Macroeconomics

411-1

Fall, 2019

Christiano

Syllabus

1. General Information.

   - Lectures are T-Th, 9-10:50AM, KGH 1410. Discussion section: Friday 11 - 12.50am, in the lecture room (the first discussion section, on 9/27, will be in a different room).
   - My office number is KGH 3359; Phone: 491-8231. Email: l-christiano@northwestern.edu. Office hours: Monday, 3:30-5:00pm.
   - Teaching Assistant: Joao Guerreiro, Office hours, Thursday, 3-5pm (he will leave at 4pm in case no one shows up by then), KGH 3411; email, joao.guerreiro2022@u.northwestern.edu.
   - The grades will be determined as follows: homeworks, 10%; midterm, 40%; final, 50%. There will be weekly homework assignments. You are requested to work in teams of three or maybe four students on these problem sets, and only one answer should be submitted per group. Homeworks should be turned in to the Economics Department office by Wednesday, 5pm, in the week after they are assigned. The first assignment is due Wednesday, October 2 (questions 2.1, 2.2, 2.3, 3.9 in S-L).
   - The midterm is on Wednesday, October 24, in the lecture room. The final is on December 9, 3-5pm, in the regular lecture room.
   - On Tuesday, October 22, Joao Guerreiro will do a review session at 9am in the lecture room. I will present a lecture on November 15, at the time and place normally reserved for the TA session.
   - Any student requesting accommodations related to a disability or other condition is required to register with AccessibleNU (accessiblenu@northwestern.edu; 847-467-5530) and provide professors with an accommodation notification from AccessibleNU, preferably within the first two weeks of class. All information will remain confidential.

2. Goals.

Macroeconomics is about: (i) developing positive models that are helpful for understanding aggregate economic phenomena; and (ii) using these models to make judgements about whether markets generate an efficient allocation of resources and, if not, what policy interventions might improve things.

To address (i), we will begin by developing the basic building block of modern macroeconomics: the infinite lived, deterministic, homogeneous agent growth model. We will use the model to review basic concepts such as the efficient allocation of resources and the role markets may play as a device to help achieve the efficient allocations. In addition, we will use the model to illustrate the theoretical and computational advantages of formulating economic models in recursive form. One set of variations of this model will allow us to review aspects of the modern theory of growth. Other variations will allow us to review several approaches to the integration of financial frictions into macroeconomics.

- The textbooks for the course are S-L and L-S:

  Nancy L. Stokey and Robert E. Lucas, Jr., with Edward C. Prescott, *Recursive Methods in Economic Dynamics*, Harvard University Press, 1989 (S-L).

  Ljungqvist and Sargent's, *Recursive Macroeconomic Theory*, 4rd Edition, MIT Press, 2018 (L-S).

- Additional reading materials will be made available on the course website.

COURSE OUTLINE

The primary and related readings for each lecture are listed. In some cases I have indicated 'extra readings'. These are not required for the course, but are for students that would like to dig deeper into a particular topic. The core material in the course is indicated by a '*'. Web addresses for handouts are included in the pdf version of this document.

1. Basic concepts: equilibrium, efficient allocations, recursive formulation*.
   (a) Efficient Allocations.
      i. Sequence approach (S-L: pp. 8-13, sec. 4.5). Extra: see Christiano, Eichenbaum and Trabandt (2014) for a discussion of the extended path method, a more efficient way to do shooting, one that works when there is uncertainty. See Kamihigashi (2002) for a simple proof of the necessity of the transversality condition.
      ii. Functional equation approach (S-L; pp. 13-16, sec. 4.2, sec. 6.1).
      iii. Projection and perturbation. Here are some notes.
   (b) Equilibrium concepts (S-L: sec. 2.3; L-S: chap. 6, 7).
      i. Sequence concepts:
         A. Date 0 Arrow-Debreu.
         B. Sequence-of-Markets.
      ii. Recursive Competitive Equilibrium.
   (c) Digging deeper into the concept of equilibrium.
      i. Equilibrium and rationality (class handout* and Chapter 8 of your Micro text by Mas-Colell, Whinston and Green, Microeconomic Theory).
      ii. Multiple equilibria, Equilibrium Implementation and Rationalizability (class handout*).
      iii. Equilibrium and learning (class notes and the basic text here is Evans & Honkapohja's *Learning and Expectations in Macroeconomics* (Princeton University Press).

