CQF 2009 Module 2.6

Live Lecture: February 23 Lecturer: Seb Lleo

Fundamentals of Optimization and Application to Portfolio Selection

In this lecture:

- how to formulate an optimization problem
- how to use calculus to solve unconstrained optimization problems
- the method of Lagrange
- the Kuhn-Tucker conditions
- how to select a portfolio in the Markowitz world
- the minimum variance portfolio
- portfolio selection with a risk-free asset
- how to derive the CAPM.

Part I Fundamentals of Optimization - Introduction	5
Formulating an Optimization Problem	
Elementary Rules and Tips	
Unconstrained Optimization.	
Optimization with Equality Constraints	
The Method of Lagrange	
Application: Maximizing the area of a rectangle	
Optimization with Inequality Constraints	
Kuhn-Tucker Theorem	
Part II: Application to Portfolio Selection	
The Setting	
Aside 1: A Useful Covariance Matrix Decomposition	
Problem Formulation	
Solving the Problem Selection Problem	
Application: A market with four assets	
The Minimum-Variance Portfolio	
Application: Global minimum-variance portfolio	
Efficient Portfolios Revisited	
A New Parameterization.	60
Covariance of Efficient Portfolios	
Introducing the Risk-Free Asset	
Problem Formulation with a Risk-Free Asset	
Application	73
The Tangency Portfolio	75
Expected Return	80
The CAPM	83
Assumptions	84
Optimization Problem	89
The Market Portfolio	92
The CAPM	94
Aside: Utility Maximization	95
Properties of Utility Functions	97
Utility and Portfolio Selection	98