

BUS 35907
Winter 2023

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TOPICS IN DYNAMIC ASSET PRICING

Course Description

This course has two main objectives: First, to bring students closer to the frontier of research in asset pricing. Topics include complete and incomplete markets equilibrium models, heterogeneous agents' models, learning and uncertainty, differences of opinion and asymmetric information, inequality, politics and asset pricing, and so on.

The second objective of the course is to teach students how to write coherent research papers: The main assignments will be three research ideas, that students (in small groups) have to develop into research papers. Each of these papers will have to include an introduction with motivation, a model and its solution (tips will be provided), the discussion of the model's predictions, and their empirical tests. In addition, students will have to turn in a final paper on a topic of their choice. By the end of the course, students will learn what it takes to write a paper, the type of assumptions sometimes we must make to solve models, when we need to resort on numerical methodologies to obtain results and model predictions, and, finally, how we confront the models' predictions with empirical data.

Required Material

- a) Teaching Notes, distributed throughout the course and available on Canvas (see <http://pietroveronesi.org/teaching/BUS35907.htm> for older versions)

Optional Material

- b) Darrell Duffie, *Dynamic Asset Pricing Theory*, Princeton University Press, 2001
- c) John Cochrane, *Asset Pricing*, Princeton University Press, 2001
- d) John Campbell, *Financial Decisions and Markets: A Course in Asset Pricing*, Princeton University Press, 2017.
- e) John Y. Campbell, Andrew W. Lo, A. Craig MacKinlay, *The Econometrics of Financial Markets*, Princeton University Press, 1997, ISBN 0-691-04301-9
- f) Campbell John and Luis Viceira "Strategic Asset Allocation" Oxford University Press 2002

- g) Kerry Back “Asset Pricing and Portfolio Choice Theory”, Oxford University Press, 2010
- h) Robert C. Merton, *Continuous Time Finance*, Blackwell, Cambridge, 1990, ISBN: 0-631-18508-9.
- i) Ioannis Karatzas and Steven E. Shreve, *Brownian Motion and Stochastic Calculus*, Springer-Verlag, New York, 1991
- j) Ioannis Karatzas and Steven E. Shreve, *Method of Mathematical Finance*, Springer-Verlag, New York, 1998, ISBN: 0-387-94839-2
- k) Oksendal Bernt, *Stochastic Differential Equations*, Springer, ISBN 3-540-63720-6
- l) Albert N. Shiryaev, *Essentials of Stochastic Finance: Facts, Models, Theory*, World Scientific, Singapore, 1999, ISBN: 981-02-3605-0
- m) James D. Hamilton: *Time Series Analysis*, Princeton University Press, 1994, ISBN 0-691-04289-6

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Review Sessions

No review sessions.

Course Requirements

One of the objectives of this course is to teach students on how to do research. During the 11 weeks, I will then assign three research topics. Students, in small groups of no more than three students per group, will have to develop a full fledged paper for each topic. This typically include: (a) Introduction with motivation; (b) the development of a model; (c) its solution and prediction; (d) calibration or test of the model’s implications.

In addition to these three big homework assignments, there will be weekly mini assignments focused on the Teaching Notes. They will mainly be questions to make sure some “missing steps” are in fact covered. They will be written on the board on a weekly basis and solutions must be turned in on the following week. This is individual effort (no group work).

Finally, students will have to take a midterm around week 7, and develop an original final paper on a topic of choice.

Grading

Problem sets, mini weekly problem sets, midterm, class participation and final paper will count 30%, 10%, 30%, 5% and 25% of the final grade, respectively.

Honor Code

Students in my class are required to adhere to the standards of conduct in the Chicago Booth Honor Code and the Chicago Booth Standards of Scholarship. The Chicago Booth Honor Code also requires students to sign the following Honor Code pledge. "I pledge my honor that I have not violated the Honor Code during this examination," on every examination, as well as on the term project.

Course Outline and Readings

Please, note the following class schedule is **preliminary** and could be (in fact, will be) subject to modifications. ➔ indicates readings that are covered in the Teaching Notes and should be done before class starts. Most articles are available in JSTOR.

