

Course Structure and Standard Syllabus

Course Topic: General Macroeconomic Analysis

Course Title: Model-Based Monetary Policy Analysis and Forecasting (MPAF)

Objectives This two-week course aims at providing participants a rigorous training on the use of simple Dynamic New Keynesian (DNK) models to conduct monetary analysis and forecasting with an emphasis on analyzing monetary policy responses to macroeconomic imbalances and shocks. Participants are provided with the tools needed to develop and/or extend the model to fit their own monetary policy framework. Country case studies are used to reinforce participants' understanding and to help them compare, contrast, and assess various experiences.

Upon completion of this course, participants should be able to:

- Customize a simple model of an economy in the region that embodies the monetary policy transmission mechanism and the shocks it may face.
- Acquire and apply tools used in modern central banks to conduct 'model-based' monetary policy analysis and forecasting utilizing a hands-on software-based framework.
- Conduct nowcasting and near-term forecasting for that economy using various estimation-based econometric techniques and expert judgment.
- Use the model to develop consistent medium-term quarterly projections of key macro variables such as output, inflation, interest rate and the exchange rate.
- Identify risks in the baseline forecast and develop medium-term projections for alternative scenarios, which assume that such risks materialize..
- Start building a simple model for monetary policy analysis using own country data, when they return home.

Topics (*Core Units*)

0. Introductory Lecture and Learning Objectives
1. Monetary Policy Modernization, FPAS and Course Overview
2. The Core Model and Other Components of a Forecasting and Policy Analysis System (FPAS)
3. Consistency of Monetary Policy Objectives and Key Macroeconomic Trends
4. Introduction to a Small New Keynesian Model for Policy Analysis
5. The CPI Components and their Relative Prices in the Model
6. Alternative Exchange Rate Regimes and Foreign Exchange Intervention
7. Estimating Long-Run Trends and Gaps
8. Methods in Model Parameterization and Model Properties Assessment
9. Nowcasting
10. Near-Term Forecasts
11. Modeling Fiscal Policy
12. Baseline and Alternative Forecast Scenarios

Topics (*Auxiliary units*)

A1. Money-Based Frameworks: Money Targeting and Flexible Money Targeting

Target Audience

Mid- to senior-level officials involved in monetary policy decision making and staff involved in macroeconomic analysis and forecasting or operating macroeconomic models.

First delivery of course

IMF HQ, July 11-22, 2016. All country case studies were ready by the delivery date.

Prerequisites

Participants should have an advanced degree in economics or equivalent experience and be comfortable with quantitative techniques. It is strongly recommended to attend the Monetary Policy (MP) course and to complete the online Macroeconometric Forecasting (MFx) course before applying for the MPAF. Participants should be comfortable using quantitative software such as EViews and Matlab/Octave although specific knowledge of these is not required. Participants are required to complete a number of complementary e-learning modules aimed at providing some necessary technical background for the course. Pre-course on-line training videos on software and code in support of running the model are also highly recommended.

Performance Evaluation

Two multiple-choice tests will be given, one at the beginning and the other at the end of the course. Performance in these tests will be recorded in participants' evaluation.

The New Course in Comparison with the Existing Monetary Policy Analysis Course

We addressed the recommendations made in the Montiel's Report in Table 1 at the end of the syllabus. In particular, certain lectures (monetary policy transmission mechanism under stress and monetary targeting analysis) are dropped; repetition in lectures on estimating long-run trends are streamlined; and the new lecture ordering is now in full coherence with the Montiel's recommended sequencing. Extensions to the core model for CPI components and their relative prices were made and the discussion of various versions of exchange rate management was extended. New module on estimation was developed as was the extension to tackle fiscal policy analysis. Other extensions to the core QPM, for e.g., (flexible) money targeting can be mentioned or discussed in some details time permitting.

Relation between MPA Training and Technical Assistance (TA)

This training should provide government officials with the technical background they will need to develop and/or extend these small policy models for their countries. MCM and RES have been providing technical advice to a variety of countries on using models of this New Keynesian type. As such, coordinating training and TA in this area would be highly beneficial. This can be done by leveraging the IMF Interdepartmental 'Coordinating Group on Monetary Policy' to identify the candidate countries who have sought or will be seeking TA on monetary framework modernization (in conducting model-based policy analysis) to attend the MPA training.

