

# Topics in Macro (Version 3)

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## 1 Basic Information About The Course

**Instructors:** Rody Manuelli, (email: manuelli@wustl.edu)

**Time and Location:** TBA

**Office Hours:** TBA

**Textbooks:** The lectures are divided in two parts. During the first few weeks we will briefly develop some results on dynamic stochastic optimization. I will use some notes but I will not do the “hard” proofs. I will try to discuss the basic math at a level slightly more formal than what can be found in chapters 3 and 4 of the book *Investment Under Uncertainty (IUU)* by Avinash Dixit and Robert Pindyck, Princeton, 1994. Pretty much the same material is covered in the relevant chapters of *The Economics of Inaction* by Nancy Stokey (Princeton University Press, 2009). I will follow some notes (to be distributed) that discuss the basic math results.

Given the emphasis on applications, I will not go into the derivations of the basic mathematical results, and I will state them without proof. I will follow a set of notes that extract the most useful results from several sources. Good books (I am told) on the basic mathematics are:

1. *Stochastic Calculus and Applications*, Robert J. Elliott, Springer-Verlag, 1982.
2. *Deterministic and Stochastic Optimal Control*, Wendell Flemming and Raymond Rishel, Springer-Verlag, 1975.
3. *Controlled Markov Processes and Viscosity Solutions*, Wendell Flemming and H. M. Soner, Springer, 2006.
4. *Brownian Motion and Stochastic Calculus*, Ioannis Karatzas and Steve Shreve, Springer, 1991.
5. *Stochastic Differential Equations*, Bernt Øksendal, Springer, 2003

6. *Applied Stochastic Control of Jump Diffusions*, Bernt Øksendal and Agnes Sulem, Springer, 2005.

Also good references with many economic applications are:

1. *Brownian Motion and Stochastic Flow Systems (BMSF)* , J. Michael Harrison, Krieger 1990.
2. *Investment Under Uncertainty (IUU)*, Avinash Dixit and Robert Pyndick, Princeton, 1994.
3. *Stochastic Optimization in Continuous Time (SCT)*, Fwu-Ranq Chang, Cambridge U. Press, 2004.
4. *Dynamic Asset Pricing Theory (DAPT)*, Darrell Duffie, Harvard, 2001.
5. *The Economics of Inaction (EI)*, Nancy Stokey, Princeton University Press 2009.

### **Truth in Advertising Statement:**

This course emphasizes applications of optimal control and stochastic calculus to economics. The lectures will be self-contained. Since I do not know much about this subject there will be some rough spots. Moreover, since I will emphasize applications more than basic results, I will not go over most proofs.

**Grading:** I will assign homework problems and the grade will be the average grade in those problems.

## **2 Topics**

1. *Background Material.* IUU, chapters 1 and 2. (I will not cover this material. It is your responsibility to read the relevant chapters)
  - I indicate with a \* the papers that we are most likely to discuss in class.
2. *Stochastic Processes and Ito's Lemma.* Class Notes.
  - Notes on *Stochastic Processes the Feynman-Kac Theorem and Optimal Stopping*
  - In addition, the material is covered in IUU. chapter 3, SCT ( several chapters), as well as the other references. (Almost every book listed covers this topic. See, in particular, the appendix in BMSF.).
3. *Options: Real and Financial. Irreversible and Indivisible Investment.*

- IUU (chapters, 5, 6, and 7), EI (chapters 4 and 5). Additional readings:
- McDonald, R. and Siegel, (1986), “The Value of Waiting to Invest,” **The Quarterly Journal of Economics**, Vol. 101, No. 4. (Nov., 1986), pp. 707-728. (\*)
- S. Agarwal, J. Driscoll and D. Laibson, (2013), “Optimal Mortgage Refinancing: A Closed Form Solution” *Journal of Money Credit and Banking*, Volume 45, Issue 4, pp: 591–622.

