

KEY ASSET MANAGEMENT

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Hedge Funds and Risk

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Key Asset Management

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Agenda

- **Standard Risk Measurement Techniques**
- **Extensions to Standard Techniques**
- **Building a Risk Measurement Framework**
- **Portfolio Construction**
- **Monitoring**
- **New Directions**

Standard Risk Measurement Techniques

- **Tend to be VaR based**
- **Tend to underestimate tail risk due to**
 - Backward looking
 - 'Fat tails in finance'
 - Correlated nature of typical long and short hedge fund portfolios
 - Complex instruments
 - Hidden theme correlation and correlation jumps
 - Liquidity and other imponderables
 - Path dependence
- **Need to be forward looking and somehow consider the above**

Extensions to Standard Techniques

- **Need to be forward looking**
 - Stress and scenario tests that consider realistic worse case scenario, not just history
 - Can't be bound to historic covariance structure or too rigid a distribution
 - Can't ignore 'event risk' nature of hedge funds
- **Problem is, if you look at the truly worst case scenario, you will never invest!**
- **Solution is to find a happy medium between traditional VaR and very worst case scenario**
 - Non-parametric / Monte Carlo
 - Realistic scenario tests
 - Shocking covariance structure
 - Must consider 'events'

Extensions to Standard Techniques: 'Events' and Worst Case Scenarios

- **Most worst case scenarios involve 'events' which could happen but haven't yet**
 - These are very difficult to measure!
 - Rare event theory???
- **Types of Events – 'Market Related'**
 - e.g. huge short-term spread widening
 - e.g. scare or poor performance followed by massive redemptions
 - e.g. liquidity shock
 - e.g. deal break
- **Types of Events – 'Operational Related'**
 - e.g. fraud
 - e.g. key person departure
 - e.g. loss of operational facilities
 - e.g. forced liquidation by prime broker

Extensions to Standard Techniques: 'Events' and Worst Case Scenarios

- **These events are often compounded**
 - e.g. huge short-term spread widening → poor performance → massive redemptions → liquidity shock → poor performance → forced liquidation by prime broker → game over
- **It's worth considering these scenarios in your risk measurement framework!**
- **However, given that the magnitude of such events is impossible to predict, it's better to construct portfolios with a view to avoiding them, rather than just being volatility focussed**
 - e.g. institutional CB arb manager vs boutique
- **Also worth noting – hard risk limits can keep you out of trouble!**

Building a Risk Measurement Framework

- **Need to use all the VaR techniques available but also be aware of**
 - Often won't have full transparency
 - Complex instruments and hidden risks
- **As a result, an additional set of techniques are useful**
 - We use factor decomposition with factors selected top-down and bottom-up
 - We then perform non-parametric Monte Carlo simulation of the factors allowing some freedom in the correlation structure
 - This gives a risk distribution with a more realistic shape

Building a Risk Measurement Framework

- **This technique allows us to**
 - Analyse the driving factors of return e.g. credit spreads
 - Generate an implied risk distribution and monitor variance over time
 - Consider realistic future scenarios
 - Stress test w.r.t. pertinent drivers of return
 - Incorporate risk asymmetry and factor dependence into our portfolio construction process
 - Consolidate the above at fund-of-funds level

Building a Risk Measurement Framework: Requirements

Risk Monitoring & Due Diligence:

- Integral to the investment process
- Implied risk distribution (VaR and tail loss)
- Style analysis
- Risk and return attribution
- Scenario and stress testing

