Quantitative Risk Management
complete 550-page book
http://www.wiley.com/buy/1118026586

A Practical Guide to Risk Management
First 5 chapters
Overview

• How to Think about Risk Management
  – Risk management as management
  – Thinking about risk and uncertainty
  – An overview of quantitative techniques – volatility and VaR, Marginal Contribution and Best Hedges

• Further Reading
Who am I?

• Educational Background
  – Physics undergraduate at Harvard, PhD economics University of Chicago
  – Taught economics and finance for four years

• Practical Experience
  – Over 20 years ago moved from academics to finance
  – Trading and quantitative model-building on a derivatives desk
  – More recently founded and managed a macro-global hedge fund
  – Short stint as risk manager at a large hedge fund
  – Recently moved back to University of Chicago – helping to run the Becker Friedman Institute for Research in Economics

• Trading and Management
  – I want to emphasize – I come from a trading and management background – not from “risk management”
My View of Risk Management

- Challenging some conventional wisdosms
  - Good Risk Management is old-fashioned management, not fancy mathematics
  - Mathematics and numbers are important, but only part of the answer

- Managing People, Processes, Institutions
  - People most important – all problems, all successes, come from people
  - Incentives, compensation, principal-agent problems

- “Risk Management” Should Not be a Separate Department and Cannot be Delegated
Risk and Uncertainty

• What is Risk? – Start from Fundamentals
  – Possibility that P&L is different from what is expected

• P&L Distribution

A. Coin Toss Bet

B. Hypothetical Yield Curve Strategy
Risk and Uncertainty – cont’d

• Becoming Comfortable With Randomness And Uncertainty
  – Randomness not intuitive
    • Birthday problem
  – We humans not good thinking about randomness

• Should Not Throw Up Hands and Give Up
  – Physics not intuitive – yet we use it all the time
  – Mathematics and probability are tools to supplement intuition

• Learn to Embrace Uncertainty and Randomness
Risk Tools

• Focus on the *Intuition* Behind the Numbers
  – Fundamental tension – Mathematics vs. Management

• Volatility (σ, standard deviation) and VaR (Value at Risk)

• Portfolio Tools (Contribution to Risk, etc.)
Volatility and VaR

- Remember – We Care About P&L Distribution
  - Volatility and VaR tell us scale or dispersion – summary measures for the distribution
  - Very simple concepts – graphically
Using Volatility (or VaR)

• “Scale” for Standard Trading Conditions
  – Tells us how big P&L might be
  – P&L outside vol roughly 30% or 1 day out of 3
  – P&L less than 5% VaR roughly 5% or 1 day out of 20

• To Compare Different Assets
  – E.g. Bond and CAC equity index futures
  – P&L matters – money is still money

• To Combine Assets
  – P&L adds, but volatilities do not – diversification

• Extreme Events – more later
Volatility to Compare and Combine

• $20mn 10-year UST; €7mn ($9.1mn) CAC
  – Very different – how to compare? Use volatility (or VaR)
Volatility and VaR Tips

• Some “Tricks-of-the-Trade” for Volatility and VaR

• Calculating Volatility
  – Use history to calculate standard deviation of changes
  – On Bloomberg, **HVT**. How many days?

• Calculating VaR
  – Quick-and-dirty – gross-up volatility
  – For normal: 1.65x for 5%, 2.33x for 1%, 2.7x for once-per-year.
  BUT BEWARE NORMAL

• Time Scaling
  – $\sqrt{t}$ – from daily to annual (255 days) multiply by 15.97

• Measure Volatility or VaR as Percentage of Portfolio
  – UST vol is $130,800, or 0.65% daily, or 10.4% annually
Portfolio Tools

• Volatility and VaR Are Only A Start. Need:
  – Sources of risk
  – How trades alter risk
  – Simple representations for complex portfolios

• Marginal Contribution and Best Hedge
  – Marginal Contribution – risk decomposition
    • Beware name confusion (RiskMetrics)
  – Best Hedge – what size trade provides “best hedge” and how risk changes
Portfolio Tools – Example

- Continue with $20mn 10-year UST; €7mn ($9.1mn) CAC Futures
  - Portfolio vol $291,300
  - Contribution: 30% bond, 70% CAC futures
  - Best hedge with CAC is short €950k

<table>
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<th>Position (stand-alone) Volatility</th>
<th>Marginal Contribution</th>
<th>Best Hedge Pos'n</th>
<th>Volatility at Best Hedge</th>
<th>% Volatility Reduction</th>
<th>All-or-Nothing Cont'n</th>
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VaR and Extreme Events

• Extreme Events – VaR usually used for this
  – 5% VaR – P&L worse 5% or roughly 1-out-of-20 days
  – Could also look at 0.4% VaR – roughly once-per-year
• Be Careful with Extreme Events
  – Really hard to measure extreme events
  – Often larger than we expect
  – Maybe use simple rule-of-thumb: once-per-year = 4σ
    • Normal says once-per-year = 2.7σ
• Thinking of VaR
  – “Statistically worst-case loss” – really misleading
  – Much better: “a regularly occurring event with which we should be comfortable” (Litterman)
Volatility and VaR – Slide 9 Again

- Remember – We Care About P&L Distribution
  - Volatility and VaR tell us scale or dispersion – summary measures for the distribution
  - Very simple concepts – graphically

A. Volatility (standard deviation)

B. VaR

Volatility (e.g., $130,800)

Z=Area (e.g., 5%)

VaR (e.g., $215,100)
Risk Management is Management

• Return to Risk Management as Management

• Remember Randomness and Uncertainty
  – Numbers don’t give us certainty – just the scale of our uncertainty

• Delicate Balance – Practice old-fashioned judgment, take advantage of quantitative tools

• Extreme Events particularly difficult
Questions

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A Practical Guide to Risk Management
Monograph