#### 4. *Options: Strategic Exercise.*

- Grenadier, S, (1996), “The Strategic Exercise of Options: Development Cascades and Overbuilding in Real Estate Markets,” **The Journal of Finance**, Vol. 51, No. 5, pp: 1653-1679. (\*)
- Mella-Barral, P. and W. Perraudin, (1997), “Strategic Debt Service,” **The Journal of Finance**, Vol. 52, No. 2, pp: 531-556. (\*)
- Grenadier, S, (1999), “Information revelation Through Option Exercise,” **Review of Financial Studies**, Vol. 12, No. 1, pp: 95-129.
- Leland, H. E. (1994), “Corporate Debt Value, Bond Covenants and Optimal Capital Structure,” **The Journal of Finance**, Vol. 49, Issue 4, pp: 1213-1252. (\*)
- Sundaresan, S. and N. Wang, (2006), “Dynamic Investment, Capital Structure and Debt Overhang,” working paper.
- Miltersen, K. and E. Schwartz, (2007), “Real Options with Uncertain Maturity and Competition,” NBER working paper # 12990. (\*)
- Lyandres, E. and A. Zhdanov, (2013), “Convertible Debt and Investment Timing,” working paper.

#### 5. *Neoclassical Investment*

- Abel, A. and J. Eberly, (1994), “A Unified Model of Investment Under Uncertainty,” **American Economic Review**, pp: 1369-1384. (\*)
- Abel, A. and J. Eberly, (1994), “An Exact Solution for the Investment and Value of a Firm Facing Uncertainty, Adjustment Costs and Irreversibility,” **Journal of Economic Dynamics and Control**, 21, pp: 831-852. (\*)

#### 6. *Consumption Dynamics*

- Merton, R, (1973), “An Intertemporal Asset Pricing Model,” **Econometrica**, Vol. 41, No. 5. (Sep., 1973), pp. 867-887. (\*)

- Cox, J, J. Ingersoll, and S. Ross, (1985a), “A Theory of the Term Structure of Interest Rates,” **Econometrica**, Vol. 53, pp: 363-384.
- Cox, J, J. Ingersoll, and S. Ross, (1985a), “An Intertemporal General Equilibrium Model of Asset Prices,” **Econometrica**, Vol. 53, pp: 385-408.
- Wang, N., (2006), “Generalizing the Permanent-Income Hypothesis: Revisiting Friedman’s Conjecture on Consumption,” **Journal of Monetary Economics**, Volume 53, Issue 4, May, Pages 737-752. (\*)
- Duffie, D., (2002), “Intertemporal Asset Pricing Theory,” working paper, Stanford University.
- Cochrane, J, F Longstaff and P. Santa-Clara, (2013), “Two Trees: Asset Pricing Dynamics Induced by Market Clearing,” NBER working paper.
- Pavlova, A. and R. Rigobon, (2007), “Asset Prices and Exchange Rates,” *Review of Financial Studies*, (2007) 20 (4), pp: 1139-1180.
- Flavin, M. and S. Nakagawa, (2008), “A Model of Housing in the Presence of Adjustment Costs: A Structural Interpretation of Habit Persistence,” *American Economic Review*, 98:1, pp: 474-495.
- Stokey, N., (2009), “Moving Costs, Nondurable Consumption and Portfolio Choice,” *Journal of Economic Theory*, 144, pp: 2419-2439. (\*)

#### 7. *The Impact of Fixed Costs on Consumption and Portfolios*

- Grossman, A., and G. Laroque, (1990) “Asset Pricing and Optimal Portfolio Choice in the Presence of Illiquid Durable Consumption Goods,” **Econometrica**, Vol. 58, No. 1 (January), pp: 25-51.
- Abel, A., J. Eberly, and S. Panageas, (2007), “Optimal Inattention to the Stock Market,” **American Economic Review**, 97(2), pp: 244-249. (\*)
- Alvarez, F and F. Lippi, (2013), “The Demand for Liquid Assets Under Uncertain Lumpy Expenditures,” **Journal of Monetary Economics**, Volume 60, Issue 7, October 2013, Pp: 753–770.
- Alvarez, F., L. Guiso and F. Lippi, (2012), “Durable Consumption and Asset Management with Transactions and Observation Costs,” **American Economic Review**, Vol. 102, No. 5, pp:2272-2300.
- Abel, A., J. Eberly and S. Panageas, (2013) “Optimal Inattention to the Stock Market with Information Costs and Transaction Costs,” **Econometrica**, Vol. 81, No. 4 (July), pp: 1455–1481.

