

*** This syllabus is tentative and subject to change as needed.

Quantitative Finance

Period IV Spring 2020

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Office hours: T306, by appointment or after class

Times: Thursday, **13:15 - 14:45** and Friday, **10:15 - 11:45**

Location: U006, Ekonominaukio 1

Course Description

This course covers basic quantitative skills for analyzing financial data. This course reviews academic papers related to empirical asset pricing topics, such as behaviors of securities prices relative to the benchmark asset pricing models. This course also introduce some applications to quantitative analysis, such as the factor-based investing. By the end of the course, students will be familiar with academic findings on the empirical asset pricing; be familiar with basic quantitative methods for analyzing financial data; be able to implement those skills in the context of developing investment strategies.

Course Material

The main reference for this course will be the class slides, which will be posted on MyCourses. The readings and other materials will be also provided through MyCourses.

Prerequisites

Investment Management (28C00300) and Econometrics for Finance (28C00200), or equivalent courses. **Basic skills to manage financial data and conduct statistical analyses are required.**

Grading Policy

The final grade (0 – 5 scale) is based on total points (max 100 points); combining assignments (50 %) and exam (50 %) points. To pass the course, you have to get at least 40% of exam points, i.e. 20 points. Conditional on that, your final grade is based on the following scale:

$90 \leq x \leq 100$:	Final grade = 5
$80 \leq x < 90$:	Final grade = 4
$70 \leq x < 80$:	Final grade = 3
$60 \leq x < 70$:	Final grade = 2
$50 \leq x < 60$:	Final grade = 1
$0 \leq x < 50$:	Final grade = 0, Fail

In this course, cheating and/or plagiarism (such as copying assignments and/or case studies used in other course and/or from other students) will result in a score of zero on the assignments. For example, if two or more individuals (or groups) assignments are almost identical, ALL will get a zero score on the assignment. **Any types of cheating activities during the exams will result in, at a minimum, a grade of “0”.**

- For a late submission of an assignment, 50% of score for the assignment will be deducted.
- The attendance is not mandatory except your group presentation dates.

Individual Assignment (15%)

There will be **one** individual assignment. The assignments will contain exercises to apply quantitative skills to the financial data and replicate academic studies. It requires programming skills and basic understanding of econometrics in addition to academic knowledge covered by the lecture. For the individual assignment, you can discuss with other students about the algorithm and empirical methodologies but it is strictly **forbidden to ‘copy’** other’s works. Both results (or answers) and codes to generate the results should be submitted. The code should include comments explaining what this code line is doing in human language. Any programming language can be used. Detailed instructions will be announced later through MyCourses.

Group Works (35%)

There will be one group work; developing a quantitative investing strategy such as factor investing. A group can have four or less members. A group of four members is recommended. (The maximum number of members can be adjusted according to number of students enrolled in the class) Each member of a group is expected to motivate others to participate equally.

There will be two group tasks:

1. Short presentation of a key paper and project execution plan (5%)
2. Final presentation and report (30%)

A final report of maximum 15 pages and a final presentation of 20 minutes will be required. The presentation times can vary with size of class. The report should include various quantitative analyses on the developed strategy, such as back-testing, robustness checks, and risk analyses. It does not have to be a completely new strategy or factor. Showing capability of quantitative skills and developing logics for the strategy will be main criteria for the evaluation. Finding a new factor will be a huge plus if it is convincingly robust. Consider yourself as a quant and this report as a proposal to adopt or sell new quantitative investment strategy. Detailed instructions will be announced later through MyCourses.

Schedule and Contents

Note: Contents are tentative and are subject to change.

#1. Course Orientation and Introduction.

27.2, Thu, U006

#2. Evaluating asset returns: Time-Series vs. Cross-sectional tests.

28.2, Fri, U006

- Jensen, M. C., Black, F., & Scholes, M. S. (1972). The capital asset pricing model: Some empirical tests.
- Fama, E. F., & MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *Journal of political economy*, 81(3), 607-636.
- Roll, R. (1977). A critique of the asset pricing theory's tests Part I: On past and potential testability of the theory. *Journal of financial economics*, 4(2), 129-176.

- Chen, N. F., Roll, R., & Ross, S. A. (1986). Economic forces and the stock market. *Journal of business*, 383-403.
- Gibbons, M. R., Ross, S. A., & Shanken, J. (1989). A test of the efficiency of a given portfolio. *Econometrica: Journal of the Econometric Society*, 1121-1152.
- Ang, Andrew and Liu, Jun and Schwarz, Krista, Using Individual Stocks or Portfolios in Tests of Factor Models (October 10, 2017). Available at SSRN: <https://ssrn.com/abstract=1106463>

#3. Value Investing.

