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**The Wharton School**  
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Empirical Research in Finance  
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FNCE-934, Spring 2011

## **I. OBJECTIVES**

This course is intended for PhD students in finance and related fields. It is designed to teach students how to conduct empirical research and quantitative analysis in the broadly defined area of asset pricing. This year I will try to provide a mix of asset pricing topics, various numerical methods for solving models, and applications in the intersection of asset pricing and corporate finance. By the end of this semester students should:

1. have a comprehensive understanding of research in empirical asset pricing (i.e., be familiar with the topics, the methodologies used, classic papers and recent contributions to frontier topics).
2. have acquired the skills to analyze, conduct and present original research in empirical asset pricing.

## **II. Prerequisite**

To register for or audit FNCE 934 it is highly recommended that you have completed FNCE 911 and FNCE 921.

## **III. Lectures**

Lectures:           Mondays   Room location SH-DH: 2301   1:30-4:30 PM

## **IV. Communication**

You are always welcome to drop by my office or set an appointment. Email will be my main mode of communication. I will use email to send assignments and administrative notices to all registered students. The official information source for FNCE 934 is my course web site:

<http://savage.wharton.upenn.edu/TEACHING/FNCE934.html>

It holds all lecture notes and assignments that I hand out. I will hand out a login and password to my web site. Please keep this information to yourself.

## **V. Time Requirement**

This is a demanding course, irrespective of whether you are registered or just auditing. The average student can expect to spend at least 15 hours per week outside of class with assigned readings, problem sets/projects and reviewing lectures.

## VI. Grading

The following components make up your course grade:

- **Assignments (40pts):**

About every other week I will assign fairly lengthy homework. These assignments can be worked in groups but should be handed in individually. You should hand in the assignments at or before the beginning of class on the day they are due. You should start working on the assignments as soon as possible. Some of the assignments could take several days to complete. Under no circumstances will I accept late homework.

The assignments are designed to help you understand the material, digest the assigned papers that I do not cover in class, and familiarize yourself with empirical research. Many problems will require the use of computers. You must know or quickly learn a statistical programming language. I recommend that you use Matlab, Gauss, although other software packages like SAS, EVIEWS may work. Of course, you may be a hard-core programmer and use C, C++, Fortran, or the more user friendly Fortran90.

- **Referee Reports, Presentation & Participation (30pts):**

In some of the weeks that you are not working on an assignment, you will have to write a referee report on a paper I will distribute in class. Each referee report should be no longer than four pages. Depending on the ultimate size of the class, I may assign different papers to different students. You will present in class an executive summary of *one* of the reports.

The referee reports extend your knowledge of the literature and give you an idea of the empirical and methodological questions current research focuses on. Perhaps more important, they teach you to form an opinion about whether a piece of research is outstanding or only mediocre. You will not be graded on whether your opinion agrees with mine, but rather on how you come to your conclusions and how well you back them up. It is quite possible that I will change my mind after reading your report.

To make this class work, everyone has to work through every assigned reading before class. I expect that you become an active participant in the class. You should ask questions, raise issues, contribute your knowledge, and challenge the opinions of others, including mine. This class will be a lot more enjoyable for everyone if you participate and therefore will reward people who do.

- **Final Exam (30pts):**

There will be a final examination. Since life after graduate school is an open-book experience, it will be open books/material – thus the point is not memorization.

## VII Topics

1. Introduction
  - Households, Firms, and Markets
  - Equilibrium
2. Market Return Predictability and PV-relations
  - Risk Premia

- Time Varying Returns, Predictability
  - Long Horizon Predictability
  - VARs
  - Volatility
3. Consumption Based Asset Pricing
- Stylized Facts
  - SDF
  - Equity Premium and Risk Free rate Puzzles
  - HJ Bound
  - Habits
  - Long Run Risks
  - Disasters
  - 'Exotic Preferences'
  - Heterogeneous beliefs
  - Learning
4. Other Asset Markets
- Cross-Section of returns (FF, V-G, etc.)
  - Term Structure
  - FX, credit spreads, Options
  - Momentum and Accruals
5. Solution methods
- Approximate Analytical
  - Polynomial and Quadrature methods
  - Discrete Grid
6. Estimation
- GMM
  - EMM
  - SMM
  - MLE
  - Particle Filter
  - Cointegration
7. Investment, Production, and Asset Pricing
- Corporate Investment
    - Tobin's Q and User Cost
    - Lumpy Investment
  - Production based Asset Pricing
    - Asset Pricing in presence of frictions
    - Financing Frictions
    - Cross section of Returns
  - Capital Structure
    - Background: Dynamic Trade-off Models, Costly Rebalancing

