

# **AgriTech Equipment & Commodity Cycle ETF:**

*Quantitative Analysis of Commodity Price Effects on Agricultural Equipment Manufacturers*

**MSDS 451 DL - Financial Machine Learning**

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# Investment Philosophy

## Core Beliefs

- Commodity markets reflect real time global supply and demand pressures.
- Commodity momentum often leads equity performance in industrial, machinery, and agriculture-linked companies.
- A rules-based, systematic approach removes emotion and bias from portfolio construction.
- Diversification across commodities and equities improves robustness.
- Risk adjusted performance matters more than raw returns

## Goal

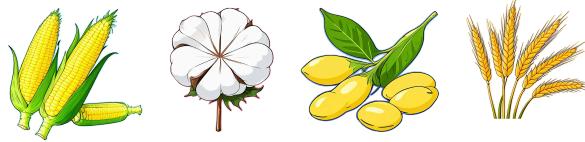
- To capture equity upside during commodity driven economic expansions while avoiding downturns by moving to cash.

# Securities Included In The Fund

## Commodity Futures Used For Signals

- Used for signal generation ONLY and not for direct investment

- Corn (ZC=F)
- Soybeans (ZS=F)
- Wheat (ZW=F)
- Cotton (CT=F)



## Equity Holdings

- I included these equities since their revenue cycles are strongly linked to agricultural and industrial commodities.

- Deere & Company (DE)
- Caterpillar (CAT)
- AGCO Corporation (AGCO)
- CNH Industrial (CNH)



+ Diversification ETF's

## Benchmarks For Comparison

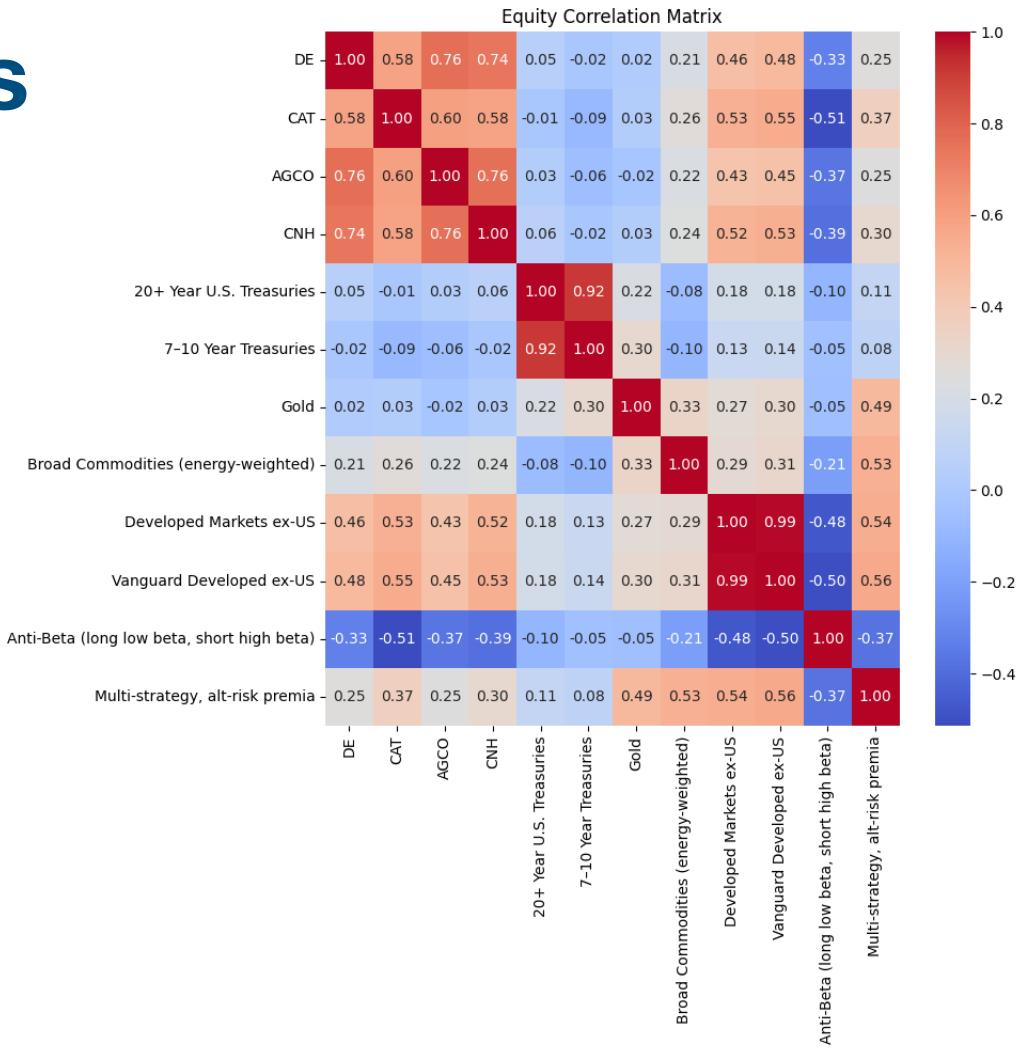
- S&P 500 ETF (SPY)
- NASDAQ 100 ETF (QQQ)
- Total Bond Market (BND)



