Dynamic Macroeconomics

Economics 630   Module 1 (Fall 2017)
Date: Mon/Wed 2:50-4:20   RAWLS 2077

Purdue University
Krannert School of Management
Department of Economics

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                    Office Hours: Mon/Wed 10:00-11:00 (also available by appointment)

Prerequisites
Economics 608, 611, 612
To complete the Macroeconomics sequence, you are required to take 4 courses:
   (i)   ECON 630, Dynamic Macroeconomics (this course),
   (ii)   ECON 632, Search Theory and Applications (offered by Cathy, Fall 2018),
   (iii)   ECON 633, Macroeconomics with Heterogeneous Agents (offered by Soojin, Spring 2018), and
   (iv)   ECON 641, Computational Economics (offered by Trevor, Fall 2018).

Course description
The course will consider both the theory of macroeconomic models along with the methodology for solving them. The course will focus on numerical methods for solving dynamic stochastic general equilibrium (DSGE) models. The numerical methods will focus on evaluating the steady state and the impulse response functions of these stochastic models. The software Dynare is ideally suited for this task and will be required to complete the problem sets in the course.

The numerical methods are rudimentary compared to the tools introduced in ECON 641. The goal of the Dynare approach is to efficiently solve the models and quantify the effects of shocks on the steady state. In terms of tools, this course will add complementary tools to those acquired in ECON 641.

Three classes of macroeconomic models that closely complement the classes of models to be introduced in this course are:
        (i)   search and matching models, taught in ECON 632,
        (ii)   incomplete markets models, taught in ECON 633,
        (iii)   heterogeneous firm models, also taught in ECON 633.
These models can be solved using the tools in this course or the tools from ECON 641.

Additionally, the course will show how the methods of this course can be applied to solve macroeconomic models using Bayesian estimation. This closely complements the material from ECON 690 BE, Bayesian Econometrics.

Course materials

<u>Required</u>

Miao, Jianjun (2014): Economic Dynamics in Discrete Time (MIT Press: Cambridge, MA).

Dynare software, available at http://www.dynare.org/
> Stéphane Adjemian, Houtan Bastani, Michel Juillard, Frédéric Karamé, Ferhat Mihoubi, George Perendia, Johannes Pfeifer, Marco Ratto and Sébastien Villemot (2011), "*Dynare: Reference Manual, Version 4*", *Dynare Working Papers*, 1, CEPREMAP.

<u>Recommended</u>

Galí, Jordi (2015): Monetary Policy, Inflation, and the Business Cycle: An Introduction to the New Keynesian Framework, 2nd Edition (Princeton University Press: Princeton, NJ).

Herbst, Edward P. and Frank Schorfheide (2016): Bayesian Estimation of DSGE Models (Princeton University Press: Princeton, NJ).

Torres, José L. (2015): Introduction to Dynamic Macroeconomic General Equilibrium Models, 2nd Edition (Vernon Press: Wilmington, DE).

Additional material (all available in pdf on Blackboard)

> Textbook chapter on New Keynesian Monetary Theory.
> Textbook chapter on New Keynesian Labor Market Theory.
> Dynare User Guide (by Tommaso Mancini Griffoli, 2007-2008).
> Video Tutorials for Dynare.

Course structure (8 weeks)

Note: Due to the solar eclipse, class on Monday, August 21 has been cancelled. If necessary, a make-up class will be scheduled at a time that is convenient for everyone.

August	Difference equations (deterministic and stochastic)
23, 28, 30	Linear quadratic equations
	Log-linearization
	Bayesian estimation
References:	Chapters 1, 2, 9, 14, 15 of Miao (2014).
	Herbst and Schorfheide (2016)
September 4	No class (Labor Day)
September 6	Applications of the RBC model: Investment and technological change
References:	Chapters 5, 6 of Torres (2015)

September	Small-scale New Keynesian models
11, 13, 18, 20	Small-scale model with sticky prices
	Monetary policy trade-offs
	Small-scale model with stick prices, sticky wages, and unemployment
	Bayesian estimation
References:	Chapter 19 of Miao (2014).
	Chapters 1, 2, 3, 6, and 7 of Galí (2015).
	Textbook chapter on New Keynesian Monetary Theory.
	Textbook chapter on New Keynesian Labor Market Theory.