A. FOUNDATIONS (REVIEW)

Review of Probability Theory and Stochastic Calculus

➔ TN 0 - 2005. (Not covered in class. Read on your own. We will cover important concepts as we go along)

Karatzas and Shreve (1991), Chapter 1.
Oksendal B. Chapter 1 – 5.
Duffie, Appendix D, E,

Review of Standard Dynamic Models with Complete Markets

State Price Densities and No Arbitrage

➔ TN1

➔ Duffie, Ch. 5 and 6
Karatzas and Shreve (1999), Ch 1.

Optimal Consumption and Portfolio Choice: Dynamic Programming and the Martingale Approach

- ➔ TN1,
- ➔ TN1_Addendum
- ➔ Duffie, Chapter 9

Campbell, John and Luis Viceira ``Strategic Asset Allocation'' Oxford University Press, 2002

➔ Merton R. (1971), "Optimum Consumption and Portfolio Rules in a Continuous Time Model," *Journal of Economic Theory*, 3, 373-413.

➔ Cox J. and C-f. Huang (1989) "Optimal Consumption and Portfolio Choices when Asset Prices Follow a Diffusion Process," *Journal of Economic Theory*, 49, 33-83.

Cox J. and C-f. Huang (1989) "A Variational Problem Arising in Financial Economics," *Journal of Mathematical Economics*, 20, 465-487.

Karatzas I., J.P. Lehoczky and S.E. Shreve (1987) "Optimal Portfolio and Consumption Decisions for a 'Small Investor' on a Finite Horizon," *SIAM Journal of Control and Optimization* 25, 1557-1586.

Jun Liu (2007) "Portfolio Selection in Stochastic Environments", *Review of Financial Studies*, v20, n1, 1-39, January.

Jun Liu and Allan Timmerman (2013) "Optimal Convergence Trade Strategies", *Review of Financial Studies*, forthcoming.

Aggregation, Equilibrium Prices, and Returns

- ➔ TN 2
- ➔ Duffie, Chapter 10.

Merton R. (1973) "An Intertemporal Capital Asset Pricing Model" *Econometrica*, 41, 867-888.

Breeden D. (1979) "An Intertemporal Asset Pricing Model with Stochastic Consumption and Investment Opportunities" *Journal of Financial Economics*, 7, 265-296.

Duffie D. and C-f. Huang (1985) "Implementing Arrow-Debreu Equilibria by Continuous Trading of a Few Long-Lived Securities" *Econometrica*, 53, 1337-1356.

Huang C-f. (1987) "An Intertemporal General Equilibrium Asset Pricing Model: The Case of Diffusion Information" *Econometrica*, 55, 117-142.

Cox J., J. Ingersoll and S. Ross (1985) "An Intertemporal General Equilibrium Model of Asset Prices" *Econometrica* 53, 363-385.

Goldstein R. and F. Zapatero (1996) "General Equilibrium with constant relative risk aversion and Vasicek interest rates" *Mathematical Finance*, 6, 331-340.

B. APPLICATIONS TO DYNAMIC ASSET PRICING

Learning, Uncertainty and Asset Pricing

➔ TN 3

Pastor and Veronesi (2009) "Learning in Financial Markets", (survey article) *Annual Review of Financial Economics*

Detemple, J. (1986) "Asset pricing in a production economy with incomplete information" *Journal of Finance*, 41, 383-392

Dothan M. and D. Feldman (1986) "Equilibrium Interest Rates and Multiperiod Bonds in a Partially Observable Economy," *Journal of Finance*, 41, 369-382.

Gennotte G. (1986) "Optimal portfolio choice under incomplete information" *Journal of Finance*, 41, 733-746.

Feldman D. (1989) "The term structure of the interest rates in a partially observable economy" *Journal of Finance*, 44, 789-812

Detemple J. (1991) "Further results on asset pricing with incomplete information" *Journal of Economic Dynamics and Control*, 15, 425-454

David A. (1997) "Fluctuating confidence in stock markets: Implications for returns and volatility" *Journal of Financial and Quantitative Analysis*, 32, 427-462

Veronesi P. (1999) "Stock market overreaction to bad news in good times: A rational expectations equilibrium model" *Review of Financial Studies*, 12,

➔ Veronesi P. (2000) “How does information quality affect stock returns?” *Journal of Finance*, 55, 2, 807-837

Brennan M. and Y. Xia (2001) “Stock Price Volatility and the Equity Premium,” *Journal of Monetary Economics*.