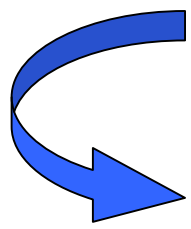
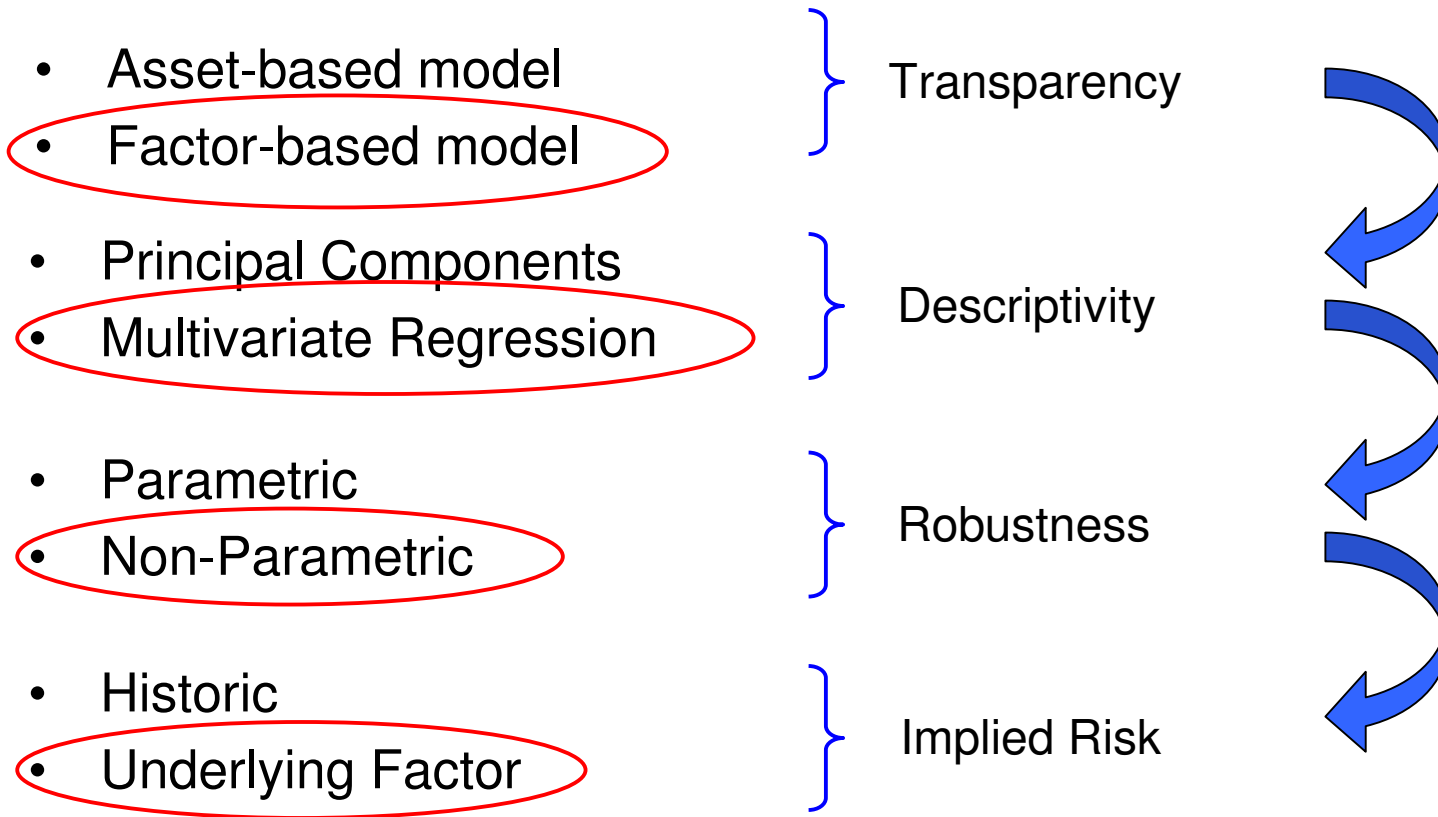
Portfolio Construction:

- Risk return analysis
- Aggregation impact (Diversification)

