ECON 5345, Spring 2026
Quantitative Macroeconomics

Instructor: Byoungchan Lee (bclee@ust.hk)
Class Meets: Mon   2 pm – 5:50 pm,   LSK 1026
Office Hours: Tue   3 pm – 5 pm,   LSK 6068

Syllabus

The course covers empirical and theoretical tools of applied macroeconomics. It is for Ph.D. students, although anyone serious about macroeconomics is welcome. With an emphasis on implementation, computation, and applications, we will discuss the following topics: time-series methods, vector autoregressions with different identification schemes, state-space models and filtering, the solution to and estimation of dynamic stochastic general equilibrium models, numerical dynamic programming, and heterogeneous agent models, if time allows. By learning advanced methods for quantitative macroeconomic research and their applications, students can better understand frontier macroeconomic research. It will also help students develop their research ideas and find proper methodological approaches to the questions.

   Exercise questions will be assigned weekly to facilitate learning. These exercises will involve a substantial amount of computation, which will help the students practice the tools. Although students can use any software for their computer projects, I can assist only with MATLAB.

Grade

1) 50% = Weekly assignments. Students must submit both word-processed reports and self-contained code. Make sure that the results in your report can be reproduced by anyone using your code. Completing each homework assignment may take 2 or more days per week.
2) 40% = Project. It can be either an **independent research** project or a **replication study**. For the replication study, select a paper that provides a cutting-edge treatment of the topic the student is interested in. Students should meet with the instructor to discuss their projects and obtain approval before April 13. The completed project, including a draft and stand-alone code, should be submitted by May 25.
3) 10% = Presentation of the project. Students will present their projects on May 4.

Prerequisites: first-year graduate sequence in macroeconomics and econometrics or their equivalents.

Intended Learning Goals

Upon successful completion of this course, students should be able to:

1) Have up-to-date and in-depth knowledge of applied macroeconomics.
2) Discuss the empirical and theoretical results of structural shocks and their propagation mechanisms.
3) Apply relevant tools to answer academic questions that students have as independent researchers.
4) Communicate the research ideas effectively to research scholars.

Recommended textbooks

There is no required textbook. I list several books that I find useful for general reference.

1) Time-series / Bayesian Statistics

Hamilton, James. 1994. *Time Series Analysis*. Princeton University Press.

Enders, Walter. 2009. *Applied Econometric Time Series*. 3rd ed. Wiley.

Brockwell, Peter J., and Richard A. Davis. 1991. *Time Series: Theory and Methods*. 2nd ed. Springer.

Brillinger, David R. 1981. *Time Series: Data Analysis and Theory*. Society for Industrial and Applied Mathematics.

Gelman, Andrew et al. 2013. *Bayesian Data Analysis*. CRC Press.

Geweke, John. 2005. *Contemporary Bayesian Econometrics and Statistics*. John Wiley & Sons.

2) VAR

Kilian, Lutz and Helmut Lütkepohl. 2017. *Structural Vector Autoregressive Analysis*. Cambridge University Press.

Lütkepohl, Helmut. 1993. *Introduction to Multiple Time Series Analysis*. Springer.

Favero, Carlo. 2001. *Applied Macroeconometrics*. Oxford University Press.

3) Applied Macro/DSGE

Canova, Fabio. 2007. *Methods for Applied Macroeconomic Research*. Princeton University Press.

De Jong, David, and Chetan Dave. 2011. *Structural Macroeconometrics*. 2nd ed. Princeton University Press.

Herbst, Edward P., and Frank Schorfheide. 2015. *Bayesian Estimation of DSGE Models*. Princeton University Press.

4) Computation of Quantitative Macroeconomic Models

Heer, Burkhard and Alfred Maussner. 2024. *Dynamic General Equilibrium Modelling: Computational Methods and Applications*. 3rd ed. Springer.

Mario Miranda and Paul Fackler. 2002. *Applied Computational Economics and Finance*. MIT Press.

Judd, Kenneth L. 1998. *Numerical Methods in Economics*. MIT Press.