# Correlation Heatmaps

## Commodities

- Diversification ensures commodity returns are NOT perfectly correlated.
- Driver for this is that it will provide diversification within the signal engine and smoothes the aggregated momentum indicator.



# Diversification

## ETF Additions & Their Role In The Portfolio

### Long-Duration Treasuries (defensive macro hedge)

To add stability during recessions and crash protection from periods similar to 2008, 2020, as well as adding negative correlation to equities

- **TLT** — 20+ year Treasuries
- **IEF** — 7–10 year Treasuries

### Real Assets / Commodities

To hedge against inflation, and diversify from agriculture only futures

- **GLD** — Gold
- **DBC** — Energy weighted commodities

### International Developed Markets

To add further geopolitical diversification and add sector weights from outside the US

- **EFA** — Developed markets ex-U.S.
- **VEA** — Vanguard developed ex-U.S.

### Factor-Neutral / Alternative Risk Premia

To add more risk control similar to hedge funds, and help during volatility spikes

- **BTAL** — Anti-Beta / Market Neutral
- **LALT** — Multi-Strategy Alternatives

# Trading Rules

## Overview

### 1. Commodity Momentum Trigger

The strategy goes **long all equities** when:

At least 2 of 4 commodities close above their moving average.

- Analysis conducted under (MA window = 20 day & 40 day)

### 2. Signal Stability Enhancements

- **3 day** minimum holding period
- **1 day** lag to avoid lookahead bias
- **Equal** weight allocation across equities