Team: Jaromir Hurnik (leader), Mikhail Pranovich, Adina Popescu (up to July 29, 2016), Philippe Karam (leader, up to March 31, 2016), Andres Gonzales Gomez (observer).

Reviewers: Internal: RES (Douglas Laxton / Ales Bulir); External: Jack Selody (formerly Bank of Canada)

EXTERNAL CURRICULUM REVIEW PROGRAM OUTLINE FOR MPAF

UNIT 1: MONETARY POLICY MODERNIZATION, FPAS AND THE COURSE OVERVIEW

Outline of Lecture (1.5 hours)

- Principles of modern monetary policy
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- Policy frameworks in practice Structure of the course

Readings

1. “Evolving Monetary Policy Frameworks in Low-Income and Other Developing Countries,” IMF Staff Report, 2015.
2. Klein, M. W., J. C. Shambaugh, 2013, “Is there a dilemma with the Trilemma?” VOXEU, 27 September 2013.

UNIT 2: THE CORE MODEL AND OTHER COMPONENTS OF A FORECASTING AND POLICY ANALYSIS SYSTEM (FPAS)

Outline of Lecture (1.5 hours)

- Role of the core component of FPAS (the core quarterly projection model)
- Effective integration of all FPAS components: databases, monitoring and reporting, forecasting (short- to medium-term), communication and decision-making
- FPAS: a coherent view of economic developments and policy implications inside central banks

Workshop

No workshop

Readings

1. Clinton, K., C. Freedman, M. Juillard, O. Kamenik, D. Laxton, and H. Wang, 2015, “Inflation-Forecast Targeting: Applying the Principle of Transparency,” IMF Working Paper No.15/132.
2. Laxton, D., D. Rose, and A. Scott, 2009, “Developing a Structured Forecasting and

UNIT 3: CONSISTENCY OF POLICY OBJECTIVES AND KEY MACROECONOMIC TRENDS

Outline of Lecture (1.5 hours)

- Convergence, relative version of PPP and the Balassa-Samuelson effect
- Empirical behavior of the exchange rate and risk-premia and implication for policy analysis and forecasting
- Uncovered interest rate parity: long-run version
- Interpreting economic trends and convergence to those (the nominal trend, the real trend, and relative price trends)

Workshop

No workshop

Readings

1. Holub, T., “Price Convergence to the EU: Some Challenges for Monetary Policy,” *CNB Economic Research Bulletin*, No. 1, Vol. 1, December 2003, pp.4-5.
 2. Beneš, J., J. Hurník and D. Vávra , 2008, “Exchange Rate Management and Inflation Targeting: Modeling the Exchange Rate in Reduced-Form New Keynesian Models”, *Czech Journal of Economics and Finance*, 58 (3–4), pp. 166–194 (See relevant section).
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UNIT 4: INTRODUCTION TO A SMALL NEW KEYNESIAN MODEL FOR POLICY ANALYSIS

Outline of Lecture (1.5 hours)

- Model structure: Aggregate Demand, New Keynesian Phillips Curve, Uncovered Interest Rate Parity (UIP), and forward-looking monetary policy rule
- Steady-states, trends and business cycle: Understanding equilibrium conditions (steady-state/trends) and short-run adjustment towards equilibrium (business cycles)
- Solving the model (Blanchard-Quah algorithm)
- Data, initial calibration and model properties

Workshops (two workshops per 1.5 hours, 3 hours in total)

These workshops lay out the technical underpinnings of the semi-structured New Keynesian model used throughout the course and applied to a number of country case studies. They show how the theoretical model introduced in the lecture is written in model code for simulation purposes. The workshop deals with data handling and provides a first-pass calibration of the parameters and testing the model properties.

