CENTRE FOR INTERNATIONAL MACROECONOMIC STUDIES (CIMS)

A Dynare-Based Course on the Construction, Estimation and Use of DSGE Macroeconomic Models

September 10-13, 2012, University of Surrey

Course Outline

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Contents

1 Introduction 1

2 Instructors 2

3 Course Outline 4
   3.1 Preliminary Exercise, Lectures and Lab Sessions 4
   3.2 Reading 6
   3.3 Software 6
1 Introduction

The Centre for International Macroeconomic Studies (CIMS) in the School of Economics will hold a 4-day Summer course, September 10-13 September, 2012 on the construction and estimation of Dynamic Stochastic General Equilibrium (DSGE) macroeconomic models, and their use for policy analysis. This is a hands-on course all based on available facilities in the software platform Dynare (see Adjemian et al. (2011) and other useful documentation available on their website www.dynare.org).

The course will be delivered in two parts. Part I on days 1 and 2 will concentrate on the basic construction of DSGE models and the estimation of the linearized New Keynesian Model in a Dynare environment. It is designed for those without any experience of setting up DSGE models in Dynare. Part II, on days 3 and 4 will focus on intermediate and advanced topics. Participants who have attended previous courses given by CIMS, or are experienced DSGE modellers and users of Dynare, would be able enrol for only Part II.

The fees for academics are: £300 for each Part I and II; for participants from central banks or the private sector the fees are £600 for each Part. Lunch, coffee, course notes and model software is included in this cost. The mornings will be devotes to lectures and the afternoons to laboratory sessions. For personal use after the course Dynare can be loaded free, but Matlab must be purchased.

Taken over the four days the participants will be guided through a seamless methodology for the construction, estimation and policy analysis of micro-founded macroeconomic models 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
7. Robust simple rules

8. The rational expectations solution, estimation and optimal policy under imperfect information

We will 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. Finally we demonstrate the latest facilities developed by members of CIMS, as part of a FP7-financed project, for policy analysis and handling imperfect information by economic agents.

2 Instructors

The instructors for the course are Dr Cristiano Cantore, Dr Vasco Gabriel, Professor Paul Levine, Professor Joseph Pearlman and Dr Bo Yang. All have considerable experience in both teaching and researching in the area of DSGE modeling.

Cristiano Cantore is a Lecturer in the School of Economics at the University of Surrey. He graduated from the Bocconi University (Milan, Italy) in 2004. He then completed his MSc degree in Economics at Pompeu Fabra University (Barcelona, Spain). In 2006, he started the PhD in Economics at University of Kent where he was awarded an ESRC Scholarship. Cristiano’s PhD focussed on financial frictions and capital labour substitution in dynamic stochastic general equilibrium (DSGE) models. Cristiano has also worked at the OECD and at the ECB as a trainee. In September 2009 he was appointed as full time lecturer at the University of Surrey. His research fields mainly include macroeconomic theory, computational economics, monetary economics and production theory.

Vasco Gabriel is a Senior Lecturer in the School of Economics at the University of Surrey. He graduated in Economics from the Technical University of Lisbon in 1995, where he was awarded the ICEP prize. He received a masters degree in Econometrics in 1998 from the same institution. In 2002, he completed his PhD in Economics at Birkbeck College, University of London. He taught at the University of Minho, Portugal, before being appointed as a Lecturer at the University of Surrey in 2004. His main field of
specialization is Macroeconometrics, focusing on the application of non-linear methods, as well as general inference issues in macro DSGE models. His recent grant from the ESRC for work on inference problems in micro-based Phillips curves and policy rules was graded “Outstanding”.

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) in the School of Economics. 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.

Joseph Pearlman received his BA in Mathematics, from Cambridge University, and his PhD in Control Systems from Imperial College. He subsequently received his MSc in Economics from the LSE, and shortly after spent a year as a visiting research fellow at London Business School. In 1992 he became a Principal Lecturer in economics London Guildhall University, and in 2002 was appointed Professor of economics. In 2011 he moved to Loughborough University to take up the post of Professor of Monetary Economics, where he is also Deputy Associate Dean of Research in the School of Business and Economics. He has also been a visiting researcher at the IMF and the ECB, and has presented revision classes in macroeconomics at the International College of Economics and Finance in Moscow. His main research activity is in policy analysis and estimation for empirically-based DSGE models. Other research interests are Growth Theory, Least Squares Learning and Macroprudential Regulation. Some of his most recent articles have been published in the Journal of Economic Theory, Journal of Monetary Economics, Economic Journal and European Economic Review.

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.

3 Course Outline

The course is divided into two parts. Part 1 on days 1 and 2 is suitable for beginners concentrates on the basics of Dynare, constructing DSGE models and the estimation in linear form. Beginners should prepare before the course with preliminary exercises and reading indicated below. Part 2 then moves on to more advanced empirical techniques on day 3, and policy exercises and information issues on day 4.

3.1 Preliminary Exercise, Lectures and Lab Sessions


- **Day 1: Basics I** (Cristano Cantore, Paul Levine)
  - 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
– Stability-Indeterminacy
– Exercises in Lab.

**Day 2: Basics II** (Vasco Gabriel, Bo Yang)

– Bayesian Estimation of Linearized NK Model
  * Preparing the Data including use of various filters
  * Bayesian Methodology
  * Estimation of Linearized Models
  * Informal Treatment of Identification
  * Model Comparisons by Likelihood Races
– Validation: Comparison of Second Moments of Model with Data
– Exercises in Lab.

**Day 3: Intermediate Topics** (Cristano Cantore, Vasco Gabriel, Bo Yang)

– Use of the External Steady State
– Calibration with an External Steady State
– Estimation of Non-Linear Models using the Generalized (One-Step) Filter
– Formal Treatment of Identification
– Variance and Historical Decomposition
– DSGE-VAR Estimated Model
– Forecasting using DSGE-VAR
– Exercises in Lab.

**Day 4: Advanced Topics** (Paul Levine, Joseph Pearlman)

– A NK Model with Monetary and Fiscal Rules
– Optimal Monetary and Fiscal Policy
  * The Ramsey Problem
* Optimal Time-Consistent Policy
* Optimized Simple Rules
  - Zero Lower Bound Considerations
  - Robust Optimized Rules
  - Imperfect Information
  - Exercises in Lab.

3.2 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!

3.3 Software

The following software will be set up in the computer laboratory at Surrey:

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.
References