5.3, Thu, U006; ***Individual assignment will be uploaded. Group formation due date.***

- Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of financial economics*, 9(1), 3-18.
- Basu, S. (1983). The relationship between earnings' yield, market value and return for NYSE common stocks: Further evidence. *Journal of financial economics*, 12(1), 129-156.
- Bhandari, L. C. (1988). Debt/equity ratio and expected common stock returns: Empirical evidence. *The journal of finance*, 43(2), 507-528.
- Black, F., Jensen, M. C., & Scholes, M. (1972). The capital asset pricing model: Some empirical tests.
- Fama, E. F. (1991). Efficient capital markets: II. *The journal of finance*, 46(5), 1575-1617.
- Fama, E. F., & MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *Journal of political economy*, 81(3), 607-636.
- Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *the Journal of Finance*, 47(2), 427-465.
- Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of financial economics*, 33(1), 3-56.
- Fama, E. F., & French, K. R. (1996). Multifactor explanations of asset pricing anomalies. *The journal of finance*, 51(1), 55-84.
- Lakonishok, J., Shleifer, A., & Vishny, R. W. (1994). Contrarian investment, extrapolation, and risk. *The journal of finance*, 49(5), 1541-1578.
- Liew, J., & Vassalou, M. (2000). Can book-to-market, size and momentum be risk factors that predict economic growth?. *Journal of Financial Economics*, 57(2), 221-245.
- Rosenberg, B., Reid, K., & Lanstein, R. (1985). Persuasive evidence of market inefficiency. *The Journal of Portfolio Management*, 11(3), 9-16.
- Stattman, D. (1980). Book values and stock returns. *The Chicago MBA: A journal of selected papers*, 4(1), 25-45.
- Zhang, L. (2005). The value premium. *The Journal of Finance*, 60(1), 67-103.

#4. Momentum Investing.

6.3, Fri, U006

- Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of finance*, 52(1), 57-82.
- Daniel, K., & Moskowitz, T. J. (2016). Momentum crashes. *Journal of Financial Economics*, 122(2), 221-247.

- George, T. J., & Hwang, C. Y. (2004). The 52-week high and momentum investing. *The Journal of Finance*, 59(5), 2145-2176.
- Goyal, A., & Wahal, S. (2015). Is momentum an echo?. *Journal of Financial and Quantitative Analysis*, 50(6), 1237-1267.
- Grinblatt, M., & Han, B. (2005). Prospect theory, mental accounting, and momentum. *Journal of financial economics*, 78(2), 311-339.
- Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of finance*, 48(1), 65-91.
- Jegadeesh, N., & Titman, S. (2001). Profitability of momentum strategies: An evaluation of alternative explanations. *The Journal of finance*, 56(2), 699-720.
- Johnson, T. C. (2002). Rational momentum effects. *The Journal of Finance*, 57(2), 585-608.
- Novy-Marx, R. (2012). Is momentum really momentum?. *Journal of Financial Economics*, 103(3), 429-453.

Execution plan slides submission due dates (11.3)

#5. Quality Investing, Betting against Beta, and Q-factor Model

12.3, Thu, U006;

- Fama, E. F., and K. R. French. (2015). A five-factor asset pricing model. *Journal of Financial Economics* 116:1–22.
- Frazzini, A., & Pedersen, L. H. (2014). Betting against beta. *Journal of Financial Economics*, 111(1), 1-25.
- Hou, K., Xue, C., & Zhang, L. (2015). Digesting anomalies: An investment approach. *The Review of Financial Studies*, 28(3), 650-705.
- Novy-Marx, R. (2013). The other side of value: The gross profitability premium. *Journal of Financial Economics*, 108(1), 1-28.

#6. Group Presentation: Key Paper and Project Execution Plan

13.3, Fri, U006;

#7. Factor Investing: is it robust?

19.3, Thu, U006

- Chordia, T., Goyal, A., & Saretto, A. (2017). p-hacking: Evidence from two million trading strategies.
- Harvey, C. R., Liu, Y., & Zhu, H. (2016). ... and the cross-section of expected returns. *The Review of Financial Studies*, 29(1), 5-68.
- Harvey, C. R., & Liu, Y. (2018). Lucky factors. National Bureau of Economic Research working paper
- Harvey, C. R. (2017). Presidential address: the scientific outlook in financial economics. *The Journal of Finance*.
- Hou, K., Xue, C., & Zhang, L. (2017). A comparison of new factor models. National Bureau of Economic Research Working paper
- McLean, R. D., & Pontiff, J. (2016). Does academic research destroy stock return predictability?. *The Journal of Finance*, 71(1), 5-32.

