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Monte Carlo Analysis: Weighing the Risks

Smart Investing Conference Call Handout

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Risk Control is Essential for Successful Investing

- Portfolio losses are difficult to recover from when required distributions are being taken from the portfolio
- Risk cannot be expressed by statistics alone
- Traditional investment models often underestimate potential losses
- Avoid short-term investment fads
- Portfolios are structured to avoid any potential for catastrophic loss

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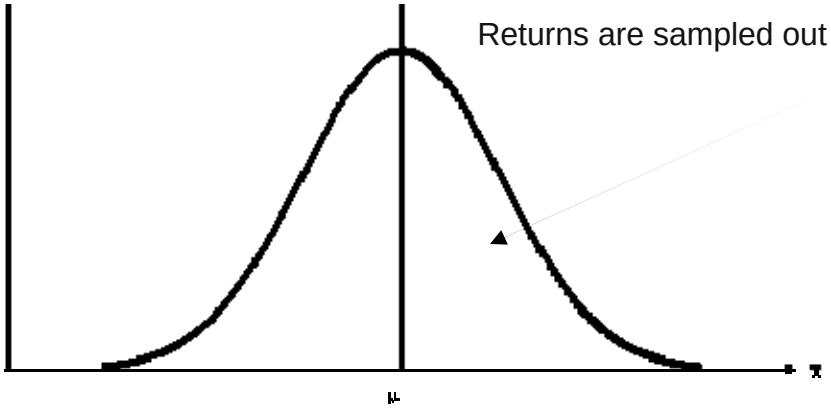
Analyze Portfolio Exposure and Tolerance for Multiple Risk Factors:

Macroeconomic factors	Credit risk
Valuation	Liquidity
Currency	Statutory or Policy compliance
Underperforming benchmarks (tracking error)	Fraud
Inflation	Geopolitical events
Deflation	Headline risk

No quantitative model can incorporate all these factors

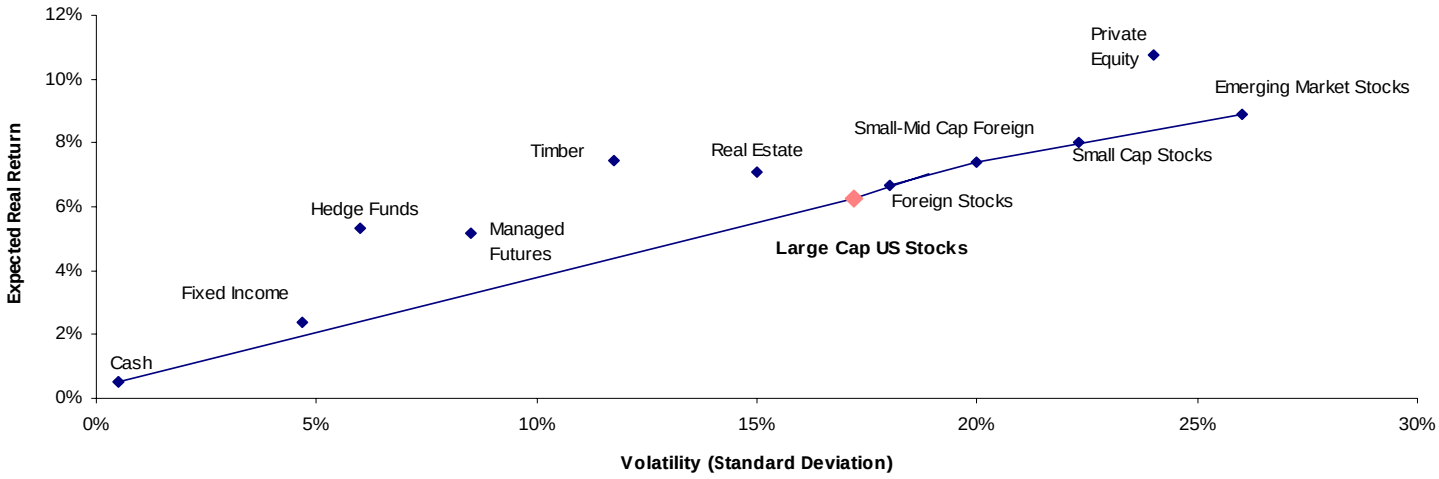
What is a Monte Carlo Simulation?

