

Bank of Portugal Minicourse: Fiscal and Monetary Policy with Heterogeneous Agents

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This is a minicourse on fiscal and monetary policy in Heterogeneous Agent New Keynesian models. We will cover the following topics (5 hours of lecture per day):

Lecture #	Date & time			Topic
1	Wed	17 June	10-12:15	The standard incomplete markets model
2	Wed	17 June	14-15:30	The canonical HANK model
3	Wed	17 June	16-17:30	Fiscal policy in the canonical model
4	Thu	18 June	10-12:15	Monetary policy in the canonical model
5	Thu	18 June	14-15:30	Monetary policy topics
6	Thu	19 June	16-17:30	The open economy
7	Fri	19 June	10-12:15	Endogenous portfolios and risk premia
8	Fri	19 June	14-15:30	Heterogeneous firms
9	Fri	19 June	16-17:30	Optimal steady-state policy

Lecture 1 introduces the standard incomplete markets model in partial equilibrium. It reviews methods for solving the policy functions of the model, the distribution of agents, and macroeconomic aggregates, both in the steady state and under perfect-foresight dynamics. It then introduces the sequence-space Jacobian method for solving for linearized perfect-foresight dynamics. The model and this solution method will be the backbone of the rest of the lectures.

Lecture 2 embeds the model from Lecture 1 into New Keynesian general equilibrium. It discusses the special cases of the representative-agent model (RANK), the two agent model (TANK), and the zero liquidity limit of the model. It then shows how to use sequence-space Jacobians to obtain the general equilibrium solution numerically.

Lecture 3 studies fiscal policy in the model of Lecture 2. It derives the intertemporal Keynesian cross equation (IKC) that relates the the dynamic effects of changes in government spending or taxes to intertemporal marginal propensities to consume (iMPCs). It discusses evidence for iMPCs, why the data tends to favor HANK models over RANK or TANK models, and how all three models have very different implications for the level and persistence of the effects of deficit-financed fiscal transfers.

Lecture 4 studies monetary policy in the model of Lecture 2. It derives an equation analogous to the IKC for studying the effects of monetary policy, and the Werning result of equivalence between RANK and HANK for these effects under acyclical income risk. It then discusses empirical evidence for countercyclical income risk and why this ingredient tends to amplify the effects of monetary policy and aggravate rather than solve the so-called forward-guidance puzzle.

Lecture 5 studies additional topics on monetary policy by expanding on the model of lecture 4. It discusses how nominal assets, long-term assets, fiscal-monetary policy interactions, investment, and illiquid accounts change the transmission of monetary policy. It also discusses the effect of Taylor rules.

Lecture 6 incorporates open economy dimensions (import and export demand as well as exchange rates) into the model of Lecture 2. For the small open economy, it derives an international IKC equation and uses it to study the effects of shocks to capital flows and monetary policy. It discusses the role of the real income channel in dampening or potentially overturning the expansionary effects of exchange rate depreciations.

Lecture 7 considers the explicit “zero-th order” solution of agent portfolios, first in the small open economy model of Lecture 5 (where risk premia are given), and then in the closed economy model of Lecture 2. It discusses the risk-sharing condition that optimal portfolios achieve and how to solve for risk premia in the closed economy. It explains the aggregate effects of portfolio choice, and those of portfolio constraints and incomplete markets.

Lecture 8 introduces heterogeneous firms facing entry and exit as well as financial frictions in the model of Lecture 6. It shows how marginal propensities to invest (MPIs) are sufficient statistics for the aggregate effects of fiscal and monetary policy, and draws the many parallels between heterogeneous-household and heterogeneous-firm New Keynesian models.

Lecture 9 begins considers optimal policy in this class of models, focusing on the steady state. It discusses the difference between the Optimal Steady State and the Ramsey Steady State. It explains how to solve for the latter as easily as the former using a first-order condition that uses discounted Sequence Space Jacobians, and applies this to solve for the optimal tax rate and the optimal level of government debt.