### 3. Trading Costs Included

- **0.05%** commission
- **0.05%** slippage
- Turnover explicitly measured daily

# Equity vs. Benchmarks

## Performance Evaluation

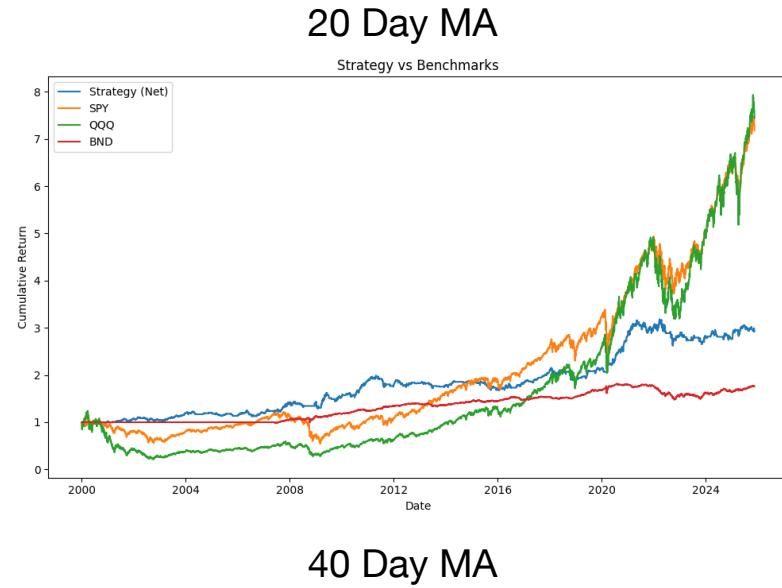
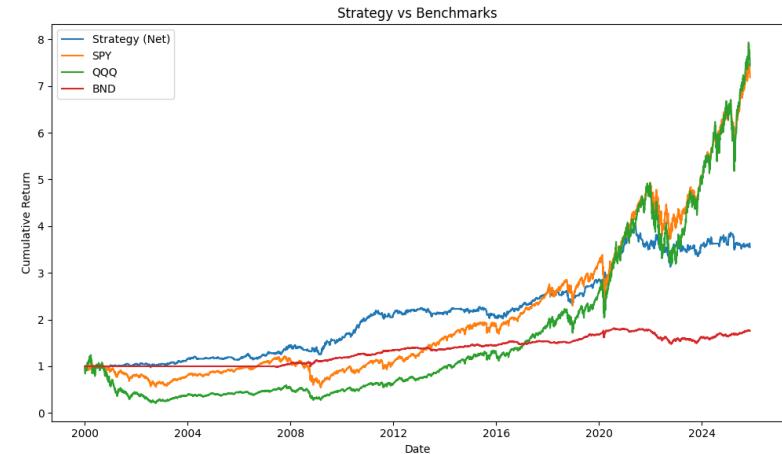
### Strategy Results

	20 Day MA	40 Day MA
Annualized Return	5.42%	4.60%
Annualized Volatility	8.62%	8.29%
Sharpe Ratio	0.61	0.54
Final Net Equity	3.55x initial	2.92x initial
Total Trades	781	583
Days in Market	4,227	4,157
Average Turnover	6%	4.48%

### Interpretation:

The 20-day commodity momentum signal was producing a stable return stream with a moderate Sharpe ratio.

Although raw returns are not extraordinarily high, the **strong risk-adjusted characteristics**, low leverage, and systematic discipline suggested robustness across regimes.



# Investment Methods

## Overview

**Commodity Momentum Regime Model:** Risk ON signal when  $\geq 50\%$  of commodities trade above MA(20)/MA(40).

**Persistence Filters:** Min consecutive days + min holding period to reduce noise.

Dynamic Asset Allocation:

- Risk-On = Equal-weight basket of diversified ETFs
- Risk-Off = Move entirely to cash

**Diversified ETF Universe:** Equities, treasuries, gold, commodities, international markets, and alt beta strategies.

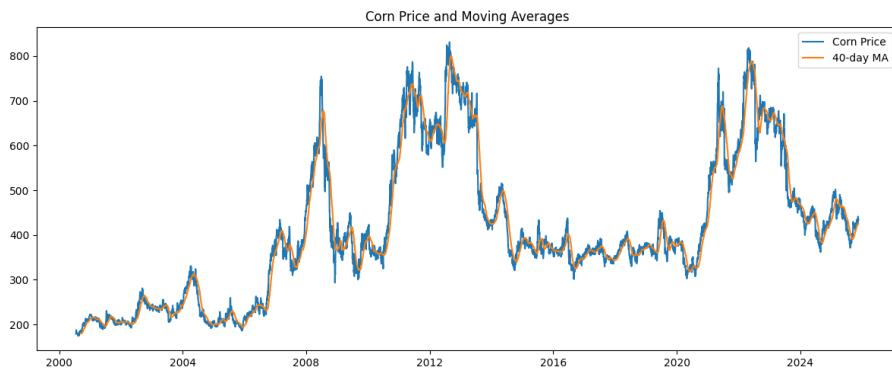
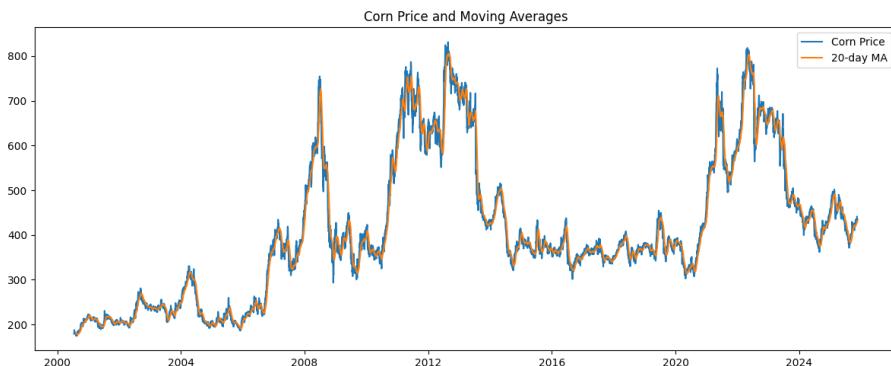
**Transaction Cost Integration:** Commission + slippage applied to turnover.