- Technique using random numbers to model a range of probable outcomes
- For portfolio modeling, it involves estimating the range of returns and generating a set of outcomes
  - Key variables are expected return, standard deviation of returns and correlation between different asset classes
- The results are summarized by percentile due to the large number of iterations



- Our model generates random annual returns, subtracts any planned expenditures and then summarizes the results

Comstock Asset Class Returns and Volatility



- Historical returns are likely unrepeatable
  - From 1871 to 2001 real EPS growth has been 1.25%[1]
  - From 1926 to 2004 a doubling in the P/E ratio accounted for 90 basis points of the S&P 500's 10.4% annualized return[2]
  - 25 years of declining interest rates have distorted historical bond returns
- 6.25% expected real return from large cap US stocks =
  - 5% normalized earnings yield (earnings / price) + 1.25% real EPS growth
  - Represents what an owner could expect to earn if the companies in the S&P 500 were privately held

1. Jeremy Siegel: Stocks for the Long Run
2. Ibbotson Associates 2005 Yearbook

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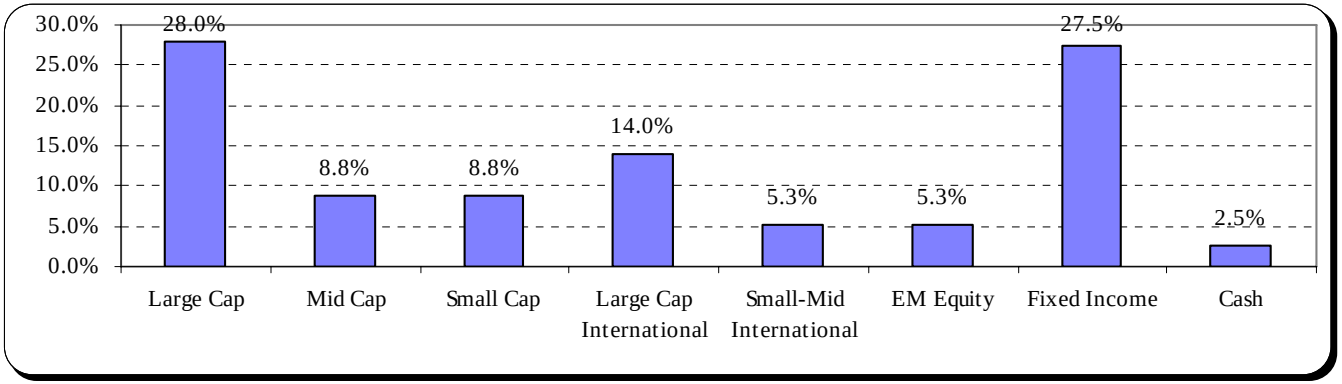
Sample Portfolio

Expected Real Return:	6.00%
Standard Deviation:	12.09%
Sharpe Ratio:	0.46



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Projected 20 Year Portfolio Values