Tentative Topics

1. Statistics review (1 week);

    LLN, CLT, OLS, IV, GMM, MLE, Primer on numerical optimization

2. Time series (2 weeks);

    ARIMA, ARCH, Unit-root, Frequency-domain analysis, Filtering

3. VAR (2.5 weeks);

    Reduced form, Short-run identification, Long-run identification, Other methods for identification

4. Single equation methods (0.5 weeks);

    ADL models, Local projections

5. State-space models (1 week);

    Kalman filter, Dynamic factor models

6. DSGE (2 weeks);

    Review of linearization-based methods, Higher-order local approximation, Occasionally binding constraints, Estimation (Calibration, GMM, MLE, Bayesian methods)

7. Dynamic programming (2 weeks);

    Computation of value functions and/or policy functions

8. Heterogeneous agent models (if time permits);

    Bewley-Hugget-Aiyagari, Krusell and Smith, HANK

There will be no lesson on February 16.

Readings

If you are serious about macroeconomics, try to read all the papers (or at least papers with *) on the list.

* Ramey, Valerie A. 2016. "Macroeconomic shocks and their propagation." *Handbook of Macroeconomics*. Vol. 2. Elsevier, 71-162.
* Blanchard, Olivier. 2025. "Convergence? Thoughts about the evolution of mainstream macroeconomics over the last 40 years." *NBER Macroeconomics Annual* 40.
Summers, Larry. 1991. "The Scientific Illusion of Empirical Macroeconomics," *Scandinavian Journal of Economics* 93(2): 129-148.
Cochrane, John H. 1994. "Shocks." *Carnegie-Rochester Conference Series on Public Policy*. Vol. 41. North-Holland,

1. Time series
    a. Theory
    Hamilton, Chapters 3, 6, and 17.

Canova, Chapter 3.
De Jong and Dave, Chapter 3.
Enders, Chapter 3.

b. Applications

Nelson, Charles and Charles Plosser. 1982. "Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications." *JME* 10(2): 139–162.

* Newey, Whitney K., and Kenneth D. West. 1987. "A Simple, Positive Semi-definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix." *ECTA* 55(3): 703-708.

Perron, Pierre, 1989. "The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis." *Econometrica* 57 (6): 1361-1401.

Andrews, Donald W. K, and J. Christopher Monahan. 1992. "An improved heteroskedasticity and autocorrelation consistent covariance matrix estimator." *ECTA*: 953-966.

Driscoll, John C., and Aart C. Kraay. 1998. "Consistent covariance matrix estimation with spatially dependent panel data." *REStat* 80(4): 549-560.

Baxter, Marianne and Robert King. 1999. "Measuring Business Cycles: Approximate Bandpass Filters for Economic Time Series," *REStat* 81(4): 575–593.

Harvey, Andrew and A. Jaeger. 1993. "Detrending, Stylized Factors, and the Business Cycle." *Journal of Applied Econometrics* 8(3): 231–247.

* Cogley, Timothy and James Nason. 1995. "Effects of the Hodrick-Prescott Filter on Trend and Difference Stationary Time Series: Implications for Business Cycle Research." *JEDC* 19(1-2): 253–278.

* Stock, James and Mark Watson. 1999. "Business Cycle Fluctuations in U.S. Macroeconomic Time Series." *Handbook of Macroeconomics*, Chapter 1.

Olea, José Luis Montiel and Carolin Pflueger. 2013. "A Robust Test for Weak Instruments." Journal of Business & Economic Statistics 31(3): 358-369.

Coibion, Olivier and Yuriy Gorodnichenko. 2015. "Information Rigidity and the Expectations Formation Process: A Simple Framework and New Facts." *AER* 105(8), 2644–2678.

Chirinko, Robert and Debdulal Mallick. 2017. "The substitution elasticity, factor shares, and the low-frequency panel model." *AEJ:Macro* 9(4): 225-253.

Hamilton, James D. 2018. "Why you should never use the Hodrick-Prescott filter." *Review of Economics and Statistics* 100(5): 831-843.

Lazarus, Eben et al. 2018. "HAR Inference: Recommendations for Practice." *JBES* 36(4): 541-559.

Coibion, Olivier, Yuriy Gorodnichenko, and Mauricio Ulate. 2018. "The Cyclical Sensitivity in Estimates of Potential Output." *Brookings Papers on Economic Activity*: 343-442.

Adrian, Tobias, Nina Boyarchenko, and Domenico Giannone. 2019. "Vulnerable Growth." *AER* 109(4): 1263-1289.

