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