

University of Pennsylvania
The Wharton School
Professor Nick Roussanov

Empirical Methods in Finance

FNCE-921, Spring 2023

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I. OBJECTIVES

This course is designed to provide students with foundational knowledge of empirical methods in finance. The course will cover time-series and cross sectional properties of asset returns and tests of asset pricing models. The course will introduce and examine various empirical/econometric methods by focusing on classical and relevant recent papers. First-year PhD students in finance: please note that the material from this class will be included in the prelims!

II. Recommended Prerequisite

FNCE 911 and Econometrics 705 or Stats 520.

III. Lectures

Lectures: Thursdays SHDH 2401 or SHDH 116 3:30-6:30 PM

IV. Communication

The official information source for FNCE 921 is the class canvas. It will hold all lecture notes and assignments, and I will use it to make announcements.

V. Grading

The following components make up your course grade:

- **Assignments (25pts):**

I will assign approximately 4 assignments. These assignments can be worked in groups of no more than 2 students. Group assignments should be submitted as a single submission. Assignments should be handed in 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/most problems will require the use of computers. You must know or quickly learn a statistical programming language. I recommend that you use Matlab, R, Gauss, although other software packages like SAS, STATA, EVIEWS may work. Of course, you may be a hard-core programmer and use C, C++, Fortran, or the more user friendly Fortran90; Python is particularly popular these days and might be a good choice if you or are interested in learning a new language (and you are welcome to use it if you already know it). I will only use Matlab for my solutions, however.

- **Presentation & Participation (20pts):**

Each student will be required to provide an in class presentation of a paper from a subset of the papers listed on the reading list (the ones marked without a star). These presentation will be during class and most will be toward the end of the semester. Further details regarding what a presentation constitute will be given later in the course. However, students should present the questions, summarize the model/findings, and then provide critique and link to the literature. Allocations will be on a first come first serve basis—so the earlier you approach me the higher the likelihood you'll present the paper you want.

- **Quiz (15pts):**

There will be a quiz examination of one hour. It will constitute one or two questions regarding the class material. I will announce the exact date later in the semester.

- **Paper/Final Project (40pts):**

I'd like you to make use of the tools you acquired throughout the class or commit to acquire more tools. This should be done by either proposing and executing your own research project or taking an existing paper and essentially replicating it and possibly extending its analysis in some way (data/question/methodology). All papers/projects should be discussed with me ahead of time. The paper/project **proposal** which will outline the question, theory/methodology, and data utilized should be submitted by April 15th. The completed paper/project can be part of or constitute all of your first year paper but **can not** serve as a topic/project for another class and should be submitted by August 15th—that gives you time to work on and complete the project after the prelims.

VI. Class Participation

Finally, 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. I will use participation as a way to increase your grade in cases in which your grade is at the borderline.

VII. Texts & Readings

You should have access to the following books:

- Campbell, J., 2018, *Financial Decisions and Markets: A Course in Asset Pricing*, Princeton University Press.
- 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.
- Singleton, K., 2006, *Empirical Dynamic Asset Pricing: Model Specification and Econometric Assessment*, Princeton University Press.

In addition, I will ask you to watch some of the videos from John Cochrane's Asset Pricing course on YouTube, they are a great way to review some of the "background" material or get a brief introduction into some of the topics that we will discuss in depth, or from a somewhat different perspective.

This course will evolve throughout the semester. Here is a preliminary reading list for the semester. I realize this is a long list that provides you with an extensive (albeit still partial) exposure to the literature. Note, however, that I designated a ★ around a small subset of the list for the papers that are required reading. Some of the more recent topics will be updated as we go on as the literature evolves.

1 Introduction

1. ★ CLM (chapters 1-2)
2. ★ Campbell, John Y., 2000, Asset Pricing at the Millennium, *Journal of Finance*, LV (4), 1515–1567.
3. Fama, Eugene F., 1991, Efficient Capital Markets: II, *Journal of Finance*, XLVI (5), 1575–1617.

