Financial Risk Analysis and Heavy Tails

1 Historical Discussion of Risk and Return

- Brief history of financial risk
- Mean-Variance Portfolio Theory by Markowitz
- Risk and Factor models
- Value at Risk

2 More on Value at Risk

- Historical Simulation
- Parametric VaR
  - present different distributional models
  - give overview of volatility forecasting models
  - discuss problems with volatility modeling over longer horizon times
- Monte Carlo Simulation
- VaR for portfolios of assets
- IVaR incremental or marginal VaR of proposed position

3 Coherent Measures of Risk

- Discuss axioms any coherent measure of risk should satisfy
- Are the popular measures coherent?
- Give examples of non-sub-additivity of VaR
- Propose coherent measure of risk: Expected Shortfall

4 Portfolios and Dependence

- Dependence and Copulas
  - linear correlation
  - perfect dependence
  - concordance measures (Kendall's tau and Spearman's rho)
  - tail dependence
- elliptical distributions and risk management
- Modeling and simulating from multivariate distributions
  - picking a copula
    - Elliptical copulas
    - Archimedean copulas
  - simulation from joint distribution: an example

5 Univariate Extreme Value Theory

- Block Maxima and Fisher Tippett
  - for iid data
  - for stationary time series
  - example using SPX 87 crash
- Excesses over Thresholds
  - excess over threshold distribution
  - characterizing $MDA(H_\xi)$ and the Pickands-Balkema-de Haan theorem
- Tail related measures of risk
  - estimating tails
  - estimating high quantiles
  - estimating expected shortfall
  - the Hill estimator
- Estimation of Tail-Related Risk Measures for Heteroscedastic Financial Time Series: an Extreme Value Approach *by McNeil and Frey*