* Andrews, Isaiah, James H. Stock, and Liyang Sun. 2019. "Weak Instruments in Instrumental Variables Regression: Theory and Practice." *Annual Review of Economics* 11: 727-53.

2. VAR

   a. Theory

   Canova, Chapter 4.
   Hamilton, Chapters 10, 11, 19, and 20.
   Kilian and Lutkepohl, Chapters 2, 4, 8, and 10.
   Favero, Chapter 6.
   Lutkepohl, Chapters 2, 3 and 4.
   Enders, Chapters 5 and 6.

   b. Applications

   Christopher Sims, 1980. "Macroeconomics and reality." *Econometrica* 48(1): 1-48.
   * Blanchard, Olivier and Danny Quah. 1988. "The Dynamic Effects of Aggregate Demand and Supply Disturbances." *AER* 79(4): 655-673.
   Christopher A. Sims. 1992. "Interpreting the Macroeconomic Time Series Facts: The Effects of Monetary Policy," *EER* 36(5): 975-1000.
   * Bernanke, Ben and Ilian Mihov. 1998. "Measuring Monetary Policy." *QJE* 113(3): 869-902.
   Faust, Jon. 1998. "The robustness of identified VAR conclusions about money." *Carnegie-Rochester Conference Series on Public Policy*. Vol. 49. North-Holland.
   * Christiano, Lawrence J., Martin Eichenbaum and Charles L. Evans. 1999. "Monetary policy shocks: What have we learned and to what end?" *Handbook of Macroeconomics*, 65-148.
   Gali, Jordi. 1999. "Technology, Employment, and the Business Cycle: Do Technology Shocks Explain Aggregate Fluctuations?" *AER* 89(1): 249-271.
   Kilian, Lutz. 1999. "Small sample confidence intervals for impulse response functions," *REStat* 80(2): 218-230.
   Auerbach, Alan J., and Yuriy Gorodnichenko. 2012. "Measuring the output responses to fiscal policy." *AEJ: Economic Policy* 4(2): 1-27.
   Blanchard, Olivier, and Roberto Perotti. 2002. "An empirical characterization of the dynamic effects of changes in government spending and taxes on output." *QJE* 117(4): 1329-1368.
   Faust, Jon and John H. Rogers. 2003. "Monetary policy's role in exchange rate behavior," *JME* 50(7): 1403-1424.
   Rigobon, Roberto. 2003. "Identification through heteroskedasticity." *REStat* 85(4): 777-792.
   Rigobon, Roberto, and Brian Sack. 2003. "Measuring the reaction of monetary policy to the stock market." *QJE* 118(2): 639-669.
   * Bernanke, Ben, Jean Boivin, and Piotr Eliasz, 2005. "Measuring the effects of monetary policy: A factor-augmented vector autoregressive (FAVAR) approach," *QJE* 120(1), 387-422.
   Beaudry, Paul and Franck Portier. 2006. "Stock Prices, News, and Economic Fluctuations," *AER* 96(4): 1293-1307.
   Christiano, Lawrence, Martin Ecihenbaum and Robert Vigfusson. 2006. "Assessing Structural VARs." *NBER Macroeconomics Annual*, Vol. 21.

Chari, Varadarajan V., Patrick J. Kehoe, and Ellen R. McGrattan. 2008. "Are structural VARs with long-run restrictions useful in developing business cycle theory?" *JME* 55(8): 1337-1352.

Kilian, Lutz. 2009. "Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market." *AER* 99(3): 1053-69.

Barsky, Robert B., and Eric R. Sims. 2011. "News shocks and business cycles." *JME* 58(3): 273-289.

* Gilchrist, Simon, and Egon Zakrajšek. 2012. "Credit spreads and business cycle fluctuations." *AER* 102(4): 1692-1720.

Wright, Jonathan H. 2012. "What does monetary policy do to long-term interest rates at the zero lower bound?" *Economic Journal* 122(564): F447-F466.

Jurado, Kyle, Sydney C. Ludvigson, and Serena Ng. 2015. "Measuring Uncertainty." *AER* 105(3): 1177-1216.

Baumeister, Christiane, and James D. Hamilton. 2018. "Inference in structural vector autoregressions when the identifying assumptions are not fully believed: Re-evaluating the role of monetary policy in economic fluctuations." *JME* 100: 48-65.

Angeletos, G. et al. 2020. "Business-Cycle Anatomy." *AER* 110(10): 3030-3070.