- Leverage, investment, and returns
- Financial Sector, Frictions, and the Macroeconomy
  - Financing & Banking
  - Liquidity

## VII. Texts & Readings

You should have access to the following books:

- Campbell, J., A. Lo, and A.C. MacKinlay, 1997, *The Econometrics of Financial Markets*, Princeton University Press.
- Cochrane, J., 2001, *Asset Pricing*, Princeton University Press.
- Hamilton, J., 1994, *Time Series Analysis*, Princeton University Press.
- Judd Kenneth, 1998, *Numerical Methods in Economics*
- Singleton Kenneth *Empirical Dynamic Asset Pricing*, Princeton University Press.

Other books that you might find useful for this course are:

- Duffie, D., *Dynamic Asset Pricing Theory*.
- Gilks, W., S. Richardson, and D. Spiegelhalter, *Markov Chain Monte Carlo in Practice*.
- Gouriéroux, C., and J. Jasiak, 2001, *Financial Econometrics: Problems, Models, and Methods*, Princeton University Press.
- Judge, G., et al., *The Theory and Practice of Econometrics*.
- Karlin, S., and H. Taylor, *A First Course in Stochastic Processes*.
- Ljungqvist, Lars, and Thomas J. Sargent, 2004, *Recursive Macroeconomic Theory*, 2nd edition, The MIT Press.
- Marimon, Ramon, and Andrew Scott, 1999, *Computational Methods for the Study of Dynamic Economies*, Oxford University Press.
- Merton, R., *Continuous-Time Finance*.

This course will evolve throughout the semester. Here is a preliminary reading list for the semester.

The approach is to list important topical areas within the overall literature and a sample of papers from each area. The choice of articles is a mix of classic papers and recent contributions so that you can trace the evolution of the research in each area to the present. The lectures will be devoted to discussing the genesis of important ideas in the literature and concurrent developments that stimulated many of the ideas. I will also try to critically evaluate the findings and research designs employed in past research. The main objective is to offer competing hypotheses and interpretations for the observed findings, and to present unresolved issues and directions for future research.

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# 1 Introduction

1. Campbell, John Y., 2000, Asset Pricing at the Millennium, *Journal of Finance*, LV (4), 1515-1567.

## 2 Return Properties

### 2.1 Return Predictability

1. Campbell, J., and R. Shiller, 1988, The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors, *Review of Financial Studies* 1, 195-228.
2. Campbell, Lo, and MacKinlay, 1997, Chapter 7.
3. Hodrick, R., 1992, Dividend Yields and Expected Stock Returns: Alternative Procedures for Inference and Measurement, *Review of Financial Studies* 5, 357- 386.
4. Lewellen, Jonathan W., 2004, Predicting Returns with Financial Ratios, *Journal of Financial Economics*, 74 (2), 209 235.
5. Stambaugh, Robert F., 1999, "Predictive Regressions, *Journal of Financial Economics*," 54, 375–421.

*More recent contribution to this debate*

6. Ang A. and Bekaert G. Is Predictability there?, RFS.
7. Boudoukh Jacob Matthew Richardson and Robert Whitelaw, 2008, "The Myth of Long Horizon Predictability," *Review of Financial Studies*.
8. Cochrane John, 2008, "The Dog that did not Bark: A Defense of Return Predictability", *Review of Financial Studies*.
9. Welch Ivo and Amit Goyal, 2008, "A Comprehensive Look at the Empirical Performance of Equity Premium Prediction," *Review of Financial Studies*.

### 2.2 Volatility Models

1. Bollerslev, T., 1986, Generalized Autoregressive Conditional Heteroscedasticity, *Journal of Econometrics* 31, 307-327.
2. Bollerslev, T., R. Chou, and K. Kroner, 1980, ARCH Modeling in Finance: A Review of the Theory and Empirical Evidence, *Journal of Econometrics* 52, 5-59.
3. Hamilton, J., 1989, A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle, *Econometrica* 57, 357-384.

## **2.3 Conditional Means and Variances**

1. Bollerslev, T., R. Engle, and J. Wooldridge, 1988, A Capital Asset Pricing Model with Time Varying Covariance, *Journal of Political Economy* 96,116-131.
2. French, K., W. Schwert and R. Stambaugh, 1987, Expected Stock Returns and Volatility, *Journal of Financial Economics* 19, 3-30.
3. Lawrence R. Glosten, Ravi Jagannathan, David E. Runkle, 1993, "On the Relation between the Expected Value and the Volatility of the Nominal Excess Return on Stocks," *The Journal of Finance*, Vol. 48, No. 5, pp. 1779-1801
4. Whitelaw, R., 1994, Time Variations and Covariations in the Expectation and Volatility of Stock Market Returns, *Journal of Finance* 49, 515-541.

