

Yale University
Department of Economics

General Economic Theory
Macroeconomics (Econ 510a)
First Half. Fall 2010

Instructor: Eduardo Engel¹
Teaching Fellow: Max Dvorkin²

FACTS, MODELS AND METHODS IN MACROECONOMICS: BASICS.

This version: August 31, 2010.

Overview

This is the first half of the first semester in the graduate macroeconomics sequence. The purpose of this half semester is to present the basic questions macroeconomics seeks to address and then begin to study the standard model used to provide the answers. In doing so we cover tools that play a central role in macroeconomics, both when describing the facts (time series analysis) and when building models to understand the stylized facts (stochastic dynamic programming).

Reading

It is essential that you be familiarized with one intermediate macroeconomics text, if you are not, make sure you read one as soon as possible, otherwise you'll perceive the macro sequence as a series of methods and models, not as a coherent attempt to understand economic fluctuations.

The main references are my lecture slides, that I will post on the course website as we go. I will indicate required readings in class, from the reading list below and will post them on the course site.

There are three textbooks for this semester (available at Yale's Bookstore), they will be useful throughout the entire first year. They are: Lars Ljungqvist and Thomas Sargent's *Recursive Macroeconomic Theory*, Second Edition, MIT Press, 2004; David Romer's *Advanced Macroeconomics*, Third Edition, McGraw-Hill, 2006; and Daron Acemoglu's *Introduction to Modern Economic Growth*, Princeton University Press, 2008.

¹Address: 28 Hillhouse Ave., Room 312. E-mail: eduardo.engel@yale.edu. Office hours: By appointment.

²Email: maximiliano.dvorkin@yale.edu

Evaluation

There will be weekly problem sets and a closed book Mid-Term on Friday, October 15, from 9 to 12am. The second half of the course will be evaluated in the Final Exam. The Mid-Term and Exam will be given equal weights in the final grade, accounting for 90% of the final grade.³ Problem sets account for the remaining 10%.

Calendar of Lectures and Problem Sets

Official times for lectures are Monday, Wednesday and Fridays, from 10.30 to 11.50. Official times for sections is Tuesdays from 4.30 to 5.30pm. See the calendar below for details.

Calendar of Lectures					
	Monday	Tuesday	Wednesday	Friday	
September			1: Lecture 1	3: Lecture 2	
	6: Lecture 3	7: Session 1	8: Lecture 4	10: Lecture 5	
	13: Lecture 6	14: Session 2	15: Lecture 7	17: Lecture 8	
	20: Lecture 9	21: Session 3	22: Lecture 10	24: Lecture 11	
	27: Lecture 12	28: Session 4	29: Lecture 13		
October				1: Lecture 14	
	4: Lecture 15	5: Session 5	6: Lecture 16	8: Lecture 17	
	11: Session 6	12: Session 7	13: Session 8	15: Mid Term	

Calendar of Problem Sets		
Problem Set	Date posted	Date due
1	September 3	September 8
2	September 10	September 15
3	September 17	September 22
4	September 24	September 29
5	October 1	October 6
6	October 8	October 13

Programming Skills

³With one exception: students who do significantly better in the Exam than in the Mid Term will receive a somewhat larger weight on their Exam grade.

As part of the course you will learn how to apply time-series techniques to actual macroeconomic series. You will also learn to solve numerically stochastic dynamic programming problems. The starting point is the Matlab sessions you had during summer camp.

SYLLABUS

I. BASIC FACTS (AND THE TOOLS TO DESCRIBE THEM).

Lectures 1–6

Macroeconomic data are time-series. Therefore the theory of stochastic processes is used to describe the features of time-series relevant for macroeconomics. This includes exploring the possibility of estimating underlying parameters based on only *one* realization of a time series, isolating trends and cyclical components, describing the relation between various time-series, and understanding the role of the driving forces ('shocks') and their empirical counterparts.

1. **Course overview.**
2. **Why time series?:** The Slutsky-Frisch propagation mechanism. Exogenous and endogenous variables. The case for linear models. Macroeconomics: dynamics, aggregation, general equilibrium.
3. **Time series for macroeconomists:** Stationarity, ARMA models, autocorrelation and autocovariance functions, prediction and impulse-responses, Wold representation. Non-linear models: ARCH models, Markov switching models. Time-series in the frequency domain: Fourier transform, spectral density, spectral representation and filtering theory. Integrated processes, unit root tests and cointegration. Trend-cycle decompositions: Beveridge-Nelson, unobserved components, Hodrick-Prescott filter, Baxter-King bandpass filter.
4. **Applications:** Co-movements of output with components. Disasters: evidence and time series properties. VARs and the effect of monetary shocks. The Great Moderation. The Calvo Pricing Model. Quantifying the cost of business cycles. Trends and cycles: emerging vs. industrialized economies.

CANOVA, F. (2007): *Methods for Applied Macroeconomic Research*, Princeton University Press. Chs. 1 and 3.

LJUNGQVIST AND SARGENT (2004): *Recursive Macroeconomic Theory*, Ch. 2.