Building a Risk Measurement Framework: Constraints

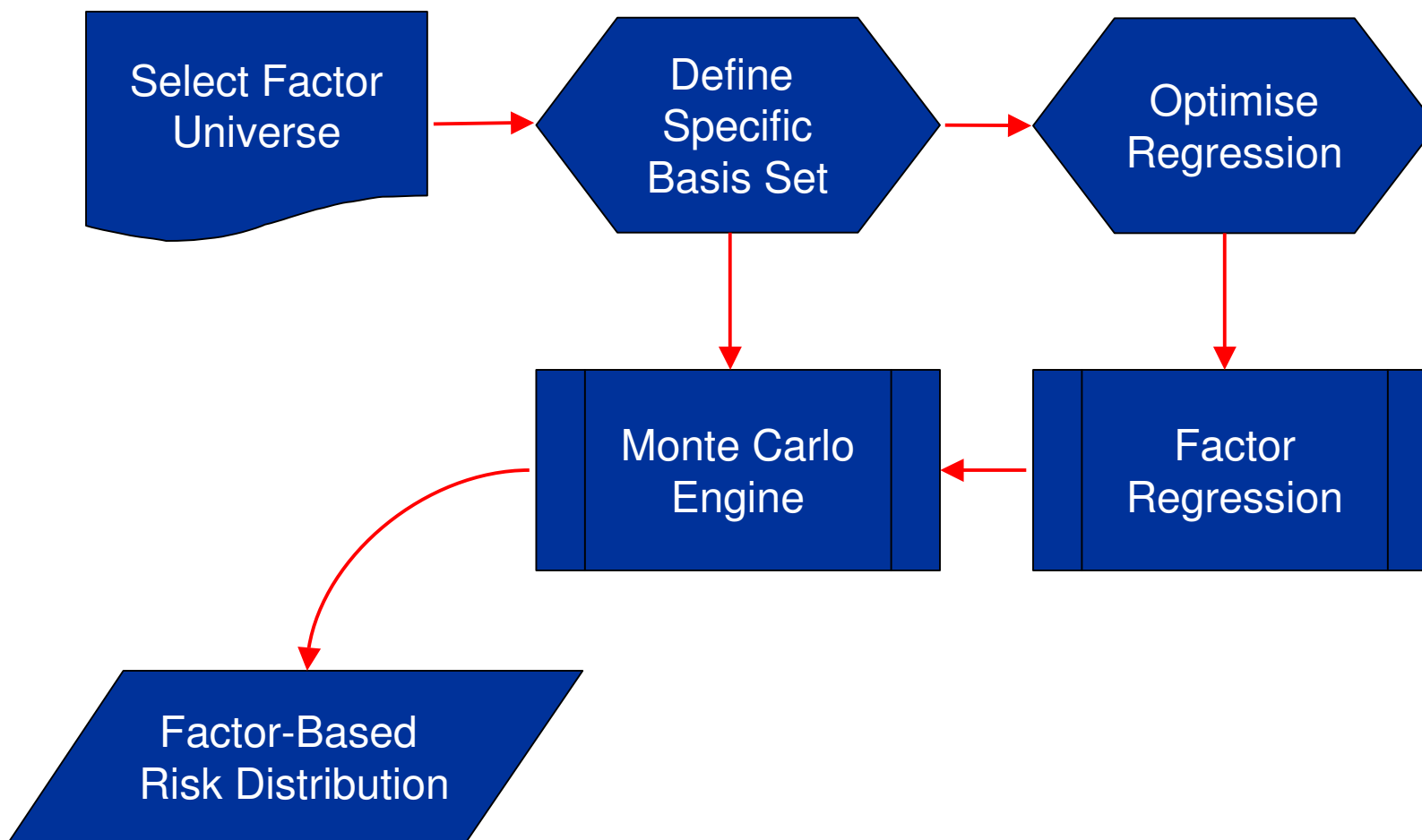
- Zero transparency
- Broad scope (multiple strategy)
- Robustness
- Short track record

