Momentum Risk Management

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What is Risk Management and Momentum?

- Momentum is a financial phenomenon that is present within stocks (and other securities)
  - In a nutshell it states that previous performance indicates future performance, i.e. high returns = high future returns
- Risk Management on the other hand is identifying and countering downside movement within a strategy
- Momentum based strategies are known for having large and unexpected drawdowns despite consistently outperforming the market
- The team investigated methods to mitigate such risk

Common Means to mitigate risk (1 of 2)

- Diversification and Asset Allocation
  - Asset Allocation: Spreading investments across different asset classes like stocks, bonds, real estate, and commodities. The mix is based on the investor's risk tolerance, financial goals, and time horizon.
  - Diversification: Holding a variety of individual assets within each asset class to avoid overexposure to any single security or industry. The goal is to invest in assets that are not highly correlated; for example, stocks and bonds often perform counter-cyclically.
  - Global Exposure: Investing across different countries and currencies to reduce concentrated exposure to a single economy or local market risks.

- Hedging and Defensive Strategies
  - Hedging: Using specific financial instruments such as options, futures, and inverse ETFs to offset potential losses in other parts of the portfolio. This acts as a form of insurance, though it incurs costs.
  - Defensive Investing: Allocating a portion of the portfolio to more conservative, stable assets like high-quality sovereign bonds or cash equivalents, which tend to retain value during equity market downturns.
  - Tail Risk Strategies: Actively managed strategies designed to protect against rare, high-impact (black swan) events that could cause catastrophic outcomes for a portfolio.

Common Means to mitigate risk (2 of 2)

- Ongoing Management and Discipline
  - Regular Monitoring and Rebalancing: Periodically reviewing the portfolio's performance and adjusting asset weights back to their strategic targets to maintain the desired risk profile.
  - Long-Term Perspective: Focusing on time in the market rather than trying to time the market. This approach helps investors avoid making reactive, emotional decisions in response to short-term volatility.
  - Risk Transfer: In a broader organizational context, risks can sometimes be transferred to a third party, for example, through insurance or contractual agreements.

- Implementing Metrics to understand Risk
  - Portfolio Analytics: (1) average daily return, (2) benchmark average daily return, (3) portfolio total return, (4) benchmark total return, (5) portfolio variance, (6) benchmark variance, (7) alpha, (8) beta, (9) Sharpe ratio, and (10) maximum drawdown
  - Value at Risk:
    - Historical Simulation: Uses past data to model future outcomes.
    - Parametric (Variance-Covariance) Method: Assumes a normal distribution of returns and uses mean and variance.
    - Monte Carlo Simulation: Runs thousands of potential scenarios to generate a probability distribution.

Strategy & Process

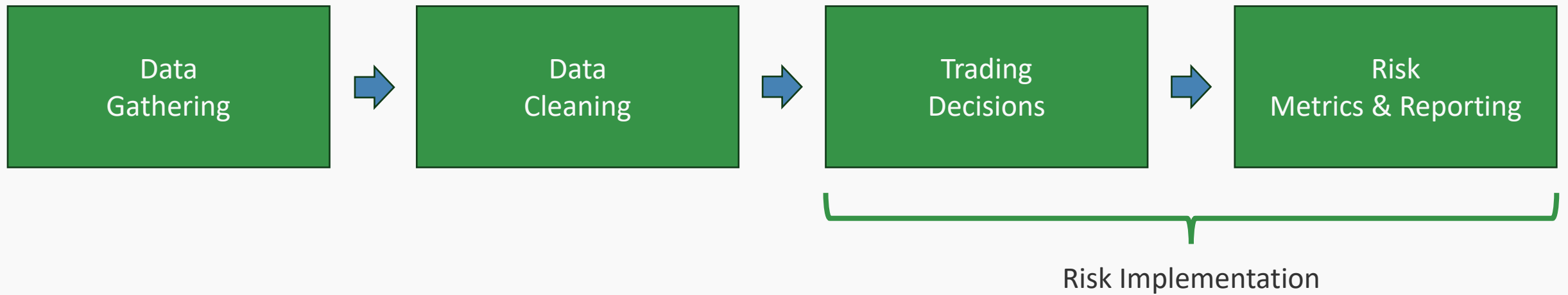## Momentum

- Rank all stocks by their past n-time period returns.