Recommended

1. Barberis, Nicholas, and Richard Thaler, 2002, A Survey of Behavioral Finance, In *Handbook of the Economics of Finance*, Forthcoming.
2. Cochrane, John H., 2005, Financial Markets and the Real Economy, NBER Working paper, W11193.
3. Cochrane, John H., 2001, Asset Pricing, Chapters 20 and 21

2 Return Properties

2.1 Basics

1. CLM Chapter 1-2
2. ★ Fama, E., and K. French, 1988a, “Permanent and Temporary Components of Stock Prices,” *Journal of Political Economy*, 96, 246-273.
3. Lo, Andrew W., and A. Craig MacKinlay, 1990, “Data-Snooping Biases in Tests of Financial Asset Pricing Models, *Review of Financial Studies*, 3, 431 – 468.
4. Poterba J. and L Summers (1998), ”Mean reversion in Stock prices: Evidence and implications,” *Journal of Financial Economics*, 22, 27-59.
5. Shiller R. J. and P. Perron (1985), “Testing for random walk hypothesis: Power versus frequency of observations,” *Economic Letters*,18, 381-386.
6. Working H. (1960) “Note on the correlation of first difference of averages in random chain,” *Econometrica*, 28, 916-918.

2.2 Return Predictability

1. ★ CLM Chapter 7
2. ★ 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.
3. ★ Hodrick, R., 1992, “Dividend Yields and Expected Stock Returns: Alternative Procedures for Inference and Measurement,” *Review of Financial Studies* 5, 357- 386.

4. ★ Stambaugh, Robert F., 1999, “Predictive Regressions, *Journal of Financial Economics*,” 54, 375–421.

More recent contributions to this debate

5. Ang A. and Bekaert G. “Is Predictability there?,” 2007, *The Review of Financial Studies*, Volume 20, Issue 3, 651–707.
6. Campbell, J., and R. Shiller, 1987, “Cointegration and Tests of Present Value Models,” *Journal of Political Economy* 95, 1062-1087.
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. ★ Cochrane John, 2011, “Presidential Address: Discount Rates,” *Journal of Finance*.
10. Lamont, Owen, 1998, “Earnings and Expected Returns, *Journal of Finance*,” 53, 1563 – 1587.
11. Lewellen, Jonathan W., 2004, Predicting Returns with Financial Ratios, *Journal of Financial Economics*, 74 (2), 209-235.
12. Welch Ivo and Amit Goyal, 2008, ”A Comprehensive Look at the Empirical Performance of Equity Premium Prediction,” *Review of Financial Studies*.
13. Larrain, B. and Moto Yogo, “ Does firm value move too much to be justified by subsequent changes in cash flow?” *Journal of Financial Economics*, 2008
14. Golez Benjamin and Peter Koudijs, 2016, “Four centuries of return predictability”, 2016, Stanford University.
15. Binsbergen, J. H. van, and R. S. J. Koijen, 2010, “Predictive regressions: A present-value approach.” *Journal of Finance* 65:1439–71.
16. Lettau Martin and Sydney Ludvigson, 2001, “Consumption, Aggregate Wealth and Expected Stock Returns,” *Journal of Finance*, LVI (3),815–849.
17. Cujean, J., and M. Hasler, 2017, “Why Does Return Predictability Concentrate in Bad Times? *The Journal of Finance*
18. Kelly, B., and S. Pruitt, 2013, “Market expectations in the cross-section of present values,” *The Journal of Finance*, 68:1721–1756.
19. Pástor, L., and R. F. Stambaugh, 2009, “Predictive systems: Living with imperfect predictors,” *The Journal of Finance* 64:1583–1628.
20. Gómez-Cram Roberto, 2018, ”Stock Return Predictability: Riding the Risk Premium,” Working paper, The Wharton School.

2.3 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, "New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle," *Econometrica* 57, 357-384.

Recommended

1. Engle, R., 1982, "Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of U.K. Inflation," *Econometrica* 50, 987-1008.
2. Nelson, D., 1991, "Conditional Heteroskedasticity in Asset Returns: A New Approach," *Econometrica* 59, 347-370.
3. Schwert, G.W., 1989, "Why Does Stock Market Volatility Change Over Time?," *Journal of Finance* 44, 1115-1153.

2.4 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.

Recommended

1. Campbell J. and Hentchell L. 1992, "No News is Good News: A Asymmetric changing Volatility in Stock Returns," *Journal of Financial Economics* 31, 281-318.
2. 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
3. Whitelaw, R., 1994, "Time Variations and Covariations in the Expectation and Volatility of Stock Market Returns," *Journal of Finance* 49, 515-541.

