

Course Structure and Standard Syllabus

Course Topic: General Macroeconomic Analysis

Course Title: Fiscal and Monetary Policy Analysis with DSGE Models (DSGE)

Objectives

This two-week course, presented by the IMF's Institute for Capacity Development, focuses on the use and interpretation of dynamic stochastic general equilibrium (DSGE) models. The emphasis is on applications of fiscal and monetary policies using models with nominal and real rigidities that are commonly used in central banks and ministries of finance. The course relies on case studies relevant for the region to illustrate the application of these models, and to show how they can be used as an input in the policymaking process.

Topics (*Core Units*)

1. The real business cycle model
2. The New Keynesian model
 - Monetary policy
 - The use of MATLAB/Octave Dynare/Iris for DSGE models
3. Labor market rigidities in the NK model
4. The NK model in an Open Economy
 - Monetary and fiscal policy analysis
5. Fiscal policy in the NK Model
6. A new Keynesian Model with Financial frictions
7. Bringing DSGE models to the data (1)
 - State-Space models
 - Bayesian techniques
8. Bringing DSGE models to the data (2)
 - Forecasting with DSGE models
9. Policy applications with DSGE models
10. Course summary and key takeaways

Target Audience

Mid- to senior-level officials from central banks and ministries of finance involved in the macroeconomic analysis of monetary and fiscal policy issues with dynamic stochastic general equilibrium (DSGE) models.

Prerequisites

Participants should have an advanced degree in economics or equivalent experience, good quantitative skills, and a basic knowledge of MATLAB/Octave and Dynare/Iris or equivalent

software. It is highly recommended that they have taken the modules available online for this course.

Performance Evaluation

Two multiple-choice quizzes will be given. One online-quiz will be given at the beginning and the other one at the end of course. If the evaluation process is universally adopted, then tests results should be recorded in participants' evaluation.

EXTERNAL CURRICULUM REVIEW PROPOSED PROGRAM OUTLINE FOR DSGE

UNIT 1: THE REAL BUSINESS CYCLE MODEL

Outline of Lecture (3 hours)

- Introduction to the basic Real Business Cycle (RBC) model
- Bellman equation and optimization
- Derivation of the first-order conditions, deterministic steady-state, log-linearization of equilibrium conditions
- Calibration
- Solution methods for linear rational expectations models.

Workshop (3 hours)

- **Topics:** Introduction to MATLAB/Octave and Dynare/Iris. Simulation of the basic RBC model

Activity: The workshop (1) introduces the MATLAB/Octave plus Dynare/Iris programming environment, (2) the structure of a Dynare/Iris program and basic commands for model simulation, (3) studies the dynamic properties of the model through impulse responses in a calibrated real business cycle model to various shocks.

References

1. N. L. Stokey and R. E. Lucas with E. C. Prescott, Recursive Methods in Economic Dynamics. Harvard University Press, 1989.
2. Dynare User Guide.

UNIT 2: THE NEW KEYNESIAN MODEL

Outline of Lecture (3 hours)

- Introduction to the basic New Keynesian (NK) model for monetary policy analysis.
- Main imperfections and assumptions of the model (monopolistic competition and sticky prices) and derivation of the key equations.

Workshop (3 hours)

- **Topic:** Simulation of the basic NK model.

Activity: Discussion of the dynamic properties of the model through impulse responses in a calibrated NK model to various shocks.

References

1. Christiano, Lawrence, Mathias Trabandt, Karl Walentin, 2011, DSGE Models for Monetary Policy Analysis, *Handbook of Monetary Economics*
 2. Galí, Jordi and M. Gertler, 2007, “Macroeconomic Modeling for Monetary Policy Evaluation,” *Journal of Economic Perspectives*, Vol. 21 (4), pp. 25–45.
 3. Clarida, Richard, J. Galí, and M. Gertler, 1999, “The Science of Monetary Policy: A New Keynesian Perspective,” *Journal of Economic Literature*, Vol. 37 (4), pp. 1661–1707.
 4. Rotemberg, J. and M. Woodford, 1999, “Interest Rate Rules in an Estimated Sticky Price Model,” in *Monetary Policy Rules*, ed. by J. B. Taylor (Chicago, IL: University of Chicago Press).
 5. Yun, T., 1996, “Monetary Policy, Nominal Price Rigidity, and Business Cycles,” *Journal of Monetary Economics*, Vol. 37, pp. 345–70.
-

UNIT 3: LABOR MARKET RIGIDITIES IN THE NEW KEYNESIAN MODEL

Outline of Lecture (3 hours)

- The “Divine Coincidence” and the role of sticky wages
- Optimal monetary policy under labor market frictions
- Labor market search models
- A NK model with commodities (oil price shocks) and wage rigidities

Workshop (3 hours)

- **Topic:** The effects of oil prices in an economy with labor market rigidities.
- **Activity:** The workshop (1) discussed how the introduction of sticky wages affects the dynamics of the NK model, (2) estimates the impacts of oil price shocks in economies with no labor market frictions; and (3) estimate the transmission of oil price shocks in an economy with labor market rigidities.