September	Financial economics
25, 27	Asset pricing
	Bubbles
	Collateral
References:	Sections 13.6-13.8 and 20.4 of Miao (2014).

October	Medium-scale New Keynesian model
2, 4	Smets-Wouters model
References:	Section 19.4 of Miao (2014).
	Section 6.2 of Herbst and Schorfheide (2016)

October 9   No class (October Break)

October 11 and 16   Student presentations

Note: Chapter 17 of Miao (2014) reviews the incomplete markets model and Chapter 18 of Miao (2014) reviews the search and matching model. This allows students who have not yet taken ECON 632 and ECON 633 to complete a research proposal using these classes of models.

Methodology
The course will be based on a series of lectures. The lectures are comprehensive, but can be supplemented by the reference texts cited above and the reference list below. The lectures are supported by:

1) *Homework*

I will assign four medium-sized homework sets throughout the course. Homeworks are submitted either as a hard copy, an online submission to Blackboard, or some combination of the two (analytical problems submitted as a hard copy and computer problems submitted online to Blackboard).

Homework 1 is due **Wednesday, September 6** at the beginning of class and includes:

- Analytical exercises associated with log-linearization of the RBC model.
- First and second order approximations of a RBC model using Dynare.
- Bayesian estimation of the RBC model using Dynare.

Homework 2 is due **Wednesday, September 20** at the beginning of class and includes:

- Solving the RBC model with investment adjustment costs.
- Solving the RBC model with technological change.
- New Keynesian Monetary Theory exercises.
- Solving the small-scale model with sticky prices using Dynare and comparing the outcomes to the analytical results from the exercises.
- Bayesian estimation of the small-scale model with sticky prices.

Homework 3 is due **Wednesday, October 4** at the beginning of class and includes:

- Analytical problems for monetary policy trade-offs.
- New Keynesian Labor Market Theory exercises.
- Solving the small-scale New Keynesian model with sticky prices, sticky wages, and unemployment using Dynare and compare the outcomes to the analytical results from the exercises.
- Bayesian estimation of the small-scale New Keynesian model with sticky prices, sticky wages, and unemployment.

Homework 4 is due **Tuesday, October 17** by 6 pm into my hands (I'll be in my office, Rawls 4070) or uploaded to Blackboard. Homework 4 includes:

- Analytical problems for financial economics.
- Solving a model with bubbles using Dynare.
- Solving the medium-scale New Keynesian model using Dynare.

2) *Paper presentation*

At the beginning of class on **Wednesday, August 30**, students will sign up to present a new paper in the literature. Each student will be assigned a date to present the paper. The assigned date will be chosen to match the lecture given on that particular date.

Student presentations will last for 15 minutes. Students are welcome to use slides. The presentation should flow seamlessly from the lecture that I deliver on that particular day. This means that all notation and terminology must be consistent with Miao (2014). It is not permissible to simply copy equations or results directly from the article without placing them in the context of the course.

The matching notation is IMPORTANT. I will take off 25% if the notation does not match.

A selected paper must satisfy the following three criteria:
a. The paper cites one of the papers in the Reference List in the Miao (2014), Galí (2015), or Herbst and Schorfheide (2016) chapters covered in the course.
b. The paper is approved by me (mostly to avoid duplication, or papers that are too closely related).
c. The paper is either a working paper as of August 1, 2017, a paper published in 2015 or 2016, or a paper accepted for future publication.

3) *Research proposal*
In the final two days of class (**October 11 and 16**), students will present their research proposal on a topic related to material covered in the class. The proposal must use one of the models introduced in class and must contain a numerical solution using Dynare.

In addition to the models from class, students are permitted to choose from the class of search and matching models (from ECON 632), the class of incomplete markets models (from ECON 633), or the class of heterogeneous firm models (from ECON 633), provided that Dynare is used for the numerical solution.

Students that are not selecting Macroeconomics as their primary field (as defined in the Student Guide) have the option to skip the research proposal, but the course grade would then be capped at B+.

Assessment

Homework	60%	(15% for each assignment)
Paper presentation	15%	
Research proposal	25%	