3 Asset Pricing Models: Euler Equations, Consumption Based 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.
5. ★ Hansen, Lars, John Heaton, Junghoon Lee, and Nikolai Roussanov, "Intertemporal substitution and risk aversion," *Handbook of econometrics* 6, 3967-4056
6. Abel, Andrew B., 1999, Risk premia and term premia in general equilibrium, *Journal of Monetary Economics* 43, 3–33.
7. Alvarez, Fernando, and Urban Jermann, "Using asset prices to measure the persistence of the marginal utility of wealth," *Econometrica*, 2005

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. ★ Frank Schorfheide, Dongho Song, and Amir Yaron, 2017, "Identifying Long Run Risks: A Bayesian Mix Frequency Approach," forthcoming *Econometrica*.
3. Bansal, Ravi, Dana Kiku, and Amir Yaron, 2010, "Long Run Risks: Estimation with Time Aggregation," *Journal of Monetary Economics*.
4. Bansal Ravi, Khatachtarian Varoujan, and Amir Yaron, "Interpretable Asset Markets?," *European Economic Review*. 49, April 2005: 531-560.
5. 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 Disasters

1. ★ Robert Barro "Rare Disasters, Asset Prices, and Welfare Costs," *American Economic Review*, March 2009.
2. Rietz, Thomas A., 1988, "The equity risk premium: A solution," *Journal of Monetary Economics* 22, 117–131.

3. Xavier Gabaix, "Gabaix, Xavier "Variable Rare Disasters: An Exactly Solved Framework for Ten Puzzles in Macro-Finance," Quarterly Journal of Economics, vol. 127(2), 2012, 645-700.
4. Wachter Jessica "Can time-varying risk of rare disasters explain aggregate stock market volatility?, forthcoming Journal of Finance
5. Bansal Ravi, Dana Kiku, Amir Yaron, 2010, Long-Run Risks, the Macroeconomy, and Asset Prices," American Economic Review

3.5 Heterogeneity and Incomplete Markets

1. ★ Constantinides, George M., and Darrell Duffie, 1996, "Asset pricing with heterogeneous consumers," Journal of Political Economy 104, 219–240.
2. Mankiw, N. Gregory, 1986, "The equity premium and the concentration of aggregate shocks," Journal of Financial Economics 17, 211–219.
3. Vissing-Jørgensen, Annette. "Limited Asset Market Participation and the Elasticity of Intertemporal Substitution." Journal of Political Economy, August 2002, 110(4), pp. 825–53.
4. Attanasio, Orazio, and Vissing-Jorgensen, "Stock-market participation, intertemporal substitution, and risk-aversion," 2003, American Economic Review 93 (2), 383-391
5. Attanasio, Orazio P.; Banks, James and Tanner, Sarah. "Assets Holding and Consumption Volatility." Journal of Political Economy, August 2002, 110(4), pp. 771–92.
6. Heaton, John C., and Deborah J. Lucas, 2000, 'Portfolio choice and asset prices: The importance of entrepreneurial risk," Journal of Finance 55, 1163–1198.
7. Grossman, S.J., Shiller, R.J., 1982. "Consumption correlatedness and risk measurement in economies with non-traded assets and heterogeneous information." J. Finan. Econ. 10, 195–210.
8. Storesletten, Kjetil, Christopher Telmer, and Amir Yaron, "Cyclical dynamics in idiosyncratic labor market risk," Journal of Political Economy 112, 2004; 695-717
9. Jacobs, Kris, 1999, "Incomplete markets and security prices: Do asset pricing puzzles result from aggregation problems?" Journal of Finance 54, 123–163.
10. Schmidt, Lawrence D. W., MIT Sloan Working Paper 5500-16. Cambridge, MA: MIT Sloan School of Management, March 2016.

4 Financial Econometric Methods

1. Cochrane John , Asset Pricing, Chapter 10, 11, 14.1-14.2.
2. Hamilton, James, Time Series Analysis
3. Kim, Chang-Jin and Charles Nelson, State-Space Models with Regime Switching, *Book*
4. Hansen, L.P., 1982, "Large Sample Properties of Generalized Method of Moments Estimators," Econometrica 50, 1029–1054.