- Understanding the model code ^{1/}
- Basic data handling
- Model solution methods
- Model parameterization: (first-round) *calibration* of business cycle, steady-state and long-term parameters, and stochastic processes

- Model parameterization: *estimation* of some key equations
- Model properties: analysis of selected impulse response functions (to prototype shocks)

1/ *On-line training material on the fundamentals of the software used in the course (MATLAB/OCTAVE (freeware) – IRIS) will be available on the course Moodle site. It uses examples based on the core model of the course.*

Readings

1. Berg, A., Karam, P. and D. Laxton, 2006, “Practical Model-Based Monetary Policy Analysis—A How-To Guide,” IMF Working Paper 06/81 (Washington: International Monetary Fund).
2. IMF Institute for Capacity Development, 2015, “Handout for the Modeling Workshop”, Revised Unpublished Manuscript (Washington: IMF Institute for Capacity Development).
3. Woodford, M., 2013, “Inflation Targeting: Fix it, Don’t Scrap it,” published in L. Reichlin and R. Baldwin, eds., *Is inflation targeting dead? Thinking ahead about central banking after the crisis* (CEPR, 2013).

UNIT 5: THE CPI COMPONENTS AND THEIR RELATIVE PRICES IN THE MODEL

Outline of Lecture (1.5 hours)

- A theory of inflation in New Keynesian models and the role of the inflation target
- Understanding the dynamics of CPI Components: core, food, and energy inflation and their relative prices
- Policy responses to first and second round effects of shocks to CPI components
- Economic foundation of transitory and permanent shocks in relative prices

Readings

1. Andrle, M., A. Berg, R. A. Morales, R. Portillo, and J. Vlcek, 2013, “Forecasting and Policy Analysis in Low Income Countries: Food and Non-Food Inflation in Kenya,” IMF Working Paper 13/31 (Washington: International Monetary Fund).

UNIT 6: ALTERNATIVE EXCHANGE RATE REGIMES AND FOREIGN EXCHANGE INTERVENTION

Outline of Lecture (1.5 hours)

- Monetary policy rule: under a pure IT- floating regime and its modification to reflect exchange rate management and targeting
- Uncovered Interest Rate Parity under alternative exchange rate regimes
- Modeling the exchange rate as the operational target
- Modeling foreign exchange intervention (as an additional instrument)
- Capital account openness, exchange rate regime and monetary policy autonomy, currency substitution

Workshop (1.5 hours)

Note: other workshops will cover the intricate modeling aspects of the various regimes

Readings

1. Andrieu, M., A. Berg, E. Berkes, R. A. Morales, R. Portillo, and J. Vlcek, 2013, “Money Targeting in a Modern Forecasting and Policy System: An Application to Kenya,” IMF Working Paper 13/239 (Washington: International Monetary Fund).
2. Beneš, J., J. Hurník and D. Vávra, 2008, “Exchange Rate Management and Inflation Targeting: Modeling the Exchange Rate in Reduced-Form New Keynesian Models”, *Czech Journal of Economics and Finance*, 58 (3–4), pp. 166–194.
3. Beneš, J., A. Berg, R. Portillo, and D. Vávra, 2013, “Modeling Sterilized Interventions and Balance Sheet Effects of Monetary Policy in a New Keynesian Framework,” IMF Working Paper 13/11 (Washington: International Monetary Fund).
4. Nordstrom, A., S. Roger, M. Stone, S. Shimizu, T. Kisinbay, and J. Restrepo, 2009, “The Role of the Exchange Rate in Inflation Targeting Emerging Economies,” IMF Occasional Paper 267 (Washington: International Monetary Fund).
5. Ostry, J., A.R. Ghosh and M. Chamon, 2012, “Two Targets, Two Instruments: Monetary and Exchange rate Policies in Emerging Market Economies,” IMF Staff Discussion Note SDN/12/01 (Washington: International Monetary Fund).

UNIT 7: ESTIMATING LONG-RUN TRENDS AND GAPS

Outline of Lecture (1.5 hours)

- Identification of trends
- Univariate filters
- Multivariate (Kalman) filters

Workshop (3 hours)

This workshop provides practical application of univariate (Hodrick-Prescott and Band-Pass) and multivariate (Kalman) filters for estimating long-term trend values of key variables.

Kalman filtration is used in further refining the model’s calibration process.

- Comparison of univariate and multivariate filters
- Full model filtration and fine-tuning of multivariate filters
- (Second-round) Calibration of the model: Kalman filtration and recursive forecasting

Readings

1. Beneš J., N’Diaye P., 2004, “A Multivariate Filter for Measuring Potential Output and the NAIRU: Application to the Czech Republic”, IMF Working Paper 04/45 (Washington: International Monetary Fund).