**Backtest Metrics:** Net/gross returns, Sharpe, exposure, drawdowns, turnover.

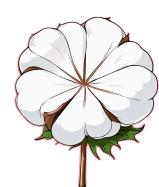
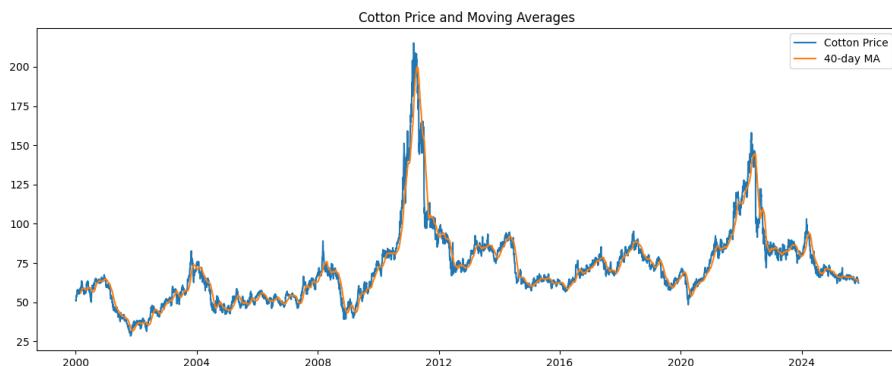
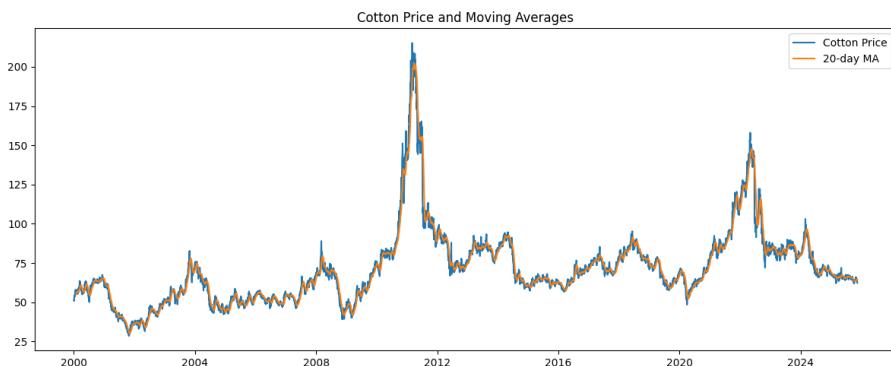
**Monte Carlo Portfolio Analysis:** Stress-tests robustness across 5000 random simulated portfolios

