

## Advanced asset pricing and portfolio management

Number of hours: 15

Second Year – Term 1

### Course objectives

The first part of the course develops the principles of portfolio construction, as well as empirical asset pricing, and introduces to risk and performance measurement in a portfolio management context. On top of the theoretical foundations, some relevant issues at the frontier of research are presented, providing students with the tools needed to understand the recent literature and to develop new research ideas.

The second part is dedicated to the study of dynamic term structure models of the interest rates, including references to new developments in monetary economics, as well as of dynamic asset allocation models.

Excel sheets and MATLAB codes for some applications are provided and an empirical assignment allows students to deepen their understanding of the models and their implementation.

### Prerequisites

Financial calculus, linear algebra, probability and statistics.

### Course content

#### Part I

- 1) **Fundamentals of empirical financial analysis**
  - Arithmetic/logarithmic returns, volatility. Portfolios of assets.
  - Data sources.
- 2) **Markowitz model and portfolio construction**
  - The two-asset case and the diversification effect.
  - The multi-asset case: efficient frontier with N risky assets.
  - Introduction of a risk-less asset in the Markowitz framework.
  - Quadratic utility function and relation with Markowitz portfolio.
  - Issues with the Markowitz model: the effect of estimation risk and transaction costs.
- 3) **The Capital Asset Pricing Model (CAPM)**
  - Derivation of the CAPM.
  - Estimation of expected returns and asset covariances with a single-factor model.
  - Lintner test (1965) and its limitations.
  - Fama-MacBeth test (1973).
  - Roll's critique (1977).
- 4) **The Arbitrage Pricing Theory (APT)**
  - Empirical evidence against the CAPM.
  - Concept of arbitrage and derivation of APT.
  - Estimation of expected returns and asset covariances with a multi-factor model.

- Explicit factor models: Fama-French 3-factor model (1993), Carhart (1997), Fama-French 5-factor model (2015),  $q$ -factor model (2015).

#### 5) **The Efficient Market Hypothesis**

- Weak form: serial correlation tests, momentum and reversal strategies, January effect.
- Semi-strong form: size and value anomalies, neglected firm effect, post-earnings announcement drift, first-day underpricing and long-run underperformance of IPOs, equity return predictability.
- Strong form: insider trading.
- Exploiting the anomalies: factor investing.

### Part II

#### 6) **Dynamics of the term structure of interest rates and no-arbitrage bond pricing**

- Vasicek model for the short-term interest rate.
- Yield curve of interest rates.
- Estimation of Vasicek model from historical bond yield data (maximum likelihood estimation).
- Advanced term structure models: multi-factor term structure models, models with a zero-lower-bound, term structure models embedding macroeconomic variables and monetary policy rules.

#### 7) **Dynamic asset allocation (if time allows)**

- Static vs dynamic asset allocation.
- Dynamic asset allocation in continuous time: Kim and Omberg (1996).
- Other dynamic allocation models.

## Evaluation

Part I will be tested by means of a written exam.

Part II will be tested by means of an empirical assignment.

## Recommended material

- **Course slides**
- **Recommended textbooks**

Cochrane, J. H. (2009). *Asset Pricing (Revised Edition)*. Princeton University Press.

E. J. Elton, M. J. Gruber, S. J. Brown and W. N. Goetzmann (2014). *Modern Portfolio Theory and Investment Analysis*. Wiley.

- **Readings for Part I**

Barber, B. M., Huang, X., & Odean, T. (2016). Which factors matter to investors? Evidence from mutual fund flows. *Review of Financial Studies*, 29(10), 2600-2642.

Chopra, V. K., & Ziemba, W. T. (1993). The Effect of Errors in Means, Variances, and Covariances on Optimal Portfolio Choice. *The Journal of Portfolio Management*, 19(2), 6-11.

DeMiguel, V., Garlappi, L., & Uppal, R. (2009). Optimal versus naive diversification: How inefficient is the 1/N portfolio strategy? *Review of Financial Studies*, 22(5), 1915-1953.

Fama, E. F., & MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *The Journal of Political Economy*, 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. (2004). The capital asset pricing model: Theory and evidence. *The Journal of Economic Perspectives*, 18(3), 25-46.

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, 116(1), 1-22

Grinblatt, M., & Titman, S. (1994). A study of monthly mutual fund returns and performance evaluation techniques. *Journal of Financial and Quantitative Analysis*, 29(03), 419-444.

Hou, K., Xue, C., & Zhang, L. (2015). Digesting Anomalies: An Investment Approach. *Review of Financial Studies*, 28(3), 650-705.

Hou, K., Xue, C., & Zhang, L. (2015). A Comparison of New Factor Models. Working paper.

Jones, C.S., & Pomorski, L. (2017). Investing in Disappearing Anomalies. *Review of Finance*, 21(1), 237-267.

Kan, R., & Zhou, G. (2007). Optimal portfolio choice with parameter uncertainty. *Journal of Financial and Quantitative Analysis*, 42(03), 621-656.

Peñaranda, F., & Sentana, E. (2015). A unifying approach to the empirical evaluation of asset pricing models. *Review of Economics and Statistics*, 97(2), 412-435.

Shanken, J., & Zhou, G. (2007). Estimating and testing beta pricing models: Alternative methods and their performance in simulations. *Journal of Financial Economics*, 84(1), 40-86.

Treynor, J., & Mazuy, K. (1966). Can mutual funds outguess the market? *Harvard Business Review*, 44(4), 131-136.

Welch, I., & Goyal, A. (2008). A comprehensive look at the empirical performance of equity premium prediction. *Review of Financial Studies*, 21(4), 1455-1508.

- **Readings for Part II**

Brennan, M. J., & Xia, Y. (2002). Dynamic asset allocation under inflation. *The Journal of Finance*, 57(3), 1201-1238.

Dai, Q., & Singleton, K. J. (2000). Specification analysis of affine term structure models. *The Journal of Finance*, 55(5), 1943-1978.

Duffee, G. R. (2002). Term premia and interest rate forecasts in affine models. *The Journal of Finance*, 57(1), 405-443.

Duffie, D., & Kan, R. (1996). A yield-factor model of interest rates. *Mathematical finance*, 6(4), 379-406.

Ireland, P. N. (2015). Monetary policy, bond risk premia, and the economy. *Journal of Monetary Economics*, 76, 124-140.

Kim, T. S., & Omberg, E. (1996). Dynamic nonmyopic portfolio behavior. *Review of Financial Studies*, 9(1), 141-161.

Krippner, L. (2013). A tractable framework for zero-lower-bound Gaussian term structure models. Working paper.

Sangvinatsos, A., & Wachter, J. A. (2005). Does the Failure of the Expectations Hypothesis Matter for Long-Term Investors? *The Journal of Finance*, 60(1), 179-230.

Vasicek, O. (1977). An equilibrium characterization of the term structure. *Journal of Financial Economics*, 5(2), 177-188.

Wachter, J. A. (2002). Portfolio and consumption decisions under mean-reverting returns: An exact solution for complete markets. *Journal of Financial and Quantitative Analysis*, 37(01), 63-91.

Wu, J. C., & Xia, F. D. (2016). Measuring the macroeconomic impact of monetary policy at the zero lower bound. *Journal of Money, Credit and Banking*, 48(2-3), 253-291.