References. Most of the high-level material for the lectures is discussed in:

Auclert, A., Rognlie, M. and Straub, L. (2025b). **Fiscal and Monetary Policy with Heterogeneous Agents**. *Annual Review of Economics* 17(Volume 17, 2025):539–562

Additionally, for references regarding numerical solution methods, please see:

Auclert, A., Bardóczy, B., Rognlie, M. and Straub, L. (2021a). **Using the Sequence-Space Jacobian to Solve and Estimate Heterogeneous-Agent Models**. *Econometrica* 89(5):2375–2408

Auclert, A., Rognlie, M. and Straub, L. (2025a). **Determinacy and Large-Scale Solutions in the**

Below follows a list of relevant references for each class. The starred article are especially relevant for each lecture.

1. The standard incomplete markets model

*Lecture slides

*Auclert, A., Bardóczy, B., Rognlie, M. and Straub, L. (2021a). *Using the Sequence-Space Jacobian to Solve and Estimate Heterogeneous-Agent Models*. *Econometrica* 89(5):2375–2408

Deaton, A. (1992). *Understanding Consumption*. Oxford University Press, USA

Carroll, C.D. (1997). *Buffer-Stock Saving and the Life Cycle/Permanent Income Hypothesis*. *Quarterly Journal of Economics* 112(1):1–55

Aiyagari, S.R. (1994). *Uninsured Idiosyncratic Risk and Aggregate Saving*. *Quarterly Journal of Economics* 109(3):659–684

Kaplan, G. and Violante, G.L. (2022). *The Marginal Propensity to Consume in Heterogeneous Agent Models*. *Annual Review of Economics* 14(1):747–775

2. The canonical HANK model

*Lecture slides

*Auclert, A., Rognlie, M. and Straub, L. (2025b). *Fiscal and Monetary Policy with Heterogeneous Agents*. *Annual Review of Economics* 17(Volume 17, 2025):539–562

Werning, I. (2015). *Incomplete Markets and Aggregate Demand*. Working Paper 21448, National Bureau of Economic Research,

Auclert, A., Bardóczy, B. and Rognlie, M. (2023). *MPCs, MPEs, and Multipliers: A Trilemma for New Keynesian Models*. *The Review of Economics and Statistics* 105(3):700–712

Broer, T., Hansen, N.J.H., Krusell, P. and Öberg, E. (2020). *The New Keynesian Transmission Mechanism: A Heterogeneous-Agent Perspective*. *Review of Economic Studies* 87(1):77–101

3. Fiscal policy in the canonical HANK model

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*Auclert, A., Rognlie, M. and Straub, L. (2024c). *The Intertemporal Keynesian Cross*. *Journal of Political Economy* 132(12):4068–4121

Woodford, M. (2011). *Simple Analytics of the Government Expenditure Multiplier*. *American Economic Journal: Macroeconomics* 3(1):1–35

McKay, A. and Reis, R. (2016). **The Role of Automatic Stabilizers in the U.S. Business Cycle**. *Econometrica* 84(1):141–194

Hagedorn, M., Manovskii, I. and Mitman, K. (2019). **The Fiscal Multiplier**. Working Paper 25571, National Bureau of Economic Research,

4. Monetary policy in the canonical HANK model

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Auclert, A. (2019). **Monetary Policy and the Redistribution Channel**. *American Economic Review* 109(6):2333–2367

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McKay, A., Nakamura, E. and Steinsson, J. (2016). **The Power of Forward Guidance Revisited**. *American Economic Review* 106(10):3133–3158

Werning, I. (2015). **Incomplete Markets and Aggregate Demand**. Working Paper 21448, National Bureau of Economic Research,

5. Advanced topics in monetary policy

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Bilbiie, F.O. (2025). **Monetary Policy and Heterogeneity: An Analytical Framework**. *The Review of Economic Studies* 92(4):2398–2436

Acharya, S. and Dogra, K. (2020). **Understanding HANK: Insights From a PRANK**. *Econometrica* 88(3):1113–1158

Doepke, M. and Schneider, M. (2006). **Inflation and the Redistribution of Nominal Wealth**. *Journal of Political Economy* 114(6):1069–1097

Auclert, A., Rognlie, M. and Straub, L. (2020). **Micro Jumps, Macro Humps: Monetary Policy and Business Cycles in an Estimated HANK Model**. Working Paper 26647, National Bureau of Economic Research,