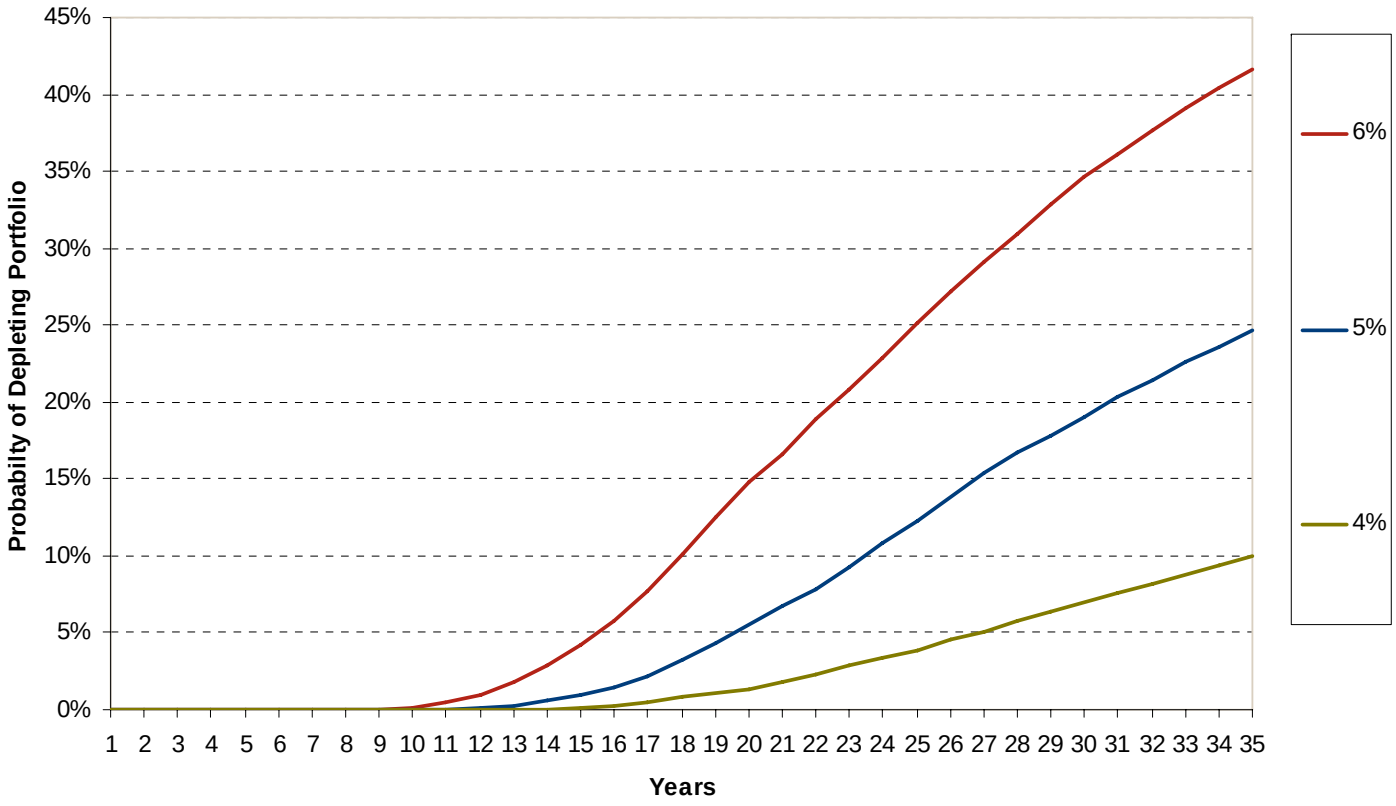
Range of Portfolio Values in 20 Years

	Distribution Rate		
Percentile	**4%**	**5%**	**6%**
95%	$2,278,802	$0	$0
75%	**$8,563,322**	**$5,383,092**	**$2,565,337**
50%	**$15,338,655**	**$11,451,246**	**$8,300,507**
25%	**$25,426,199**	**$21,019,188**	**$16,823,427**
5%	$48,965,715	$42,085,384	$37,334,429

- $10 million initial portfolio value net of constant real dollar distributions of 4% (400K), 5% (500K) and 6% (600K)
- Values are in current dollars and represent today's purchasing power

Sample Portfolio: Likelihood of Depletion

- Distribution rate of 4%, 5% & 6% of beginning capital, taken each year and adjusted for inflation
  - Represents fixed budget as opposed to a variable percentage of assets
- A 6% distribution has a high likelihood of depleting the portfolio



