**Topic 9: Risk Management for Alternative Investments**



* Asset liquidity risk
* Autocorrelation
* Backward-looking window
* Blowup
* Capital calls
* Component VaR
* Conditional VaR (CVaR)
* Cornish-Fisher expansion
* Counterparty risk
* Credit risk
* Decay factor
* Delta-normal
* Dimson beta
* Economic capital
* Estimation error
* Excess kurtosis
* Exponentially weighted moving average (EWMA)
* Exposures
* Full valuation methods
* Funding liquidity risk
* Gates
* Histogram
* Historical
* Historical simulation
* Hot spots
* Hypothetical returns
* Leveraged buyouts (LBOs)
* Linear methods
* Liquidity risk
* Lockup periods
* Long option
* Marginal risk
* Market risk
* Mean
* Mezzanine debt
* Model risk
* Modified duration D
* Monte Carlo simulation
* Notice period
* Over the counter (OTC)
* Parametric
* Position-based
* Positions
* Price impact function
* Prospective scenarios
* Quantile
* Regulatory risks
* Returns-based information
* Risk aggregation
* Risk budgeting
* Risk engines
* Risk factors
* Risk monitoring
* Senior debt
* Sharpe ratio
* Short option
* Skewness
* Stale
* Stop-loss rules
* Subordinated debt
* Suspension
* Systemic risk
* Standard deviation
* Trend-following systems
* Value at Risk (VaR)
* Variance-covariance
* Venture capital

**1. Describe the challenges that Alternative Investments pose to risk managers.**

* Alternative Investment managers cover a broad range of investment styles.
* Have a much wider investment range and are less regulated.
* They can impose lockup and minimum redemption notice periods.
* They can short securities and apply leverage
* More secretive.

**2. Describe market, credit and liquidity risks.**

* Market: risk of losses due to movements in the financial markets
* Credit: changes in the perceived default probabilities or actual defaults
* Liquidity: risk of losses due to having to liquidate the position

**3. Describe the steps that are typically taken to measure market risk.**

**ESSAY:**

1. Collect the current Positions
2. Construct the Statistical Distribution of risk Factors from market data
3. Use a Risk Engine like VaR or Worst Case Scenarios

**4. Compare position-based vs. return-based measures of risk.**

Position-based

* uses things like VaR engine
* vastly more informative

Return based

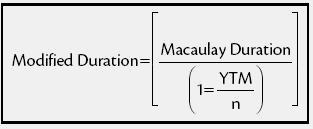
* is cheap to implement.
* But they offer NO information for new instruments and markets.

**5. Explain how hidden risk can lead to misleading results when SHARPE ratio is used to measure performance, and how risk can be properly measured in the presence of such hidden risks.**

* Selling OTM puts is totally misleading.

**6. Describe the relationship between modified duration and risk of fixed income instruments. DO NOT CALCULATE.**

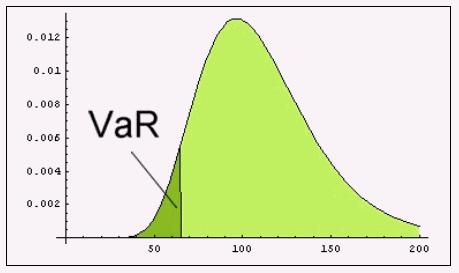
* Modified duration takes the basic comparison of bond duration and uses it to determine how much the price of a bond will change if its interest rate changes one percent.



**7. Identify, describe and calculate various measures of leverage. Pg 254 Integrated Topics and Applications**

* Long leverage – Long stock / equity position
* Short leverage – leveraged up short stock / equity position
* Gross leverage - is the long and short / equity position
* Net leverage - is the long minus short / equity position

**8. Describe and calculate VaR.**



* VaR: The cutoff point in the lower quantile of the left tail.
* VaR is defined as the maximum loss over a defined period of time at a stated level of confidence, give normal market conditions.

**9. Compare VaR to Conditional VaR (CVaR**).

* A complementary risk measure is the conditional VAR (CVAR), which is the average of losses beyond VAR.
* CVaR > VaR.
* Goes beyond VaR
* Mathematically speaking, CVaR is derived by taking a weighted average between the value at risk and losses exceeding the value at risk.
* Conditional value at risk is derived from the value at risk for a portfolio or investment
* The use of CVaR as opposed to just VaR tends to lead to a more conservative approach in terms of risk exposure.
* The choice between VaR and CVaR is not always clear, but volatile and engineered investments can benefit from CVaR as a check to the assumptions imposed by VaR.

**10. Describe and calculate VaR when the return distribution is skewed.**

* Cornish-Fisher expansion
* The Cornish–Fisher expansion is an asymptotic expansion used to approximate the quantiles of a probability distribution based on its cumulants.
* It is named after E. A. Cornish and R. A. Fisher, who first described the technique in 1937.
* It relates the cumulative distribution function of a normal distribution to some distribution of interest.
* VaR = Z-score x s.d.

**11. Describe the relationship among VaR calculations for different time horizons and explain how autocorrelation in historical returns could impact this relationship.**

* Autocorrelation creates 🡪 higher Volatility
* Longer horizons increase risk measures.
* If the VaR number is being used to decide how much capital to set aside to avoid bankruptcy, then a long horizon is advisable.