Building a Risk Measurement Framework: Selecting An Approach

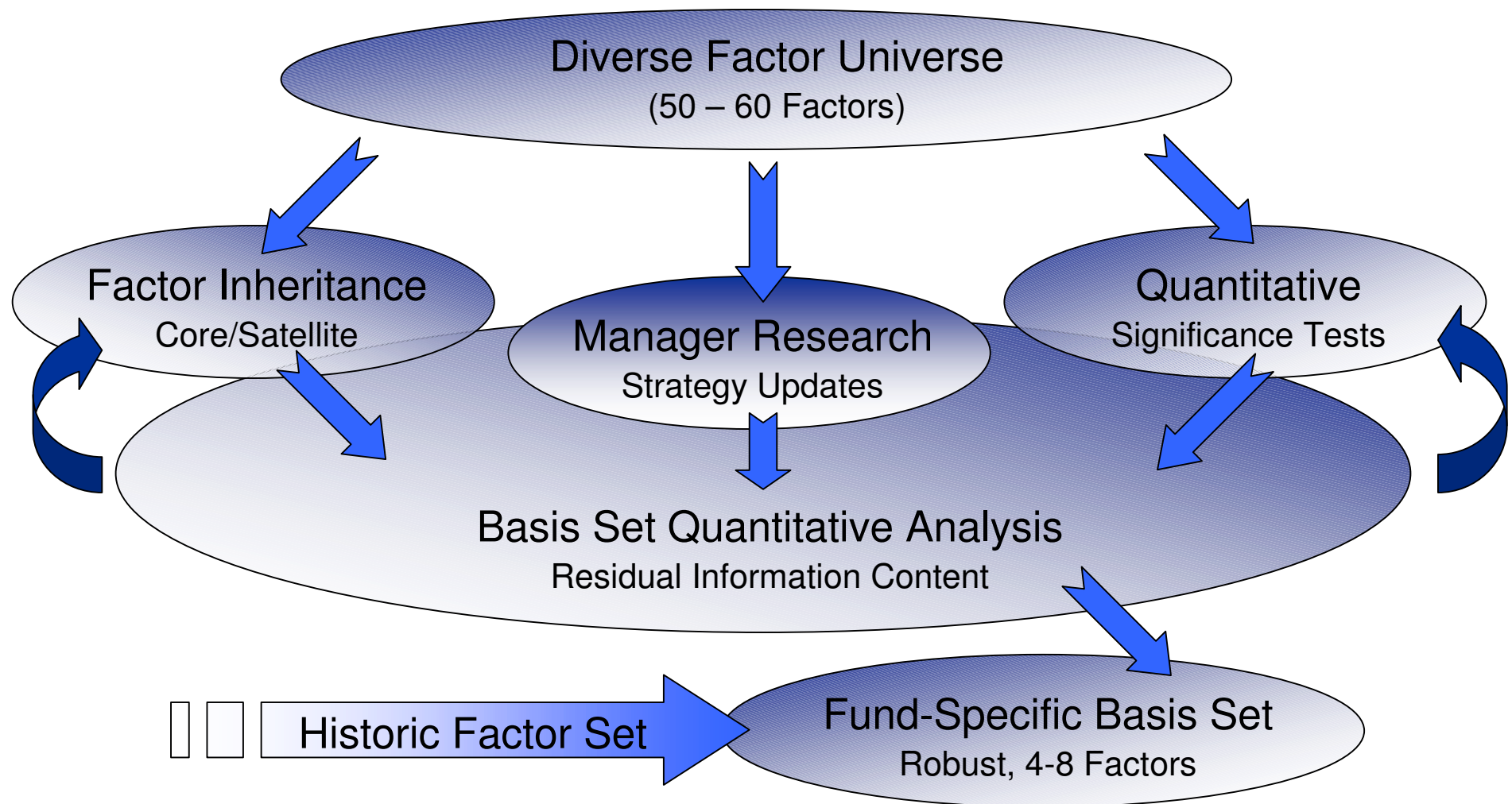


Factor-Based, Non-Parametric Risk Measurement Framework

Building a Risk Measurement Framework: Risk Framework Outline



Building a Risk Measurement Framework: Factor Universe to Fund Basis Set



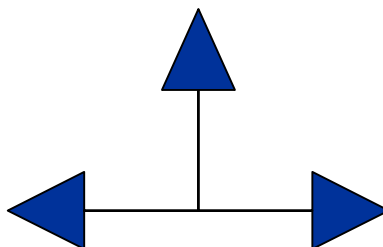
Building a Risk Measurement Framework: Rolling Multivariate Regression

Linear Regression Model

Minimise degrees of freedom
Maximise Robustness
Maximise Factor Information Content

Optimised Regression Window

Scree Test
Broad Strategy-Specific Grouping
Typically 18 – 21 month window



Significance Tests

(Varying length track records)
Confidence-adjusted R-squared
Correlation matrix screen
Micro-setting
Kolmogorov-Smirnov Residual Test

Time-Dependent Factor Exposure Matrix + Alpha

Inputs to Monte Carlo Engine

Building a Risk Measurement Framework: Monte Carlo Engine

Aims:

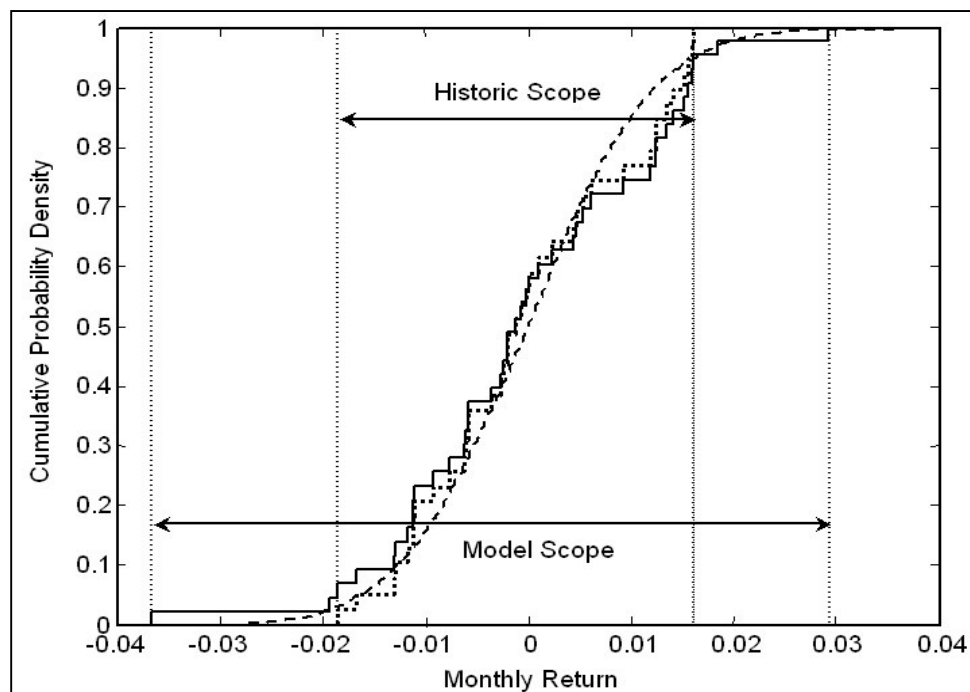
- Preserve covariance matrix
- Permit *extra*-historic (rare) events
- Prevent normal-dependency