# Moving Averages

## Corn



## Cotton

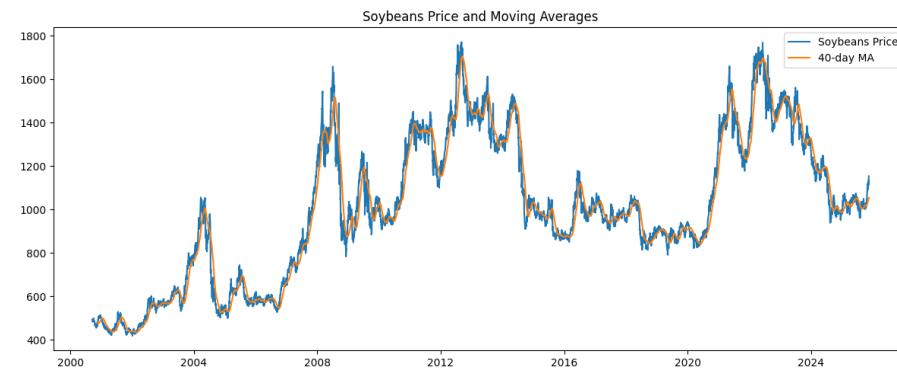
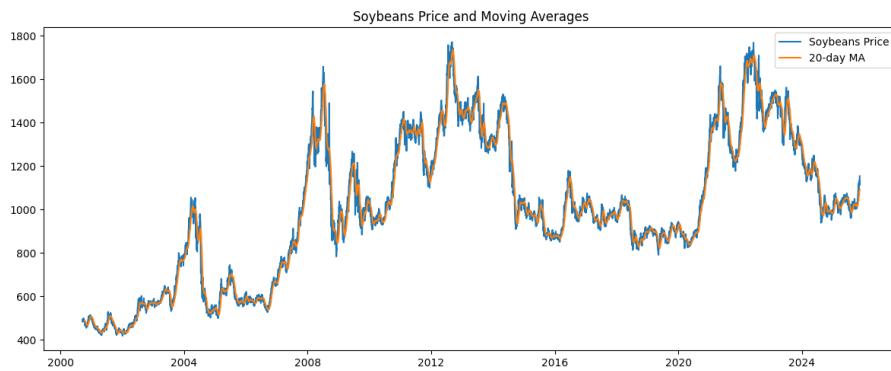


20 Day MA

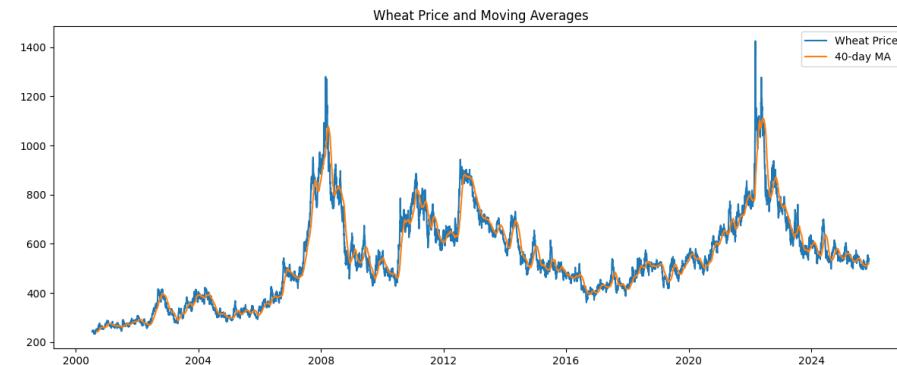
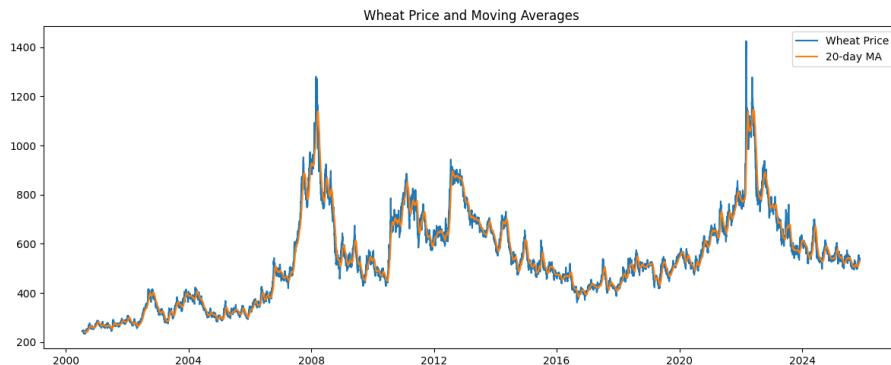
40 Day MA