Wolf, Christian. 2020. "SVAR (Mis)Identification and the Real Effects of Monetary Policy Shocks." *AEJ:Macro* 12(4): 1-32.

* Jarocinski, M. and P. Karadi. 2020. "Deconstructing Monetary Policy Surprises--The Role of Information Shocks." *AEJ:Macro* 12(2): 1-43.

Mavroeidis, S. 2021. "Identification at the Zero Lower Bound." *Econometrica* 89(6): 2855-2885.

Aruoba, S. et al. 2022. "SVARs with Occasionally-Binding Constraints." *JOEconometrics* 231(2): 477-499.

Bergholt, D., F. Furlanetto, and N. Maffei-Facciolo. 2022. "The Decline of the Labor Share: New Empirical Evidence." *AEJ:Macro* 14(3): 163-198.

Caldara, Dario and Matteo Iacoviello. 2022, "Measuring Geopolitical Risk." *AER* 112(4): 1194-1225.

Miescu, M.S. and Mumtaz, H. 2024. "CORPORATE EARNINGS ANNOUNCEMENTS AND ECONOMIC ACTIVITY." *IER*, 65: 1777-1793.

Alessandri, P. and H. Mumtaz. 2025. "The macroeconomic cost of temperature risk." *JIE*: 104157.

Kim, Hee Soo, Christian Matthes, and Toan Phan. 2025. "Severe Weather and the Macroeconomy." *AEJ:Macro* 17(2): 315-341.

3. Identified shocks and single equation methods

   a. Theory

Jordà, Òscar. 2005. "Estimation and inference of impulse responses by local projections." *AER* 95(1): 161-182.

Stock, James H., and Mark W. Watson. 2018. "Identification and estimation of dynamic causal effects in macroeconomics using external instruments." *Economic Journal* 128: 917-948.

Plagborg-Møller, Mikkel, and Christian K. Wolf. 2022. "Instrumental Variable Identification of Dynamic Variance Decompositions." *JPE* 130(8): 2164-2202.

Jordà, Òscar, and Alan M. Taylor. 2025. "Local projections." *Journal of Economic Literature* 63(1): 59-110.

b.   Applications

* Christina Romer and David Romer. 2004. "A New Measure of Monetary Shocks: Derivation and Implications," *AER* 94(4): 1055-1084.

Basu, Susanto, John G. Fernald, and Miles S. Kimball. 2006. "Are technology improvements contractionary?" *AER* 96(5): 1418-1448.

Cerra, Valerie, and Sweta Chaman Saxena. 2008. "Growth dynamics: the myth of economic recovery." *AER* 98(1): 439-57.

Romer, Christina D., and David H. Romer. 2010. "The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks." *AER* 100(3): 763-801.

Mertens, Karel, and Morten O. Ravn. 2013. "The dynamic effects of personal and corporate income tax changes in the United States." *AER* 103(4): 1212-47.

* Nakamura, Emi, and Jon Steinsson. 2014. "Fiscal stimulus in a monetary union: Evidence from US regions." *AER* 104(3): 753-92.

* Gertler, Mark, and Peter Karadi. 2015. "Monetary policy surprises, credit costs, and economic activity." *AEJ: Macroeconomics* 7(1): 44-76.

Arezki, Rabah, Valerie A. Ramey, and Liugang Sheng. 2017. "News shocks in open economies: Evidence from giant oil discoveries." *QJE* 132(1): 103-155.

Miyamoto, Wataru, Thuy Lan Nguyen, and Dmitriy Sergeyev. 2018. "Government spending multipliers under the zero lower bound: Evidence from Japan." *AEJ: Macroeconomics* 10(3): 247-77.

* Ramey, Valerie A., and Sarah Zubairy. 2018. "Government spending multipliers in good times and in bad: evidence from US historical data." *JPE* 126(2): 850-901.

* Romer, Christina D., and David H. Romer. 2018. "Phillips Lecture–Why Some Times Are Different: Macroeconomic Policy and the Aftermath of Financial Crises." *Economica* 85: 1-40.

Nakamura, Emi, and Jón Steinsson. 2018. "High-frequency identification of monetary non-neutrality: the information effect." *QJE* 133(3): 1283-1330.

