Rmetrics – Subject Classification Scheme

An Environment for Teaching

Financial Engineering and Computational Finance

with R   Rmetrics Built 221.10065

The Rmetrics Subject Classification Scheme is used to identify fields and sub-fields in the financial engineering and computational finance packages. The Classification Scheme is designed to assist in the retrieval of R functions. The Classification Scheme is arranged hierarchically, by subdivision of the whole spectrum of functions for financial applications.

1 fBasics

1.1 Economic and Financial Markets
Selected Market Data

1.2 Financial Time Series Data
Time Series Representations
Time Series Plots
Basic Statistics

1.3 Distribution Functions in Finance
Financial Returns
Central Limit Theorem
Normal Distribution
Stable Distribution
Hyperbolic Distribution
Empirical Distribution

1.4 Structures and Dependencies
Short Time Return Correlations
Long Range Dependent Volatilities
Lagged Volatility Correlations
Leverage Effect
Taylor Effect

1.5 Probability Theory and Hypothesis Testing
One Sample Tests
Two Sample Tests

2 fCalendar

2.1 Time and Date Conventions and Standards
ISO8601 Standard

2.2 POSIX Based Implementation
Functions and Tools from R's Pase Package

2.3 'timeDate' Class
Financial Center Concept
Time Zone support
Daylight Savings Time Rules

2.4 'timeSeries' Class
Representation of timeSeries Objects
Mathematical Operations on timeSeries Objects
Operations on Daily Time Schedules

2.5 Calendrical Calculations
Ecclesiastical and Public Holidays
Business and Holiday Calendars

3 fSeries

3.1 Stationary Time Series: ARMA Modelling
Time Series Simulation
True Model Statistics
Parameter Estimation
Diagnostic Analysis
Forecasting

3.2 Time Series Trends: Unit Roots

3.3 Long Range Dependent Time Series
FGN and FARIMA Simulations
True Model Statistics
Estimation of the Hurst Exponent

NEW Nonstationarity and Structural Breaks

3.4 GARCH/APARCH Volatility Models
Alternative Conditional Distributions
Time Series Simulation
True Model Statistics
Parameter Estimation
Diagnostic Analysis
Ox/G@RCH Interface

NEW   **Seasonal Time Series Modelling**

NEW   **Filtering of Financial and Economic Series**

3.5 Nonlinear and Chaotic Time Series
Simulation of Chaotic Time Series
Nonlinear and Chaotic Modeling
Hypothesis Tests

4. fMultivar

4.1 Trading and Forecasting with Regression Models
Technical Analysis and Trading Indicators
Rolling Descriptive Statistics
Regression Based Trading Models
    LM, GLM, GAM, PPR, MARS, POLYMARS

4.2 Neural Networks in Finance and Economocs
Regression Analysys by Neural Networks
Time Series Analysis with Neural Networks

4.3 Demand and Supply Models
Linear Equations Modelling
Nonlinear Equations Modelling

NEW   **Vector ARMA Models**

NEW   **Cointegration and Error Correction Models**

4.4 Multivariate GARCH Models
VEC, BEKK, DCC, ...

NEW   **Kalman Filter and State Space Modelling**

4.5 Matrix Calculus and Linear Algebra Addon
Vector and Matrix Operations
Linear Algebra

5. fExtremes

5.1 Explorative Data Analysis
Extreme Value Plots
Declustering of Time Series

5.2 Fluctuation of Maxima
Block Maxima and the GEV Distribution
L-Moments and log-Likelihood Estimation
Estimation under MDA Conditions

5.3 Extremes via Point Processes
Point Processes and Pareto Distribution
Generalized Pareto Distribution
Generalized Linear Modelling

5.4 Extremal Index
Block Method
Mean Cluster Size Method
Runs Method

6. fCopulae

6.1 Copulae Basics
Distributions and Copulae Densities
Measures of Concordance
Tail Dependencies
Random Samples
Empirical Copulae and Parameter Estimation

6.2 Elliptical Copulae

6.3 Archimedean Copulae

7. fTickdata

NEW   **High Frequency Financial Market Data**

NEW   **OTC: Foreign Exchange Rate Modelling**

NEW   **Time+Sales: Data from Exchanges**

NEW   **De-Seasonoiazation and De-Volatilization**

NEW   **Outlier Detection**

NEW   **Real Time Trading and Decision Making**

8. fOptions

8.1 Basics of Option Pricing
Black-Scholes and Related Options
Sensitivity Analysis and Greeks
Bi- and Trinomial Option Models

8.2 Pricing Formulas for Exotic Options
Options with Contract Variations
Simple Path Dependent Options
Limit Dependent Options
Multiple Assets Options

8.3 Exponential Brownian Motions
Density Based Approaches
Partial Differential Equation Approaches
Laplace Inversion Approach
Spectral Expansion Approach
Lower and Upper Bounds
Symmetry and Equivalence Relations

8.4 GARCH Option Pricing
    Heston-Nandi Options
    Duan GARCH Model

8.5 Monte Carlo Simulation of Options
    Path Dependent Options
    American Options

9. fBonds

NEW **Bond Arithmetic**

NEW **Discount Curve Modelling**

NEW **Yield Curve Modelling**

NEW **Interest Rate Options**

NEW **Mortgages and Savings**

10. fPortfolio

10.1 Multivariate Assets Modelling
    Multivariate Normal Distribution
    Multivariate Student-t Distribution

10.2 Drawdown Statistics

10.3 Value-at-Risk Modeling

10.4 Two-Assets Portfolios
    Mean Variance Portfolio
    CVaR Portfolio
    CDaR Portfolio

10.5 Mean Variance Markowitz Portfolios

10.6 CvaR and CDaR Portfolios
    Hedge Funds
    Alternative Investments

10.7 Performance Measures and Benchmarks

11. fActuar

NEW **Actuarial Models**

NEW **Survival Models**

12. fAgents

NEW **Behaviorial Finance**

NEW **Agent Based Modelling**
    Minority Games
    Lux-Marchesi Mode

This Subject Classification Scheme is still uncomplete and may be cahnged and enhanced. Suggestions are welcome.