- Buy the top 10% (highest returns) and short the bottom 10%.
  - Realistically purchase top m-stocks

- Hold for n-time period, then rebalance

- Historically, this approach earned positive excess returns in many markets.
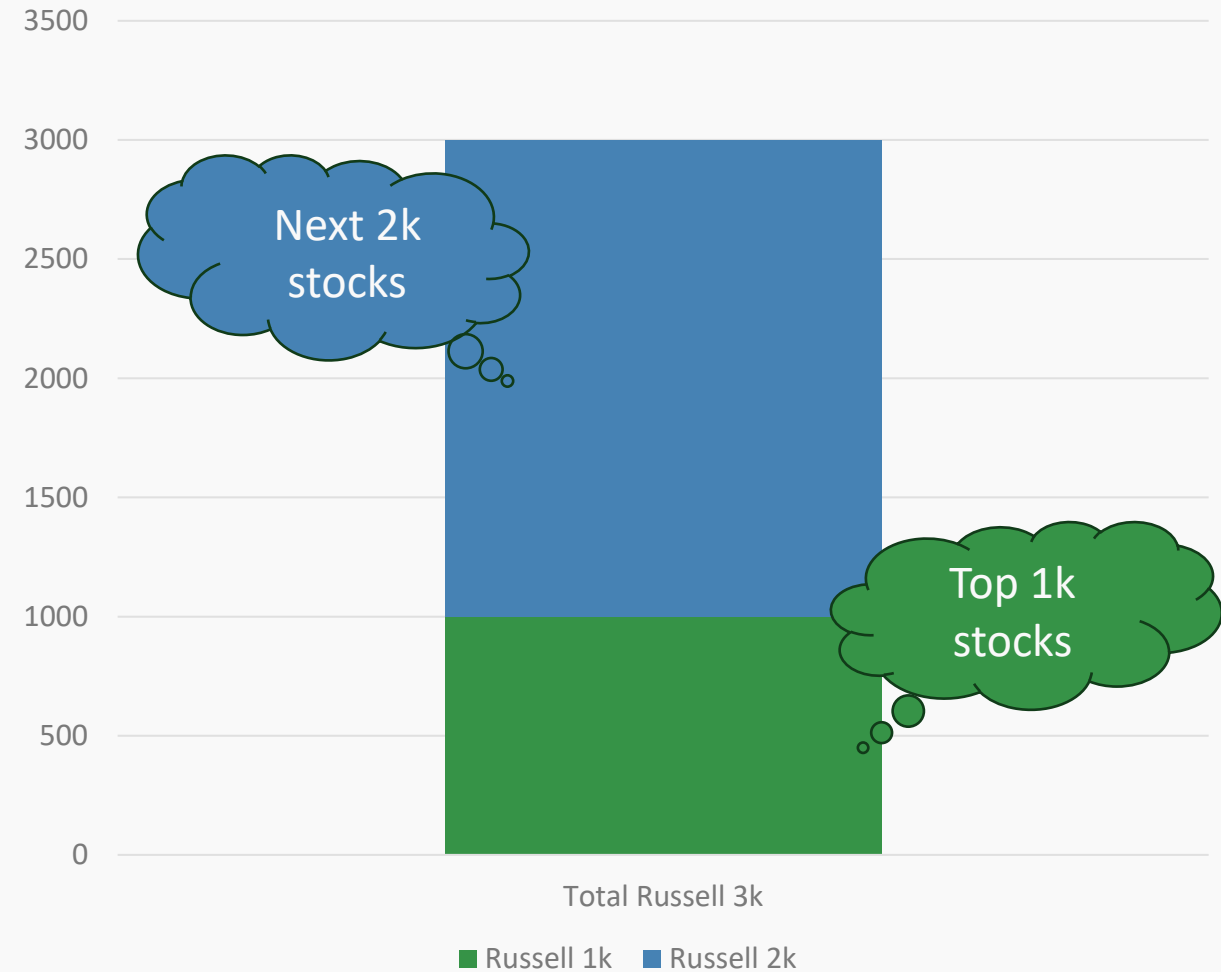
Implementation

