# Master Thesis Topics

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Chair of Quantitative Methods in Economics and Finance

# Remarks

- The following slides offer **suggestions for potential topics for MSc theses**.
- Students are free to **suggest their own topics**.
- If you are interested in one of the topics or would like to suggest your own topic, please send an email to Prof. Dr. Fabian Hollstein. Please attach your CV and transcript of records to this email.
- The MSc thesis will be supervised by Prof. Dr. Fabian Hollstein.
- **Guidelines** for writing MSc Theses can be downloaded from the **institute's webpage**.

# Main Topics

1. **Volatility and Beta Estimation**
2. **Dependence and Jumps**
3. **Forecasting**
4. **Empirical Asset Pricing**

# 1. Volatility and Beta Estimation

# Beta Estimation for Illiquid Stocks

- **Outline**:
  Beta coefficients are very important for many applications, such as calculating risk-adjusted returns. They can be estimated using simple regressions methods. However, for infrequently traded stocks, such estimations might be severely biased. The literature has proposed a variety of methods to tackle this issue. The goal of this thesis is to compare the different methodologies.
- **Literature**:
  - Cohen K.J., Hawawini, G.A., Maier, S.F., Schwartz, R.A., & Whitcomb, D.K. (1983): Friction in the trading process and systematic risk. Journal of Financial Economics, 12, 263-278.
  - Dimson, E. (1979): Risk measurement when shares are subject to infrequent trading. Journal of Financial Economics, 7, 197-226.
  - Fowler, D.J., Rorke, C.H. & Jog, V.M. (1989): A bias-correcting procedure for beta estimation in the presence of thin trading. Journal of Financial Research, 12, 23-32.
  - Scholes, M. & Williams, J. (1977): Estimating betas from nonsynchronous data. Journal of Financial Economic, 5, 309-327.

# Good Beta, Bad Beta

- **Outline**:
  Asset price changes are determined by news affecting two major channels. On the one hand, there are direct news about future cash flows. On the other, investors might react to other news by increasing the discount rate applied to future dividend streams. Using this insight, the Campbell–Shiller decomposition delivers a powerful tool that enables us to split the market beta into two parts – a cash-flow beta and a discount-rate beta. The main task is the empirical replication of the Study of Campbell and Vuolteenaho (2004) for a more recent dataset.
- **Literature**:
  - Campbell, J. Y., & Shiller, R. J. (1988). The dividend-price ratio and expectations of future dividends and discount factors. Review of financial studies, 1(3), 195-228.
  - Campbell, J. Y., & Vuolteenaho, T. (2004). Bad beta, good beta. American Economic Review, 94(5), 1249-1275.

# Fundamentals-based Priors for Beta Estimation

- **Outline**:
  Prior information can be useful to hedge the measurement error in beta estimates. The paper cited below uses a fundamentals-based prior estimated with the Markov Chain Monte Carlo (MCMC) method. The authors show that the betas using the fundamentals-based prior have superior properties. The main task is to replicate the study of Cosemans et al. (2016) for a European dataset.
- **Literature**:
  - Cosemans, M., Frehen, R., Schotman, P. C., & Bauer, R. (2016). Estimating security betas using prior information based on firm fundamentals. Review of Financial Studies, 29(4), 1072-1112.

# Estimating Factor Pricing Models: OLS vs. GMM

- **Outline**:
  Empirical testing of an asset pricing model is a non-trivial task. Several econometric approaches have been put forward in the literature. Most prominent are simple time-series and cross-sectional regressions employing OLS and the Generalized Method of Moments. The objective of this topic is to first comprehensively review these approaches and discussing their theoretical advantages and disadvantages. In the second part, a detailed simulation study should be performed to analyze the practical implications of the theoretical arguments.
- **Literature**:
  - Cochrane (2005): Asset Pricing. Princeton University Press.

# Volatility Prediction

- **Outline**:
  Machine learning methods have recently gained attention in financial research. One particiular question is whether such methods can be succesfully employed to forecast volatility. The objective of this topic is to implement various machine learning methods as well as the standard HAR model and analyze their performance for volatility predictability over different horizons.
- **Literature**:
  - Christensen, K., Siggaard, M., & Veliyev, B. (2021). A machine learning approach to volatility forecasting. Working Paper.
  - Corsi, F. (2009). A simple approximate long-memory model of realized volatility. Journal of Financial Econometrics, 7(2), 174-196.

# The Correlation Risk Premium

- **Outline**:
  Correlation swaps are recently introduced derivatives instruments, whose payoffs depend on the realized average bi variate correlation of index constituents. These instruments deliver insurance against increases in correlations that typically occur around market downturns. Estimate correlation swap payoffs for the German index with options and evaluate the properties.
- **Literature**:
  - Driessen, J., Maenhout , P. J., & Vilkov, G. (2009). The price of correlation risk: Evidence from equity options. Journal of Finance , 64 (3), 1377–1406.
  - Driessen, J., Maenhout , P. J., & Vilkov, G. (2013). Option implied correlations and the price of correlation risk. Working Paper.
  - Hollstein, F., & Simen, C. W. (2020). Variance risk: A bird's eye view. Journal of Econometrics, 215(2), 517–535.

