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Asset Pricing I: Standard Models

Course Objective

This course provides an in-depth treatment of selected topics of advanced capital market theory (asset pricing). The main topics are the following:

- We extend the standard one-period setting to multiperiod / intertemporal portfolio decisions and equilibrium.
- We get familiar with stochastic discount factors (SDF) and their economic interpretation. SDF approach provides a general, unifying framework for representing a wide range of asset pricing models (utility-based, macro-finance models, multifactor models, state preference), depending on the specification of the SDF. Moreover, the SDF-setting can be directly used for empirical tests.
- Special emphasis is put on the testing of multifactor asset pricing models: time-series and cross-sectional tests.
- The pricing of risks that are not traded on capital markets (non-traded risk) is a particular challenge for asset pricing, and is discussed as well.
- Pricing errors of asset pricing models can be either interpreted as model diagnostics or performance measures; we show how they can be put in relation to mean-variance efficiency tests (spanning tests).

Prerequisites

Standard textbook finance (portfolio theory, asset pricing, option pricing) and micro-economics are required to follow the course. The master lecture “Finance” (Lengwiler/ Zimmermann) is an ideal basis for following the course.

The mathematics we use does not exceed bachelor level, except for some stochastic calculus. The empirical part of the course requires some econometrics, in particular time-series analysis. Empirical exercises complement the lectures.

MATLAB will be used as the programming language, and a brief introduction is given at the beginning of the course. Please download MATLAB before the first day of the lecture from the University Basel asknet software shop. It is free for students. Link: <https://its.unibas.ch/de/aktuelles/softwareangebot-service-news/softwareangebot-fuer-studierende/>

Complimentary course

The students are motivated to take the course “Advanced Empirical Finance” by Tim Kröncke which is an excellent complement to this lecture.

Course Material

There is no official textbook, but complimentary reading is strongly encouraged. Handouts are put on ADAM in advance of the lectures; they include

- lecture notes (book chapter drafts) or slides
- reading guides
- exercises, data, codes
- occasionally, original papers

Individual notes are indispensable however. Check ADAM regularly:

https://adam.unibas.ch/goto_adam_crs_1453662.html

Background reading

The following papers are useful as background reading:

- **Goyal** (2012). “Empirical cross-sectional Asset Pricing: A Survey”. *Financial Markets and Portfolio Management* 26(1), pp. 3-38.
- **Lewellen/ Nagel/ Shanken** (2010). “A skeptical appraisal of asset pricing tests”. *Journal of Financial Economics* 96, pp. 175-194.

Overview

1 Introduction to Asset Pricing

We start with an overview of the topics covered by the field “asset pricing”, including an overview on the most important models which have been developed over the years, and some selected “puzzles”.

2 Intertemporal Asset Pricing

The CAPM one-factor one-period world is generalized by developing an intertemporal framework for portfolio decisions and equilibrium-based asset pricing. We start with a discrete time framework, and then introduce the continuous-time framework by Merton which allows for intertemporal hedging decisions. The C-CAPM is related to this framework.

3 Factor Pricing and Estimation

The major alternatives to equilibrium asset pricing are arbitrage-based factor pricing models. We present the basic structure of linear factor models, in particular how they are related to arbitrage pricing. We moreover discuss econometric testing issues, in particular the two-pass approach of Fama-MacBeth. We discuss GMM as an integrated framework that allows to estimate risk exposures and factor premiums jointly.

4 SDF Approach to Asset Pricing

The stochastic-discount factor approach is a very flexible way to represent asset pricing models; it is a fairly general framework for relating risk premiums to an underlying economic setting, in particular to (non-traded) economic risks. Moreover, it offers new approaches for empirical testing.

5 Asset Pricing Errors

Expected returns differ from actual returns which can be interpreted either as inadequate model specification or mispricing of assets (alpha). We discuss various ways to represent asset pricing errors or model diagnostics, their practical meaning and important test statistics (GRS, HJD, etc.).