Solution:

- Cholesky decomposition
- 100,000 Simulations

Results:

- Factor-based CDF
- 1st derivative yields risk profile

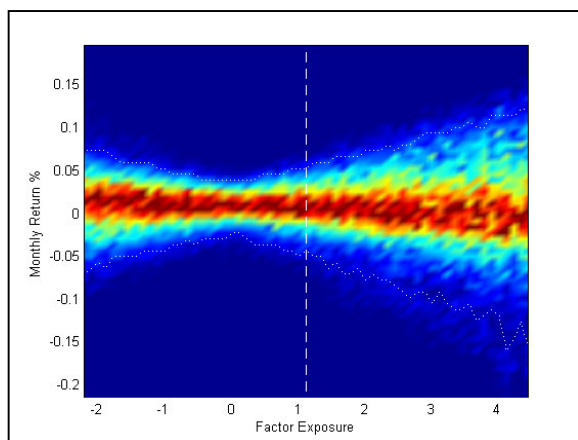
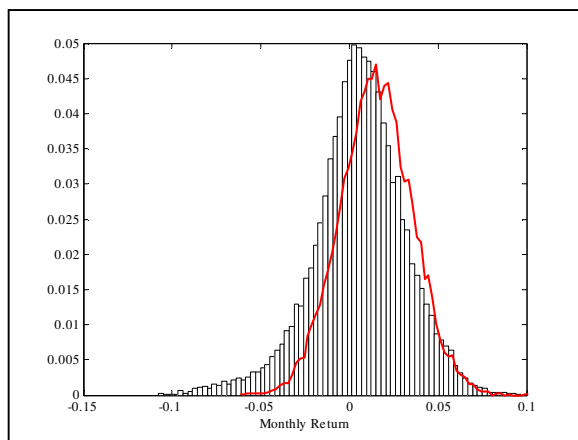


Observations:

- Extra-historic events typically 2% of probability density in each tail
- Model twice as likely to hit 98% historic VaR compared to 2σ calculation
- Skew and Kurtosis solutions of the system, not fitted inputs

Building a Risk Measurement Framework: Outputs

The non-parametric return distribution and factor exposure matrix together permit full flexibility for statistic generation.



Typical Statistics:

- Value-at-risk (percentile counting **not** n -sigma)
 - Extreme tail loss
 - Expectation value & alpha
 - Factor exposures
 - Higher moments
-
- Marginal return contributions
 - Factor risk attribution
 - Fund risk attribution (FoF only)
 - Style analysis
 - Stress & scenario tests
 - Factor influence analysis

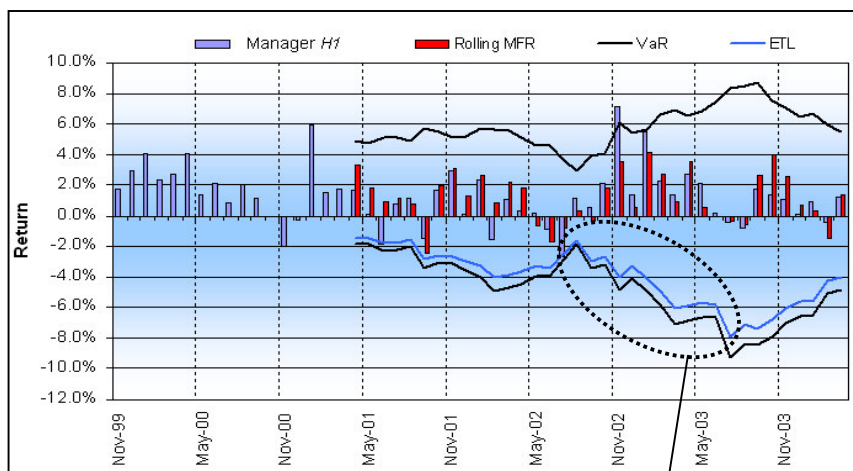
Building a Risk Measurement Framework

Examples:

- Convertible Arbitrage Hedge Fund
- Market-Independent Hedge Fund-of-Funds

Building a Risk Measurement Framework: Hedge Fund Example

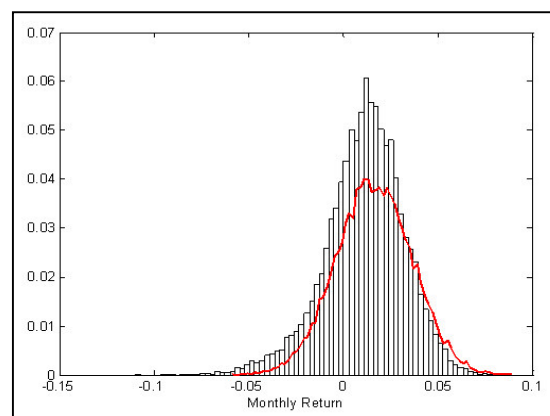
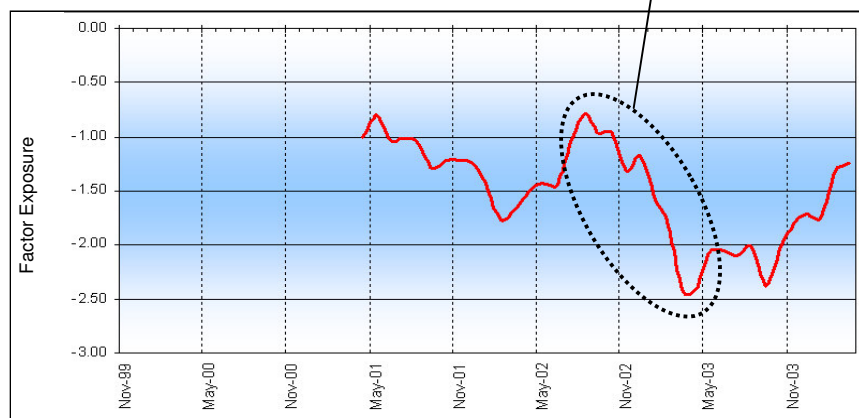
Implied Risk



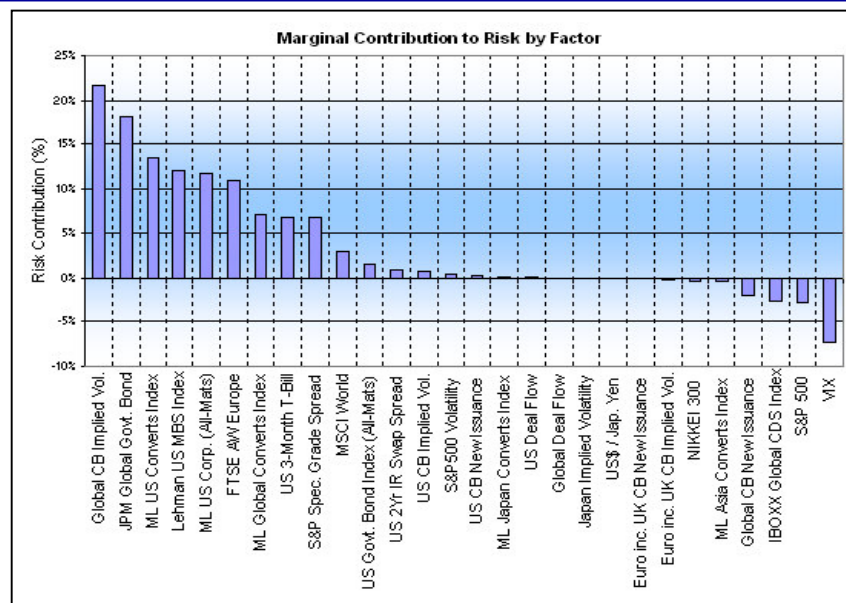
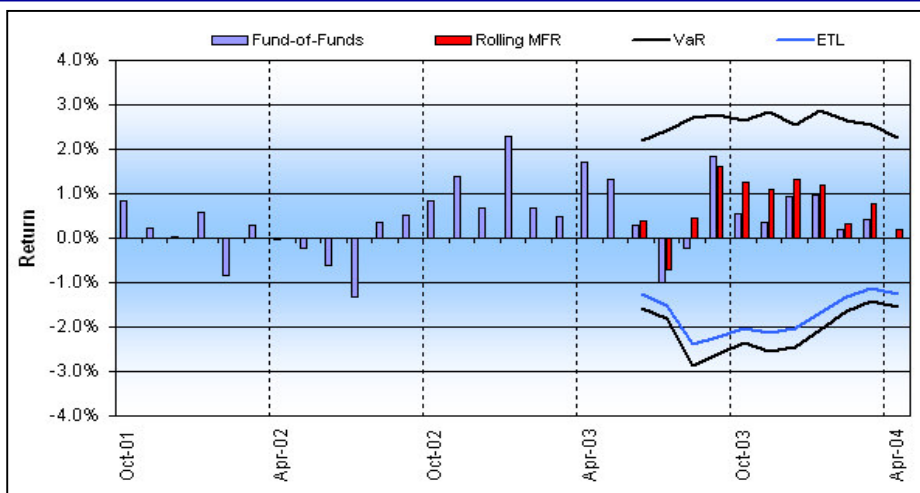
- Dynamic risk control clearly evident
- Credit spreads dominate implied risk profile
- Good agreement with position level VaR