#8. Investing Other Asset Market: Fixed Income Markets

20.3, Fri, U006

- Admati, A. R., & Pfleiderer, P. (1988). A theory of intraday patterns: Volume and price variability. *The Review of Financial Studies*, 1(1), 3-40.
- Campbell, T. C., Chichernea, D. C., & Petkevich, A. (2016). Dissecting the bond profitability premium. *Journal of Financial Markets*, 27, 102-131.
- Chordia, T., Goyal, A., Nozawa, Y., Subrahmanyam, A., & Tong, Q. (2017). Are capital market anomalies common to equity and corporate bond markets? An empirical investigation. *Journal of Financial and Quantitative Analysis*, 52(4), 1301-1342.
- Elton, E. J., Gruber, M. J., Agrawal, D., & Mann, C. (2001). Explaining the rate spread on corporate bonds. *the journal of finance*, 56(1), 247-277.
- Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of financial economics*, 33(1), 3-56.
- Gebhardt, W. R., Hvidkjaer, S., & Swaminathan, B. (2005). Stock and bond market interaction: Does momentum spill over?. *Journal of Financial Economics*, 75(3), 651-690.
- Hou, K., Xue, C., & Zhang, L. (2015). Digesting anomalies: An investment approach. *The Review of Financial Studies*, 28(3), 650-705.
- Jostova, G., Nikolova, S., Philipov, A., & Stahel, C. W. (2013). Momentum in corporate bond returns. *The Review of Financial Studies*, 26(7), 1649-1693.
- Lakonishok, J., Shleifer, A., & Vishny, R. W. (1994). Contrarian investment, extrapolation, and risk. *The journal of finance*, 49(5), 1541-1578.
- Vassalou, M., & Xing, Y. (2004). Default risk in equity returns. *The journal of finance*, 59(2), 831-868.

Individual assignment submission due date (22.3)

#9. Big Data and Machine Learning in Finance Research

26.3, Thu, U006

- This lecture note largely refers Mullainathan and Spiess (2017) and Professor Mullainathan's AFA Lecture 2017
- Banko, M., & Brill, E. (2001, July). Scaling to very very large corpora for natural language disambiguation. In *Proceedings of the 39th annual meeting on association for computational linguistics* (pp. 26-33). Association for Computational Linguistics.
- Blei, D. M., & Lafferty, J. D. (2006, June). Dynamic topic models. In *Proceedings of the 23rd international conference on Machine learning* (pp. 113-120). ACM.
- Choi, H., & Varian, H. (2012). Predicting the present with Google Trends. *Economic Record*, 88(s1), 2-9.
- Edge detection example: Yongha Kim, iO Studio Project Director
- Erel, I., Stern, L. H., Tan, C., & Weisbach, M. S. (2018). Selecting Directors Using Machine Learning (No. w24435). National Bureau of Economic Research.
- Gu, S., Kelly, B. T., & Xiu, D. (2018). Empirical Asset Pricing Via Machine Learning.
- Griffiths, T. L., & Steyvers, M. (2004). Finding scientific topics. *Proceedings of the National academy of Sciences*, 101(suppl 1), 5228-5235.
- Hoberg, G., & Phillips, G. (2016). Text-based network industries and endogenous product differentiation. *Journal of Political Economy*, 124(5), 1423-1465.
- James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). *An introduction to statistical learning* (Vol. 112). New York: springer.
- Kogan, S., Levin, D., Routledge, B. R., Sagi, J. S., & Smith, N. A. (2009, May). Predicting risk

from financial reports with regression. In Proceedings of Human Language Technologies: The 2009 Annual Conference of the North American Chapter of the Association for Computational Linguistics (pp. 272-280). Association for Computational Linguistics.

- Moritz, B., & Zimmermann, T. (2016). Tree-based conditional portfolio sorts: The relation between past and future stock returns.
- Pang, B., Lee, L., & Vaithyanathan, S. (2002, July). Thumbs up?: sentiment classification using machine learning techniques. In Proceedings of the ACL-02 conference on Empirical methods in natural language processing-Volume 10 (pp. 79-86). Association for Computational Linguistics.
- Vosen, S., & Schmidt, T. (2011). Forecasting private consumption: survey-based indicators vs. Google trends. Journal of Forecasting, 30(6), 565-578.

#10. Big Data and Machine Learning in Finance Research (cont.)

27.3, Fri, U006

Due date 1.4: the final presentation slides and final report submission

#11. Final Group Presentation 1

2.4, Thu, U006

#12. Final Group Presentation 2

3.4, Fri, U006

*** The reading list is tentative. The exam will cover all materials and papers that are appeared in the lecture notes. (i.e., the exam will be based on the lecture notes)