Time Schedule (may be subject to minor changes)

| Date | Nr. | Topic | Instr |
|--------------|----------|---|---------|
| 1 line = 90' | | | |
| | 1 | Introduction to Asset Pricing | |
| Feb 1 | | Overview on Asset Pricing | HZI |
| Feb 1 | | Empirical Foundations and Introduction to MATLAB | MHU |
| | | | |
| | 2 | Intertemporal Asset Pricing | |
| Feb 1 | | Discrete time portfolio choice | HZI |
| Feb 2 | | Continuous time portfolio choice | HZI |
| Feb 2 | | <i>Cont., Application</i> | HZI/KBU |
| Feb 2 | | Intertemporal asset pricing | HZI |
| | | | |
| | 3 | Factor Pricing and Estimation | |
| Feb 3 | | Foundations of Factor Pricing Models | MHU |
| Feb 3 | | Testing Factor Pricing Models: Methodological Approaches | MHU |
| Feb 3 | | <i>Application: Empirical Estimation of Factor Pricing Models</i> | MHU |
| Feb 6 | | Introduction: Generalized Method of Moments (<i>with Application</i>) | MHU |
| Feb 6 | | Q&A part MHU, homework discussion 1 | MHU |
| Feb 6 | | FREE SLOT IF NEEDED | FREE |
| | | | |
| | 4 | SDF Approach to Asset Pricing | |
| Feb 7 | | Economic interpretation of SDF models | HZI |
| Feb 7 | | Utility based models | HZI |
| Feb 7 | | <i>Application: CCAPM with GMM</i> | KBU |
| Feb 8 | | Projection based models, HJ-Frontier | HZI |
| | | | |
| | 5 | Asset Pricing Errors | |
| Feb 8 | | LSSR and active Management | HZI |
| Feb 8 | | <i>Application: Mean-variance spanning tests</i> | KBU |
| | | | |
| tbd | | Q&A part HZI/PBO, homework discussion 2, prep exam | HZI/KBU |

Readings

The main references for the course are:

Cochrane, J. (2005). Asset pricing. Princeton University Press. Revised edition
– Available at Karger Libri

Ferson, W. (2003). Tests of multifactor pricing models, volatility bounds, and portfolio performance, in: Handbook of the Economics of Finance, Edited by G.M. Constantinides, M. Harris and R. Stulz, Elsevier

Campbell J. and L. M. Viceira (2002). Strategic Asset Allocation, Oxford University Press.

Brandt, M. (2010). Portfolio choice problems, in: Y. Ait-Sahalia and L.P. Hansen (eds.), Handbook of Financial Econometrics, Volume 1: Tools and Techniques, North Holland, 2010, 269-336.

Two new books of particular interest are:

Campbell, J. (2018). Financial Decisions and Markets. A Course in Asset Pricing, Princeton University Press.

Ferson, W. (2019). Empirical Asset Pricing: Models and Methods, MIT Press.

There are alternative textbooks that cover much of the material, and you may want to consider these for parallel study. For the theoretical part, the following is suggested:

LeRoy S. and J. Werner (2001). Principles of Financial Economics, Cambridge University Press. (covers much of the non-empirical part of standard equilibrium asset pricing theory)

Back, K. (2010). Asset Pricing and Portfolio Choice Theory, Oxford University Press

Gollier, C. (2001). The Economics of Risk and Time, MIT Press (great economic text)

Ingersoll, J. (1987). Theory of Financial Decision Making, Rowman & Littlefield (slightly outdated, but still extremely useful)

Lengwiler, Y. (2004). Microfoundations of Financial Economics, Princeton University Press.

Munk, C. (2013). Financial Asset Pricing Theory, Oxford University Press

For the empirical part of the lecture, the following texts are also useful:

Campbell J. , A. Lo and C. MacKinlay (1997). *The Econometrics of Financial Markets*, Princeton University Press.

Jagannathan R., E. Schaumburg and G. Zhou (2010). *Cross-Sectional Asset Pricing Tests*, *Annual Review of Financial Economics* 2, 49-74.

Selective Literature List

Classic papers which are major references of the lecture

The sections do not exactly follow those of the Lecture

More detailed references are found in the Handouts.

(1) Some classic papers as foundations of advanced asset pricing

Arrow (1963). "The Role of Securities in the Optimal Allocation of Risk-Bearing", *Review of Economic Studies* 31, pp. 91-96, Reprinted in *Essays in the Theory of Risk-Bearing*, North-Holland, 1970.

Radner (1972). "Existence of Equilibrium of Plans, Prices, and Price Expectations in a Sequence of Markets", *Econometrica* 40 (2), 289-303.

Rubinstein (1974). "An Aggregation Theorem for Securities Markets", *Journal of Financial Economics* 1, 225-244.

Lucas (1978). "Asset prices in an exchange economy", *Econometrica* 46, 1429-1445.