- Credit spreads tighten
- Exposure increased to capitalise on opportunity set
- Implied risk responds accordingly

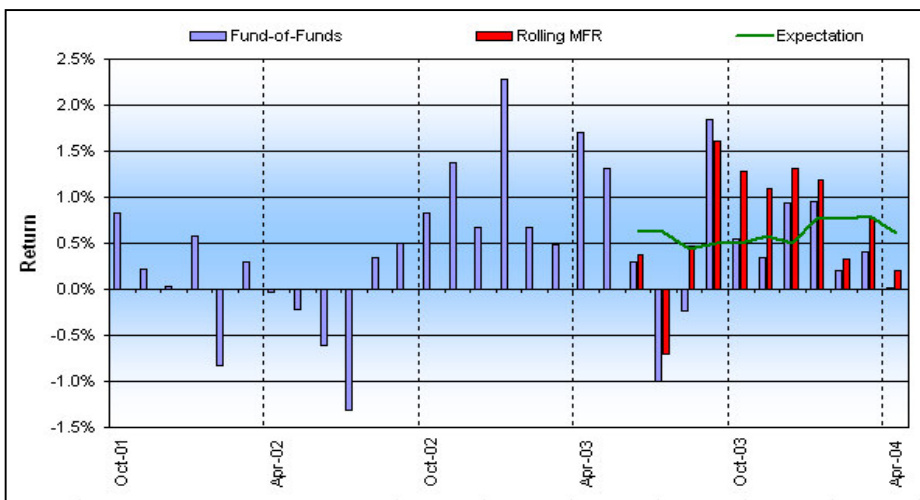
Credit Spread Exposure



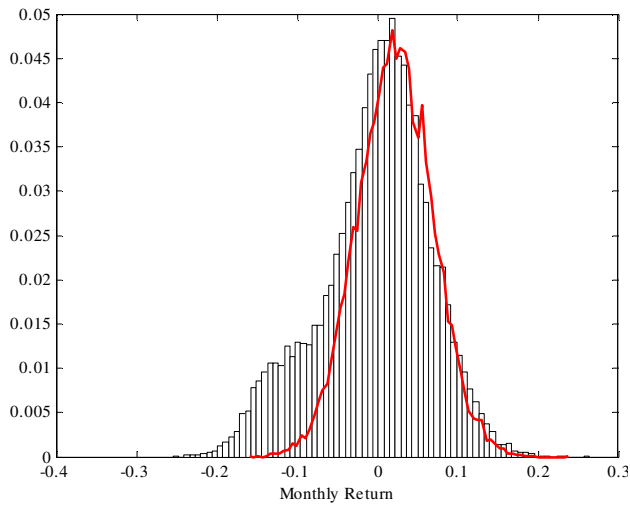
Building a Risk Measurement Framework: Hedge Fund-of-Funds Example



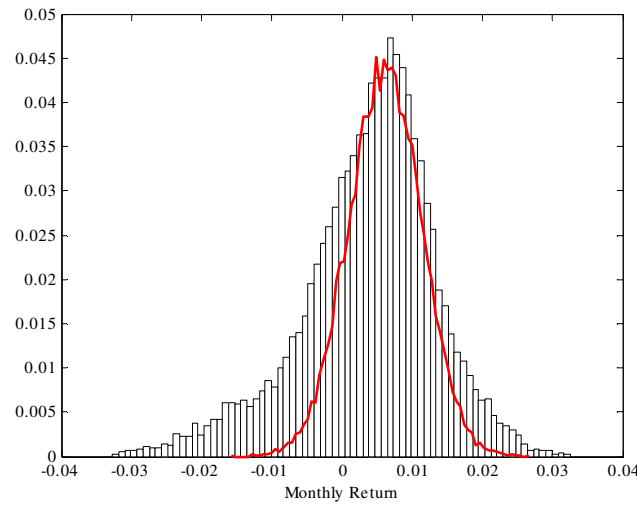
- Stability through diversification
- Consistent expectation value
- Orderly factor risk attribution



