



# Correlation and Related Dependency Concepts

**Program Description:** Information about advanced methodologies in modelling dependency structures is hard to find and often fragmentary. In this 2-day programme, correlation and related dependency concepts take centre stage: After an introduction to empirical and mathematical properties of the traditional correlation concept, more recent methodologies are presented which allow deeper insights into real-world dependency structures and solve practical issues in working with scenario-based approaches and deriving forward-looking estimators.

**Target Audience:** risk analysts, quantitative analysts, investment analysts, asset managers (both traditional and alternative), system developers

**Materials:** Participants will receive a binder with the slides presented and access to spreadsheets containing example calculations for all models and concepts discussed.

The content of this program can be combined with content from other programs for customized **inhouse training** purposes. Please contact [email@andreassteiner.net](mailto:email@andreassteiner.net) for details.

Information relating to **scheduling, course venues and pricing** for the public courses is available on [www.andreassteiner.net/consulting](http://www.andreassteiner.net/consulting)

## Day One

### Overview and Review Correlation and Dependency Concepts

### Stylized Facts about Correlations & Dependencies in Financial Market Data

- Contagion Effects in Stock Correlations
- Globalisation in Global Equity Investing
- Bonds as a Safe Haven Asset
- Is Gold a Safe Haven?

**Exercise:** Calculating tail and downside correlations

### Mathematical Properties of Correlation and the Correlation Matrix

- Validity of a Correlation Matrix
- Fixing a Broken Correlation Matrix
- Alternative Correlation Concepts
- Spearman Rank Correlation
- Kendall's T



- Spectral Decomposition of a Correlation Matrix: Eigenvalues and Eigenvectors
- Singular Value Decomposition of Correlations
- Autocorrelation: Dependency Over Time
- Co-integration and its Use in Trading

**Exercise:** Examining the validity of a correlation matrix

## Day Two

### Correlation in Modern Portfolio Theory: Diversification

#### Scenario Analysis & Stress Testing

- Tweaking Individual Entries in a Correlation Matrix
- Changing Blocks of Correlation Values
- Extrapolating Trends in Correlations: "Risk On" and "Risk Off" Scenarios
- Randomizing a Correlation Matrix
- Handling the Additivity of Conditional Correlations

#### A General Theory of Dependency: Copulas

- Introduction to Copula Theory
- Applications of Copula Theory
  - Data Analysis
  - Stress Testing

**Exercise:** Identifying copulas in an international asset class universe

#### Simulating Correlated Data

- Multivariate Normal Data
- Solutions for Non-Normal Data

#### Stochastic Process Models for the Correlation Coefficient

#### Forecasting Correlations

- Historical Estimators
- Robust Estimators
- Bayesian Shrinkage Estimators: Jorion, Ledoit/Wolf
- Implied Correlations from Derivatives Instruments
- Deriving Asset Correlations from Factor Correlations



## Time Series Models for Correlations

- Exponential Smoothing
- Multivariate GARCH
- Dynamic Conditional Correlation (DCC)

**Exercise:** Analysing the volatility risk of a multi-asset-class portfolio based on robust correlation scenarios