Portfolio Management
Group 4

Introduction

My name is Cheng Wen btw

Base ETF Strategy

Buy and Hold

Allocates **equal weight** to all ETFs at the start and then holds the position forever.

Equal Weight

Rebalances to equal weight across all ETFs **every bar** (daily or otherwise).

Trend Following

Allocates equally to ETFs trading **above their K-day SMA**, drops the rest.

Cross Sectional Momentum

Ranks ETFs by L-day return and **goes long the top N**, equal-weighted. Updated **monthly**.

Risk Parity

Default
Allocates inversely to each ETF's recent volatility, so equal contribution to risk.

Tilted Risk Parity Strategy
Adds momentum tilt to Risk Parity Strategy weight using RSI

Volatility Tilted Risk Parity Strategy
Extends previous by adding volatility targeting

Minimum Variance

Computes empirical covariance matrix of returns and solves for **minimum variance weights**.

Shortlisted ETF Strategies

I like them long only

Base ETF Strategy

Risk Window: 252, Sum of weights of components: 1, Minimum Portfolio Volatility = 3%

Weights

Benchmark: Buy and Hold

Allocates equal weight to all ETFs at the start and then holds the position forever.

- Passive Strategy
- Rebalanced once

Tilted Risk Parity

Unhedged

Allocates **inversely** to each ETF's recent volatility, so equal contribution to risk. Adds **momentum tilt** to Risk Parity Strategy weight using RSI.

- Risk + Momentum Strategy
- Rebalanced Monthly

Hedged

Performance without Fama French measures.

- Alpha Strategy
- Rebalanced Monthly

Minimum Variance

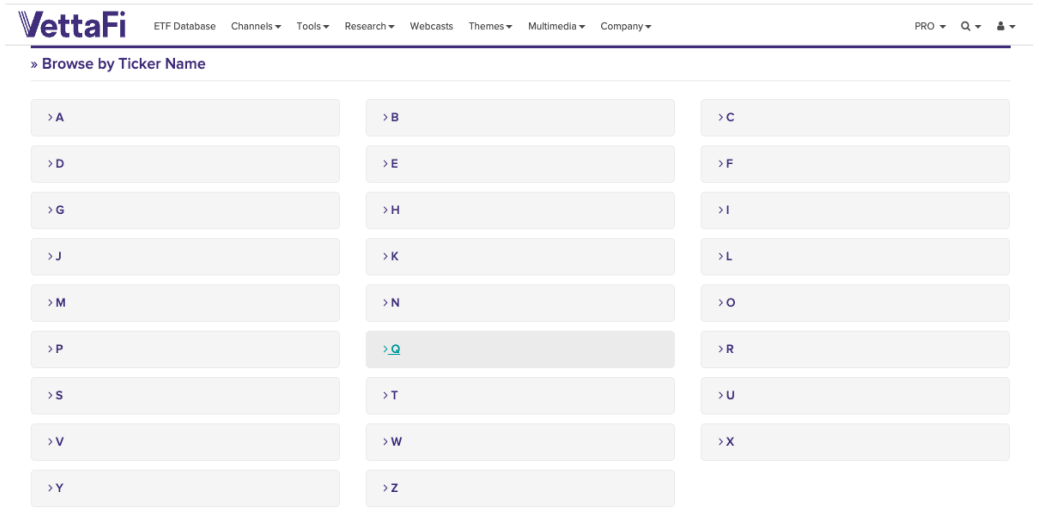
Computes empirical covariance matrix of returns and solves for **minimum variance weights**.