Gorodnichenko, Yuriy, and Byoungchan Lee. 2020. "Forecast Error Variance Decompositions with Local Projections." *JBES* 38(4): 921-933.

* Barnichon, Regis and Geert Mesters. 2020. "Identifying Modern Macro Equations with Old Shocks." *QJE* 135(4): 2255-98.

Barnichon, Regis and Geert Mesters. 2021. "The Phillips Multiplier." *JME* 117: 698-705.

Plagborg-Møller, Mikkel, and Christian K. Wolf. 2021. "Local projections and VARs estimate the same impulse responses." *Econometrica* 89(2): 955-980.

Kanzig, Diego R. 2021. "The Macroeconomic Effects of Oil Supply News: Evidence from OPEC Announcements." *AER* 111(4): 1092-1125l.

Baek, ChaeWon and Byoungchan Lee. 2022. "A Guide to Autoregressive Distributed Lag Models for Impulse Response Estimations." *OBES*: 0305-9049.

McKay, Alisdair and Christian Wolf. 2022. "What Can Time Series Regressions Tell Us About Policy Counterfactuals?" *manuscript.*

Rüdiger Bachmann, Isabel Gödl-Hanisch, and Eric R. Sims. 2022. "Identifying monetary policy shocks using the central bank′s information set." *JEDC* 145: 104555.

* Michael Bauer and Eric. T. Swanson. 2023. "A Reassessment of Monetary Policy Surprises and High-Frequency Identification." *NBER Macroeconomics Annual* 37: 87-155.

Michael Bauer and Eric. T. Swanson. 2023. "An Alternative Explanation for the "Fed Information Effect." *AER* 113(3):664-700.

Ma, Yueran and Kaspar Zimmermann. 2023. "Monetary Policy and Innovation." *Jackson Hole Economic Policy Symposium 2023.*

Mei, Ziwei, Liugang Sheng and Zhentao Shi. 2023. "Nickell Bias in Panel Local Projection: Financial Crises Are Worse Than You Think'' *forthcoming in JIE.*

4. State-space models

   a. Theory

   Hamilton, Chapter 13.

   Canova, Chapters 6.1 and 11.1.

   Stock, James H., and Mark W. Watson. 2016. "Dynamic factor models, factor-augmented vector autoregressions, and structural vector autoregressions in macroeconomics." *Handbook of Macroeconomics*. Vol. 2. Elsevier, 415-525.

   b. Applications

   * Robert Townsend, 1983. "Forecasting the Forecasts of Others," *JPE* 91(4), 546-588.

   Stock, James and Mark Watson. 1989. "New Indexes of Coincident and Leading Economic Indicators." *NBER Macroeconomics Annual*.

   Forni, Mario, Marc Hallin, Marco Lippi, and Lucrezia Reichlin. 2000. "The Generalized Dynamic Factor Model: Identification and Estimation," *REStat* 82(4), 540-554.

   Stock, James and Mark Watson. 2002. "Macroeconomic forecasting using diffusion indexes," *JBES* 20 (2), 147-162.

   * Michael Woodford, 2002, "Imperfect Common Knowledge and the Effects of Monetary Policy," in P. Aghion, R. Frydman, J. Stiglitz, and M. Woodford, eds., *Knowledge, Information, and Expectations in Modern Macroeconomics: In Honour of Edmund S. Phelps*, Princeton: Princeton University Press.

   * Laubach, Thomas, and John C. Williams. 2003. "Measuring the natural rate of interest." *REStat* 85(4): 1063-1070.

   * Kose, Ayhan, Christopher Otrok, and Charles Whiteman, 2003. "International Business Cycles: World, Region, and Country-Specific Factors," *AER* 93(4), 1216-1239.

   * Gürkaynak, R. S., B. Sack, and E. T. Swanson. 2005. "Do actions speak louder than words? The response of asset prices to monetary policy actions and statements." *International Journal of Central Banking* 1(1): 55-93.

   Boivin, Jean and Marc Giannoni. 2006. "DSGE models in a data-rich environment," NBER WP 12772.

   Boivin, Giannoni, and Mihov. 2009. "Sticky Prices and Monetary Policy: Evidence from Disaggregated US Data."*AER* 99(1): 350-384.

   Guido Lorenzoni. 2009. "A Theory of Demand Shocks." *AER* 99(5): 2050–2084.