➔ Xia Y. (2001) “Learning about Predictability” *Journal of Finance* 56, 205-246, February

Johnson Tim (2004), Dispersion of Beliefs and the Cross-Section of Expected Returns, *Journal of Finance*.

➔ David A. and P. Veronesi (2013) “What Ties Return Volatilities to Price Valuations and Fundamentals?” *Journal of Political Economy*.

David A. and P. Veronesi (2014) “Option prices with uncertain fundamentals” *Review of Financial Studies*.

➔ Pastor L. and P. Veronesi (2003) “Stock Valuation and Learning about Profitability”, *Journal of Finance*.

Miao J, and N. Ju, (2012), Ambiguity, Learning, and Asset Returns, *Econometrica* 80 (2012), 559-591

Learning, Uncertainty and Bubbles

➔ TN 3 (still)

Abreu and Brunnermeier (2003) “Bubbles and Crashes”, *Econometrica*.

Abreu and Brunnermeier (2002) “Synchronization risk and delayed arbitrage,” *Journal of Financial Economics*, Volume 66, Number 2-3, p.341-360, (2002)

➔ Scheinkman and Xiong (2003) “Overconfidence and Speculative Bubbles” *Journal of Political Economy*

Pastor L. and P. Veronesi (2006) “Was There a NASDAQ Bubble in the Late 1990s?” *Journal of Financial Economics*,

➔ Pastor L. and P. Veronesi (2009) “Technological Revolutions and Stock Prices”, *American Economic Review*.

Government and Asset Prices

➔ TN 4

➔ Baker, Scott, Nick Bloom, and Steve Davis (2016) “Measuring Economic Policy Uncertainty”, *Quarterly Journal of Economics*

Belo, Gala, and Li (2012), “Government Spending, Political Cycles and the Cross Section of Stock Returns”, *Journal of Financial Economics*

Brogaard J. and A. Detzel (2015) “The Asset Pricing Implications of Government Economic Policy Uncertainty”, *Management Science*.

Croce, M. H. Kung, T. Nguyen and L. Schmid, (2013) “Fiscal Policies and Asset Prices.” *Review of Financial Studies*.

Gao, P. and X. Qi “Political Uncertainty and Public Financing Costs: Evidence from United States Gubernatorial Elections and Municipal Bond Markets” Working Paper.

Pastor L. and P. Veronesi (2012) “Uncertainty about Government Policy and Stock Prices”, *Journal of Finance*.

➔ Pastor L. and P. Veronesi (2013) “Political Uncertainty and Risk Premia ”, *Journal of Financial Economics*.

➔ Kelly, Pastor, and Veronesi (2016) “The Price of Political Uncertainty: Evidence from the Options Market”. *Journal of Finance*.

➔ Pastor L. and P. Veronesi (2020) “Political Cycles and Stock Returns”, *Journal of Political Economy*.

Santa-Clara, Pedro, and Rossen Valkanov, (2003), “The presidential puzzle: Political cycles and the stock market,” *Journal of Finance* 58, 1841–1872.

➔ Snowberg, Erik, Justin Wolfers, and Eric Zitzewitz, 2007, “Partisan impacts on the economy: Evidence from prediction markets and close elections,” *The Quarterly Journal of Economics*, 122, 807–829.

Heterogeneity

➔ TN 5

Heterogeneous Preferences

Dumas, B. 1989. Two-person dynamic equilibrium in the capital market. *Review of Financial Studies* 2:157–88.

Garleanu N. and S. Panageas, 2015, Young, Old, Conservative, and Bold: The Implications of Heterogeneity and Finite Lives for Asset Pricing. *Journal of Political Economy*

➔ Longstaff F. and J. Wang (2012) Asset Pricing and the Credit Market, *Review of Financial Studies*, 25, 11, 3169 – 3215

➔ Santos, T. and P. Veronesi (2021) Leverage, *Journal of Financial Economics*.

➔ Veronesi (2021) Heterogeneous households under uncertainty. Working paper.

