

Risk Management for Pension Funds and Asset Managers



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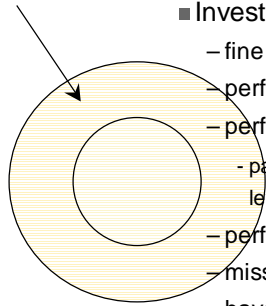
Deutsche Bank Group

12 May 2000

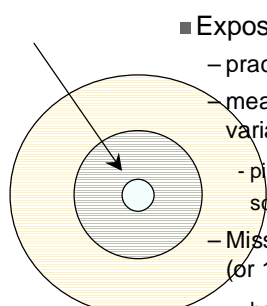
Overview

- A historical perspective on VaR
- How does VaR differ from classic investment risk measures?
- Understanding VaR and adapting it to investors' needs: Where does "traditional" VaR fall short?
 - Benchmarks, liabilities
 - Longer holding period
 - Alternative assets
- Coping with the other limitations of VaR for all types of users
 - Complex instruments: choosing the right VaR model
 - Granularity: capturing relative value strategies
 - Liquidity
- A working VaR and risk budgeting system for pensions, asset managers

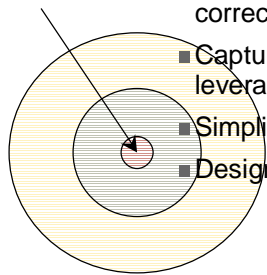
A historical perspective on VaR: why it was adopted by banks

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- Investment guidelines and position size limits
 - fine for simpler, outright long portfolios
 - perform poorly for overlays, long-short portfolios
 - perform very poorly with product innovation
 - particularly products with small principal size but embedded leverage
 - perform awkwardly with duration
 - miss the portfolio context: correlation
 - have a hard time distinguishing simply between more or less risky markets: volatility
 - perform poorly with multiple asset classes

Historical perspective on VaR, cont.

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- Exposure/sensitivity limits
 - practiced by banks more than investors
 - measuring sensitivity to a 1 bp, or 1%, change in key variables
 - pick up duration, embedded leverage, some complex products, some portfolio effects
 - Misses that some underlying assets more likely to move 1% (or 10%) than others...
 - how different should Russian equities (90% vol) limits be vs U.S. equities (17% vol)?
 - Doesn't give credit for diversification, correlation effects
 - For arbitrage and hedging, the rules would have to be more complicated than the portfolio

Historical perspective on VaR, cont.



- Combines sensitivity with volatility and correlation to correct the deficiencies of the other measures
- Captures duration, complex products, embedded leverage
- Simplifies the display of the risk of an arbitrage strategy
- Designed to cope with mixing multiple asset classes

Comparing VaR to classic investment risk measures

- Investment guidelines
 - Can be too constrictive, harming performance
 - Can be too lax
 - Name-based rules can miss leverage, embedded options
 - Have a difficult time controlling currency risk
 - Not necessarily even-handed across asset classes and countries
 - VaR designed to handle derivatives, currencies, and provide same metric across asset classes
- Standard deviation
 - Excellent when used for risk-adjusted performance measurement
 - Not useful for providing early warning that a manager has begun to deviate from your intention
 - VaR doesn't show manager skill--but does provide early warning before a manager's changes are crystallized as performance

Comparing VaR to classic investment risk measures, cont.

■ Duration

- Duration is a sensitivity measure, not weighted by the likely degree of an interest rate move; misses volatility
- Duration may be summed across yield curve segments or across credit qualities, which will reduce the appearance of risk; misses correlation
- Duration (and convexity) an insufficient measure for instruments with embedded options

■ Beta and tracking error

- These do make use of volatility and correlation information
- Usually available for only equity portfolios; should be available for all managers, and at plan levels
- Most tools that calculate these for equities cannot cope well with foreign exchange, fixed income, convertibles or derivatives in an equity portfolio

But VaR's not actually perfect

It's backward looking

- VaR uses historical data over some period, collected at some frequency, to estimate potential future losses
- Like driving using the rear view mirror
- Compared to what?



- Has led to popularity of stress testing

Where VaR models used by banks may let investors down

- Where are the liabilities?
- Long holding period
- Equity analysis
 - VaR not flawed as an analysis method for equities
 - Common application misses distinctive characteristics of equities
- Covering alternative assets
 - real estate, venture capital
- Many academic VaR studies irrelevant for investors
 - particularly in determining the “best” lookback period for data
 - long holding period, less frequent analysis make investors difficult to compare to banks

Addressing VaR's shortcomings for investors

- Relative to benchmark, liabilities
 - making use of actuarial work on liabilities
- Long holding period; modelling drift
 - forecasting returns
- Articulate approach to equities
 - not mapping stocks directly to an index
 - using sectors, factors, beta mapping
- Alternative assets
 - proxy mapping to a similar stock or index
 - making use of available data histories

Challenges for all types of users: ensuring a quality VAR measure

- Right model for
 - non-linear instruments
 - options, convexity, mortgages, convertibles
 - non-normal markets
- Granularity
- Illiquidity
 - Emerging markets
 - Large, single holdings