iv. Complete/incomplete markets: perfect insurance (complete markets) in the 'frictionless' Arrow-Debreu model with perfect commitment and incomplete insurance in the presence of imperfect commitment (see class handout*, Marcet and Marimon (1992, 1999) and Ljungqvist and Sargent (2018)).

2. Growth Theory (L-S, chap11; Jones and Manuelli, 1997).

   (a) Exogenous growth models.

      i. Growth generated by 'disembodied' technical change (S-L, sec. 5.4; related paper: Christiano (1989)).*

      ii. Growth generated by investment-specific technical change (Greenwood, Hercowitz and Krusell, 1997, Hornstein and Krusell, 1996).

   (b) Endogenous growth models (will do relatively little of this).

      i. "Ak" models (Rebelo (1991), Jones-Manuelli, 1997).*

      ii. Learning-by-doing and learning-or-doing (S-L; sec. 5.7).

      iii. Increasing variety and specialization (Romer, 1987*; extra reading: Matsuyama, 1999; class notes on Matsuyama).

   (c) Reasons that growth might not happen, even if the technology is 'right'.

      i. The young might not be rich enough to buy an ever-growing stock of capital (Jones and Manuelli, 1997)*.

      A twist on this model provides a theory of perpetually increasing income inequality.

      ii. Extra reading: the politics of vested interests may get in the way of growth (Herrendorf and Teixeira, (2003), Parente and Prescott (1994, 1999), Krusell and Rios-Rull (1996)).

3. Business cycles (will do relatively little of this).

   (a) Business cycles driven by technology disturbances ('real business cycles') (Cooley and Prescott (1995); Prescott (1986); extra reading: Summers (1986)).

(b) Business cycles driven by 'animal spirits'. These models complement the earlier discussion of equilibrium because they highlight the possibility that equilibrium might not be unique (see: Bryant (1981,1983); Christiano and Harrison (1999), class notes on Christiano-Harrison*; Shleifer (1983), class notes on Shleifer; extra readings: Cass and Shell (1983); Cooper and John (1988); Diamond and Dybvig (1983); Diamond (1982); Farmer (1993); Farmer and Guo (1994,1995); Farmer and Woodford (1984); Gali (1994a,b); Krugman (1991); Woodford (1986,1991)).

4. Macroeconomics and financial frictions (here is some background (not required) material: JEP, article.)

   (a) Frictions in the banking system.

      i. Running away model (handout*, Gertler-Karadi (2011), section 3 in reading).

      ii. Maturity mismatch (handout*, Gertler-Kiyotaki (2015), Gertler-Kiyotaki-Prespitino (2018))

   (b) Frictions in non-financial firms.

      i. A model with heterogeneous firms and households who have Kiyotaki-Moore type collateral constraints (handout*). We will evaluate what happens to consumption, investment, output, interest rates and total factor productivity when there is 'deleveraging'. It will look surprisingly similar to what we saw after 2008 in the US. The lecture will summarize Buera and Moll (2015).

      ii. The macroeconomic implications of costly state verification and asymmetric information (handout). Readings: Bernanke, Gertler and Gilchrist, (1999); Bernanke and Gertler (1989), Christiano, Motto and Rostagno (2014) and Townsend (1979)).

References

[1] Alvarez, Fernando and Urban Jermann, 2000, 'Efficiency, Equilibrium, and Asset Pricing with Risk of Default,' *Econometrica*, vol. 68, pp. 775-797.