5. Pakes, A., and Pollard. D. 1989. "Simulation and the asymptotics of optimization estimators." *Econometrica* 57(5):1027–57
6. Lee, B., and B. Ingram, 1991, "Simulation Estimation of Time-Series Models," *Journal of Econometrics* 47, 197–205.
7. Ogaki, M., 1993, "Generalized Method of Moments: Econometric Applications," in *Handbook of Statistics*, Vol. 11.
8. Gallant, R., and G. Tauchen, 1996, "Which Moments to Match," *Econometric Theory* 12, 657–681.
9. 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.
10. Duffie, Darrell, and Kenneth J Singleton, 1993, "Simulated moments estimation of Markov models of asset prices," *Econometrica* 61, 929-52.
11. Gourieroux, C, A Monfort, and E Renault, 1993, "Indirect inference," *Journal of Applied Econometrics*, 8.
12. Dridi, Ramdan, Alain Guay, and Eric Renault, 2007, "Indirect inference and calibration of dynamic stochastic general equilibrium models," *Journal of Econometrics* 136, 397 - 430.
13. Hansen, Lars P.; Heaton, John and Yaron, Amir. "Finite-Sample Properties of Some Alternative GMM Estimators." *Journal of Business and Economic Statistics*, July 1996, 14(3), pp. 262–80.

5 Cross-section of Returns: ICAPM, Beta Representation, and SDF Methods

5.1 Cross section of returns: Facts

1. ★ CLM – Chapters 5,6
2. ★ Cochrane Chapters 14-16.
3. ★ Fama, Eugene F., and Kenneth R. French, 1992, The Cross-Section of Expected Stock Returns, *Journal of Finance*, 47, 427–465.
4. ★ Fama, Eugene F., and Kenneth R. French, 1993, Common Risk Factors in the Returns on Stocks and Bonds," *Journal of Financial Economics*, 33, 3-56.
5. Fama, Eugene F., and Kenneth R. French, 1995, Size and Book-to-Market Factors in Earnings and Returns, *Journal of Finance*, 50, 131–155.
6. Fama, Eugene F., and Kenneth R. French, 1996, Multifactor Explanations of Asset Pricing Anomalies, *Journal of Finance*, 51, 55–84.
7. Berk, Jonathan, 1995, A Critique of Size-Related Anomalies, *Review of Financial Studies*, 8, 275–286.

5.2 Methods: SDF & Cross sectional Regressions

1. ★ Cochrane –Chapter 9.1, 8.3-8.4, 12.2-12.3
2. ★ Fama Eugene F., and J MacBeth, 1973, "Risk, Return and Equilibrium test", *Journal of Political Economy*, 91, 607-636.
3. ★ Gibbons, Michael R., Stephen A. Ross, and Jay Shanken, 1989, A Test of the Efficiency of a Given Portfolio, *Econometrica*, 57, 1121–1152.
4. Hansen, L.P., and R. Jagannathan, 1997, "Assessing Specification Errors in Stochastic Discount Factor Models," *Journal of Finance* 52, 557-590.
5. ★ Jagannathan, Ravi, and Zhenyu Wang, 1996, The Conditional CAPM and the Cross-Section of Expected Returns, *Journal of Finance*, 51, 3–54.
6. ★ 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.
7. Jonathan Lewellen, and Stefan Nagel, and Jay Shanken, 2010, A Skeptical Appraisal of Asset Pricing Tests, *Journal of Financial Economics*.
8. 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.
9. Lewellen, J., and S. Nagel, 2006, "The Conditional CAPM Does Not Explain Asset-Pricing Anomalies," *Journal of Financial Economics*, 82, 289-314.
10. Roussanov, N., "Composition of wealth, conditioning information, and the cross-section of stock returns," *Journal of Financial Economics* 111 (2), 352-380

Examining Cashflows

11. Bansal R. Dittmar R. and C. Lundblad 2005, "Consumption, Dividends, and the Cross-Section of Equity Returns," *Journal of Finance*.
12. Hansen Lars Peter, John Heaton, and Nan Li. Consumption Strikes Back?, 2011, *Journal of Political Economy*.
13. Menzly Lior, Tano Santos, Pietro Veronesi, 2004, The Time Series of the Cross Section of Asset Prices, *Journal of Political Economy*.
14. Davydiuk Tetiana, Scott Richard, Ivan Shaliastovich, and Amir Yaron, 2017, "How Risky is the U.S. Corporate Sector?", working paper, Wharton.