# Moving Averages

## Soybeans



## Wheat

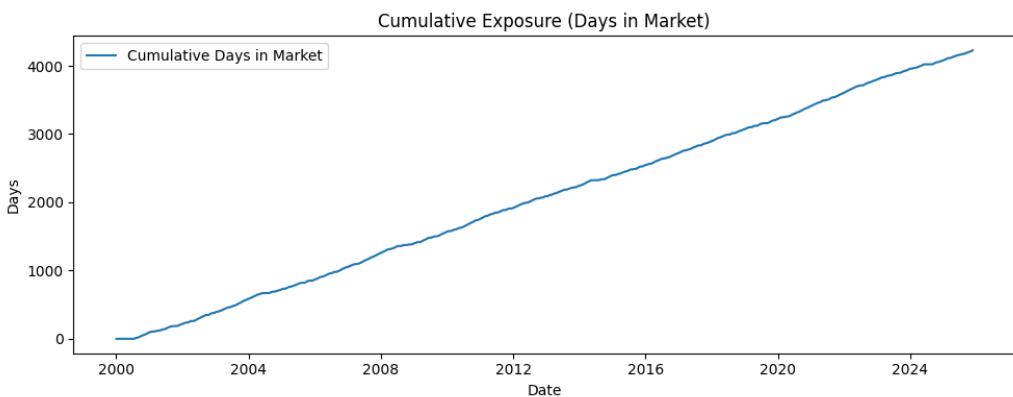


20 Day MA

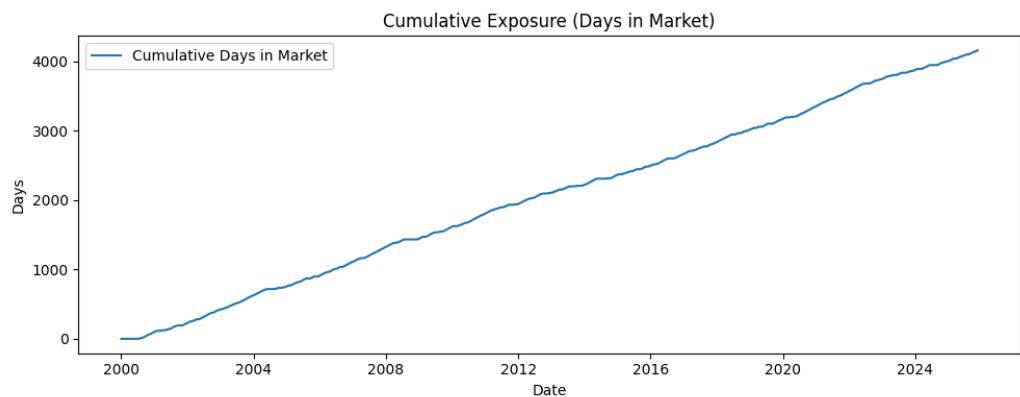
40 Day MA

# Cumulative Exposures

## Days in Market



20 Day MA

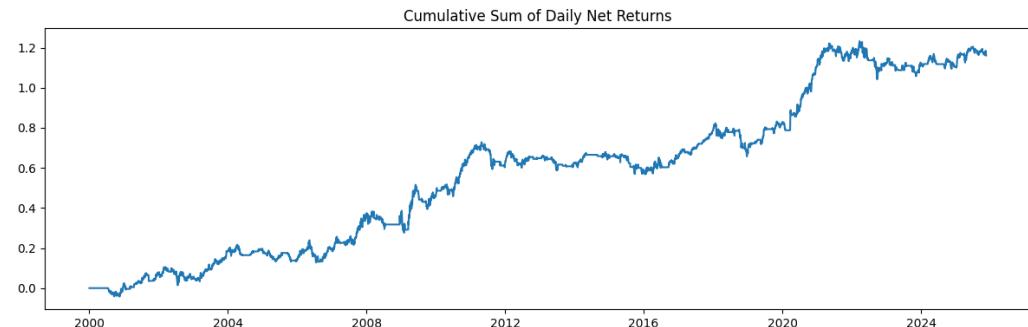


40 Day MA

# Cumulative Sum Daily Net Returns



20 Day MA

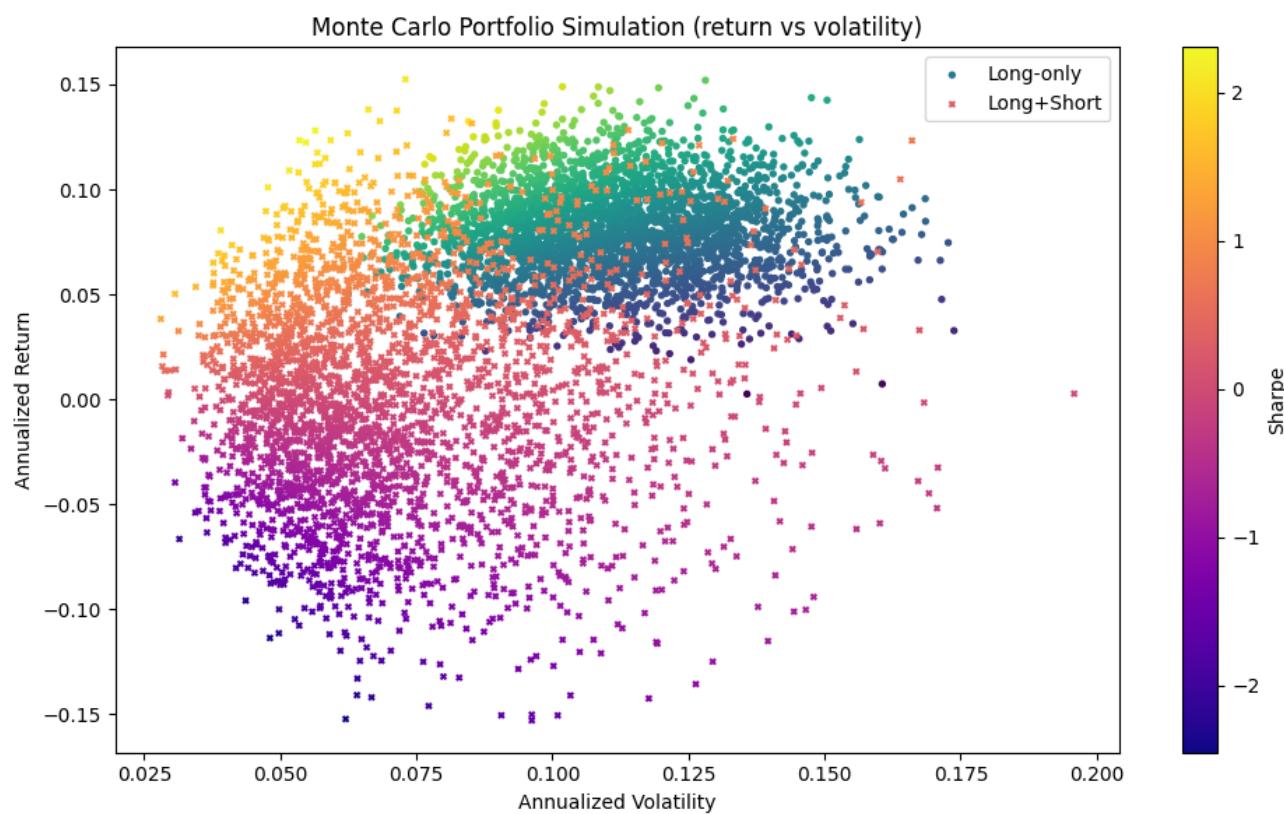


40 Day MA

# Monte Carlo

## Returns vs. Volatility

- Shows the feasible risk-return region for random equity weightings.
- Strategy lies above most long-only or long-short portfolios.
- Confirms the strategy's diversification and risk-adjusted efficiency.



# Would I Invest Personally?

**Yes, as a satellite investment – NOT a core holding.**

This strategy is:

- low volatility
- low drawdown risk
- uncorrelated with equity benchmarks
- stable over decades

But returns are moderate.

Portfolio Fit (Personal Wealth Building)

It COULD be a strong long-term component **if combined with:**

- broad equity exposure
- bond exposure
- real assets
- possibly ML-enhanced tactical overlays

As a **10–20% allocation**, it smooths the ride, reduces drawdown risk, and improves risk-adjusted returns

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## Thank You

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