[2] Alvarez, Fernando and Urban Jermann, 2001, 'Quantitative Asset Pricing Implications of Endogenous Solvency Constraints,' *Review of Financial Studies*, vol. 14, pp. 1117-1151.

[3] Azariadis, Costas, 1981, 'Self-Fulfilling Prophesies,' *Journal of Economic Theory*, 25, pp. 380-396.

[4] Bodenstein, Martin, 2005, 'International Asset Markets and Real Exchange Rate Volatility,' mimeo, Northwestern University.

[5] Benhabib, Jess, and Roger E. A. Farmer, 1994, 'Indeterminacy and Growth,' *Journal of Economic Theory* 63, pp. 19-41.

[6] Benhabib, Jess, and Roger E. A. Farmer, 1995, 'Indeterminacy and Sector-Specific Externalities,' manuscript, department of economics, UCLA, May.

[7] Benhabib, Jess, and Roberto Perli, 1994, 'Uniqueness and Indeterminacy: On the Dynamics of Endogenous Growth,' *Journal of Economic Theory*, 63, pp. 113-142.

[8] Bernanke, Ben and Mark Gertler, 1989, "Agency Costs, Net Worth, and Business Fluctuations," American Economic Review, March, 79 (1), pp. 14-31.

[9] Bernanke, Ben, Mark Gertler and Simon Gilchrist, 1999, "The Financial Accelerator in a Quantitative Business Cycle Framework," in Taylor, J. B. and M. Woodford (editors), Handbook of Macroeconomics, Volume 1C, chapter 21, Amsterdam: Elsevier Science.

[10] Bryant, John, 1981, 'Bank Collapse and Depression,' *Journal of Money, Credit and Banking*, XIII, pp. 454-464.

[11] Bryant, John, 1983, 'A Simple Rational Expectations Keynes-Type Model,' *Quarterly Journal of Economics*, Vol. XCVIII, no. 3.

[12] Buera, Francisco J. and Benjamin Moll, 2014, 'Aggregate Implications of a Credit Crunch: The Importance of Heterogeneity,' Forthcoming, *American Economic Journal, Macroeconomics*.

[13] Cass, David, and Karl Shell, 1983, 'Do Sunspots Matter?', *Journal of Political Economy* 91, 193-227.

[14] Chari, V.V., 1988, 'Time Consistency and Optimal Policy Design,' Federal Reserve Bank of Minneapolis *Quarterly Review*, Fall.

[15] Chari, V.V., and Patrick J. Kehoe, 1990, 'Sustainable Plans,' *Journal of Political Economy*, vol. 98, no. 4, pp. 783-802.

[16] Chari, V.V., Lawrence J. Christiano, and Martin Eichenbaum, 1998, 'Expectation Traps and Discretion,' *Journal of Economic Theory*.

[17] Chari, V.V., Lawrence J. Christiano and Patrick Kehoe, 1994, 'Policy Analysis in Business Cycle Models,' in Thomas F. Cooley, editor, *Frontiers of Business Cycle Research*, Princeton University Press.

[18] Christiano, Lawrence J., 1989, 'Understanding Japan's Saving Rate: The Reconstruction Hypothesis,' Federal Reserve Bank of Minneapolis *Quarterly Review*, Spring.

[19] Christiano, Lawrence, Martin Eichenbaum and Mathias Trabandt, 2014, Stochastic Simulation of a Nonlinear, Dynamic Stochastic Model.

[20] Christiano, Lawrence J., and Terry Fitzgerald, 2003, 'Inflation and Monetary Policy in the 20th Century,' in Federal Reserve Bank of Chicago, *Economic Perspectives*, first quarter.

[21] Christiano, Lawrence J., and Sharon Harrison, 1999, 'Chaos, Sunspots and Automatic Stabilizers,' *Journal of Monetary Economics*.

[22] Christiano, Lawrence J., and Daisuke Ikeda, 2013, 'Government Policy, Credit Markets and Economic Activity,' in "A Return to Jekyll Island: the Origins, History, and Future of the Federal Reserve", forthcoming, Cambridge University Press.

