



Correlation and Other Dependency Concepts

Program Description: Information about advanced methodologies in modelling dependency structures is hard to find and often fragmentary. In this 2-day program, correlation and related dependency concepts take center 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. Frontier research topics like graph theory, clustering algorithms and copula theory are also discussed.

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 for details.

Information relating to **scheduling, course venues and pricing** for the public courses is available on www.andreassteiner.net/consulting

Day One

Overview and Review Correlation and Dependency Concepts

- The Many Meanings of Correlation
- Alternative Correlation Concepts
- Correlations vs. Causality vs. Impulse/Response

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?

Mathematical Properties of Correlation and the Correlation Matrix

- Validity of a Correlation Matrix
- Fixing a Broken Correlation Matrix
- Spearman Rank Correlation
- From Kendall's Tau to the Gerber Index



- Spectral Decomposition of a Correlation Matrix: Eigenvalues and Eigenvectors, Principal Component Analysis (PCA)
- Geometrical Interpretation of Correlation as an Angle
- The Cholesky Decomposition of a Correlation Matrix
- Singular Value Decomposition of Correlations
- Autocorrelation: Dependency Over Time
- The Co-integration Approach
- Correlations As Distances: Clustering with Correlations, Visualising Correlations as Dendrograms

Day Two

Correlation in Modern Portfolio Theory: Diversification

Scenario Analysis & Stress Testing

- Extrapolating Trends in Correlations, "Risk On" Scenarios, Shrinkage
- Changing Blocks: Intra-Block Correlations and Inter-Block Correlations
- Tweaking Individual Entries in a Correlation Matrix
- Randomizing a Correlation Matrix
- Scenario Correlations vs. Correlation Scenarios

A General Theory of Dependency: Copulas

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

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

- Preparing Correlations for Time Series Analysis: Vectorizations of a Correlation Matrix, Fisher Transformation
- Rolling, Exponentially-Weighted Correlations



- The Multivariate GARCH Approach: CCC, BEKK, DCC and DECO
- The Markov Regime-Switching Approach