2. Beneš, J., K. Clinton, R. Garcia-Saltos, D. Laxton, P. Manchev and T. Matheson 2010, “Estimating Potential Output with a Multivariate Filter,” IMF Working Paper 10/285 (Washington: International Monetary Fund).
 3. Cohen-Setton, J., and N. Valla, 2010, “Unnoticed Potential Output Revisions and their Impact on the Stimulus/Austerity Debate,” VOXEU, 17 August 2010
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UNIT 8: METHODS IN MODEL PARAMETERIZATION AND MODEL PROPERTIES ASSESSMENT

Outline of Lecture (1.5 hours)

- Calibration versus estimation (Bayesian and maximum likelihood) methods: in more detail
- Model properties: model and data implied correlations
- Model properties: recursive forecast

Workshop (1.5 hours)

This workshop discusses Bayesian and maximum likelihood estimation techniques. It also provides a discussion of model properties along many dimensions beyond the impulse response functions, including coherence of model moments with data and its ability to interpret past data and forecast future developments.

- Model parameterization: maximum likelihood and Bayesian estimation (of coefficients)
- Model properties: assessing model plausibility through the (cross) *correlation structure* of the model’s variables
- Model properties: assessment based on *recursive (multi-step ahead projection) forecast*: how good is the model’s forecasting performance?

Readings

1. An, S. and F. Schorfheide, 2007. “Bayesian Analysis of DSGE Models,” *Econometric Reviews*, Taylor and Francis Journals, vol. 26(2-4), pages 113-172. [*Advanced for the interested*].
 2. Guerron-Quintana, P. and J. Nason, 2012, “Bayesian Estimation of DSGE Models,” Federal Reserve Bank of Philadelphia Working Paper 12-4. [*Advanced for the interested*].
 3. Kamenik, O., Smidova, Z., Tuma, Z., Vavra, D., 2013, “A Simple Fiscal Stress Testing Model: Case Studies of Austrian, Czech and German Economies”, OECD WP No. 1074 (Focus on the relevant section).
 4. Schorfheide, F., 2011, “Estimation and Evaluation of DSGE Models: Progress and Challenges,” NBER Working Paper No. 16781 (Cambridge, Massachusetts: National Bureau of Economic Research) [*Advanced for the interested*].
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UNITS 9 AND 10: NOWCAST AND NEAR-TERM FORECAST

Outline of Lecture (two lectures per 1.5 hours, 3 hours in total)

- Short-term analysis and nowcasting in the FPAS context
- State Space models
- Near-term forecasting

Workshop (two workshops per 1.5 hours, 3 hours in total)

This workshop focuses on short run analysis in building up the forecast profile. It focuses on questions of where the economy is now and the likely path of the economy in the near term. Lacking structure, they are not however geared to provide insight about the reaction of the economy to economic imbalances or how the economy might respond to economic policies. Examples using models and techniques for capturing these aspects of the short-run trends are provided.

- *Nowcasting*: ‘dynamic factor models’ for GDP nowcast
- *Near-term forecasting*: A Narrative Approach (analysis of inflation data and factors)
- *Near-term forecasting*: A Quantitative Approach (analyzing inflation determinants)

Readings

1. Aruoba, S. B., F. X. Diebold and C. Scotti, 2009, “Real Time Measurement of Business Conditions,” *Journal of Business and Economic Statistics*, 27:4, 417-427.
 2. Stock, J. and M. Watson, 1989, “New Indexes of Coincident and Leading Economic Indicators,” NBER Macroeconomics Annual, Vol. 4, pp. 351–409, (Cambridge: National Bureau of Economic Research).
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UNIT 11: MODELING FISCAL POLICY

Outline of Lecture (1.5 hours)

- An auxiliary satellite model to analyze the fiscal impact / fiscal impulse
- Introducing the fiscal impulse measure in the aggregate demand equation
- Simulation properties of different fiscal stimulus / adjustment scenarios

Workshop(s) (1.5 hours)

This workshop presents the technical detail of the satellite model. It builds on the prototype [country example] auxiliary model.