# 2. Dependence and Jumps

# Correlation Trading

- **Outline**:
  Correlation trading refers to a strategy that is exposed to the (average) correlation of different assets. Increasing (decreasing) correlations in the market lead to profit or losses. The objectives is to first provide an overview how correlation trading strategies can be implemented. The second objective is to empirically and theoretically analyze why and when correlation trading might be a worthwhile strategy. How is correlation trading related to volatility trading.
- **Literature**:
  - Deng, Q. (2008). Volatility Dispersion Trading. Working Paper.
  - Driessen, J., Maenhout, P. and Vilkov, G. (2012). Option-Implied Correlations and the Price of Correlation Risk. Working Paper.

# Fractional Co-integration in Commodity Futures Markets

- **Outline**:
  Prices of many commodities are considered and often found to be cointegrated, which poses certain implications for price discovery and market efficiency. However, recent econometric work suggests that these markets are fractionally cointegrated. The objective of this topic is to first provide a comprehensive review of fractional cointegration. In the second part, an empirical study should be performed which analyzes major commodity markets regarding these aspects.
- **Literature**:
  - Dolatabadi, S., Nielsen, M. & Xu, K. (2015): A fractionally Cointegrated VAR Analysis of Price Discovery in Commodity Futures Markets. Journal of Futures Markets, 35, 339-356.
  - Lien, D. & Tse, Y. K. (1999). Fractional cointegration and futures hedging. Journal of Futures Markets, 19, 457–474.

# 3. Forecasting

# Machine Learning for Asset Pricing

- **Outline**:
  Machine learning methods have recently gained attention in financial research. One of the key questions is whether such methods can successfully be used in asset pricing. The objective of this project is to first review the most important machine learning techniques. These techniques should then be implemented in the context of asset pricing.
- **Literature**:
  - Gu, S., Kelly, B., & Xiu, D. (2020). Empirical asset pricing via machine learning. Review of Financial Studies, 33(5), 2223-2273.

# Partial Least Squares vs. Principal Components Analysis

- **Outline**:
  The partial least squares (PLS) approach is a recent alternative to principal components (PCA) analysis for forecasting. The objective of this project is to first describe the PLS and PCA approaches and review the related literature. Then apply both approaches for various forecasting exercises and compare their performance.
- **Literature**:
  - Kelly, B., & Pruitt, S. (2013). Market expectations in the cross-section of present values. Journal of Finance, 68(5), 1721-1756.
  - Kelly, B., & Pruitt, S. (2015). The three-pass regression filter: A new approach to forecasting using many predictors. Journal of Econometrics, 186(2), 294-316.

# 4. Empirical Asset Pricing

# Terrorism and Asset Prices

- **Outline**:
  Terrorists try to impose political and economic costs on governments. However, it is unclear whether they are able to affect stock prices. Review the literature on terrorism and the economy / asset markets and examine empirically how stock markets react to terrorist threats and attacks.
- **Literature**:
  - Abadie, A., & Gardeazabal, J. (2008). Terrorism and the world economy. European Economic Review, 52(1), 1-27.
  - Arin, K. P., Ciferri, D., & Spagnolo, N. (2008). The price of terror: The effects of terrorism on stock market returns and volatility. Economics Letters, 101(3), 164-16.
  - Chen, A. H., & Siems, T. F. (2004). The effects of terrorism on global capital markets. European Journal of Political Economy, 20(2), 349-366.

# Asset Pricing Factor Models in the German Stock Market

- **Outline**:
  Recently, there have been various new developments of asset pricing factor models. Their common features are that they account for investment and profitability risk on top of the market and size factors in previous factor models. Review this literature and calculate and test these new asset pricing models for the German stock market.
- **Literature**:
  - Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. Journal of Financial Economics, 116(1), 1-22.
  - Hou, K., Xue, C., & Zhang, L. (2015). Digesting anomalies: An investment approach. Review of Financial Studies, 28(3), 650-705.
  - Stambaugh, R. F., & Yuan, Y. (2016). Mispricing factors. Review of Financial Studies, 30(4), 1270-1315.

# Idiosyncratic Volatility

- **Outline**:
  According to classical theory, idiosyncratic volatility can be fully diversified and, thus, should not be priced in the market. However, Ang et al. (2006) show that idiosyncratic volatility is strongly negatively priced, a finding which is often referred to as "idiosyncratic volatility puzzle". However, the measurement of idiosyncratic volatility depends on the factor model used. The two tasks are to first review of the literature on idiosyncratic volatility. Secondly, you should empirically evaluate the idiosyncratic volatility puzzle with the newly developed factor models.
- **Literature**:
  - Ang, A., Hodrick, R. J., Xing, Y., & Zhang, X. (2006). The cross-section of volatility and expected returns. Journal of Finance, 61(1), 259-299.
  - Fama, E.F., & French, K.R., 2015. A five-factor pricing model. Journal of Financial Economics, 116, 1-22.
  - Hou, K., Xue, C., & Zhang, L., 2015. Digesting anomalies: An investment approach. Review of Financial Studies, 28, 650-705.