- Optimisation Based
- Rebalanced Daily

Source: Brain

Narrowing Our ETF Universe

From 4193 -> 774



etf_master

	Unnamed: 0	Symbol	ETF Name	ETF Database Category	Total Assets*	YTD	Expense Ratio	yf cat
0	0	AAA	Alternative Access First Priority CLO Bond ETF	Corporate Bonds	42298.0	0.0098	0.0025	Ultrashort Bond
1	1	AAAU	Goldman Sachs Physical Gold ETF	Precious Metals	1503330.0	0.2298	0.0018	Commodities Focused
2	2	AADR	AdvisorShares Dorsey Wright ADR ETF	Global Equities	38806.0	0.0822	0.0110	Foreign Large Growth
3	3	AAPB	GraniteShares 2x Long AAPL Daily ETF	Leveraged Equities	19297.0	-0.3402	0.0115	Trading--Leveraged Equity
4	4	AAPD	Direxion Daily AAPL Bear 1X Shares ETF	Inverse Equities	34963.0	0.1235	0.0100	Trading--Inverse Equity
...	...	...	...	...	...	...	...	...
4188	4188	ZTOP	F/m High Yield 100 ETF	NaN	5098.0	NaN	0.0039	Unknown
4189	4189	ZTRE	F/M 3-Year Investment Grade Corporate Bond Etf	NaN	150723.0	0.0202	0.0015	Short-Term Bond
4190	4190	ZTWO	F/M 2-Year Investment Grade Corporate Bond Etf	NaN	131880.0	0.0160	0.0015	Short-Term Bond
4191	4191	ZVOL	Volatility Premium Plus ETF	NaN	16465.0	-0.2365	0.0142	Unknown
4192	4192	ZZZ	Cyber Hornet S&P 500 and Bitcoin 75/25 Strateg...	NaN	5158.0	-0.0307	0.0101	Large Blend

4193 rows × 8 columns

Criteria

Remove the following:

1) yfinance category == ‘Unknown’ (142)
2) Category contains keywords:
[Leveraged, Inverse, Defined Outcome, Derivative Income] (835)
3) NAV < 100,000 (1428)

Require a minimum history of 10y to be eligible (2015 – 2025)

Final list: 774

Pipeline

I love BackTrader (but why is it so slow)