- Understanding the model code of the fiscal satellite module
- Fiscal multiplier effects over the short run
- Size of multiplier under different monetary policy frameworks

Readings

1. Bornhorst, Fabian, and others, 2011, “When and How to Adjust Beyond the Business Cycle? A Guide to Structural Fiscal Balances,” Technical Notes and Manuals (Washington: International Monetary Fund).
<http://www.imf.org/external/pubs/ft/tnm/2011/tnm1102.pdf> 2.
2. Spilimbergo, Antonio, Steve Symansky, and Martin Schindler, 2009, “Fiscal Multipliers,” IMF Staff Position Note SPN/09/11, May 20 (Washington: International Monetary Fund). <http://www.imf.org/external/pubs/ft/spn/2009/spn0911.pdf> 3.

3. Kamenik, O. et al. (2013), “A Simple Fiscal Stress Testing Model: Case Studies of Austrian, Czech and German Economies”, OECD Economics Department Working Papers, No. 1074, OECD Publishing. http://www.oecd-ilibrary.org/economics/a-simple-fiscal-stress-testing-model_5k43n xm8hfvfen
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UNIT 12. MEDIUM-TERM FORECASTING: BASELINE AND COUNTERFACTUALS FOR POLICY ANALYSIS

Outline of Lecture (1.5 hours)

- Baseline forecast: building macro scenarios for policy dialogue
- Baseline forecast: discussion of specific risks and developing contingency plans
- Role of judgment
- Alternative forecast scenarios
- List of scenario possibilities
- Scenarios and communication

Readings

1. Andrlé, M., T. Hlédik, O. Kameník and J. Vlček, 2010, “Implementing the New Structural Model of the Czech National Bank,” *Economic Research Bulletin*, Vol. 8, No. 1, pp. 2–7, (Prague: Czech National Bank).
 2. Czech National Bank, *Quarterly Inflation Reports*, various years—for baseline forecasts and scenarios: https://www.cnb.cz/en/monetary_policy/inflation_reports/
 3. Sveriges Riksbank, Central Bank of Sweden, *Monetary Policy Reports*, various years—for baseline forecasts and scenarios: <http://www.riksbank.se/en/Press-and-published/Published-from-the-Riksbank/Monetary-policy/Monetary-Policy-Report/2015/>
 4. Clinton, K. J. Dagher, O. Kamenik, D. Laxton, A. Alich, and M. Mills, 2010, “A Model for Full-Fledged Inflation Targeting and Application to Ghana,” IMF Working Paper 10/25 (Washington: International Monetary Fund).
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UNIT 13 WORKSHOP ON POLICY ANALYSIS AND FORECASTING

Workshops (6 hours)

Now that participants have a picture of the likely short-run scenario and the key pressures in the economy identified, medium-term analysis (based on the model’s logic concerning medium-term equilibrating forces) is then conducted. The workshops go through the process of preparing a *medium-term baseline* forecast. In an uncertain environment, the focus is on a structured analysis of the *main risks* in helping participants identify and communicate policy choices: what do monetary and fiscal policies need to do to accomplish stabilization and other objectives?

- Formulation of baseline and alternative scenarios and policy analysis
- Preparation of the final presentation

PARTICIPANTS' PRESENTATIONS—COUNTRY CASE STUDIES

Preparation for final participant presentations (9 hours)

- The presentations should focus on the main story line, using simple charts and tables to illustrate the main points. They should reflect a coherent and systematic analysis starting from external conditions moving to the outlook of the domestic economy and the implications for policies. Along a timeline, the presentations should start with the near-term outlook and then move to the medium-term outlook, concluding with a discussion of the main risks that have been considered by the group.

- **Country case studies.** Six case studies (currently the Czech Republic, Ghana, Kazakhstan, Singapore, Morocco and Honduras) have been selected to reflect a wide range of countries with different monetary-exchange rate regimes. They are aimed at reflecting the circumstances and policy frameworks and institutions in different regions of the world. The case studies also mirror the distinct challenges of monetary-exchange rate policy interactions, the role of exchange rate while also being aware of the significant role for monetary aggregates, under limited market-based monetary policy and severe fiscal dominance.

