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„Financial Econometrics“

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Recent years have witnessed a growing need for econometric methods in financial research and practice. As a result, financial econometrics has become one of the most active areas of research in econometrics. This is documented by the award of the Nobel Prize 2003 to the (financial) econometrician Robert F. Engle for his pioneering contribution to the modelling of time-varying asset return volatility. The importance of the field of financial econometrics is also indicated by the recent foundation of the “Society for Financial Econometrics” in 2007.

This course aims to provide students an introduction into the field and an overview of the most important topics and techniques. Having predominantly an applied focus, it attempts to balance between derivations of basic theoretical relations, fundamental methodology, the analysis of specific financial econometric models, applications thereof as well as the discussion of important empirical findings.

The course deals with fundamental time series techniques to model and to predict financial data, the modelling of time-varying volatility as well as the estimation and testing of asset pricing models. Ongoing topics in modern financial econometric research, such as the modelling of realized volatility as well as the analysis of financial high-frequency data is covered as well.

Moreover, an important objective is to provide a comprehensive knowledge to do empirical work in financial research and practice. Therefore, a part of the course consists of practical exercises where students are instructed to apply econometric concepts to real financial data.

Course Outline

1. Financial Returns: Basic Concepts and Properties

1.1. Introduction and Motivation

1.2. Financial Time Series

- 1.2.1. Illustrations
- 1.2.2. Returns on Financial Assets

1.3. Distributional Properties of Financial Returns

- 1.3.1. Conditional and Marginal Distributions
- 1.3.2. Evaluating Marginal Distributions
- 1.3.3. Empirical Evidence
- 1.3.4. Distributions for Returns

2. Foundations in Time Series Analysis

2.1. Basic Concepts of Time Series Analysis

- 2.1.1. Autocovariances and Stationarity
- 2.1.2. Testing for White Noise
- 2.1.3. Stability of Difference Equations
- 2.1.4. ARMA Processes
- 2.1.5. Properties of Selected ARMA Processes
- 2.1.6. Estimation and Forecasting of ARMA Processes
- 2.1.7. Integrated Time Series and Unit Root Tests
- 2.1.8. Box-Jenkins Analysis
- 2.1.9. Fractional ARIMA Processes

2.2. State-Space Models and the Kalman Filter

- 2.2.1. The State-Space Representation
- 2.2.2. The Kalman Filter
- 2.2.3. The Derivation of the Kalman Filter

2.3. Financial Prices and Returns

- 2.3.1. The Efficient Market Hypothesis
- 2.3.2. Random Walk Tests
- 2.3.3. Empirical Evidence
- 2.3.4. Present Value Relationships

3. Modelling Time-Varying Volatility

3.1. Introduction

- 3.1.1. Different Volatility Concepts
- 3.1.2. Some Empirical Facts
- 3.1.3. Why to Care?

3.2. GARCH Models

- 3.2.1. Model Structure
- 3.2.2. The ARCH Model
- 3.2.3. The GARCH Model
- 3.2.4. Further GARCH Specifications
- 3.2.5. Estimation and Testing
- 3.2.6. Illustrations
- 3.2.7. Value-at-Risk Estimation
- 3.2.8. Multivariate GARCH Models

3.3. Stochastic Volatility Models

- 3.3.1. Motivation
- 3.3.2. Independent SV Processes
- 3.3.3. The Standard SV Model
- 3.3.4. Empirical Evidence

3.4. Realized Volatility

- 3.4.1. Basic Concepts of Continuous-Time Processes
- 3.4.2. The Realized Volatility Estimator
- 3.4.3. Empirical Properties of the RV Estimator
- 3.4.4. RV and Market Microstructure Noise
- 3.4.5. Realized Correlation

4. Estimating and Testing Asset Pricing Models

4.1. Stochastic Discount Factor Based Asset Pricing

- 4.1.1. The Stochastic Discount Factor
- 4.1.2. The Consumption Based Model
- 4.1.3. The Equity Premium Puzzle

4.2. The Capital Asset Pricing Model (CAPM)

- 4.2.1. Beta Representations
- 4.2.2. Two Period Quadratic Utility
- 4.2.3. Exponential Utility and Normality
- 4.2.4. Testable Implications

4.3. Factor Pricing Regressions

- 4.3.1. Seemingly Unrelated Regression
- 4.3.2. Time Series Regressions
- 4.3.3. Cross-Sectional Regressions

4.4. Extensions and Multi-Factor Models

- 4.4.1. The CAPM Debate
- 4.4.2. The Fama-French Three-Factor Model
- 4.4.3. Time-Varying Betas

5. Modelling High-Frequency Financial Data

5.1. Financial Transaction Data

- 5.1.1. Market Microstructure Relationships
- 5.1.2. Properties of Financial Transaction Data

5.2. Modelling Transaction Price Processes

- 5.2.1. Decomposition of the Price Process
- 5.2.2. Modelling Prices and Quotes

5.3. Multiplicative Error Models

- 5.3.1. Autoregressive Conditional Duration (ACD) Models
- 5.3.2. Theoretical Properties of ACD Models
- 5.3.3. Generalized ACD Models
- 5.3.4. Multivariate Models for Trading Processes

Literature:

- Campbell, J. Y., A. W. Lo, and A. C. MacKinlay (1997): *"The Econometrics of Financial Markets"*, Princeton University Press.
- Cochrane, J. H. (2005): *"Asset Pricing"*, revised edition, Princeton University Press
- Franses, P. H., and D. van Dijk (2000): *"Non-Linear Time Series Models in Empirical Finance"*, Cambridge University Press.
- Härdle, W., Hautsch, N., and Overbeck L. (2008): *"Applied Quantitative Finance"*, 2nd ed., Springer.
- Hamilton, J. D. (1994): *"Time Series Analysis"*, Princeton University Press.
- Hasbrouck, J. (2007): *"Empirical Market Microstructure: The Institutions, Economics and Econometrics of Securities Trading"*, Oxford University Press.
- Hautsch, N. (2004): *"Modelling Irregularly Spaced Financial Data: Theory and Practice of Dynamic Duration Models"*, Springer.
- Taylor, S. J. (2005): *"Asset Price Dynamics, Volatility, and Prediction"*, Princeton University Press.
- Tsay, R. S. (2005): *"Analysis of Financial Time Series: Financial Econometrics"*, Wiley, 2nd edition.