(2) Intertemporal asset allocation and asset pricing

Samuelson (1969). "Lifetime Portfolio Selection By Dynamic Stochastic Programming," *Review of Economics and Statistics*, 51, 239-46.

Merton (1973). "An intertemporal capital asset pricing model", *Econometrica* 41, 867-80.

Breeden (1979). "An intertemporal asset pricing model with stochastic consumption and investment opportunities", *Journal of Financial Economics* 7, 265-296.

Campbell (1996). "Understanding risk and return", *Journal of Political Economy* 104, 298-345.

Gerard/ Wu (2006). "How important is intertemporal risk for asset allocation?" *Journal of Business*, 79, 2203-2241.

(3) Multifactor beta (arbitrage) pricing models: Theory

Ingersoll (1984). "Some Results in the Theory of Arbitrage Pricing". *Journal of Finance* 39, pp. 1021–1039.

Ross (1977). "Return, Risk, and Arbitrage. Risk and Return in Finance", ed. I. Friend and J. Bicksler, 189–218, Ballinger, Cambridge, MA.

Ross (1976). The arbitrage pricing of capital asset pricing. *Journal of Economic Theory* 13, 341-360.

Chamberlain (1983). Funds, factors, and diversification in arbitrage pricing models. *Econometrica* 51, 1305–1324.

(4) Anomalies and multifactor beta pricing models: Testing

Banz (1981). "The relationship between return and market value of common stocks", *Journal of Financial Economics* 9, pp. 3-18.

Fama/ French (1992). "The Cross-Section of Expected Stock Returns". *Journal of Finance* 47, pp. 427–465.

Fama/ French (1993). "Common risk factors in the returns on stocks and bonds", *Journal of Financial Economics* 33, pp. 3-56.

Chen/ Roll/ Ross (1986). "Economic Forces and the Stock Market". *Journal of Business* 59, 383-403.

Pástor/ Stambaugh (2003). "Liquidity risk and expected stock returns." *Journal of Political economy* 111, pp. 642-685.

Boudoukh/ Michaely/ Richardson/ Roberts (2007). On the importance of measuring payout yield: Implications for empirical asset pricing. *Journal of Finance* 62, pp. 877-915.

Balduzzi/ Robotti (2008). "Mimicking Portfolios, Economic Risk Premia, and Tests of Multi-Beta Models". *Journal of Business and Economic Statistics* 26, 354-368.

Goyal (2012). "Empirical cross-sectional Asset Pricing: A Survey". *Financial Markets and Portfolio Management* 26(1), pp. 3-38.

Novy-Marx (2013). "The other side of value: The gross profitability premium." *Journal of Financial Economics* 108, pp. 1-28.

Characteristics versus risk:

Daniel/ Titman (1997). "Evidence on the characteristics of cross-sectional variation in stock returns." *Journal of Finance* 52, pp. 1–33.

Berk (2000). "Sorting out sorts." *Journal of Finance* 55, pp. 407-427.

Zhang (2005). "The value premium." *Journal of Finance* 60, 67-103.

Zhang (2009). "On the explanatory power of firm-specific variables in cross-sections of expected returns", *Journal of Empirical Finance* 16, pp. 306–317

Methodology:

Fama/ MacBeth (1973). "Risk, return, and equilibrium: Empirical tests", *Journal of Political Economy*, pp. 607-636 → quoted as "FM"

Shanken/ Zhou (2007). "Estimating and testing beta pricing models: Alternative methods and their performance in simulations". *Journal of Financial Economics* 84, pp. 40-86.

Harvey/ Liu/ Zhu (2016). "... and the cross-section of expected returns." *Review of Financial Studies* 29, pp. 5-68.

McLean/ Pontiff (2016). "Does academic research destroy stock return predictability?" *Journal of Finance* 71, pp. 5-32.

Pukthuanthong/ Roll/ Subrahmanyam (2018). "A protocol for factor identification." *Review of Financial Studies* 32, pp. 1573-1607.

Predictive performance of FM:

Lewellen (2015). "The cross-section of expected stock returns." *Critical Finance Review* 4, pp. 1–44.

(5) Critique of the Portfolio Sorts Testing Methodology

Lo/ MacKinlay (1990). "Data-snooping biases in tests of financial asset pricing models." *Review of Financial Studies* 3, pp. 431-467.