Luetticke, R. (2021). **Transmission of Monetary Policy with Heterogeneity in Household Portfolios**. *American Economic Journal: Macroeconomics* 13(2):1–25

6. Monetary policy in the open economy

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- *Auclert, A., Rognlie, M., Souchier, M. and Straub, L. (2021b). *Exchange Rates and Monetary Policy with Heterogeneous Agents: Sizing up the Real Income Channel*. Working Paper 28872, National Bureau of Economic Research,
- Aggarwal, R., Auclert, A., Rognlie, M. and Straub, L. (2023). *Excess Savings and Twin Deficits: The Transmission of Fiscal Stimulus in Open Economies*. *NBER Macroeconomics Annual* 2022 37:325–412
- Auclert, A., Monnery, H., Rognlie, M. and Straub, L. (2024b). *Managing an Energy Shock: Fiscal and Monetary Policy*. In: S. Bauducco, A. Fernández and G.L. Violante (eds.) *Heterogeneity in Macroeconomics: Implications for Monetary Policy*, no. 30 in Series on Central Banking, Analysis, and Economic Policies, pp. 39 – 108. Santiago, Chile: Banco Central de Chile
- Galí, J. and Monacelli, T. (2005). *Monetary Policy and Exchange Rate Volatility in a Small Open Economy*. *Review of Economic Studies* 72(3):707–734
- de Ferra, S., Mitman, K. and Romei, F. (2020). *Household Heterogeneity and the Transmission of Foreign Shocks*. *Journal of International Economics* 124:1–18

7. Endogenous portfolios and risk premia

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- *Auclert, A., Rognlie, M., Straub, L. and Tapák, T. (2024d). *When do Endogenous Portfolios Matter for HANK?* *Manuscript*
- Bhandari, A., Bourany, T., Evans, D. and Golosov, M. (2023). *A Perturbational Approach for Approximating Heterogeneous-Agent Models*. *Manuscript*
- Tille, C. and van Wincoop, E. (2010). *International Capital Flows*. *Journal of International Economics* 80(2):157–175
- Devereux, M.B. and Sutherland, A. (2011). *Country Portfolios in Open Economy Macro-Models*. *Journal of the European Economic Association* 9(2):337–369
- Coeurdacier, N. and Rey, H. (2013). *Home Bias in Open Economy Financial Macroeconomics*. *Journal of Economic Literature* 51(1):63–115

8. Monetary policy with heterogeneous firms

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Winberry, T., Auclert, A., Rognlie, M. and Straub, L. (2025). *New Keynesian Economics with Household and Firm Heterogeneity*

Ottobello, P. and Winberry, T. (2020). *Financial Heterogeneity and the Investment Channel of Monetary Policy*. *Econometrica* 88(6):2473–2502

Jeenas, P. (2025). *Firm Balance Sheet Liquidity, Monetary Policy Shocks, and Investment Dynamics*. *Manuscript*

Bernanke, B.S., Gertler, M. and Gilchrist, S. (1999). *Chapter 21 – The Financial Accelerator in a Quantitative Business Cycle Framework*. In: J.B. Taylor and M. Woodford (eds.) *Handbook of Macroeconomics*, vol. 1, Part C, pp. 1341–1393. Elsevier

9. Optimal policy: Ramsey steady state

*Lecture slides

*Auclert, A., Cai, M., Rognlie, M. and Straub, L. (2024a). *Optimal Long-Run Fiscal Policy with Heterogeneous Agents*. *Manuscript*

Aiyagari, S.R. (1995). *Optimal Capital Income Taxation with Incomplete Markets, Borrowing Constraints, and Constant Discounting*. *Journal of Political Economy* 103(6):1158–1175

Acikgoz, O., Hagedorn, M., Holter, H.A. and Wang, Y. (2018). *The Optimum Quantity of Capital and Debt*. *Working Paper*

Chien, Y. and Wen, Y. (2022). *The Ramsey Steady-State Conundrum in Heterogeneous-Agent Economies*. *FRB St. Louis Working Paper* 2022-09