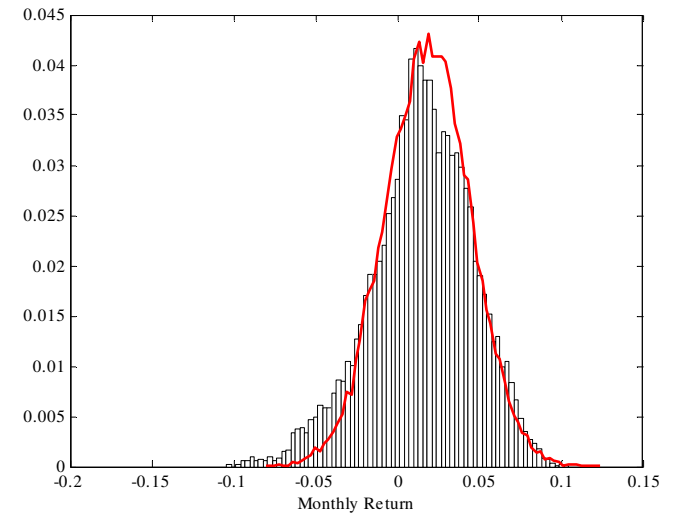
Building a Risk Measurement Framework: Typical Distributions



• Small / Mid Cap Bulge



• Distressed Tail



• Historic Replication

Building a Risk Measurement Framework: Summary

- Methodology for constructing a generalised risk framework
- Factor-based linear regression
- Monte Carlo Simulation
- Applicable to hedge funds and hedge fund-of-funds without the need for transparency or long track-record.
- Comprehensive risk and style analysis
- Non-parametric implied risk distribution
- Time-dependent factor exposure matrix

Portfolio Construction

- **Standard diversification techniques can fail**
- **It's important to not be fooled into thinking that a portfolio is robust just due to superficial backward looking quant analysis**
 - Correlated worst case scenarios
 - e.g. stock market crash leads to multiple deal breaks
 - Shared factor exposure between different strategies
 - e.g. distressed and CB arb exposure both exposed to credit spreads
 - Shifting factor dependence
 - e.g. CB arb shifting from implied volatility exposure to credit spread exposure and back
 - The unthinkable
 - e.g. Multiple CDS default
- **Obvious point but worth noting – keep all info up-to-date!**

After Investing - Monitoring

- **Manager Level**
 - Performance
 - Attribution
 - Risk
 - Assets, Operational & Other Change

- **Strategy Level**
 - Risks
 - Opportunity Set
 - Structural
 - Assets In Strategy

After Investing - Monitoring Managers

- **Performance**
 - Must have realistic expectations
 - Look for changes in distribution of returns
- **Assets**
 - Are they growing too fast?
 - Have they fallen by too much?
 - What is optimal?
- **Attribution**
 - Factor decomposition
 - Has the source of returns changed?
- **Risk**
 - As already covered
- **Operational issues**
 - e.g. change in infrastructure
 - e.g. key person departure
 - e.g. legal action

After Investing - Monitoring Strategies

- **e.g. CB Arbitrage**
 - Risks – credit spreads, volatility, liquidity
 - Opportunity set - new issuance, undervaluations, extremities of return drivers
 - Structural - US dividend taxation
 - Assets in strategy – recent record inflows

Important To Act

- **Not good enough to monitor – have to act on information**
- **Need to have pre-agreed thresholds and exit criteria**
 - Risk limits, shifts to performance distribution, acceptable asset levels and momentum, who is key etc
- **Slow drift is your enemy!**
- **Visualisation is your friend!**

New Directions

- **Rare events & tail evaluation**
- **Correlation distributions**
- **Better modelling of operational and other 'difficult to measure' risk**
- **Better incorporation of path dependency in risk models**

Summary

- **Need more than VaR**
- **Very important to consider worst case scenario**
- **Can't ignore operational risk and other 'difficult to measure' risks**
- **Need more than superficial diversification**
- **Ongoing monitoring essential**

Biographies

- **Dr Chris Jones, CIO, Key Asset Management**

Chris has been investing in hedge funds in a professional capacity for 11 years, previously heading up the hedge fund effort at Io Investors. Prior to this, he has worked in trading and asset management capacities at Société Générale and Crédit Lyonnais. Chris has presented lectures, conference papers and seminars at universities in North America, Europe and Australasia and has published several papers on trading and investment strategies. He has an BA in Mathematics from Oxford University and a Ph.D. in Finance from the University of Cambridge, where he is a Visiting Associate and occasional Lecturer.

- **Dr Toby Goodworth, Head of Risk Management, Key Asset Management**

Toby's background lies in hedge fund risk management and quantitative investment management. Previously Toby worked at Io Investors as Risk Manager, where he developed and ran bespoke risk management tools for the hedge fund of fund products. Prior to this he was a Risk Analyst focusing on global equity quantitative trading strategies within Io Investors. He holds a Ph.D. in physics from University College London, and a First Class honours degree (MSci) in physics, also from UCL