[23] Christiano, Lawrence J., and Daisuke Ikeda, 2016, 'Bank Leverage and Social Welfare,' *American Economic Review (P&P)*, vol. 106, no. 5, May (pp. 560-64).

[24] Christiano, Lawrence J., Roberto Motto and Massimo Rostagno, 2014, 'Risk Shocks,' *American Economic Review*.

[25] Cooley, Thomas F. and Edward C. Prescott, 1995, 'Economic Growth and Business Cycles,' in Thomas F. Cooley, editor, *Frontiers of Business Cycle Research*, Princeton University Press.

[26] Cooper, Russell, and Andrew John, 1988, 'Coordinating Coordination Failures in Keynesian Models,' *Quarterly Journal of Economics*, 103, August, pp. 441-463.

[27] Diamond, Douglas, and Philip Dybvig, 1983, 'Bank Runs, Deposit Insurance, and Liquidity,' *Journal of Political Economy* 91, 3, pp. 401-419.

[28] Diamond, Peter, 1982, 'Aggregate-Demand Management in Search Equilibrium,' *Journal of Political Economy*, 90, no. 5, pp. 881-894.

[29] Farmer, Roger E. A., 1993, *The Macroeconomics of Self-Fulfilling Prophecies*, MIT Press.

[30] Farmer, Roger E. A., and Guo, J.-T., 1994, 'Real Business Cycles and the Animal Spirits Hypothesis,' *Journal of Economic Theory* 63, pp. 42-73.

[31] Farmer, Roger E. A., and Guo, J.-T., 1995, 'The Econometrics of Indeterminacy: an Applied Study,' *Journal of Monetary Economics*.

[32] Farmer, Roger E. A., and Michael Woodford, 1984, 'Self-Fulfilling Prophecies and the Business Cycle,' Center for Analytic Research in Economics and Social Science, Working Paper no. 84-12, University of Pennsylvania, April.

[33] Gali, Jordi, 1994a, 'Monopolistic Competition, Business Cycles, and the Composition of Aggregate Demand,' *Journal of Economic Theory* 63, pp. 73-96.

[34] Gali, Jordi, 1994b, 'Monopolistic Competition, Endogenous Markups and Growth,' *European Economic Review* 38, pp. 748-756.

[35] Gertler, Mark and Peter Karadi, 2011,"A Model of Unconventional Monetary Policy," *Journal of Monetary Economics*, 58(1): 17–34.

[36] Gertler, Mark, and Nobuhiro Kiyotaki, 2011, "Financial intermediation and credit policy in business cycle analysis," in Benjamin M. Friedman, and Michael Woodford, editors: Handbook of Monetary Economics, Vol. 3A, The Netherlands: North-Holland.

[37] Heaton, John, and Debbie Lucas, 1996, 'Evaluating the Effects of Incomplete Markets on Risk-Sharing and Asset Pricing,' *Journal of Political Economy* 104, pp. 443-487.

[38] Herrendorf, Berthold and Arilton Teixeira, 2003, 'Monopoly Rights Can Reduce Income Big Time,' manuscript.

[39] Hornstein, Andreas and Per Krusell, 1996, 'Can Technology Improvements Cause Productivity Slowdowns?', *Macroeconomics Annual*.

[40] Jones, Larry, and Rodolfo Manuelli, 1997, 'The Sources of Growth', *Journal of Economic Dynamics and Control*, vol. 21, no. 1.

[41] Kamihigashi, Takashi, 2002, 'A Simple Proof of the Necessity of the Transversality Condition,' Economic Theory 20, 427-433 (see also Kamihigashi, Econometrica, 2001, vol. 69, no. 4, pp. 995-1012).

[42] Kehoe, Timothy, and David Levine, 1993, 'Debt Constrained Asset Markets,' *Review of Economic Studies* vol. 60, pp. 865-888.