**12. Describe back testing and the implications of Type I and Type II errors.**

* Type I: Bad luck, unusual markets. Rejecting a model when it is correct.
* Type II: Worse problem. Accepting an incorrect



* Forecasting Exceptions. With a 95% Confidence Level.
* 5% x 250 = 12.5 days of exceptions

13. Describe the EWMA to volatility and calculate volatility using this approach.

The Exponentially Weighted Moving Average (EWMA) is a statistic for monitoring the process that averages the data in a way that gives less and less weight to data as they are further removed in time.

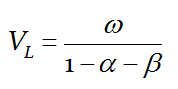
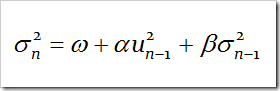
The statistic that is calculated is:

EWMAt=λYt+(1−λ)EWMAt−1fort=1,2,…,n.

where

* EWMA0 is the mean of historical data (target)
* Yt is the observation at time t
* n is the number of observations to be monitored including EWMA0
* 0<λ≤1 is a constant that determines the depth of memory of the EWMA.

**14. Describe GARCH (1,1) approach to volatility and calculate volatility using this approach.**

* + - Long Run Average Variance =  Note: Take the square Root
* Estimate of volatility = 

**15. Compare linear models to full-valuation models for calculating VaR for large portfolios.**

* Linear methods (1st derivative) replace the positions by their linear exposures on risk factors (e.g., bonds by their dollar duration and options by their delta).
* Full valuation methods, in contrast, reevaluate the entire instrument for the new values of the risk factors. So, sounds like it relates to Gamma which changes the delta and makes the delta not a linear factor.

**16. Describe the delta-normal or variance-covariance model for calculating VaR for large portfolios.**

VaR for large portfolios:

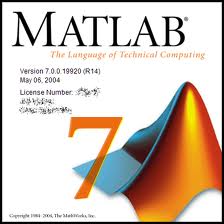
Delta-Normal Method

* The delta-normal method assumes that all asset returns are normally distributed. As the portfolio return is a linear combination of normal variables, it is also normally distributed.
* This method consists of going back in time, e.g. over the last 5 years, and computing variances and correlations for all risk factors. Portfolio risk is then generated by a combination of linear exposures to many factors that are assumed to be normally distributed, and by the forecast of the covariance matrix.
* Delta-Normal Method: This is the simplest method to implement. Drawbacks, however, are the assumptions of normal distributions for all risk factors, and that all securities are linear in the risk factors (e.g. no options).

The parametric method, also known as the [variance-covariance](https://www.investopedia.com/ask/answers/041515/what-difference-between-variance-and-covariance.asp) method,

* Is a risk management technique for calculating the VaR of a portfolio of assets that first identifies the mean, or expected value, and [standard deviation](https://www.investopedia.com/terms/s/standarddeviation.asp) of an investment portfolio.
* The parametric method looks at the price movements of investments over a look-back period and uses probability theory to compute a portfolio's maximum loss.
* The variance-covariance method for the value at risk calculates the standard deviation of price movements of an investment or security. Assuming stock price returns and volatility follow a normal distribution, the maximum loss within the specified confidence level is calculated.

**17. Describe the historical simulation approach and compare it to the Monte Carlo method.**



* This is a full valuation method that simulates movements in the risk factors from their recent history

## Historical-Simulation Method

This method consists of going back in time, e.g. over the last 5 years, and applying current weights to a time-series of historical asset returns. This return does not represent an actual portfolio but rather reconstructs the history of a hypothetical portfolio using the current position. Of course, if asset returns are all normally distributed, the VAR obtained under the historical-simulation method should be the same as that under the delta-normal method.  
Required:  
(1) for each risk factor, a time-series of actual movements, and  
(2) positions on risk factors.

## Monte Carlo Method

Monte Carlo simulations proceed in two steps.

First, the risk manager specifies a stochastic process for financial variables as well as process parameters; the choice of distributions and parameters such as risk and correlations can be derived from historical data.

Second, fictitious price paths are simulated for all variables of interest. At each horizon considered, which can go from one day to many months ahead, the portfolio is marked-to-market using full valuation. Each of these ``pseudo'' realizations is then used to compile a distribution of returns, from which a VAR figure can be measured.  
  
Required:  
(1) for each risk factor, specification of a stochastic process (i.e., distribution and parameters),  
(2) valuation models for all assets in the portfolio, and  
(3) positions on various securities.

## Comparison of Methods

## Historical-Simulation Method: This is also relatively simple to implement. We just keep a historical record of previous price changes; distributions can be non-normal, and securities can be non-linear. One drawback is that only one sample path is used, which may not adequately represent future distributions.

Monte Carlo Method: This is the most sophisticated method. It allows for any distribution and non-linear securities. The method, unfortunately, requires computer time and a good understanding of the stochastic process used.

**18. Describe the marginal risk and component risk of a position in a large portfolio.**

* Marginal is the risk due to a small change.
* Marginal risk provides more than a single summary measure of risk. They also help the portfolio manager understand the sources of risk and drill down to the level of sub portfolios and even individual positions.

