

PhD Course: Financial Econometrics

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Course Description

The course offers a comprehensive review of econometric methods used to study cross-sectional variation of asset returns. The course is intended for Ph.D. students in Economics and Finance. The course will cover 12 hours.

The course is centered on a factor asset pricing model framework, with asset returns following a linear structure with observable factors. After introducing the general setting, the three estimation approaches are introduced: (i) the cross-sectional regression (CSR) method, (ii) the maximum likelihood (ML) method, and (iii) the generalized method of moments (GMM). These methodologies are used to estimate factor models with a small number of assets. In this context, the two-pass procedure of Fama and MacBeth is introduced, and its N -consistency of the risk premium estimator is discussed. Furthermore, conditional factor models with a small number of assets will be presented. The framework will be extended to a setting considering a large number of assets. We focus on estimating conditional risk premia under increasing cross-sectional and time-series dimensions.

Course Outline

1. Introduction
2. Linear Beta pricing models, factors and characteristics
3. Estimation approaches: CRS estimator, ML, and GMM estimation approaches
4. Test of asset pricing restriction
5. Conditional factor models and large dimensional
6. Advances in Asset Pricing

Course Structure

The course is structured into six sections. A (non-exhaustive) list of the references is reported for each section. The course will be taught using part of the following published books:

- John Y. Campbell, 2018 “Financial decisions and markets: A course in asset pricing”, Princeton University Press.
- John Y. Campbell and Luis M. Viceira, 2002, “Strategic asset allocation: Portfolio choice for long-term investors”, Oxford University Press.
- John H. Cochrane, “Asset pricing”, 2005, Princeton University Press, revised edition.
- Kenneth J. Singleton, “Empirical dynamic asset pricing”, 2006, Princeton University Press.
- Linton O., “Financial Econometrics. Models and methods”, 2020, Cambridge University Press.

Section 1

1.1 Introduction: What is finance?

1.2 The framework of contemporary finance:

- (i) The SDF in complete markets
 - (ii) The SDF in incomplete markets
 - (iii) Properties of the SDF: risk premia, volatility bounds, and factor structure
- Campbell, John Y., 2014, “Empirical asset pricing: Eugene Fama, Lars Peter Hansen, and Robert Shiller”, *Scandinavian Journal of Economics* 116(3), 593–634.
 - Cochrane, John H., 2011, “Presidential address: Discount rates”, *Journal of Finance*, 66: 1047-1108.

Section 2

2.1 Linear beta pricing models

2.2 Factor selection

2.3 Traded and non-traded factors

- Chamberlain, G. and M. Rothschild, 1983, “Arbitrage, factor structure, and mean-variance analysis on large asset markets”, *Econometrica*, 51, 1281-1304.
- Connor, G. and R.A., Korajczyk, 1993, “A test for the number of factors in an approximate factor model”, *Journal of Finance*, 48, 1263-1291.
- Fama, E.F. and K.R. French, 1993, “Common risk factors in the returns on stocks and bonds”, *Journal of Financial Economics*, 33, 3-56.
- Fama, E.F. and K.R. French, 2015, “A five-factor asset pricing model”, *Journal of Financial Economics*, 116(1), 1–22.

- Harvey, C.R., Y. Liu, and H. Zhu, 2016, "... and the cross-section of expected returns", Review of Financial Studies, 29(1), 5–68.
- Jagannathan, R., Z. Wang, 2002, "Empirical evaluation of asset-pricing models: A comparison of the SDF and beta models", Journal of Finance, 57, 2337-2367.

Section 3

3.1 The cross-sectional regression methods

- (i) Description of the CSR method
- (ii) Consistency and asymptotic properties of the CSR estimator
- (iii) Fama-MacBeth variance estimator
- (iv) N -consistency of the CSR estimator

3.2 ML and GMM estimation approaches

- (i) ML estimator with non-traded and traded factors
- (ii) GMM estimator using the beta representation
- (iii) GMM estimator using the SDF representation
- Fama, E. F. and J. D. MacBeth, 1973, "Risk, return, and equilibrium: Empirical tests", Journal of Political Economy, 81, 607-36.
- Goyal A., "Empirical cross-sectional asset pricing: A survey", 2012, Financial Markets and Portfolio Management, 26(1), 3–38.
- Jagannathan, R., G. Skoulakis, and Z. Wang, 2009, "The analysis of the cross-section of security returns." Handbook of Financial Econometrics, 2, 73–134, North-Holland.

Section 4

4.1 Test of the asset pricing restrictions

- Gibbons, R., S. A. Ross and J. Shanken, 1989, "A test of the Efficiency of a Given Portfolio", Econometrica, 57, 1121-1152.
- Jagannathan, R., E. Schaumburg, and G. Zhou, 2010, "Cross-sectional asset pricing tests", Annual Review of Financial Economics, 2, 49-74.

Section 5

5.1 Conditional factor models

- (i) From unconditional to conditional factor models
- (ii) Inference in conditional models with unobservable factors
- (iii) Conditional factor models and large dimensional
- Ferson, W. E. and C.R. Harvey, 1991, "The variation of economic risk premiums", Journal of Political Economy, 99, 385-415.

- Ferson, W. E. and C.R. Harvey, 1999, “Conditioning variables and the cross-section of stock returns”, *Journal of Finance*, 54, 1325-1360.
- Gagliardini, P. and Ma, H., 2019, “Extracting Statistical Factors When Betas are Time-Varying”, Working paper.
- Gagliardini, P. and E. Ossola and O. Scaillet, 2020, “Estimation of large dimensional conditional factor models in finance”, *Handbook of Econometrics*, North Holland, 7A, 219-282.
- Kelly, B. T., Pruitt, S. and Su, Y., 2020, “Instrumented Principal Component Analysis”, Working paper.
- Jagannathan, R. and Z. Wang, 1996, “The conditional CAPM and the cross-section of expected returns”, *Journal of Finance*, 51, 3-53.
- Nagel, S. and K. Singleton, 2011, “Estimation and evaluation of conditional asset pricing models”, *Journal of Finance*, 66, 873-909.

Section 6

6.1 Advances in Asset Pricing

- (i) Standard/linear models, advanced econometrics;
- (ii) Machine Learning;
- (iii) Theoretical/equilibrium based.
- Kelly, B., Pruitt, S., and Su, Y. 2019, 2019: “Characteristics are covariances: A unified model of risk and return”, *Journal of Financial Economics*, 134, 501-524.
- Gu, S., Kelly, B., and Xiu, D., 2020, “Empirical asset pricing via machine learning”, *The Review of Financial Studies*, 33, 2223-2273.

Schedule

- Wed 03/12, 14:30-17:30, Cattolica University, via Olona 2, room OL 209.
- Wed 04/12, 14:30-17:30, Cattolica University, via Olona 2, room OL 209.
- Wed 10/12, 09:30-12:30, Bicocca University, Building U4, room 10.
- Wed 17/12, 10:30-13:30, Bicocca University, Building U6, room 35.

Grading Policy

The grade will be determined by a presentation and discussion of a recent paper on advanced asset pricing (a list of papers will be available at the beginning of the course). The date of discussions will be scheduled at the beginning of the course.