Wang, J. 1996. The term structure of interest rates in a pure-exchange economy with heterogeneous investors. *Journal of Financial Economics* 41:75–110

Differences of Beliefs

Detemple J. and S. Murphy (1994) “Intertemporal asset pricing with heterogeneous beliefs” *Journal of Economic Theory* 62, 294-320

Basak S. (1999) “A Model of Dynamic Equilibrium Asset Pricing with Heterogeneous Beliefs” *Journal of Economic Dynamics and Control*, 24, 63-95.

Zapatero F. (1998) “Effects of financial innovation on market volatility when beliefs are heterogeneous” *Journal of Economic Dynamics and Control*, 22, 597-626.

➔ Basak S. and Croitoru B (2000). “Equilibrium mispricing in a capital market with portfolio constraints” *RFS*, 13, 3, Fall, 715-748

➔ Atmaz A. and S. Basak (2018) “Belief Dispersion in the Stock Market”, *Journal of Finance*

Heterogeneity and Inequality

➔ Pastor L. and P. Veronesi (2020) “Inequality Aversion, Populism, and the Backlash against Globalization”, *Journal of Finance*

➔ Kogan L., D. Papanikolaou, and N. Stoffman (2020) “Left behind: Creative Destruction, Inequality, and the Stock Market”, *Journal of Political Economy*

Asymmetric Information

Kyle P. (1985) “Continuous Auction and Insider Trading” *Econometrica*, 53, 1315-1335.

Back K. (1992) “Insider Trading in Continuous Time,” *Review of Financial Studies*, 5, 3, 387-409.

➔ Wang J. (1993) “A Model of Intertemporal Asset Prices Under Asymmetric Information,” *Review of Economic Studies*, 60. 249-282

Back K. (1993) “Asymmetric Information and Options” *Review of Financial Studies*, 6, 435-472

He H. and J. Wang (1995) “Differential Information and Dynamic Behavior of Stock Trading Volume,” 8, 4, 919-972.

Back K, H. Cao and G. Willard (2000) Imperfect Competition among Informed Traders, *Journal of Finance*, 55, 5..

Incomplete Markets and Frictions

➔ TN 6

Karatzas and Shreve (1999), Chapter 6.

➔ Chabakauri G. (2013) “Dynamic Equilibrium with Two Stocks, Heterogeneous Investors, and Portfolio Constraints”, *Review of Financial Studies*.

Constantinides, G. (1986) “Capital Market Equilibrium with Transaction Costs,” *Journal of Political Economy*, 94, 842-862.

He H. and N.D. Pearson (1991) "Consumption and Portfolio Choices with Incomplete Markets and Short-Sale Constraints: The Infinite-Dimensional Case," *Journal of Economic Theory*, 54, 259-305.

He H. and D.M. Modest (1995) “Market Frictions and Consumption-Based Asset Pricing,” *Journal of Political Economy*, 103, 94-117.

➔ Cuoco D. (1997) "Optimal Consumption and Equilibrium Prices with Portfolio Constraints and Stochastic Income," Journal of Economic Theory, 72, 33-73.

Detemple J. and S. Murthy (1997) "Equilibrium asset pricing and no-arbitrage with portfolio constraints" Review of Financial Studies, 10, 4, 1133-1174.

Vayanos D. (1998) "Transaction Costs and Asset Prices: A Dynamic Equilibrium Model," Review of Financial Studies, 11, 1-58.

Applications of incomplete market settings

Longstaff F. and Jun Liu (2000) "Losing money on arbitrage: Optimal portfolio choice in markets with arbitrage opportunities" Review of Financial Studies.

➔ Basak S. and D. Cuoco (1998) "An equilibrium model with restricted stock market participation" Review of Financial Studies, 11, 309-341.

Shapiro A. (2001) "The Investor Recognition Hypothesis in a Dynamic General Equilibrium: Theory and Evidence" Review of Financial Studies

Cuoco D. and R. Kaniel (2011) "Equilibrium Prices in the presence of Delegated Portfolio Management," Journal of Financial Economics.

Kondor P. and R. Kaniel (2012) "The Delegated Lucas Tree", Review of Financial Studies.

C: ADDITIONAL TOPICS (if time permits)

Fixed Income Securities and the Macroeconomy

Piazzesi (2005), "Bond Yields and the Federal Reserve", Journal of Political Economy, Volume 113, Issue 2, pp. 311-344.