Constraints

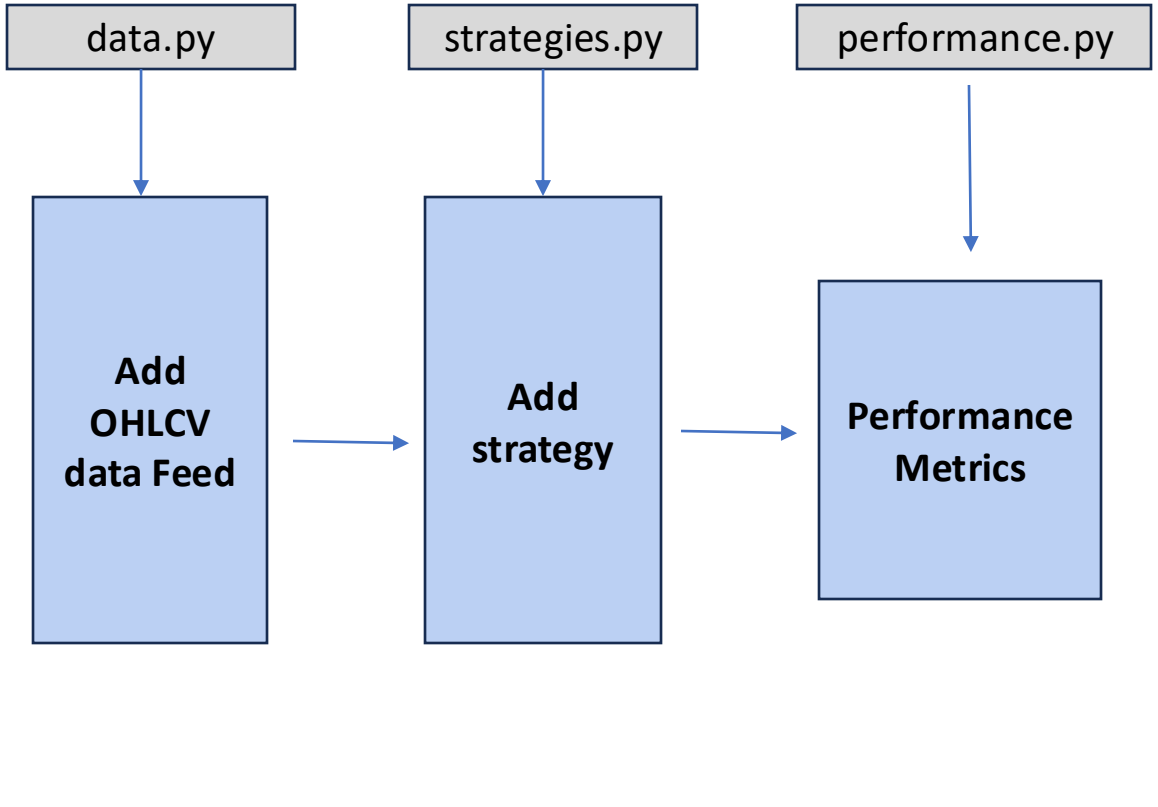
ZeroGuardCommInfo

- Per Share Fee: 0.005
- Minimum commission (per order): 1.0
- Percentage commission (of notional): 0.01%

BackTestEngine

- Initial capital: 1,000,000
- Slippage percentage: 0.01%
- Minimum portfolio volatility: 3%
- Total portfolio weight must sum to 1
- Risk window: 252 days

Backtester



Performance Metrics

Data -> Backtest -> ??? -> Profit

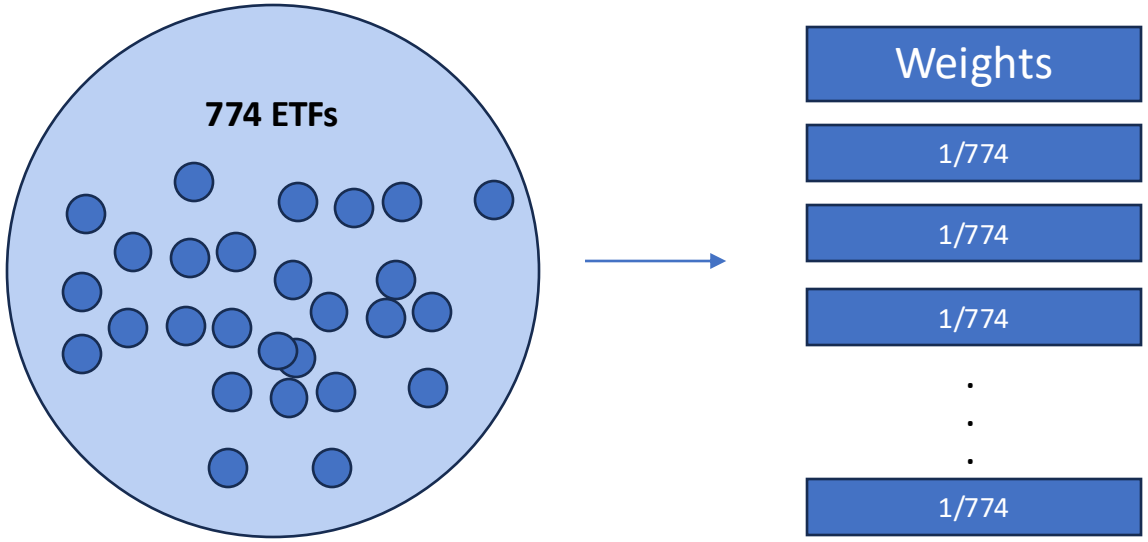
Performance.py

Cumulative Returns	Maximum Drawdown	Annualised Sharpe Ratio	Treynor Ratio	Carhart-4 Betas	Information Ratio	Modigliani M^2
Total growth of $1 invested	Largest peak-to-trough decline in equity curve	Risk-adjusted return to risk ratio, multiplied by sqrt(252)	Annualised excess returns per unit of market beta	Static loadings (sensitivities) of strategy to each factor (MKT, HML, SMB, MOM)	Annualised mean active return divided by volatility of active return (relative to benchmark)	Scales Sharpe to the benchmark's risk level, then adds the risk-free rate