STOCK, J. AND M. WATSON (1988): "Variable Trends in Economic Time Series,," *J. of Economic Perspectives*, **2**, Summer 1988, 147–174.

- KYDLAND, F. AND E. PRESCOTT (1990): “Business Cycles: Real Facts and a Monetary Myth”. *Federal Reserve Bank of Minneapolis Quarterly Review*, Spring, 3–18.
- STOCK, J. AND M. WATSON (1999): “Business Cycle Fluctuations in U.S. Macroeconomic Time Series,” Ch. 1, Vol. 1A, *Handbook of Macroeconomics*, J. Taylor and M. Woodford, eds., North Holland, 1999.
- HAMILTON, J. (2005): “What’s Real About the Real Business Cycle,” NBER Working Paper No. 11161, February 2005.
- FERNÁNDEZ-VILLAYERDE, J., P. GERRÓN-QUINTANA AND J. RUBIO-RAMÍREZ (2010): “Fortune or Virtue: Time-Variant Volatilities Versus Parameter Drifting in US Data”. Mimeo. U. of Pennsylvania.
- MEGHIR, C. AND L. PISTAFERRI (2004): “Income Variance Dynamics and Heterogeneity,” *Econometrica*.
- AGUIAR M. AND G. GOPINATH (2007): “Emerging Market Business Cycles: The Cycle is the Trend,” *J. of Political Economy*, **115**, 69–102.

II. THE STOCHASTIC GROWTH MODEL.

Lectures 7–9

The stochastic growth model is the workhorse model in macroeconomics. We begin our study in this section (a study that continues throughout the entire year). You will learn to log-linearize this model to obtain an approximate solution, and use it to introduce important topics in dynamic optimization and to motivate stochastic dynamic programming.

- KRUSELL, P. (2004): *Lecture Notes in Macroeconomics I*. Mimeo. Chapters 3 and 4.
- UHLIG, H. (1997): “A Toolkit for Analyzing Nonlinear Dynamic Stochastic Models Easily”, mimeo, Tilburg.
- CAMPBELL, J. (1994): “Inspecting the Mechanism: An Analytic Approach to the Stochastic Growth Model,” *J. of Monetary Economics*, **33**, June 1994, 463–506.
- LUCAS, R.E. (1987): *Models of Business Cycles*, Oxford: Basic Blackwell.

III. STOCHASTIC DYNAMIC PROGRAMMING.

Lectures 10–13

Stochastic dynamic programming (SDP) have become the central tool in macroeconomics. It provides a tractable, and at the same time broad enough way of incorporating dynamics. It is useful in other fields of economics as well (e.g., finance and industrial organization). In this part of the course we concentrate on individual agents solving a stochastic dynamic programming problem. Problem formulation, existence, uniqueness and computation of a solution are our main concerns. The closely related concept of recursive equilibrium is covered in the second half of the course.

- 1.
2. Problem Formulation: sequential formulation, recursive formulation and Bellman equation
3. Existence and uniqueness of a solution: contraction mapping theorem, Blackwell's Theorem
4. Finding the solution: cases with closed form solutions, log-linearization and solving linear rational expectations equations, numerical methods
5. Properties of the solution: envelope theorem, garbage in–garbage out result
6. Applications: search, quadratic adjustment costs and partial adjustment models, non-convex adjustment costs and Ss policies.

Chapters 2.1 and 2.2 in Stokey and Lucas is a classic introductions to dynamic programming in macroeconomics. Well worth reading and working through.

STOKEY, N. AND R. LUCAS (1989): *Recursive Methods in Economic Dynamics*, Ch. 2 (sections 1 and 2). Cambridge–Mass.: Harvard University Press, 1989.

LJUNGQVIST AND SARGENT (2004): *Recursive Macroeconomic Theory*, Chs. 3 and 4.

STOKEY, N. AND R. LUCAS (1989): *Recursive Methods in Economic Dynamics*, Chs. 3, 4 and 9. Cambridge–Mass.: Harvard University Press, 1989.

ACEMOGLU (2008): *Introduction to Modern Economic Growth*, Ch. 6.

IV. ADVANCED TOPICS IN CONSUMPTION.

Lectures 14–17

The consumption/saving decision lies at the heart of the dynamics of most macroeconomic models. We apply the SDP formulation to solve a relatively general problem and obtain many classical models as particular cases. We emphasize the empirical implications of the models and the interplay between theory and evidence. You return to this topic later during the first year, when you consider dynamic stochastic general equilibrium (DSGE) models that incorporate household default and risk-sharing; when you do this the main insights from this section will be the benchmark against which you'll compare the models' predictions. We also cover two important topics related to fiscal policy: Ricardian equivalence and tax smoothing.