Ferson/ Sarkissian/ Simin (1999). "The Alpha Factor Asset Pricing Model: A Parable." *Journal of Financial Markets* 2, pp. 49-68.

Grauer/ Janmaat (2004). «The unintended consequences of grouping in tests of asset pricing models." *Journal of Banking & Finance* 28, pp. 2889-2914.

Kan (2004). "On the Explanatory Power of Asset Pricing Models Across and Within Portfolios." Working Paper

Ang/ Liu/ Schwarz (2009). "Using Individual Stocks or Portfolios in Tests of Factor Models." Working Paper

Daniel/ Titman (2012), "Testing Factor-Model Explanations of Market Anomalies", *Critical Finance Review* 1, pp. 103-139.

Jegadeesh/ Noh/ Pukthuanthong/ Roll/ Wang (2016). "Empirical Tests of Asset Pricing Models with Individual Assets: Resolving the Errors-in-Variables Bias in Risk Premium Estimation". Working Paper

Ledoit/ Wolf/ Zhao (2016). "Beyond Sorting: A More Powerful Test for Cross-Sectional Anomalies", Working Paper [from Sorts to Markowitz: estim of covar matrix]

Hoechle/ Schmid/ Zimmermann (2020). "Does Unobservable Heterogeneity Matter for Portfolio-Based Asset Pricing Tests?", Working Paper

(6) SDF-Approach to Asset Pricing

Beja (1971). "The structure of the cost of capital under uncertainty". *Review of Economic Studies* 38, pp. 359–368.

Dybvig/ Ingersoll (1982). "Mean variance theory in complete markets". *Journal of Business* 55, pp. 233-251.

Hansen/ Jagannathan (1991). "Implications of security market data for models of the dynamic economies". *Journal of Political Economy* 99, pp. 225-262.

Rosenberg / Engle (2002). "Empirical pricing kernels". *Journal of Financial Economics*, 64(3), 341-372.

Behavioral applications:

Shefrin (2008). "Risk and return in behavioral SDF-based asset pricing models", *Journal of Investment Management* 6, pp. 1-18.

GMM:

Hansen (1982). "Large Sample Properties of Generalized Method of Moments Estimators", *Econometrica* 50, pp. 1029-1054.

(7) Representation and equivalence of asset pricing models

Roll (1977). "A critique of the asset pricing theory's tests – part 1: On past and potential testability of the theory", *Journal of Financial Economics* 4, pp. 129–176.

Hansen/ Richard (1987). "The role of conditioning information in deducing testable restrictions implied by dynamic asset pricing models", *Econometrica* 55, pp. 587–613.

Gibbons/ Ross/ Shanken (1989). "A test of the efficiency of a given portfolio", *Econometrica* 57, pp. 1121–1152.

MacKinlay (1995). "Multifactor models do not explain deviations from the CAPM", *Journal of Financial Economics* 38, pp. 3–28.

Huberman/ Kandel/ Stambaugh (1987). "Mimicking portfolios and exact arbitrage pricing", *Journal of Finance* 42, pp. 1–10.

Campbell/ Cochrane (2000). "Explaining the poor performance of consumption-based asset pricing models." *Journal of Finance* 55, pp. 2863-2878.

Jagannathan/ Wang (2002). "Empirical Evaluation of Asset–Pricing Models: A Comparison of the SDF and Beta Methods". *The Journal of Finance* 57, pp. 2337-2367.

(8) Pricing errors and alphas

Treynor/ Black (1973). "How to use security analysis to improve portfolio selection", *Journal of Business* 46, pp. 66-86.

Shanken (1987): "Multivariate proxies and asset pricing relations: living with the Roll critique", *Journal of Financial Economics* 18, pp. 91–110.

Kandel/ Stambaugh (1995). «Portfolio Inefficiency and the Cross-section of Expected Returns." *Journal of Finance* 50, pp. 157-184 [GLS as diagnostic]

MacKinlay (1995). "Multifactor models do not explain deviations from the CAPM." *Journal of Financial Economics* 38, pp. 3-28.

Hansen/ Jagannathan (1997). "Assessing specification errors in stochastic discount factor models", *Journal of Finance* 52, pp. 557–590.

Balduzzi/ Robotti (2010): "Asset pricing models and economic risk premia: A decomposition", *Journal of Empirical Finance* 17, pp. 54-80

Lewellen/ Nagel/ Shanken (2010). "A skeptical appraisal of asset pricing tests". *Journal of Financial Economics* 96, pp. 175-194.