## **3 Consumption Based Asset Pricing Models**

### **3.1 Preferences & Equilibrium Endowment**

1. Hansen, L.P., and R. Jagannathan, 1991, Implications of Security Market Data for Models of Dynamic Economies, *Journal of Political Economy* 99, 225 – 262.
2. Hansen, L.P., and K. Singleton, 1982, Generalized Instrumental Variables Estimation of Nonlinear Rational Expectation Models, *Econometrica* 50, 1269 – 1286.
3. Lucas Robert Jr., 1978, "Asset Prices in an Exchange Economy", *Econometrica*, 46, 1429-1446.
4. Mehra, R., and E. Prescott, 1985, The Equity Premium: A Puzzle, *Journal of Monetary Economics* 15, 145 – 161.

### **3.2 Habits**

1. Abel, Andrew B., 1990, Asset prices under habit formation and catching up with the Joneses, *American Economic Review* 80, 38–42.
2. Campbell, John Y., and John H. Cochrane, 1999, By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior, *Journal of Political Economy*, 107, 205 - 251.
3. Constantinides, George, 1990, Habit Formation: A Resolution of the Equity Premium Puzzle, *Journal of Political Economy* 98, 519 – 543.

### **3.3 Long Run Risks**

1. Bansal, Ravi, and Amir Yaron, 2004, "Risk for the Long Run: A Potential Resolution of Asset Pricing Puzzles," *Journal of Finance*, 59(4), 1481-1509,
2. Bansal, Ravi, Dana Kiku, and Amir Yaron, 2010, "Long Run Risks: Estimation and Inference".
3. Bansal Ravi, Khatacharian Varoujan, and Amir Yaron, "Interpretable Asset Markets?", *European Economic Review*. 49, April 2005: 531-560.



4. Epstein, L., and S. Zin, 1989, Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: An Empirical Analysis, *Journal of Political Economy* 99, 263-286.

### **3.4 Exotic Preferences & Learning**

1. Backus Dave, Brian Routledge, Stan Zin, 2004, Exotic preferences for macroeconomists, NBER Macroannual.
2. Hansen and Sargent: Robustness-book
3. Hansen Lars Peter and Thomas Sargent, Fragile beliefs and the price of uncertainty, 2010, *Quantitative Economics*, first volume.
4. Pietro Veronesi How Does Information Quality Affect Stock Returns? *Journal of Finance* , 55, 2, April 2000.
5. Ai Hengjie, " Information about Long-Run Risk: Asset Pricing Implications, forthcoming *Journal of Finance*
6. Lubos Pastor and Pietro Veronesi "Stock Valuation and Learning about Profitability", *Journal of Finance* , 58, 5, October 2003.

## **4 Cross-section of Returns: ICAPM, Beta and SDF Methods**

### **4.1 Cross section of returns**

1. Revisit Fama/French
2. Bansal R. Dittmar R. and C. Lundblad 2005, "Consumption, Dividends, and the Cross-Section of Equity Returns," *Journal of Finance*.
3. Berk, Jonnathan, 2000, Sorting out Sorts, *Journal of Finance*, 55 (1), 407-427.
4. Campbell, Lo, and MacKinlay, 1997, Chapter 6.
5. Campbell, John and Vuolteenaho, Tuomo, 2004, Bad Beta, Good Beta. *American Economic Review* 94:1249-1275.
6. Cochrane Chapters 14-16.
7. Fama, Eugene F., and Kenneth R. French, 1992, The Cross-Section of Expected Stock Returns, *Journal of Finance*, 47, 427-465.
8. Fama, Eugene F., and Kenneth R. French, 1995, Size and Book-to-Market Factors in Earnings and Returns, *Journal of Finance*, 50, 131-155.
9. Fama, Eugene F., and Kenneth R. French, 1996, Multifactor Explanations of Asset Pricing Anomalies, *Journal of Finance*, 51, 55-84.
10. Jagannathan, Ravi, and Zhenyu Wang, 1996, The Conditional CAPM and the Cross-Section of Expected Returns, *Journal of Finance*, 51, 35-4.