References

1. Christiano, L. and M. Eichenbaum and C. L. Evans, 2005. “Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy,” *Journal of Political Economy*, University of Chicago Press, vol. 113(1), pages 1-45, February.
2. Christiano, Lawrence, Martin Eichenbaum, Mathias Trabandt, 2015, “Unemployment and Business Cycles”, mimeo Federal Reserve Board.

3. Blanchard, Olivier and Jordi Galí, 2009, “The Macroeconomic Effects of Oil Price Shocks: Why are the 2000s so different from the 1970s?” in *International Dimensions of Monetary Policy*, ed. by J. Gali and M. Gertler, (Chicago, IL: University of Chicago Press), pp. 373–428.
4. Erceg, Chris, Dale Henderson, and Andrew Levin, 1999, "Optimal Monetary Policy with Staggered Wage and Price Contracts," International Finance Discussion Paper No. 640 (Board of Governors of the Federal Reserve System).
5. Galí, Jordi, 2011, “Monetary Policy and Unemployment,” in *Handbook of Monetary Economics*, ed. by B. Friedman and M. Woodfords, Vol. 3A, Elsevier B.V., pp. 487–546.
6. Galí, Jordi, 2011, “The Return of the Wage Phillips Curve,” *Journal of the European Economic Association*, Vol. 9 (3), pp. 436–61.
<http://www.crei.cat/people/gali/bgoil08wp.pdf>

UNIT 4: THE NEW KEYNESIAN MODEL IN AN OPEN ECONOMY

Outline of Lecture (3 hours)

- Extension to an small-open economy framework
- International risk-sharing
- Discussion of fixed versus flexible exchange rates

Workshop (3 hours)

- **Topic:** The transmission mechanism in the open economy
- **Activity:** The workshop discusses the transmission mechanisms under fixed versus flexible exchange rates. Extension to include oil as input in the production function and as part of the consumption basket.

References

1. Galí, J. and T. Monacelli, 2005, “Monetary Policy and Exchange Rate Volatility in a Small Open Economy,” *Review of Economic Studies*, Vol. 72, pp. 707–34.
2. Corsetti, G. and P. Pesenti, 2005, “International Dimensions of Optimal Monetary Policy,” *Journal of Monetary Economics* Vol. 52, pp. 281–305.

3. De Paoli, B., 2009, “Monetary Policy and Welfare in a Small Open Economy,” *Journal of International Economics*, Vol. 77, pp. 11–22.

UNIT 5: FISCAL POLICY IN THE NEW KEYNESIAN MODEL

Outline of Lecture (3 hours)

- Extensions of the NK model to distortionary taxation, liquidity constrained households and OLG Households
- Introducing a fiscal policy reaction function

Workshop (3 hours)

- **Topic:** The effects of fiscal policy in the NK model and interactions between fiscal and monetary policy
- **Activity:** The workshop illustrates the effects of various fiscal policies (1) simulate the effect of different fiscal policy shocks (fiscal multipliers to government spending and tax shocks) under different assumptions for monetary policy.

References

1. Anderson, D., B. Hunt, M. Kortelainen, M. Kumhof, D. Laxton, D. Muir, S. Mursula, and S. Snudden. 2013, “*Getting to Know GIMF – The Simulation Properties of the Global Integrated Monetary and Fiscal Model*,” IMF Working Paper No. 13/55.
2. Laxton, D., S. Mursula, M. Kumhof and D. Muir, 2010, “*The Global Integrated Monetary and Fiscal Model (GIMF); Theoretical Structure*,” IMF Working Papers 10/34, International Monetary Fund.
3. Fernández-Villaverde, J., 2010, “Fiscal Policy in a Model with Financial Frictions,” *American Economic Review Papers & Proceedings*, Vol. 100, pp. 35–40.
4. Smets, F. and R. Wouters, 2007. “Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach,” *American Economic Review*, American Economic Association, vol. 97(3), pages 586-606, June.

UNIT 6: A NEW KEYNESIAN MODEL WITH FINANCIAL FRICTIONS

Outline of Lecture (3 hours)

- A medium scale model in an open economy with financial frictions (financial accelerator model)
- Macro-prudential policies and financial frictions

Workshop (3 hours)

- **Topic:** External shocks, monetary and macro-prudential policies
- **Activity:** The workshop helps to generate optimal responses of monetary, fiscal, and macro-prudential policies to capital flows.

References

1. Bernanke, B.S., M. Gertler, and S. Gilchrist, 1999, “The Financial Accelerator in a Quantitative Business Cycle Framework,” in *Handbook of Macroeconomics*, Vol. 1C, ed. by J.B. Taylor and M. Woodford (Amsterdam: Elsevier Science).
2. Carlstrom, C. and T. Fuerst, 1997, “Agency Costs, Net Worth, and Business Fluctuations: A Computable General Equilibrium Analysis”, *American Economic Review* 87, pp. 893—910.
3. Christiano, L, R. Motto and M. Rostagno, 2013, “Risk Shocks”, *NBER Working Paper* 18682.