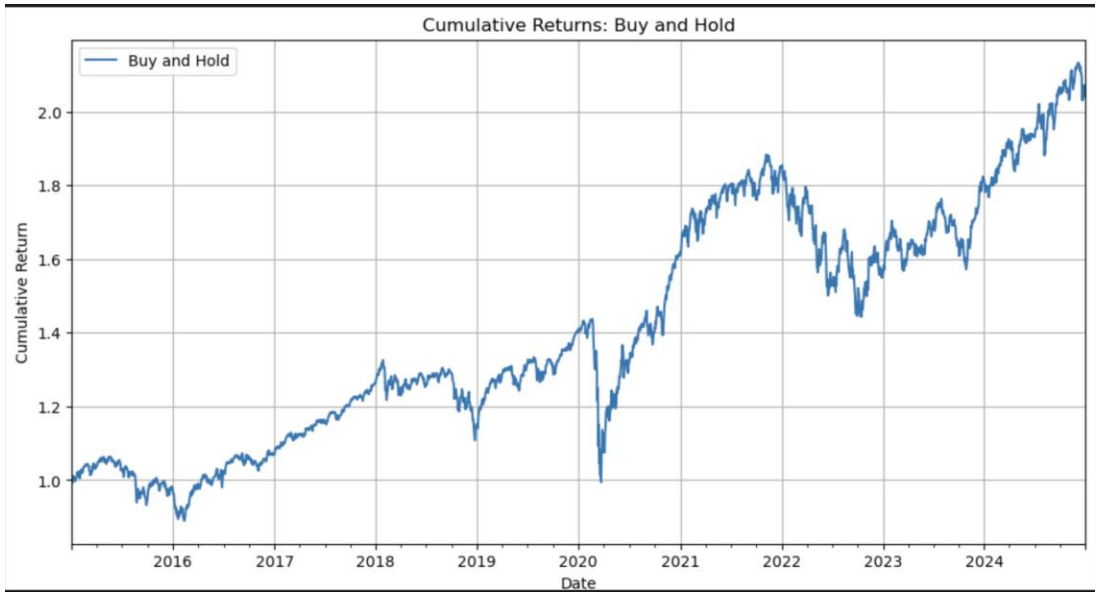
Strategy 1: Buy and Hold

Passive income maxxing

Creation of ETF



Performance and Metrics



Advantages and Drawbacks

Easy to construct
Low trading cost
Low maintenance cost

Volatile
Large Drawdown
High beta to market

Strategy 2: Tilted Risk Premia

When you try so hard but don't succeed

ETF Creation

Inverse Volatility Risk Parity

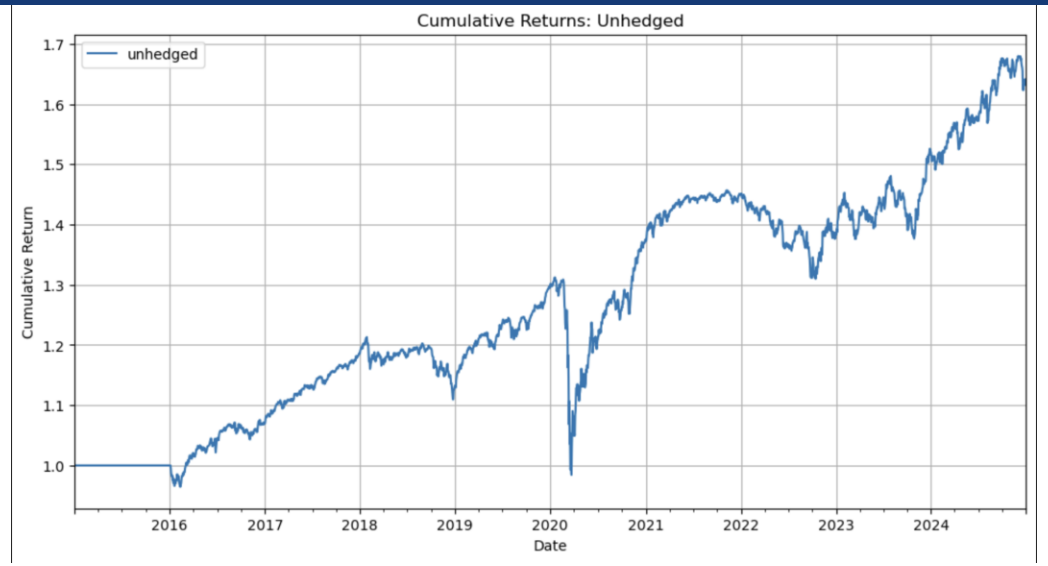
Compute base inverse volatility weights for each ETF (equal volatility contribution)

