Cooley, Thomas F., ed. (1995). *Frontiers of Business Cycles Research*. Princeton University Press.
- Hoy, Michael, John Livernois, Chris McKenna, Ray Rees, and Thanasis Stengos (2001). *Mathematics for Economics*. Second. The MIT Press.
- Ljungqvist, Lars and Thomas J. Sargent (2012). *Recursive Macroeconomic Theory*. third. Cambridge, Massachusetts: MIT Press.
- McCandless, George (2008). *The ABCs of RBCs: An introduction to dynamic macroeconomic models*. Cambridge, Massachusetts: Harvard University Press.
- Pissarides, Christopher A. (2000). *Equilibrium Unemployment Theory*. 2nd. MA: MIT Press.
- Stachurski, John (2009). *Economic Dynamics: Theory and Computation*. MIT Press.
- Uribe, Martín and Stephanie Schmitt-Grohé (2017). *Open Economy Macroeconomics*. Princeton University Press.

## Evaluation

Quiz / Assignments / Presentations: 20%, Mid-semester Exam: 40%, End-semester Exam: 40%.