[43] Kehoe, Patrick, and Fabrizzio Perri, 2002, International Business Cycles with Endogenous Incomplete Markets, *Econometrica* vol. 70, pp. 907-928.

[44] Kocherlakota, Narayana, 1996, Implications of Efficient Risk Sharing Without Commitment, *Review of Economic Studies*, vol. 63, pp. 595-609.

[45] Krusell, Per, and Jose-Victor Rios-Rull, Vested Interests in a Positive Theory of Stagnation and Growth, *The Review of Economic Studies*, vol. 63, no. 2, 301-329.

[46] Greenwood, Jeremy, Zvi Hercowitz and Per Krusell, 1997, 'Long-Run Implications of Investment-Specific Technological Change,' *American Economic Review.*

[47] Krugman, Paul, 1991, 'History Versus Expectations,' *Quarterly Journal of Economics*, vol. CVI, no. 2, pp. 651-667.

[48] Kydland, Finn, and Edward C. Prescott, 1977, 'Rules Rather than Discretion: The Inconsistency of Optimal Plans,' *Journal of Political Economy*, vol. 85, pp. 473-491.

[49] Lochner, Lance, and Alexander Monge-Naranjo, 2002, 'Human Capital Formation and Endogenous Credit Constraints,' unpublished manuscript, Northwestern University.

[50] Lucas, Robert E., Jr., and Nancy L. Stokey, 1983, 'Optimal Fiscal and Monetary Policy in an Economy Without Capital,' *Journal of Monetary Economics*, vol. 12, pp. 55-93.

[51] Marcet, Albert and Ramon Marimon, 1992, 'Communication, Commitment and Growth,' *Journal of Economic Theory* 58, no. 2, pp. 219-249.

[52] Marcet, Albert and Ramon Marimon, 1999, 'Recursive Contracts,' mimeo, University of Pompeu Fabra.

[53] Matsuyama, Kiminori, 1999, 'Growing Through Cycles,' *Econometrica.*

[54] Parente, Stephen L., and Edward C. Prescott, 1994, Barriers to Technology Adoption and Development, *The Journal of Political Economy*, vol. 102, Issue 2, 298-321.

[55] Parente, Stephen L., and Edward C. Prescott, 1999, Monopoly Rights: A Barrier to Riches, *The American Economic Review*, vol. 89, no. 5.

[56] Prescott, Edward, 1986, 'Theory Ahead of Business Cycle Measurement,' Carnegie-Rochester Conference on Public Policy 24:11-44, Reprinted in Federal Reserve Bank of Minneapolis *Quarterly Review* 10:9-22.

[57] Rebelo, Sergio, 1991, 'Long-Run Policy Analysis and Long-Run Growth,' *Journal of Political Economy*, 99, 3, June, 500-521.

[58] Romer, Paul, 1987, 'Growth Based on Increasing Returns Due to Specialization,' *American Economic Review*, 77, 2, (May), 56-62.

[59] Shleifer, A., 1986, Implementation cycles, *Journal of Political Economy* 94, 1163–1190.

[60] Stokey, Nancy, 1991, 'Credible Public Policy,' *Journal of Economic Dynamics and Control*, vol. 15, pp. 627-656.

[61] Summers, Lawrence, 1986, 'Some Skeptical Observations on Real Business Cycle Theory,' Federal Reserve Bank of Minneapolis *Quarterly Review.*

[62] Townsend, Robert M., 1979, "Optimal Contracts and Competitive Markets with Costly State Verification," *Journal of Economic Theory*, October, 21 (2), pp. 265-293.

[63] Woodford, Michael, 1986, 'Stationary Sunspot Equilibria in a Finance Constrained Economy,' *Journal of Economic Theory*, vol. 40, no. 1, October.

[64] Woodford, Michael, 1991, 'Self-Fulfilling Expectations and Fluctuations in Aggregate Demand,' in N. Gregory Mankiw and David Romer, editors, *New Keynesian Economics, vol. 2, Coordination Failures and Real Rigidities,* MIT Press.