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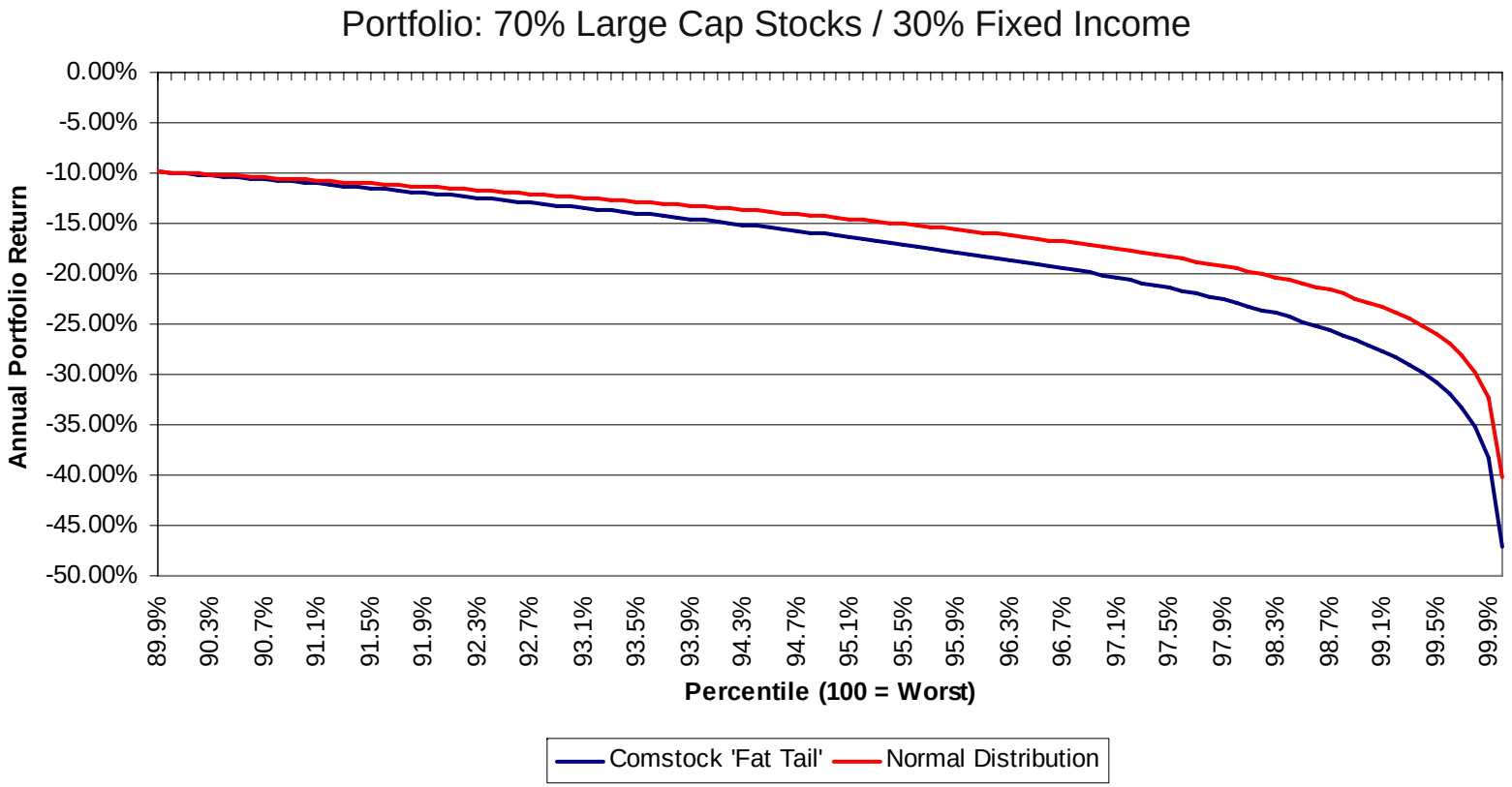
Its Only a Model..

- Most quantitative models rely on estimates of standard deviations from past behavior and assumptions of normally distributed returns
  - Both assumptions are faulty
- Volatility in the markets is not a constant
  - There are no guarantees that volatility in the future will be comparable to volatility observed in the past
- Returns on stocks and bonds are not normally distributed
  - They have fat "tails" – meaning that losses often exceed what statistical models would predict
  - For example, based on estimates derived from observable market data available at the time, the October 1987 crash was a more than "once in the age of the universe" event
- It is somewhat surprising that well-trained professionals still use phrases like a "1 in 100,000 year event" when this fat-tail phenomenon is well documented in economic literature
- Unlevered investors can withstand the "1 in 100,000 year events" that seem to happen every few years, but leveraged investors will often be wiped out
- Fortunately these factors tend to level out over longer time periods
- Our model generates negative "fat tails" by increasing the volatility and correlation for results in the bottom 10%
  - Statistical tests for these results match empirical market data
  - Cash and high quality fixed income are excluded

Comstock Downside Modeling vs. Typical Statistics



- Modeling downside risks accurately leads to more robust results

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Economic Forecasting is Unreliable

- Analyzing current economic conditions and important macroeconomic variables is a useful exercise
- Making predictions based upon the interactions of these conditions and variables is an impossible endeavor
- The problem is that it is not possible to correctly estimate the proper weightings and interactions of these variables

Even simple causal chains like this are unpredictable, there is no reliable way to measure and calculate the impact of one link on another and there are tens if not hundreds of additional variables that impact the analysis

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