#### 8. *Capital Structure and Industry Equilibrium*

- Miao, J. (2005), “Optimal Capital Structure and Industry Dynamics,” **The Journal of Finance**, Vol. LX, No. 6, pp: 2621-2259.
- Hackbarth, D., Miao, J. and E. Morellec, (2006), “Capital Structure, Credit Risk, and Macroeconomic Conditions,” **Journal of Financial Economics**, 82 (2006), pp: 519-550.
- Novy-Marx, R, (2007), “An Equilibrium Model of Investment Under Uncertainty,” **Review of Financial Studies**, (2007) 20 (5): 1461-1502.

#### 9. *Macro Models with Financial Sectors*

- Basak, S. and D. Cuoco, (1998), “An Equilibrium Model with Restricted Stock Market Participation,” *The Review of Financial Studies*, Vol. 11, No. 2, pp: 309-341. (\*)
- Brunnermeier, and Y. Sannikov, (2014), “A Macroeconomic Model with a Financial Sector,” **American Economic Review**, 104(2): 379-421. (\*)
- He, Z. and A. Krishnamurty, (2014), “A Macroeconomic Framework for Quantifying Systemic Risk,” working paper.
- Brunnermeier, M., T. Eisenbach, and Y. Sannikov (2012), “Macroeconomics with Financial Frictions: A Survey,” in **Advances in Economics and Econometrics: Tenth World Congress of the Econometric Society**. Vol. 2, , ed. Daron Acemoglu, Manuel Arellano and Eddie Dekel, 3{94.Cambridge University Press, Cambridge, UK.
- Golosov, M and R. E. Lucas, (2007), “Menu Costs and Phillips Curves,” **Journal of Political Economy**, Vol. 115, No. 2, April 2007. (\*)

#### 10. *Principal Agent Models*

- Sannikov, Yuliy, (2008), “A Continuous-Time Version of the Principal Agent Problem,” **Review of Economic Studies**, Vol. 75, pp: 957-984. (\*)
- DeMarzo, P. and Y. Sannikov, 2006, “Optimal Security Design and Dynamic Capital Structure in a Continuous-Time Agency Model,” **The Journal of Finance**, Vol. LXI, No. 6, pp: 2681-2724. (\*)
- Philippon, T. and Y. Sannikov, 2007, “Real Options in a Dynamic Agency Model, with Applications to Financial Development, IPOs, and Business Risk,” NBER working paper No 13584. (\*)
- Grenadier, S. and N. Wang, 2005, “Investment Timing, Agency and Information,” **Journal of Financial Economics**, Vol. 75, pp: 493-533.
- He, Z. (2011), “A Model of Dynamic Compensation and Capital Structure,” **Journal of Financial Economics**, Vol 100, pp: 351–366.

11. *Strategic Experimentation.*

- Bolton, P. and C. Harris, (1999), “Strategic Experimentation,” **Econometrica**, Vol. 67, NO. 2, pp: 349-374.
- Keller G. and S. Rady, (2009), “Strategic Experimentation with Poisson Bandits,” working paper.
- Fryer, R. and P. Harms, (2013), “Two-Armed Restless Bandits with Imperfect Information: Stochastic Control and Indexability,”

12. *Search Models* (to be completed)

- Moscarini, G., (2005), “Job Matching and the Wage Distribution,” **Econometrica**, Vol. 73, No. 2, pp: 481–516. (\*)
- Prat, J., (2006), “Job Separation Under Uncertainty and the Wage Distribution,” **The B.E. Journal of Macroeconomics**, Vol 6, No 1
- Alvarez, F. and R. Shimer, (2011), “Search and Rest Unemployment,” *Econometrica*, Vol. 79, No. 1, pp: 75–122. (\*)
- Alvarez, F. and R. Shimer, (2011), “Unions and Unemployment,” working paper