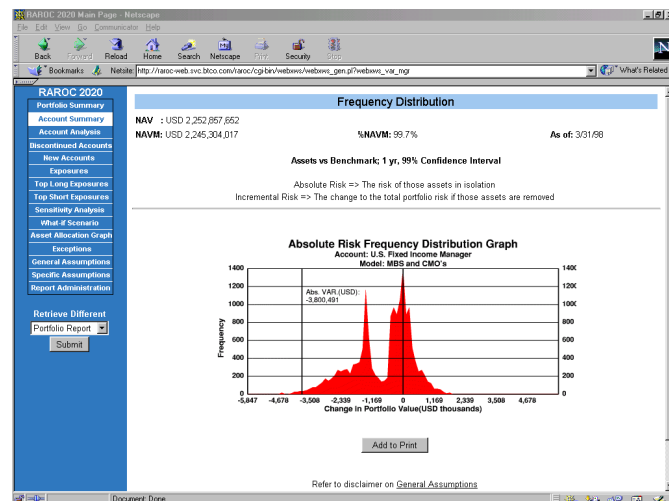
Quick overview of popular VaR methodologies

- “Parametric” / “Delta-Normal” / Variance-Covariance
 - Assumes normality of markets and normality of instruments
 - Misses the “fat tails” of illiquid or emerging markets in particular
 - May miss the risk of options, convertibles, mortgages-- particularly when non-linear products are “out of the money”
- Historical Simulation
 - Corrects for non-normality of markets
 - Can deal with non-linear instruments
 - Difficult to use for a longer holding period
- Monte Carlo
 - Assumes normality of markets
 - Deals with non-linear instruments
 - Easy to use for a longer holding period

Risk measurement for non-linears...

When delta is not enough...

full repricing, or point repricing



Challenges for VaR: Granularity

- The risk factors in the VaR model must capture the main drivers of the fund's strategy
 - critical for long/short and relative value strategies
- If the risk factors are too crude, they will miss the risk of the fund

VAR: special challenges in illiquid and emerging markets

- Volatility-based measures less effective for any market which is
 - natively illiquid
 - in which you are overconcentrated
- Markets which are illiquid have "fat tails"
 - rare events more common than estimated by statistics built around a normal distribution
 - long periods of boredom, short periods of terror
- Lack of historic price data
- Instrument models not suitable
 - convertibles

Strategies which are vulnerable to single, unlikely events need special treatment

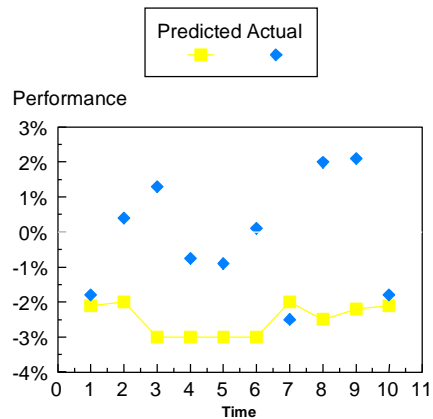
- Currency devaluation trades
- Merger/arbitrage trades
- Extraordinarily out-of-the-money options

Treating liquidity risk and “rare event” strategies

- Investment guidelines focus reasonably well on this
 - Concentration in a single issuer or market
- Compare your holdings to daily trading volume
- Above a certain percentage
 - require that positions be trimmed, or
 - add a liquidity “charge” to VaR
 - based on size of bid/offer, or less scientifically
- Size limits on “rare event” strategies, relative value pairs

Backtesting

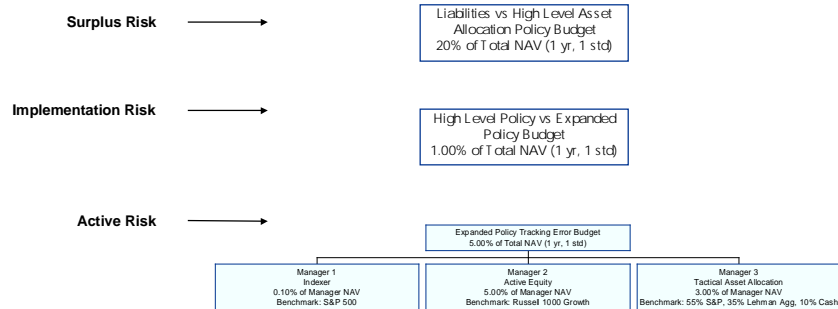
- "Backtesting": if VAR prediction does not come true within statistical confidence interval
 - bad model
 - illiquid market
 - concentration in single issue



A working VaR system for pension funds

- VaR for asset allocation vs liabilities ("surplus at risk")
 - as a stream of fixed income, or other, more relevant proxy
 - may also compute for actual portfolio, not just asset allocation
- VaR for tactical vs strategic asset allocation ("implementation risk")
- VaR for actual holdings vs tactical asset allocation, for the plan, and for each manager ("active risk")

“Risk budgeting” for pensions



How asset managers use VaR

- Monitor each fund's total and active VaR
 - 1 year holding period, 84% confidence common
- Set internal standards to flag funds that deserve senior management attention
 - can be on active VaR, total VaR, or both
 - active VaR most common
- Standards can be arrived at via
 - marketing materials and the Sharpe ratio
 - bad historical experiences that no one wants to repeat
- Clients may explicitly agree these standards as guidelines