Christiano, L., M. Trabandt and K. Walentin, 2011, “Introducing Financial Frictions and Unemployment into a Small Open Economy Model”, *Journal of Economic Dynamics and Control*, Vol. 35(12): 1999-2041.

4. Gertler, M., S. Gilchrist, and F. Natalucci, 2007, “External Constraints on Monetary Policy and the Financial Accelerator,” *Journal of Money, Credit and Banking*, Vol. 39, No. 2–3, pp. 295–330.
5. Kiyotaki, N. and Moore, J., 1997.”Credit Cycles,” *Journal of Political Economy*, University of Chicago Press, vol. 105(2), pages 211-48, April.
6. Medina, J. P. and Jorge Roldós, 2014, “Monetary and Macroprudential Policies to Manage Capital Flows” IMF Working Paper No 14/30.

UNIT 7: BRINGING DSGE MODELS TO THE DATA (1)

Outline of Lecture (3 hours)

- State-space model representation, the Kalman Filter and Maximum Likelihood estimation of linearized DSGE models
- Introduction to Bayesian methods
- Bayesian estimation of linearized DSGE models (Markov Chain Monte Carlo methods, the Metropolis-Hastings algorithm).

Workshop (3 hours)

- **Topic:** Bayesian estimation of DSGE Models
- **Activity:** The workshop presents applications of different techniques to estimate DSGE models on simulated data.

References

1. Guerron-Quintana, Pablo and Jim Nason, 2012, "Bayesian Estimation of DSGE Models," Federal Reserve Bank of Philadelphia Working Paper 12-4.
2. Ruge-Murcia, Francisco, 2007, "Methods to Estimate Dynamic Stochastic General Equilibrium Models," *Journal of Economic Dynamics and Control*, Vol. 31, No. 8 (August), pp. 2599-2636
3. Schorfheide, Frank, 2011, "Estimation and Evaluation of DSGE Models: Progress and Challenges," NBER Working Paper No. 16781 (Cambridge, Massachusetts: National Bureau of Economic Research).
4. Smets, Frank and Rafael Wouters, 2003. "An Estimated Dynamic Stochastic General Equilibrium Model of the Euro Area," *Journal of the European Economic Association*, MIT Press, vol. 1(5), pages 1123-1175, 09.
5. Sungbae An & Frank Schorfheide, 2007. "Bayesian Analysis of DSGE Models," *Econometric Reviews*, Taylor and Francis Journals, vol. 26(2-4), pages 113-172.

UNIT 8: BRINGING DSGE MODELS TO THE DATA (2)

Outline of Lecture (3 hours)

- Forecasting with DSGE models (conditional and unconditional), forecasting performance of DSGE models
- Generating risk scenarios and fan charts

Workshop (3 hours)

- **Topic:** Forecasting with DSGE models
- **Activity:** The workshop generate scenarios and fan charts using data from a real economy.

Note

It is recommended the adoption of regional examples/applications for each division.

References

1. Del Negro, M. and Schorfheide, F., 2012. "DSGE model-based forecasting," Handbook of Economic Forecasting Vol. II, edited by G. Elliott and A. Timmerman, Elsevier, or Staff Reports 554, Federal Reserve Bank of New York.

UNIT 9: POLICY APPLICATIONS WITH DSGE MODELS

Outline of Lecture (3 hours)

- Use of DSGE models for computing natural levels
- Conducting counterfactual policy analysis

Workshop (3 hours)

- **Topic:** Application the case of Chile
- **Activity:** The workshop describes how to conduct policy analysis and counterfactual policy analysis using the Chilean economy.

Note

It is recommended the adoption of regional examples/applications for each division.

References

1. Adolfson, Malin, Stefan Laseén, Jesper Lindé, and Mattias Villani, 2007, "RAMSES—A New General Equilibrium Model for Monetary Policy Analysis," *Sveriges Riksbank Economic Review*, Vol. 2, pp. 5–39.
2. Sbordone, Argia, Andrea Tambalotti, Rao, Krishna, and Kieran Walsh, 2010, "Policy Analysis Using DSGE Models: An Introduction," *Economic Policy Review* (October), pp. 23–43 (New York: Federal Reserve Bank of New York).

UNIT 10: COURSE SUMMARY AND KEY TAKEAWAYS

Outline (1 hour)

- Key takeaways from lectures and workshops

Summary of Instructional Time		
Topics	Lecture	Workshop
1. The Real business Cycle Model	3	3
2. The New Keynesian Model	3	3
3. Labor Market Rigidities in the NK Model	3	3
4. The NK Model in an Open Economy	3	3
5. Fiscal Policy in the NK Model	3	3
6. A NK Model with Financial Frictions	3	3
7. Bringing DSGE Models to the Data 1	3	3
8. Bringing DSGE Models to the Data 2	3	3
9. Policy Applications with DSGE Models	3	3
10. Course Summary and Main Takeaways	1	
Subtotal	28	27
Other Components		
Admin Briefing	1	
Welcome	0.5	
Introductory remarks	0.5	
Initial/Final Quizzes	1	
Participant course evaluation	0.5	
Subtotal	3.5	0
Total	31.5	27