Ang and Piazzesi (2003) "A No-Arbitrage Vector Regression of Term Structure Dynamics with Macroeconomic and Latent Variables", Journal of Monetary Economics, Volume 50, Issue 4, May 2003, pp. 745-787.

Ang, Piazzesi, and Wei (2006) “What does the yield curve tell us about GDP growth?”, *Journal of Econometrics* , 131, pp. 359-403.

Moench (2008) “Forecasting the Yield Curve in a Data-Rich Environment: A No-Arbitrage Factor-Augmented VAR Approach” *Journal of Econometrics*, Vol. 146 No. 1, September 2008

Multiple Assets, Labor Income and Market Clearing Conditions

➔ Menzly L., T. Santos and P. Veronesi (2004), “Explaining Predictability”, *JPE*

➔ Santos T. and P. Veronesi (2005) “Labor Income and Predictable Stock Returns,” *Review of Financial Studies*

➔ Cochrane J., F. Longstaff and P. Santa Clara (2004) “Two Trees” Working paper

Longstaff F. and M. Piazzesi (2005) Corporate Earnings and the Equity Premium" *JFE*

Conditional models and the explanation of the cross-section of stock returns

Lettau M. and S. Ludvigson (2000) “Resurrecting the (C)CAPM,” *Journal of Political Economy*, forthcoming

Hansen L., J. Heaton and N. Li (2004) “Consumption strikes back?” Working paper

Heaton J. and D. Lucas (2000) “Portfolio Choice and Asset Prices: The Importance of Entrepreneurial Risk” *Journal of Finance*, 55, 3, 1163-1198.

Lustig and Van Nieuwerburgh (2004), “Housing Collateral, Consumption Insurance and Risk Premia: an Empirical Perspective” forthcoming *Journal of Finance*

Parkett J. and C. Julliard (2005), “Consumption Risk and the Cross-Section of Expected Returns,” *JPE*, forthcoming.

Piazzesi, Schneider and Tuzel (2004) "Housing, consumption, and asset pricing", Working paper

Investments and Equilibrium Returns

➔ Jerman U. (1998) "Asset Pricing in Production Economies" JME

Berk J., R. Green and V. Naik (1999) "Optimal Investment, Growth Options and Security Returns" Journal of Finance, 54,5.

➔ Gomes J., L. Kogan and L. Zhang (2003) "Equilibrium Cross-Section of Returns," JPE

➔ Pastor L. and P. Veronesi (2005) "Rational IPO Waves" Journal of Finance.

Various Preferences

Recursive Utility

Epstein L. and S. Zin (1989) "Substitution, Risk Aversion and the Temporal Behavior of Consumption and Asset Returns: A Theoretical Framework" Econometrica, 57, 937-969.

➔ Epstein L. and S. Zin (1991) "Substitution, Risk Aversion and the Temporal Behavior of Consumption and Asset Returns: An Empirical Analysis" Journal of Political Economy, 99, 263-286.

➔ Duffie D. and Epstein L. (1992) "Asset Pricing with Stochastic Differential Utility," Review of Financial Studies, 5, 3, 411-436

➔ Campbell, Chacko, Rodriguez and Viceira "Strategic Asset Allocation in a Continuous Time VAR Model, Journal of Economic Dynamics and Control (2005).

Habit Formation

Constantinides G. (1990) "Habit formation: A resolution of the equity premium puzzle" Journal of Political Economy, 104, 2, 519-543

➔ Detemple J. and F. Zapatero (1991) "Asset Prices in an Exchange Economy with Habit Formation" Econometrica, 59, 6, 1633-1657

➔ Campbell J. and J. Cochrane (1996) “By force of habit: A consumption-based explanation of aggregate stock market behavior” *Journal of Political Economy*, 107

➔ Chan Y.L. and L. Kogan (2002) “Catching Up with the Joneses: Heterogeneous Preferences and the Dynamics of Asset Prices” *JPE*

Other Preference Specifications

Barberis N., M. Huang and J. Santos (2000) “Prospect Theory and Asset Prices,” *Quarterly Journal of Economics*, Forthcoming.

Bakshi G. and Z. Chen (1996) “The spirit of capitalism and stock market prices” *American Economic Review*, 86, 1, 133-157.