**19. Explain the relationship between marginal risk, component risk and total risk of a portfolio.**

* + - * Marginal risk is the piece of risk added each time.
      * Component risk is the bigger piece added.
      * Total Risk is the combination of both?

**20. Calculate marginal and component risks of a portfolio.**

* \*\*\*\* Marginal Formula

**21. Describe the concept of risk budgeting.**

* Risk budgeting: is the process by which an investor selects a total risk budget for the fund that is then parceled out to various investments and position

**22. Describe scenario analysis in the context of stress testing. This was on PRMIA**

* Scenario analysis is routinely used to set margin requirements by prime brokers and clearing counterparties, often in combination with VaR measures.

**23. Explain how autocorrelation/ serial correlation can be used to measure illiquidity.**

* Positive autocorrelation increases volatility over time horizon.
* Think of the double jump trampoline effect.

**24. Describe the impact of illiquidity on measures of risk.**

* Reported monthly volatility is biased downward
* Monthly changes will display positive autocorrelation meansing tha t movement in one direction will be only partially captured during one month if prices are stale

**25. Describe various types of liquidity risk and explain their impacts on alternative assets.\**



1. Funding liquidity risk
2. Asset liquidity risk

**26. Explain how alternative asset managers cope with various types of liquidity risk.**

* Matching the horizon of their assets and liabilities

**27. Explain the limitations of conventional measures of risk when applied to alternative assets.**

1. VaR does not capture Tail Event Risk!!!!
2. Assumes all positions are fixed over a time period
3. Models tend to be oversimplified
4. Risk measures are based on the recent past

**28. Describe regulatory and counterparty risks.**

* Regulatory risk sudden restrictions on short sales, which wreaked havoc on hedging strategies in 2008.
* Counterparty risk: you need to know your counterparties and their risk. Such contagion effects transform traditional risks into systemic risk.

**29. Describe the distributional properties of long and short option positions and compare these to distributional properties of trend following and stop loss trading strategies.**

* Long options give positive skew.
* Short options give negative skew.
* Trend and Stop-Loss can help mimic positive skew

**30. Explain the implications of non-transparency for risk management and describe how problems related to lack of transparency can be overcome.**

1. Have an external risk measurement service provide investors with risk aggregating measures.
2. Invest in a fund of hedge funds that has both the ability to supply position information to investors and the capability to construct proper risk models

A Perspective on Liquidity Risk Horizon Uncertainty

 Note: “Selling contagion”

* Counterparty risk
* Delevering
* De-risking
* High-volatility regime
* Risk-transfer
* Selling contagion
* Single horizon

**1. Explain the three primary forces that affect the returns of broad equity indices (S&P Index) during a tail-risk event. BID ASK.**

TAIL RISK EVENT

1. The company risk grows because of higher fundamental and flow related risk grows at the company level
2. De-leveraging and de-risking occur simultaneously across large groups of securities introducing higher levels of short term return increases correlation.
3. Bid- Offer spreads widen and the market impact of trades become large as market makes charge higher prices for providing liquidity; this affects all risky assets and further induces correlation to rise

**2. Explain why during financial crises security prices may be determined by factors other than economic and financial fundamentals. ESSAY**

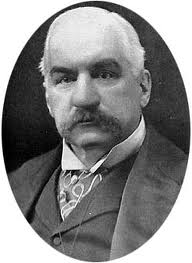
1. Liquidity Risk
2. Selling behavior Contagious

* A selling contagion is the spread of an economic crisis from one market or region to another and can occur at both a domestic or international level.

**3. Discuss the dynamics of high liquidity-risk periods in the U.S. throughout the last several decades.**

* Rapid Growth BUBBLE
* Lack of Adequate Market Safeguards
* System like architecture. Too COMPLEX
* Poor leadership - Secretary of Treasury
* Occurrence of economic shock

Three examples:

1. Panic of 1907 
2. Great Depression
3. Recent period of 2007

Causes of these liquidity-risk periods can often be traced back to capacity constraints at financial institutions and exchanges.

* Capacity restraints
* Position unwinding
* Predatory trading

1. **Analyze the underpinnings and limitations of Capital Market Theory as it pertains to investment horizon uncertainty and liquidity risk.**
2. Underpinnings

* Single horizon model. LONG HORIZON.
* Mean/Variance approach
* Static trading costs
* Investment size is boundless

CMT Limitations. Breaks down in the face of liquidity risk

* Public equity
* Private equity
* Debt

**5. Describe the disadvantages of carrying illiquid investments.**

* Creates forgone opportunities.
* Liquidity risk often rises when asset prices fall
* Liquidity risk is not diversifiable
* Liquidity risk is not a continuous risk non-linear – big jumps

**6. Argue whether derivatives are a cause or a solution (or both) of liquidity risk**

* Options free investors from needing to transact and use liquidity to alter their exposure via transactions
* They are a cause, solution and a bit of both when it comes to liquidity risk.

**7. Discuss how options can be used to manage risk during periods of financial stress.**

1. Puts
2. VIX