11. Lettau, Martin, and Sydney Ludvigson, 2001, Resurrecting the (C)CAPM: A Cross-Sectional Test When Risk Premia Are Time-Varying, *Journal of Political Economy*, 109 (6), 1238-1287.
12. Menzly Lior, Tano Santos, Pietro Veronesi, 2004, The Time Series of the Cross Section of Asset Prices, *Journal of Political Economy*.
13. Jonathan Lewellen, and Stefan Nagel, and Jay Shanken, 2007, A Skeptical Appraisal of Asset Pricing Tests, working paper Stanford.
14. Jagannathan, Ravi and Zhenyu Wang, 2002, Empirical evaluation of asset pricing models: A comparison of the SDF and Beta methods, *Journal of Finance* 57, 2337 – 2367.

## 4.2 Term Structure

1. Singleton — Chapters 12 and 13
2. Ang, Andrew, and Monika Piazzesi, 2002, A No-Arbitrage Vector Autoregression of Term Structure Dynamics with Macroeconomic and Latent Variables, *Journal of Monetary Economics*,
3. Campbell John Adi Sunderam, Luis Viceira, 2009, "Inflation Bets or Deflation Hedges: The Changing Risks of Nominal Bonds".
4. Cochrane, John, and Monika Piazzesi, 2004, Bond Risk Premia, *American Economic Review*.
5. Duffie, D., and R. Kan, 1996, A Yield-Factor Model of Interest Rates, *Mathematical Finance* 6, 379-406.
6. Eraker Bjorn, "Affine General Equilibrium Models", 2006, Working paper, Duke University.
7. Fama, Eugene F., and Robert R. Bliss, 1987, The Information in Long-Maturity Forward Rates, *American Economic Review*, 77, 680692.

## 4.3 Momentum, Payouts & Accruals

1. Asness Clifford, Tobias J. Moskowitz, and Lasse H. Pedersen, 2009, Value and Momentum Everywhere, NBER working paper.
2. Conrad, Jennifer, and Gautam Kaul, 1998, An Anatomy of Trading Strategies, *Review of Financial Studies*, 11 (3), 489519.
3. Grundy, Bruce D., and J. Spencer Martin, 2001, Understanding the Nature of the Risks and the Source of the Rewards to Momentum Investing, *Review of Financial Studies*, 14 (1), 2978.
4. Jegadeesh, Narasimhan, and Sheridan Titman, 2002, Cross-Sectional and Time-Series Determinants of Momentum Returns, *Review of Financial Studies*, 15 (1), 143157.
5. Liu, Laura Xiaolei, and Lu Zhang, 2008, Momentum profits, factor pricing, and macroeconomic risk, *Review of Financial Studies* 21 (6), 2417-2448.
6. Moskowitz, Tobias J., and Mark Grinblatt, 1999, Do Industries Explain Momentum? *Journal of Finance*, LIV (4), 12491290.
7. Sloan, Richard G., 1996, Do Stock Prices Fully Reflect Information in Accruals and Cash Flows About Future Earnings? *The Accounting Review* 71 (3), 289315.

#### 4.4 Other Assets

1. Bansal Ravi and Ivan Shaliatovich "Long-Run Risks Explanation of Predictability Puzzles in Bond and Currency Markets"
2. Bahrma Horjat, Lars Kuehn and Ilya Strebulaev "The Levered Equity Risk Premium and Credit Spreads: A Unified Framework"
3. Benzoni Luca, Pierre Colin Dufrense, and Robert Goldstein "Can Standard Preferences Explain the Prices of Out-of-the-Money S&P 500 Put Options?"
4. Hui Chen " Macroeconomic Conditions and the Puzzles of Credit Spreads and Capital Structure",
5. Drechsler Itamar and Amir Yaron "What's Vol Got To Do With It", 2011, January, Review of Financial Studies.
6. Buraschi Andrea and Fabio Trojani The Joint Behaviour of Credit Spreads, Options, and Equity Returns when Investors Disagree.
7. Buraschi Andrea and A Jilstov, Model Uncertainty and Option Markets with Heterogeneous Agents , The Journal of Finance.
8. Borri, N. and Verdelhan, A. (2008) Sovereign Risk Premia, unpublished working paper, Boston University.