Equilibrium with Endogenous Default

Alvarez and Jerman (2000) “Efficiency, Equilibrium and Asset Pricing with Risk of Default,” *Econometrica*, 68, 4, 775-798.

Alvarez and Jerman (2001) “Quantitative Asset Pricing Implications of Endogenous Solvency Constraints”, *Review of Financial Studies*, 14, 1117-1152.

Hanno Lustig (2002) “The Market Price of Aggregate Risk and the Wealth Distribution” *University of Chicago Working Paper*.

Dynamic Asset Allocation Strategies

➔ Duffie, Chapter 9

➔ Campbell, John and Luis Viceira “Strategic Asset Allocation” Oxford University Press, 2002

➔ Merton R. (1971), "Optimum Consumption and Portfolio Rules in a Continuous Time Model," *Journal of Economic Theory*, 3, 373-413.

Cox J. and C-f. Huang (1989) "Optimal Consumption and Portfolio Choices when Asset Prices Follow a Diffusion Process," *Journal of Economic Theory*, 49, 33-83.

Cox J. and C-f. Huang (1989) " A Variational Problem Arising in Financial Economics," Journal of Mathematical Economics, 20, 465-487.

Karatzas I., J,P Lehocsky and S.E. Shreve (1987) "Optimal Portfolio and Consumption Decisions for a 'Small Investor' on a Finite Horizon," SIAM Journal of Control and Optimization 25, 1557-1586.

Ambiguity

Hansen L.P., T. J. Sargent and T. D. Tallarini, "Robust Permanent Income and Pricing," The Review of Economic Studies, 66, 1999.

Cagetti, L.P. Hansen, T.J. Sargent and N. Williams, (2002) "Robustness and Pricing with Uncertain Growth," Review of Financial Studies

➔ Chen and Epstein (2002) "Ambiguity, Risk, and Asset Returns in Continuous Time" Econometrica

➔ Maenhout (2003) "Robust Portfolio Rules and Asset Pricing", Review of Financial Studies (forthcoming)

➔ R. Uppal and T. Wang (2003), "Model Misspecification and Underdiversification," Journal of Finance 58.6, 2465-2486.

Epstein and Schneider (2004): Learning under Ambiguity, Working paper

Intermediated Asset Pricing

Adrian, Ettula, Muir "Financial Intermediaries, and the Cross Section of Asset Returns" Journal of Finance, forthcoming

Brunnermier and Sannikov: A Macroeconomic Model with a Financial Sector, AER (forthcoming)

He and Krishnamurthy: Intermediary Asset Pricing, AER, 2013

He and Kirshnamurthy: A Model of Capital and Crisis, ReStud, 2012

Rare Events (but not only Rietz and Barro)

Barro R. (2007) "Rare Disasters and Asset Markets in the Twentieth Century," Quarterly Journal of Economics, August 2006.

Goetzman, Ingersoll and Ross (1997) “Survival” Journal of Finance

Gabaix : Ten puzzles. QJE

Wachter J. (forthcoming) “Can time-varying risk of rare disasters explain aggregate stock market volatility?” Journal of Finance.

Du Du (2011) “General equilibrium pricing of options with habit formation and event risks,” Journal of Financial Economics

Chen, Joslin, and Tran (2012), "Rare Disasters and Risk Sharing with Heterogeneous Beliefs" Review of Financial Studies, 2012, 25(7): 2189-2224

Liquidity and Asset Prices

Brunnermeier, Markus K., and Pedersen Lasse Heje : Market Liquidity and Funding Liquidity, , Review of Financial Studies, Volume 22, Number 6, p.2201-2238, (2009)

Acharya and Pedersen “Liquidity Based Asset Pricing” , JFE

Structural Credit Risk Model

➔Duffie and Lando (2001) “Term Structure of Credit Spreads with Incomplete Accounting Information", Econometrica 2001, Volume 69: 633-664.”

➔Chen Hui (2010) "Macroeconomic Conditions and the Puzzles of Credit Spreads and Capital Structure" Journal of Finance, 65(6): 2171-2212

➔Chen, Collin-Dufresne, and Goldstein (2008), “On the Relation between Credit Spread Puzzles and the Equity Premium Puzzle," RFS.