   Foerster, Andrew T., Pierre-Daniel G. Sarte, and Mark W. Watson. 2011. "Sectoral versus Aggregate Shocks: A Structural Factor Analysis of Industrial Production." *JPE* 119 (1): 1-38.

Blanchard, Olivier, Eugenio Cerutti, and Lawrence Summers. 2015. "Inflation and activity–two explorations and their monetary policy implications." *NBER Working Papers*.

Ductor, Lorenzo, and Danilo Leiva-Leon. 2016. "Dynamics of global business cycle interdependence." *Journal of International Economics* 102: 110-127.

* McCracken, Michael W., and Serena Ng. 2016. "FRED-MD: A monthly database for macroeconomic research." *JBES* 34(4): 574-589.

Gorodnichenko, Yuriy, and Serena Ng. 2017. "Level and volatility factors in macroeconomic data." *JME* 91: 52-68.

* Fernald, John et al. 2017. "The Disappointing Recovery of Output after 2009." *Brookings Papers on Economic Activity*.

Miranda-Agrippino and Rey. 2020. "US Monetary Policy and the Global Financial Cycle." *REStud* forthcoming.

* Swanson, Eric. 2021. "Measuring the effects of federal reserve forward guidance and asset purchases on financial markets." *JME* 118: 32-53.

McCracken, Michael W., and Serena Ng. 2021. "FRED-QD: A Quarterly Database for Macroeconomic Research." Federal Reserve Bank of St. Louis Review 103 (1): 1-44.

Forni, Mario et al. 2025. "An American Macroeconomic Picture: Supply and Demand Shocks in the Frequency Domain." *AEJ:Macro* 17(3): 311-41.

5. DSGE
    a. Theory

Heer and Maussner, Chapter 2.
Canova, Chapter 2.
Favero, Chapter 8.
DeJong and Dave, Chapter 2.

* Blanchard, Olivier Jean, and Charles M. Kahn. 1980. "The solution of linear difference models under rational expectations." *Econometrica*: 1305-1311.

Schmitt-Grohé, Stephanie, and Martın Uribe. 2004. "Solving dynamic general equilibrium models using a second-order approximation to the policy function." *JEDC* 28(4): 755-775.

Guerrieri, Luca, and Matteo Iacoviello. 2015. "OccBin: A toolkit for solving dynamic models with occasionally binding constraints easily." *JME* 70: 22-38.

Andreasen, Martin M., Jesús Fernández-Villaverde, and Juan F. Rubio-Ramírez. 2018. "The pruned state-space system for non-linear DSGE models: Theory and empirical applications." *ReStud* 85(1): 1-49.

    b. Estimation and Inference

Canova, Chapters 5.4, 6.4, and 7.
Herbst and Schorfheide.
De Jong and Dave, Chapters 6, 7, and 8.

    c. Applications

* Finn E. Kydland; Edward C. Prescott, 1982. "Time to Build and Aggregate Fluctuations," *Econometrica* 50(6), 1345-1370.

Craig Burnside, Martin Eichenbaum and Sergio Rebelo, 1993. "Labor Hoarding and the Business Cycle," *JPE* 101, 245–273.

* Richard Clarida, Jordi Gali, and Mark Gertler. 2000. "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory," *QJE* 115: 147–180.

Ireland, Peter. 2004. "Technology shocks in the New Keynesian model," *REStat* 86(4): 923-936

* Christiano, Lawrence, Martin Eichenbaum, and Charles Evans. 2005. "Nominal rigidities and the dynamic effects of a shock to monetary policy," *JPE* 113(1), 1-45.

House, Christopher and Matthew Shapiro. 2006. "Phased-in tax cuts and economic activity," *AER* 96(3), 1835-1849.

* Smets, Frank and Rafael Wouters. 2007. "Shocks and frictions in US business cycles: A Bayesian DSGE approach," *AER* 97 (3), 586-606

* Fernandez-Villaverde, Jesus, Juan Rubio-Ramirez, Tom Sargent, and Mark Watson, 2007. "ABCs (and Ds) of understanding VARs," *AER* 97(3): 1021-1026.

Marco Del Negro, Frank Schorfheide, Frank Smets, and Raf Wouters, 2007, "On the Fit and Forecasting Performance of New Keynesian Models," *JBES* 25: 123–143.

