# Dynamic Macroeconomics (Spring 2019)

## Purpose:

This course prepares you to write a high quality thesis in the area of Macroeconomics using quantitative models to analyze the impact of policy on aggregate outcomes and welfare. You will work collaboratively with other students on exercises aimed at developing quantitative skills essential for macroeconomic policy analysis. The models and the numerical tools emphasized in the course are geared toward policy questions related to pension reform, taxation, and stabilization policy. You will develop building blocks to construct micro founded models of individual behavior where fiscal policy is explicitly modeled. You will simulate models to evaluate the welfare consequences of hypothetical policy reforms and the ability of standard economic models replicate essential moments of the data.

## Content:

You will apply several types of macroeconomic models common for studying long and short run economic phenomenon, from life-cycle savings decisions, to aggregate growth, to business cycles. You will take these models to the data using computational software (Matlab or similar) in order answer quantitative policy questions. You will work on exercises where you will evaluate the welfare costs of business cycles, or quantify the implications for aggregate savings of alternative pension schemes. You will learn to use numerical methods to solve a variety of problems common in macroeconomics. The analytical skills emphasized in the course are of direct relevance to policy makers at the National Institute of Economic Research (NIER/Konjunkturinstitutet), the Ministry of Finance, the Riksbank and elsewhere. External speakers from agencies which employ macroeconomists will provide further context for the course lectures and exercises.

You will develop a detailed research proposal (‘mini-thesis’) which integrates the theoretical models and quantitative methods developed in the course. You will present your research in class and write a report based on your analysis. In the past, successful students have had the opportunity to collaborate with researchers at agencies such as the Ministry of Finance in the execution of their theses.

The course consists of five main theoretical topics and closely related methodological techniques plus optional applications to other areas:

1. Calibration and the Solow Model
2. Overlapping Generations Models
3. Infinitely Lived Agent Models
4. Recursive Models
5. Real Business Cycle Models

## Intended Learning Outcomes:

Upon completion of the course you will be able to

i. use macroeconomic models to derive intuition for how policy affects economic outcomes;
ii. calibrate macroeconomic models to real world data;
iii. use numerical methods to analyze economic models and derive quantitative conclusions regarding the effect of policy;
iv. evaluate macroeconomic questions integrating general theoretical analyses with specific quantitative results.

## Format and Structure:

The course consists of lectures, computer lab sessions, guest lectures, student presentation sessions, and tutorial sessions to introduce students to using Matlab. Computer labs will emphasize student participation through joint problem solving in Matlab. Course lectures will emphasize student participation through discussions. You will be required to present an overview of your research proposal ('mini-thesis') and discuss the work of classmates during the course.

## Examination:

Examination consists of three parts:

1) The research proposal ('mini-thesis'): you will pose a research question, develop an appropriate economic model to address your question, describe/implement a quantitative analysis and present preliminary results in the form of a presentation (week 21) and written summary (due by noon on June 5th). The research proposal will evaluate all ILOs and will account for **30%** of the grade. Students will work on the original research proposal in groups of 2.
2) An individual take-home project will evaluate ILOs i-iii, and to some extent ILO iv. The take-home project will account for **60%** of the grade and is scheduled for May 14th-16th.
3) Active participation in computer lab sessions, lectures, and student presentations will account for an additional **10%** of the grade.

## Course Requirements:

All students should have access to Matlab (or similar) available at www.mathworks.se. Matlab is also available in the student computing labs. Lecture notes and articles will supplement the primary course textbook:

McCandless, George. *The ABCs of RBCs: An Introduction to Dynamic Macroeconomic Models*. Harvard University Press, Cambridge, 2008.

# Preliminary Course Outline (L=Lecture, T=Tutorial)

## I. Preliminaries

**L1 (3/25)**
Part 1: Introduction to the course.
Part 2: Beyond Kaldor Facts: Does Solow Match the Data?

- E. Prescott (*Quarterly Review*, 1986)
- D. Gollin (*Journal of Political Economy*, 2002)

To Do: Download and install Matlab on your PC/Laptop. Work on Matlab practice problems. Begin reading Chapter 1 in McCandless.

**L2 (3/27)**
Introduction to Matlab in the PC lab

- Lecture notes and in-class exercises posted on the courseweb.

**T1 (3/29)** Matlab Tutorial Session in the PC lab led by Zoltan Racz. Zoltan will discuss data visualization topics in Matlab and answer student questions. If there is a specific topic or question you would like Zoltan to cover please contact him at Zoltan.Racz@phdstudent.hhs.se.

