The Science and Art of DSGE Modelling:  
A Dynare-Based Course on Model Construction, 
Calibration, Estimation and Policy Analysis

NIPE, University of Minho - Course Outline

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1 Introduction

The three-day course focuses on a seamless methodology for construction, estimation and policy analysis of macroeconomics, summarized by the following steps.

1. The construction of a DSGE model describing the first-order conditions for economic agents in the form of a set of non-linear difference equations

2. The solution of the steady state to be used for both solution and calibration

3. Bayesian estimation methods

4. Model comparisons between different models or variants of same model

5. Model validation by comparison with second moments and a benchmark DSGE-VAR

6. Optimal policy analysis

Thus, we show that the main features of New Keynesian (NK) Dynamic Stochastic General Equilibrium (DSGE) models consist of a ‘Real Business Cycle’ (RBC) core, with an outer shell that includes nominal rigidities and other frictions. We then discuss how to take these models to the data, focusing on empirical implementations based on Bayesian system estimation methods. This is a hands-on course all based on existing facilities in the software platform Dynare (see Adjemian et al. (2011) and other useful documentation available on their website www.dynare.org). The mornings will be devoted to lectures and in the afternoons students will be requested to perform practical exercises on Dynare.

2 Course Outline

- Preliminary Reading and Basic requirements for Matlab and Dynare.

We expect students to read Gali (2008) chapters 1-3 before the course. As the course is software based we expect students to be familiar with the basics of Matlab and Dynare. Documentation to familiarize with Matlab is available on the Mathworks website and summarized below. We do not expect students to be familiar with advanced programming techniques in Matlab but a basic knowledge of matrix and array operations, graphics and programming skills is required to understand the material of the course.
1. Getting Started with Matlab documentation.
   http://www.mathworks.co.uk/help/techdoc/learn_matlab/bqr_2pl.html

2. A short video presenting the basics of Matlab.
   http://www.mathworks.co.uk/videos/matlab/getting-started-with-matlab.html

3. A long presentation with more details about operations, presenting plots and programming. (Requires registration and login; It is not required go through everything that is presented here for the course).
   http://www.mathworks.co.uk/webex/recordings/NA_110719_introml/index.html


5. Dynare Quick Start.
   http://www.dynare.org/documentation-and-support/quick-start

6. Dynare Example codes.
   http://www.dynare.org/documentation-and-support/examples

- **Day 1: Basics**
  - Introduction
  - Dynare Basics
  - RBC Model (first with zero growth steady state and then an exogenous balance growth path)
  - Dynare Set-up without separate steady state
  - The New Keynesian (NK) Model
  - Linearization
  - Bayesian Estimation of Linearized NK Model
    * Preparing the Data including use of various filters
    * Bayesian Methodology
    * Estimation of Linear using First Difference (FD) filter
    * Informal Treatment of Identification
    * Exercises in Lab.

- **Day 2: Intermediate Topics**
– Estimation of Non-Linear Models using FD filter
– Model Comparisons
– Variance and Historical Decomposition
– Validation - Comparison of Second Moments of Model with Data
– Calibration and Use of the External Steady State
– Introducing Financial Frictions
– Optimal Monetary Policy
– Stability-Indeterminacy
– Exercises in Lab.

• Day 3: Further Topics

– DSGE-VAR Estimated Model
– Formal Treatment of Identification
– Generalized Filter and One-Step Estimation
– Forecasting using DSGE-VAR
– The Small Open Economy
– “Beyond DSGE Models?” The Debate
– Exercises in Lab.

2.1 Reading

There are a number of excellent books on modern dynamic macroeconomics that provide background reading for the course. Dejong and Dave (2007) covers many of the empirical aspects of DSGE modelling. This should be supplemented with Del Negro et al. (2007) and Del Negro and Schorfheide (2004). To understand the models themselves a good recent text-book to start with is Wickens (2008). Then go on to Gali (2008). Other useful books are Koop (2003), McCandless (2008) and Lim and McNelis (2008). On optimal policy, rules and discretion, Currie and Levine (1993) may also prove useful.

At some stage researchers will need to dip into two seminal books: one on New Keynesian models, Woodford (2003) and the other covering the empirical side, Canova (2007); but they are both challenging reads!
2.2 Software

The course is based on the following software:

1. Matlab with the optimization toolbox

2. The latest Dynare (Currently 4.2.4)

For personal use, Dynare can be downloaded free from its web-site, but Matlab is rather expensive. Users would also find Winedt or Lyx useful as part of the output from Dynare is in the form of Latex files.

3 Instructors

The instructors for the course are Professor Paul Levine and Dr Bo Yang.

Paul Levine received a first-class BSc and a PhD, both in Mathematics, from the University of Manchester and an MSc in economics (distinction) at Queen Mary. In 1984 he became a senior research officer at the Centre for Economic Forecasting, London Business School and was appointed Professor of Economics at the University of Leicester in 1989. In 1994 he moved to the University of Surrey where he now leads the Centre for International Macroeconomic Studies (CIMS). He has acted as a consultant and/or visiting researcher at the IMF, the ECB, the National Institute of Public Finance and Policy in New Delhi and the central banks of Nigeria and Pakistan. His main research activity is in constructing empirically-based DSGE models for the purpose of macroeconomic policy analysis. Other research interests are Growth Theory, Labour Migration, Defence Economics and Conflict, and the Economics of Regulation. He has published over 100 refereed articles or chapters and 2 books in these areas.

Bo Yang is a visiting Research Fellow in the School of Economics at the University of Surrey. He graduated from the University of Hull in 2003. He then completed his MSc degree in Financial Economics at Queen Mary, University of London, where he has been awarded a distinction in the MSc. In 2005, he moved to the University of Surrey to undertake a PhD with a full research scholarship. Bos PhD was on the topic of dynamic stochastic general equilibrium (DSGE) modeling. Following the completion of his PhD degree in 2008, Bo was appointed, by Surrey and London Metropolitan University, as a
research officer to support the research activities of the EU-funded project “The Modelling and Implementation of Optimal Fiscal and Monetary Policy Algorithms in Multi-Country Econometric Models”. His research fields mainly include macro-econometrics, monetary economics, Bayesian econometrics and computational economics, focusing on the applications and quantitative analysis of DSGE models.

References