Gorodnichenko, Yuriy and Serena Ng, 2010. "Estimation of DSGE models when data are persistent," *JME* 57: 325–340.

Olivier Coibion, and Yuriy Gorodnichenko. 2011. "Monetary Policy, Trend Inflation and the Great Moderation: An Alternative Interpretation," *AER* 101: 341–370.

* Gertler, Mark, and Peter Karadi. 2011. "A model of unconventional monetary policy." *JME* 58(1): 17-34.

Fernández-Villaverde, J., Guerrón-Quintana, P., Rubio-Ramírez, J. F., and Uribe, M. 2011. "Risk matters: The real effects of volatility shocks." *AER* 101(6): 2530-61.

Christiano, Lawrence J., Roberto Motto, and Massimo Rostagno. 2014. "Risk shocks." *AER* 104(1): 27-65.

Christiano, Lawrence J., Martin S. Eichenbaum, and Mathias Trabandt. 2016. "Unemployment and business cycles." *Econometrica* 84(4): 1523-1569.

* Anzoategui, D., Comin, D., Gertler, M., & Martinez, J. 2019. "Endogenous technology adoption and R&D as sources of business cycle persistence." *AEJ: Macroeconomics* 11(3): 67-110.

Gertler, Mark, Nobuhiro Kiyotaki, and Andrea Prestipino. 2020. "A macroeconomic model with financial panics." *REStud* 87(1): 240-288.

Andreasen, Martin. M. and Anders. F. Kronborg. 2022. "The extended perturbation method: With applications to the New Keynesian model and the zero lower bound." *QE* 13: 1171-1202.

Martin Harding, Jesper Linde and Mathias Trabandt. 2023. "Understanding Post-COVID Inflation Dynamics." *JME* 140: S101-S118.

6. Dynamic programming

   a. Theory and Computation

Heer and Maussner, Chapter 4.

Den Haan, Wouter J., and Albert Marcet. 1994. "Accuracy in simulations." *REStud* 61(1): 3-17.

* Carroll, Christopher D. 2006. "The method of endogenous gridpoints for solving dynamic stochastic optimization problems." *Economics Letters* 91(3): 312-320.

Kopecky, Karen A., and Richard MH Suen. 2010. "Finite state Markov-chain approximations to highly persistent processes." *RED* 13(3): 701-714.

Fella, Giulio, Giovanni Gallipoli, and Jutong Pan. 2019. "Markov-chain approximations for life-cycle models." *RED* 34: 183-201.

Rendahl, Pontus. 2015. "Inequality Constraints and Euler equation-based solution methods." *EJ* 125:1110-35.

Rendahl, Pontus. 2022. "Continuous vs. discrete time: Some computational insights." *JEDC* 144: 104552.

b. Applications

Hubbard, Glenn, Jonathan Skinner and Stephen Zeldes. 1995. "Precautionary Saving and Social Insurance," *JPE* 103(2): 360-399.

Slade, Margaret. 1998. "Optimal pricing with costly adjustment: Evidence from retail-grocery prices," *REStud* 65(1), 87-107.

Cooper, Russell, John Haltiwanger, and Laura Power. 1999. "Machine replacement and the business cycle: lumps and bumps." *AER* 89(4): 921-946.

* Gourinchas, Pierre-Olivier and Jonathan Parker. 2002. "Consumption over the Life Cycle," *Econometrica* 70(1): 47-89.

Cocco, Joao F. 2005. "Portfolio choice in the presence of housing." *Review of Financial Studies* 18(2): 535-567.

Russell Cooper and John Haltiwanger. 2006. "On the nature of capital adjustment costs," *REStud* 73(3), 611-633.

* Arellano, Cristina. 2008. "Default risk and income fluctuations in emerging economies." *AER* 98(3): 690-712.

Bloom, Nicholas (2009), "The Impact of Uncertainty Shocks," *ECTA* 77(3): 623-685.

* Kaplan, Greg, and Giovanni L. Violante. 2014. "A model of the consumption response to fiscal stimulus payments." *Econometrica* 82(4): 1199-1239.

7. Heterogeneous agent models

a. Theory and Computation

Heer and Maussner, Chapters 5, 6, 7, and 8.

Rios-Rull, Victor. 1995. "Models with Heterogeneous Agents," in T. Cooley, ed., *Frontiers of Business Cycle Research*, Princeton University Press.

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