## II. Calibration and the Solow Model

**L3 (4/1)**
Part 1: Revisiting the Solow model.

- McCandless 1.1-1.3 and lecture notes

Part 2: A Log-linearized version of Solow and the Hodrick-Prescott Filter

- McCandless 1.4-1.6 and lecture notes
- Hodrick and Prescott (*Journal of Money, Credit and Banking*, 1997)

Part 3: Problem Set 1 is presented and posted on the courseweb.
To Do: Work on problem Set 1 and, if necessary, review notes on the Solow Model posted on the courseweb.

**T2 (4/3)** Matlab Tutorial Session in the PC lab led by Guilherme Garcia Teijeiro. Guilherme will discuss topics related to filtering of time series data and answer student questions. If there is a specific topic or question you would like Guilherme to cover please contact him at Guilherme.Tonsiggarciateijeiro@phdstudent.hhs.se.

**L4 (4/8)**
P art 1: Student Led Q&A on Problem Set 1. (Bring USB drive with your solutions.)
Part 2: Building blocks for the OLG model: Solving a two-period savings problem

- Mapping the savings problem into a Matlab function.
- Solution algorithms: how they work and when they may fail.
- Get started on Problem Set 2 in the lab.

To Do: Read 2.1-2.2 in McCandless and continue working on Problem Set 2.

## III. Overlapping Generations Models and Multi Period Savings Problems

**L5 (4/10):** Introduction to Overlapping Generations (OLG) Models

- McCandless Chapter 2

**T3 (4/12)** Matlab Tutorial Session in the PC lab led by Guilherme Garcia Teijeiro. Guilherme will discuss topics related to optimization and answer student questions. If there is a specific topic or question you would like Guilherme to cover please contact him at Guilherme.Tonsiggarciateijeiro@phdstudent.hhs.se.

**L6 (4/15):**

Part 1: Extending the 2-period OLG model to look at lifecycle savings and retirement.
Part 2: Pension policy

- Lecture notes
- Cooley and Soares (*Journal of Political Economy*, 1999)

Part 3: Problem Set 3 is presented and posted on the course web.

**L7 (4/17)**

Part 1: Student led Q&A on Problem Set 2. (Bring USB drive with your solutions.)
Part 2: Get started on Problem Set 3 in the lab.

## IV. Infinitely Lived Agent Models

**L8 (4/23)**

Part 1: From Robinson Crusoe to a Competitive Economy

- McCandless Chapter 3 and Lecture Notes

Part 2: Handling infinite horizon problems in Matlab.
Part 3: Problem Set 4 is presented and posted on the course web.

**L9 (4/24)**

Part 1: Guest presentation by Jakob Almerud of the National Institute of Economic Research (NIER/Konjunkturinstitutet) and the Ministry of Finance will present an overview of the MoF/NIER OLG model.

**L10 (4/29)**

Part 1: Student led Q&A on Problem Set 3. (Bring USB drive with your solutions.)
Part 2: Get started on Problem Set 4 in the lab.

**L11 (5/2)**

Part 1: Student led Q&A on Problem Set 4. (Bring USB drive with your solutions.)
Part 2: Welfare Costs of Business Cycles

- Lecture notes
- Lucas (*Models of Business Cycles*, 1987)

Part 3: Problem Set 5 is presented and posted on the course web.

**L12 (5/6)**
Part 1: Guest Speakers Markus Sigonius and Svante Midander of the National Institute of Economic Research (NIER/Konjunkturinstitutet) will discuss fiscal policy over the business cycle and the role of automatic stabilizers.
Part 2: Steady State Analysis of Models with Taxes

- McCandless 3.4 and Lecture Notes
- Ragan (*American Economic Journal:Macroeconomics*, 2013)

## V. Recursive Models

**L13 (5/8)**
Part 1: Student led Q&A on Problem Set 5.
Part 2: Recursive Deterministic Models

- McCandless Chapter 4 and Lecture Notes

Part 3: Problem Set 6 is presented and posted on the course web.

**L14 (5/13)**
Part 1: Stochastic Recursive Models

- McCandless Chapter 5 and Lecture Notes

**L15 (5/14)**
Part 1: Student led Q&A on Problem Set 6
Part 2: Take home exam distributed. **NO COLLABORATION PERMITTED!**

## VI. Real Business Cycle Model

**L16 (5/20)**
Part 1: Erika Farnstrand-Damsgaard, Director of Research at the National Institute of Economic Research (NIER/Konjunkturinstitutet) will present an overview of SELMA, a DSGE model recently introduced by the NIER.
Part 2: Hansen's Stochastic Variable Labor Supply Model

- McCandless 6.1-6.3 & 6.5-6.7
- Lecture notes

## Mini Thesis Presentations

**Presentations (5/21-5/22)** Mini thesis presentations.