Recommended

1. ★ Berk, Jonathan, 1995, A Critique of Size-Related Anomalies, *Review of Financial Studies*, 8, 275–286.
2. Campbell, John and Vuolteenaho, Tuomo, 2004, Bad Beta, Good Beta. *American Economic Review* 94:1249-1275.

3. Daniel, Kent, and Sheridan Titman, 1997, Evidence on the Characteristics of Cross Sectional Variation in Stock Returns, *Journal of Finance*, 52, 1–33.
4. Fama, Eugene F., and Kenneth R. French, 1999, Value Versus Growth: The International Evidence, *Journal of Finance*, 53 (6), 1975–1999.
5. Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny, 1994, Contrarian Investment, Extrapolation, and Risk, *Journal of Finance*, XLIX (5), 1541–1578.
6. LaPorta, Rafael, Josef Lakonishok, Andrei Shleifer, and Robert Vishny, 1997, Good News for Value Stocks: Further Evidence on Market Efficiency, *Journal of Finance*, 52 (2), 859–874.
7. Jonathan Lewellen, and Stefan Nagel, 2006, “The Conditional CAPM Does Not Explain Asset Pricing Anomalies,” *Journal of Financial Economics*
8. Moskowitz Tobias, Chris Malloy, Annette Vising-Jorgensen, 2010, “Long run consumption risk of stockholders,” *Journal of Finance*,
9. Liew, Jimmy, and Maria Vassalou, 2000, Can Book-to-Market, Size, and Momentum Be Risk Factors That Predict Economic Growth? *Journal of Financial Economics*, 57, 221–245.

5.3 Cross Section: Arbitrage, Multifactor Models

1. CLM —Chapter 6
2. Cochrane Chapter 9.4, 12-16
3. ★ Chen, Nai-Fu, Richard Roll, and Stephen Ross, 1986, Economic Forces and the Stock Market, *Journal of Business*, 59, 3, 383–403.
4. Bansal, Ravi and Viswanathan, S. (1993), No-arbitrage and and arbitrage pricing: A new approach”, *Journal of Finance* 48, 1231 – 1262.
5. Ferson, Wayne E., and Campbell R. Harvey, 1999, Conditioning Variables And Cross-Section of Stock Returns, *Journal of Finance*, 54, 1325–1360.
6. Ferson Wayne, and Campbell R. Harvey, 1991, The Variation of Economic Risk Premiums, *Journal of Political Economy*, 99, 285–315.
7. Pastor L. and R.F. Stambaugh, 2003, Liquidity risk and expected stock returns, *Journal of Political Economy*, 111, 642-85.
8. Frazzini Andrea and Lasse Pederson, 2014, “Betting Against Beta,” *Journal of Financial Economics*, Volume 111, Issue 1, 1-25.
9. Ralph Koijen, Toby Moskowitz, Lasse Pedersen, and Evert Vrugt, 2016, “Carry” forthcoming *Journal of Financial Economics*.
10. Asness Cliff, Frazzini Andrea, and Lasse Pedersen, 2015, ”Quality Minus Junk”, SSRN
11. Fama Eugene and Kenneth French, 2015, A Five Factor Asset Pricing Model,” *Journal of Financial Economics*, Volume 116, Issue 1, 1-22.
12. Hou, Kewei, Chen Xue, and Lu Zhang, 2015, “Digesting anomalies: An investment approach,” *Review of Financial Studies* 28 (3), 650-70