- Data Setup

- Strategy Design

- Performance & Risk Metrics

- Risk Management Extensions

Overall Process

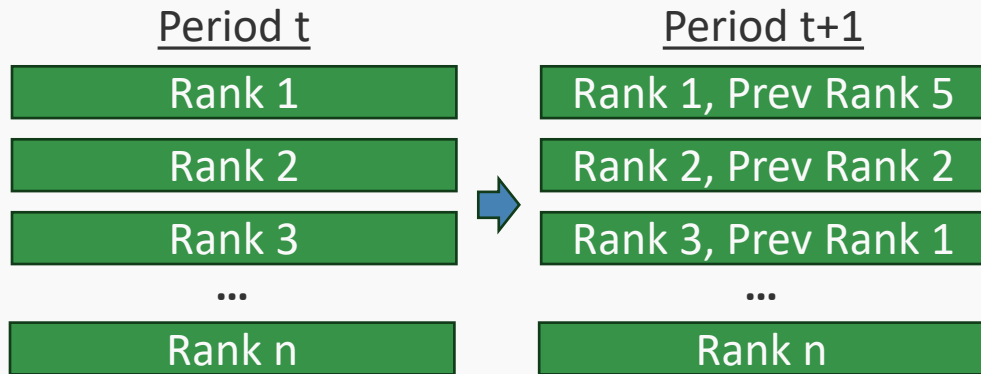| Data Gathering | → | Data Cleaning | → | Trading Decisions | → | Risk Metrics & Reporting |

Risk Implementation

Universe Set Up & Data Gathering

- Russell 3000 is the benchmark (Russell 2000, IWM + Russell 1000, IWB) –> IWV, iShares Russell 3000 ETF

- Pull down universe of Russell 2000 + Russell 1000 stocks, prices, and dates
  – Period: EOY 2014 to EOY 2024
  – Time Step: Daily, 1 week, 2 week, 1 month

- Process:
  1. GetHoldings.py to scrape from Zacks.com
  2. UniversePriceReturns.py to use yfinance api to grab period data with adjusted daily steps

- Known Issues & Error:
  – Naming scheme between yfinance and Zacks.com (BRK.B vs BRK-B)
  – Accuracy regarding current vs historic ETF holdings

Momentum Strategy Design

Period t	Period t+1
Rank 1	Rank 1, Prev Rank 5
Rank 2	Rank 2, Prev Rank 2
Rank 3	Rank 3, Prev Rank 1
…	…
Rank n	Rank n

"Buying higher and selling higher" – Richard Driehaus

General Momentum guidelines:

1. Choose a universe and benchmark (incl. liquid assets)
2. Create momentum indicator (sort assets by previous time step returns)
3. Purchase stocks with highest momentum indicator, potentially short the stocks with the lowest indicator
4. Repeat

- The risk management project team wanted to have pure benchmarks of the strategy (regardless of liquidity or adjusted momentum factors); future augmentation can be done.

- Created portfolioDecisions_Diversification_Lag.py to grab N stocks across various time steps as benchmarks for the strategy.
  - Diversification of including more stocks in a portfolio is a known risk mitigation tactic
  - Changing the turnover and signal lag for the momentum indicator is a way to mitigate downside risk as well.
  - portfolioDecisions{RiskTactic}.py serves to implement what in the universe to trade

- Roll up into portfolioAnalytics.py

Risk Metrics & Overall Progress

- Completed/In progress:
  - Created consistent way to scrape ETF holdings
  - Universe selection from yfinance
  - Benchmark (long-only, equal weighted) risk mitigation tactics completed
    - Diversification of including more stocks from 10 –> 25 –> 50
    - Implementation of time step differences 1-day, 1-week, 2-week, 1-month
      - Note: 1-day is trading daily, 1-week is trading weekly, … vs trading daily with lag of 1-day, 1-week,…
    - 12 total portfolios thus far (3 holdings x 4 time periods)
  - Beginning portfolio metrics (portfolioAnalytics.py)
    - Take Portfolio Decisions then report on (1) average daily return, (2) benchmark average daily return, (3) portfolio total return, (4) benchmark total return,…

- Completed/In Progress (cont.):
  - …, (5) portfolio variance, (6) benchmark variance, (7) alpha, (8) beta, (9) Sharpe ratio, and (10) max drawdown
- Planned:
  - Portfolio Visualizations
  - Other Momentum risk mitigation tactics & routes
    - Change momentum indicator lag (trading daily)
    - Refine momentum indicator:
      - Volatility control – inverse scaling to volatility and position size relative to volatility
      - Diversification – company size filter, industry/sector filter
      - Execution and cost management – liquidity filters, trade/holding period frequency
    - Hedging, tail hedges (equity put, long volatility)
  - Value at Risk:
    - Historical, Variance/Co-Variance, Monte-Carlo methods

Q&A