AUXILIARY UNITS

UNIT A1: MONEY-BASED FRAMEWORKS: MONEY TARGETING AND FLEXIBLE MONEY TARGETING

Outline of Lecture (1.5 hours)

- In Coordination with the Monetary Policy Course

Workshop

- In Coordination with the Monetary Policy Course
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Time Allocation – Lectures, Workshops, and Other Course Components		
Topics	Lecture	Workshop
1. Monetary Policy Frameworks and Transmission Channels	1.5	0
2. Introduction to a Small New Keynesian Model for Policy Analysis	1.5	1.5
3. The CPI Components and their Relative Prices in the Model	1.5	1.5
4. Consistency of Policy Objectives and Key Macroeconomic Trends	1.5	0
5. Estimating Long-Run Trends and Gaps	1.5	1.5
6. Core Model Extension: Fiscal Policy Impact Analysis, and Other Topics	1.5	3
7. Alternative Exchange Rate Regimes and Forex Intervention	1.5	1.5
8. Methods in Model Parameterization and Model Properties Assessment	1.5	1.5
9. The Core Model and Other Components of a Forecasting and Policy Analysis System	1.5	0
10. Short-Term Forecasting: Nowcast and Near-Term Forecast	3	3
11. Medium-Term Forecasting: Baseline and Counterfactuals for Policy Analysis	1.5	3
12. Alternative Forecast Scenarios: Risk Analysis under Uncertainty	1.5	3
Preparation for final participant presentations: <i>Preparing a formal quarterly forecast and scenarios for policy dialogue</i>	0	9
<i>Subtotal</i>	<i>19.5</i>	<i>28.5</i>
Other Components		
Admin Briefing and Welcoming Remarks	0.5	
Introductory Lecture	1.5	
Initial/Final Quizzes	1	
Participant final presentations		2
Participant course evaluation	0.5	
Closing remarks	0.5	
<i>Subtotal</i>	<i>4.0</i>	
Total	25.0	30.5

Table 1. Course Review Recommendations by Peter Montiel and Actions Taken

- **Extraneous lecture: issue 1.** “Approaches to Monetary Policy Analysis”, was disliked. He labels it as a strange lecture on using money-based monetary analysis. Peter rightly understands the LIC/LMICs circumstances in which a significant role for monetary aggregates may be warranted (mainly those facing limited scope for market-based (interest rate) monetary policy) but believes that it does not fit in a course on using the course’s core model with interest rate as the main policy instrument. **Action taken:** we omitted the lecture and its associated workshop.
- **Extraneous lecture: issue 2.** “Monetary Policy Transmission under Stress”, was disliked. He sees it as a very informative lecture, belonging to a monetary policy course but wondered if it belonged in a course on the use of models for policy analysis. **Action taken:** Lecture omitted.
- **Repetitive material issue.** In two lectures “Nowcasts and Near-Term Forecasts” and “Models for Policy Analysis: Long -Run Trends”. **Action taken:** the lectures now titled “Unit 10: Short-Term Forecasting: Nowcast and Near-Term Forecast” and “Unit 5. Estimating Long-Run Trends (Univariate and Multivariate Filters): Model-Dependency” are geared to techniques and model-centered forecasting applications, respectively.
- **Sequencing: issue 1.** The lecture “Models for Policy Analysis: Long -Run Trends” is far removed (in terms of sequencing) from “Introduction to New Keynesian Economics”. **Action taken:** the lecture now titled “Unit 5. Estimating Long-Run Trends and Gaps” comes immediately after “Unit 2: Introduction to a Small New Keynesian Model for Policy Analysis”.
- **Sequencing: issue 2.** The lecture “Monetary Policy and the Transmission Mechanism” is oddly placed before “Introduction to New Keynesian Economics”. **Action taken:** the lecture “Monetary Policy and the Transmission Mechanism” is omitted, to free up space for the fiscal analysis. Also an on-line module on the topic largely covers the topic.
- **Suggested “Financial Stability” topic.** The topic is relegated to an auxiliary unit, time permitting.
- **Recommendation for lectures’ re-ordering.** **Action taken:** we now reflect Peter’s sequence of (re-titled) lectures in the new course, namely: Unit 1, 2, 5, 10, 11, 12.
- **Recommendation to introduce a dedicated course on the subject of using small New Keynesian policy models as an IET course.** **Action taken:** a course on “Monetary Policy Analysis and Forecasting” is now part of the IET curriculum.
- No particular recommendations made on the selection of country case studies. However the group observed a good balance between lectures and workshops (evenly split).