13. Robert Stambaugh and Yu Yuan, 2017, “Mispricing Factors,” *Review of Financial Studies*, forthcoming.

5.4 New methods for big data: nonparametrics, machine learning, etc.

1. Freyberger, Joachim, Andreas Neuhierl, and Michael Weber. 2020. ” Dissecting Characteristics Nonparametrically.” *The Review of Financial Studies* 33 (5): 2326-2377. issn: 0893-9454. <https://doi.org/10.1093/rfs/hhz123>. <https://doi.org/10.1093/rfs/hhz123>.
2. Giannone, Domenico, Michele Lenza, and Giorgio E Primiceri. 2017. ” Economic Predictions with Big Data: The Illusion Of Sparsity.” *CEPR Discussion Papers*, <https://ideas.repec.org/p/cpr/ceprdp/12256.html>.
3. Gu, Shihao, Bryan Kelly, and Dacheng Xiu, 2020, Empirical asset pricing via machine learning, *The Review of Financial Studies* 33, 2223–2273
4. Giglio, Stefano, and Dacheng Xiu. 2021. ”Asset pricing with omitted factors.” *Journal of Political Economy* 129 (7): 1947-1990. issn: 1537534X. <https://doi.org/10.1086/714090>. <https://www.journals.uchicago.edu/doi/abs/10.1086/714090>.
5. Giglio, Stefano, Dacheng Xiu, and Dake Zhang. 2021. ” Test Assets and Weak Factors.” *SSRN Electronic Journal*, <https://doi.org/10.2139/ssrn.3768081>. <https://papers.ssrn.com/abstract=3768081>.
6. Lopez Lira, Alejandro, and Nikolai Roussanov, 2022. ”Do Common Factors Really Explain the Cross Section of Stock Returns?”
7. Dong, Xi, Yan Li, David E Rapach, and Guofu Zhou, 2022, ”Anomalies and the expected market return,” *The Journal of Finance* 77, 639–681
8. Chen, Qihui, Nikolai Roussanov, and Xiaoliang Wang, ”Semiparametric Conditional Factor Models: Estimation and Inference,” 2021.
9. Didisheim, Antoine, Shikun Ke, Bryan Kelly, and Semyon Malamud, ”Complexity for the Cross-Section,” *Swiss Finance Institute Research Paper*, 2022, (22-57).
10. Fan, Jianqing, Zheng Tracy Ke, Yuan Liao, and Andreas Neuhierl, ”Structural Deep Learning in Conditional Asset Pricing,” Available at SSRN 4117882, 2022.
11. Kelly, Bryan, Semyon Malamud, and Kangying Zhou, ”The Virtue of Complexity in Return Prediction,” *Swiss Finance Institute Research Paper*, 2021, (21-90).
12. More recent papers to be added later!

6 Other Asset Classes

6.1 Bonds and Term Structure of Interest Rates

1. ★ Singleton book — 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. ★ Cox John, Ingersoll John, and Stephan Ross, 1985, “A Theory of the Term Structure of Interest Rates”, *Econometrica*. 53: 385–407.
4. ★ Vasicek, O. ,1977,“An equilibrium characterization of the term structure”. *Journal of Financial Economics*. 5 (2): 177–188.
5. Bansal, R. and H. Zhou (2002). Term Structure of Interest Rates with Regime Shifts. *Journal of Finance* 57, 1997–2043.
6. ★ Cochrane, John, and Monika Piazzesi, 2004, Bond Risk Premia, *American Economic Review*.
7. Campbell, John Y., and Robert J. Shiller, 1991, Yield Spreads and Interest Rates: A Bird’s Eye View, *Review of Economic Studies*, 58, 495–514.
8. Bansal Ravi and Ivan Shaliastovich, 2009, ”A Long-Run Risks Explanation of Predictability Puzzles in Bond and Currency Markets
9. Dai Q. and K. Singleton, 2000, ”Analysis of Affine Term Structure Models,” *Journal of Finance*, Vol. LV, 1943-1978.
10. Fama, Eugene F., and Robert R. Bliss, 1987, The Information in Long-Maturity Forward Rates, *American Economic Review*, 77, 680–692.
11. Joslin, Scott, Marcel Priebisch and Ken Singleton, 2013, Risk Premiums in Dynamic Term Structure Models with Unspanned Macro Risks, *Journal of Finance*, forthcoming.
12. Duffee Gregory, 2018, “Expected inflation and other determinants of Treasury yields,” *Journal of Finance*.
13. Rudebusch Glenn and Eric T. Swanson, 2012, “The Bond Premium in a DSGE Model with Long-Run Real and Nominal Risks,” *American Economic Journal: Macroeconomics*, VOL. 4, NO. 1,105-43.
14. Kung Howard,2015, “Macroeconomic linkages between monetary policy and the term structure of interest rates. *Journal of Financial Economics*, Volume 115, Issue 1, 42-57.
15. Van Binsbergen, Jules, Wouter Hueskes, Ralph Koijen, and Evert Vrugt, 2013, Equity yields, *Journal of Financial Economics* 110, 503–519.
16. Ravi Bansal, Shane Miller, Amir Yaron, 2017, “Is The Term Structure of Equity Risk Premia Upward Sloping?” Working paper, Wharton.

6.2 Currencies and commodity futures

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9 Other Applications in Finance

1. Time permitting
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