### 5 Econometric & Solution Methods

1. Judd, Chapter 10,

#### 5.1 Financial Econometric Methods

1. Gallant, R., and G. Tauchen, 1996, Which Moments to Match, *Econometric Theory* 12, 657–681.
2. Cochrane John , *Asset Pricing*, Chapter 20.
3. Hansen, L.P., 1982, Large Sample Properties of Generalized Method of Moments Estimators, *Econometrica* 50, 1029–1054.
4. Lee, B., and B. Ingram, 1991, Simulation Estimation of Time-Series Models, *Journal of Econometrics* 47, 197–205.
5. Ogaki, M., 1993, Generalized Method of Moments: Econometric Applications, in *Handbook of Statistics*, Vol. 11.
6. Tauchen G. and R. Hussey, 1991, "Quadrature-Based Methods for Obtaining Approximate Solutions to Nonlinear Asset Pricing Models," *Econometrica*, Volume 59, No. 2, pp. 371–396.
7. Bansal, R., A. R. Gallant, and G. Tauchen (2007): Rational Pessimism, Rational Exuberance, and Asset Pricing Models,.*Review of Economic Studies*, 74, 1005.1033.
8. Chen, X., J. Favilukis, and S. C. Ludvigson (2007): An Estimation of Economic Models with Recursive Preferences,.Unpublished paper, New York University.

9. Add Particle filter and MLE

## **6 Production Based Asset Pricing**

### **6.1 Corporate Investment**

1. Abel, Andrew and Eberly, Janice, A Unified Model of Investment Under Uncertainty, American Economic Review, 84, 1369-84, 1994. ” Caballero,
2. Ricardo, and Engel, Eduardo, Explaining Investment Dynamics in U.S. Manufacturing: A Generalized (S, s) Approach, Econometrica 67, 783-826, 1999. ”
3. Dixit, Avinash, and Pindyck, Robert, Ch. 5, 6, 10 and 11, Investment Under Uncertainty, Princeton University Press, 1994. ”
4. Gomes Joao ”Financing Investment, American Economic Review, 91, 1263-85, 2001.
5. Fazzari, Steven, Hubbard, R. Glenn, and Petersen, Bruce, Financing Constraints and Corporate Investment, Brookings Papers on Economic Activity, 1, 141-206, 1988.”
6. Hayashi, Fumio, Tobin’s Marginal Q and Average Q: A Neoclassical Interpretation, Econometrica, 50, 213-224, 1982.
7. Whited Toni, ”Debt, Liquidity Constraints and Corporate Investments: Evidence from Panel Data, Journal of Finance, 47, 1425-1460,1992.

### **6.2 Capital Structure**

1. Fischer, Edwin, Heinkel, Robert, and Zechner, Josef, Dynamic Capital Structure Choice: Theory and Tests, Journal of Finance 44, 19-40, 1989. ”
2. Goldstein, Robert, Ju, Nengjiu, and Leland, Hayne, An EBIT Based Model of Dynamic Capital Structure, Journal of Business 74, 483-512, 2001. ”
3. Hennessy, Christopher, and Whited, Toni, Debt Dynamics, Journal of Finance, 2005. ”
4. Leland, Hayne, Corporate Debt Value, Bond Covenants, and Optimal Capital Structure, Journal of Finance 49, 1213-1252, 1994.
5. Gomes Joao and Lukas Schmid Levered Returns.
6. Miao, Jiunjin, Capital Structure and Industry Dynamics, Journal of Finance 2005. ”
7. Strebulaev, Ilya, Do Tests of Capital Structure Theory Mean What They Say? working paper, Stanford University, 2005. ”

### **6.3 Production and Returns**

1. Berk, Jonathan B, Richard C. Green and Vasant Naik, 1999, Optimal Investment, Growth Options and Security Returns, Journal of Finance, 54, 1153 - 1607.
2. Carlson, Murray, Adlai Fisher, and Ronald Giammarino, 2004a, Corporate Investment and Asset Price Dynamics: Implications for the Cross-Section of Returns, forthcoming, Journal of Finance.

3. Cochrane, J., 1991, Production-Based Asset Pricing and the Link between Stock Returns and Economic Fluctuations, *Journal of Finance* 46, 207-234.
4. Dow, James, Gary Gorton, and Arvind Krishnamurthy, 2002, Corporate Finance and the Term Structure of Interest Rates, Working Paper, Kellogg School of Management, Northwestern University.
5. Gomes, Joao F., Leonid Kogan, and Lu Zhang, 2002, Equilibrium Cross-Section of Returns, *Journal of Political Economy*, Forthcoming.
6. Jermann, Urban J., 1998, Asset Pricing in Production Economies, *Journal of Monetary Economics*, 41, 257 - 275.
7. Gomes, Joao F., Amir Yaron, and Lu Zhang, 2002a, Asset Prices and Business Cycles with Costly External Finance, *Review of Economic Dynamics*, Forthcoming.
8. Kuehn Lars-Alexander, 2007, "Asset Pricing with Real Investment Commitment", Working Paper UBC.
9. Lochstoer Lars, 2006, Long-Run Risk through Consumption Smoothing, Working Paper, LBS.
10. Zhang, Lu, 2005, The Value Premium, *Journal of Finance*