Kan/ Robotti (2011). "On the estimation of asset pricing models using univariate betas", *Economics Letters* 110, pp.117-121.

Kan/ Robotti (2012). "Pricing model performance and the two-pass cross-sectional regression methodology". *Journal of Finance* 68, pp. 2617-2649.

(9) Spanning Tests

Huberman/ Kandel (1987). "Mean-variance spanning", *Journal of Finance* 42, pp. 873–888.

Jobson/ Korkie (1989). "A performance interpretation of multivariate tests of asset set intersection, spanning, and mean-variance efficiency." *Journal of Financial and Quantitative Analysis* 24, pp. 185-204.

Kandel/ Stambaugh (1989). "A Mean-Variance Framework for Tests of Asset Pricing Models", *Review of Financial Studies* 2, pp.125-156.

Errunza/ Hogan/ Hung (1999). "Can the gains from international diversification be achieved without trading abroad?" *Journal of Finance* 54, pp. 2075-2107.

Kan/ Zhou (2012). "Tests of mean-variance spanning". *Annals of Economics and Finance* 13, pp. 139-187.

Overview:

DeRoos/ Nijman (2001). "Testing for mean-variance spanning: A survey", *Journal of Empirical Finance* 8, pp. 111–155.

(10) Conditioning information in asset pricing and asset allocation

Dybvig/ Ross (1985). "Differential Information and Performance Measurement Using a Security Market Line", *Journal of Finance* 40, pp. 383–399

Hansen/ Richard (1987): "The role of conditioning information in deducing testable restrictions implied by dynamic asset pricing models", *Econometrica* 55, pp. 587–613.

Campbell (1991). "A variance decomposition for stock returns", *The Economic Journal* 101, pp. 157-179

Fama/ French (1989) "Business conditions and expected returns on stocks and bonds", *Journal of Financial Economics* 25, pp. 23-49.

Ferson/ Harvey (1993). "The risk and predictability of international equity returns", *Review of Financial Studies* 6, pp. 527-566.

Oertmann/ Zimmermann (1998). "Global economic conditions and risk premia on international investments", Working paper, University of St. Gallen.

Ferson/ Schadt (1996). "Measuring Fund Strategy and Performance in Changing Economic Conditions", *Journal of Finance* 51, 425-462

Ferson/ Siegel (2001). „The Efficient Use of Conditioning Information in Portfolios," *Journal of Finance* 56, pp. 967-982.

Brandt/ Santa-Clara/ Valkanov (2009). "Parametric portfolio policies: Exploiting characteristics in the cross-section of equity returns." *Review of Financial Studies* 22, pp. 3411-3447.

(11) International Asset Pricing

(suppl. topic, not covered in class, but as special session upon request)

Solnik (1974). "An equilibrium model of the international capital market", *Journal of Economic Theory* 8, pp. 500-524.

Sercu (1980). "A generalization of the international asset pricing model", *Finance* 1, pp. 91-135.

Stulz (1981). "A model of international asset pricing", *Journal of Financial Economics* 9, pp. 383-406

Adler/ Dumas (1983). "International portfolio choice and corporation finance. A synthesis", *Journal of Finance* 38, pp. 925-984.

Black (1990). "Equilibrium exchange rate hedging", *Journal of Finance* 45, pp. 899-908.

Adler/ Prasad (1992). "On universal currency hedges", *Journal of Financial and Quantitative Analysis* 27, pp. 19-38.

Solnik (1993). "Currency hedging and Siegel's paradox: On Black's universal hedging rule", *Review of International Economics* 1, pp. 33-55.

Dumas/ Solnik (1995). "The world price of foreign exchange risk", *Journal of Finance* 50, pp. 445-479.

Overviews:

Stulz (1984). "Pricing Capital Assets in an International Setting: An Introduction", *Journal of International Business Studies* 15, pp. 55-73.

Dumas (1994). "Partial vs General Equilibrium Models of the International Capital Market," in Van der Ploeg, ed., *Handbook of International Macroeconomics*, Blackwell, chap. 10

Stulz (1999). "Globalization, corporate finance, and the cost of capital", *Journal of Applied Corporate Finance* 12, pp. 8-25.

Zimmermann/ Drobetz/ Oertmann (2003). "Global Asset Allocation", Wiley, chap. 2