1. A consumption model with risky assets
2. Certainty equivalence: transitory and permanent shocks, Hall's random walk result, natural experiments and the PIH
3. Estimating Euler equations
4. Precautionary Saving
5. Beyond standard utility maximization: habit formation, hyperbolic discounting,...
6. Asset pricing: Consumption CAPM, equity premium (and other) puzzles
7. Risk sharing and consumption
8. Consumption of durables
9. Deficits: Ricardian equivalence, tax smoothing

Reading the classics is particularly worthwhile for this material: Friedman and Modigliani's original work has many interesting insights and makes you wonder to what an extent the formal work that followed captured what they had in mind. The Summer 2001 issue of the *Journal of Economic Perspectives* includes a collection of good articles as well. The chapter in Romer's book on consumption is the chapter I like most in that book. Among the technically more sophisticated papers, Gourinchas-Parker illustrates well a type of paper that aggregates in a mechanical manner microeconomic behavior resulting from relatively sophisticated dynamic programming to match aggregate variables (consumption in this case).

- ROMER, D. (2006): *Advanced Macroeconomics*, Third Edition, Ch. 7.
- FRIEDMAN, M. (1957): *A Theory of the Consumption Function* Chaps. 1,2 3 and 9, Princeton University Press.
- MODIGLIANI, F. (1986): "Life Cycle, Individual Thrift, and the Wealth of Nations," *American Economic Review*, **76**: 297–313.
- HALL, R.E. (1978): "Stochastic Implications of the Life Cycle–Permanent Income Hypothesis: Theory and Evidence", *J. of Political Economy*, **86**, 971–987, 1978.
- CARROLL, C. (1992): "The Buffer-Stock Theory of Saving: Some Macroeconomic Evidence," *Brookings Papers on Economic Activity*, No. 2, 61–156, 1992.
- GOURRINCHAS, P.O., AND J. PARKER (2002): "Consumption over the Life-Cycle," *Econometrica*, **70** (1), 47–89.
- CARROLL, C. (2001): "A Theory of the Consumption Function, With and Without Liquidity Constraints," *J. of Economic Perspectives*, **15** (3), Summer 2001, 23–45.
- DEATON, A. (2005): "Franco Modigliani and the Life Cycle Theory of Consumption," mimeo, Princeton University, March 2005.
- DEATON, A. (1992): *Understanding Consumption*, Oxford: Oxford University Press, 1992.
- GOLLIER, C. (2001): *The Economics of Risk and Time*, Section VI, Cambridge, Mass.: MIT Press, 2001.
- FUCHS-SCHÜNDELN, N., AND M. SCHÜNDELN (2005): "Precautionary Savings and Self-Selection – Evidence from the German Reunification 'Experiment' " *Quarterly Journal of Economics*, **120**, 1085–1020.
- HURST, E., A. LUSARDI, A. KENNICKELL AND F. TORRALBA: "The Importance of Business Owners in Assessing the Size of Precautionary Savings," *Review of Economics and Statistics*, **92**, 43–60, 2010.
- GROSS, D. AND N. SOULELES (2002): "Do Liquidity Constraints and Interest Rates Matter for Consumer Behavior? Evidence From Credit Card Data," *Quarterly Journal of Economics*, **117** (1), February 2002, 149–185. Also, NBER WP No. 8314, June 2001.

- LUCAS, R.E. (1978): “Asset Prices in an Exchange Economy,” *Econometrica*, **46**, 1429–1446, 1978.
- MEHRA,, R. AND E. PRESCOTT (1985): “The Equity Premium: A Puzzle,” *J. of Monetary Economics*, **15** (2), 145–161, March 1985.
- CAMPBELL, J. (1999): “Asset Prices, Consumption, and the Business Cycle,” Chap. 19 in J. Taylor and M. Woodford, eds, *Handbook of Macroeconomics*, Amsterdam: North Holland, 1999.
- BARRO, R.J. AND S. URSUA (2008): “Macroeconomic Crises since 1870,” *Brookings Papers on Economic Activity*, 255–350, 2008.
- KRUEGER, D. AND F. PERRI (2006), “Does Income Inequality Lead to Consumption Inequality? Evidence and Theory,” *Review of Economic Studies*, **73** (1), 163–193.
- DELONG, J. B. AND K. MAGIN (2009): “The U.S. Equity Return Premium: Past, Present and Future,” *J. of Economic Perspectives*, **23** (1), 193–208, Winter 2009.
- BACKUS, D., D. ROUTLEDGE, AND S. ZIN (2004): “Exotic Preferences for Macroeconomists,” NBER Working Paper No. 10597, June 2004.
- AKERLOF, G. (2007): “The Missing Motivation in Macroeconomics,” *American Economic Review*, **97**:1, 5–36.
- FUCHS-SCHÜNDELN, N. (2008): “The Response of Household Saving to the Large Shock of German Reunification,” *American Economic Review*, **98**, 5, 1798–1828.
- JAPPELLI, T., M. PADULA AND L. PISTAFERRI (2008): “A Direct Test of the Buffer-Stock Model of Saving,” *J. of the European Economic Association*, **6**, 1186–1210.
- BLUNDELL, R., L. PISTAFERRI AND I. PRESTON (2008): “Consumption Inequality and Partial Insurance,” *American Economic Review*, **98**, 5, 1887–1921.
- DE SANTIS, M. (2010): “Demystifying the equity premium,” *B.E. Journal of Macroeconomics – Advances*.