Cross Sectional Momentum

- Compute 60d RSI for each etf
- Normalise around midpoint $S_i = (RSI - 50)/50 \in [-1,1]$.

- Form tilted weight: w_i = w_i ^{RP} * (1 + alpha * S_i).
- Floor any negative weight to a small epsilon, then renormalise.
- By default, alpha = 0.05 (i.e. up to ±5% tilt).

Performance



Features

- RSI: Average gain/Average loss (scaled to 0 – 100)
- Equalize each ETF's vol-contribution (risk parity)
- Overweight recent winners, underweight recent losers (momentum)
- Bound tilt to ±α so you never stray too far from base RP
- Executes once per month to rebalance to target weights

Advantages and Drawbacks

Low correlation to volatility
Momentum premium capture
Not static

High trading cost
Parameter sensitivity
Active rebalancing

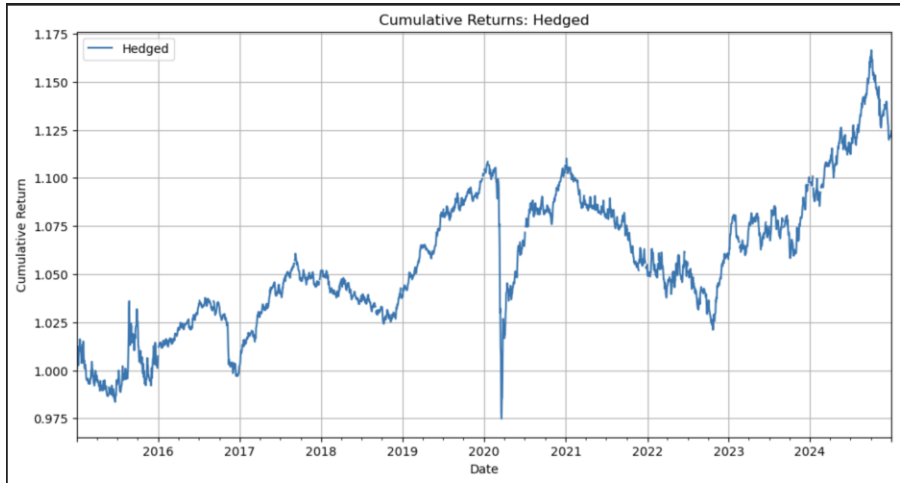
Strategy 3: Hedged Tilted Risk Premia

Been a hopeless beta all my life

Creation of ETF

1. Inverse Volatility Risk Parity + Cross Sectional Momentum = Tilted Risk Parity
2. Find betas of price vs each factor (mkt, smb, hml, mom) with regression
3. Tilted Risk Parity = Mkt * beta + smb * beta + hml * beta + mom * beta + Alpha

Performance



Features

Strip out the strategy's systematic exposures to the four Carhart factors:

– Market (MKT): broad market risk
– Size (SMB): small vs large-cap
– Value (HML): high (value) vs low (growth) BTM
– Momentum (MOM): past winners vs losers

The residual ("hedged") return series should be orthogonal to these common risk premia, isolating any true α (skill or idiosyncratic returns).

Advantages and Drawbacks

✓ Pure alpha
Low correlation

✗ Low returns
Sizeable drawdowns

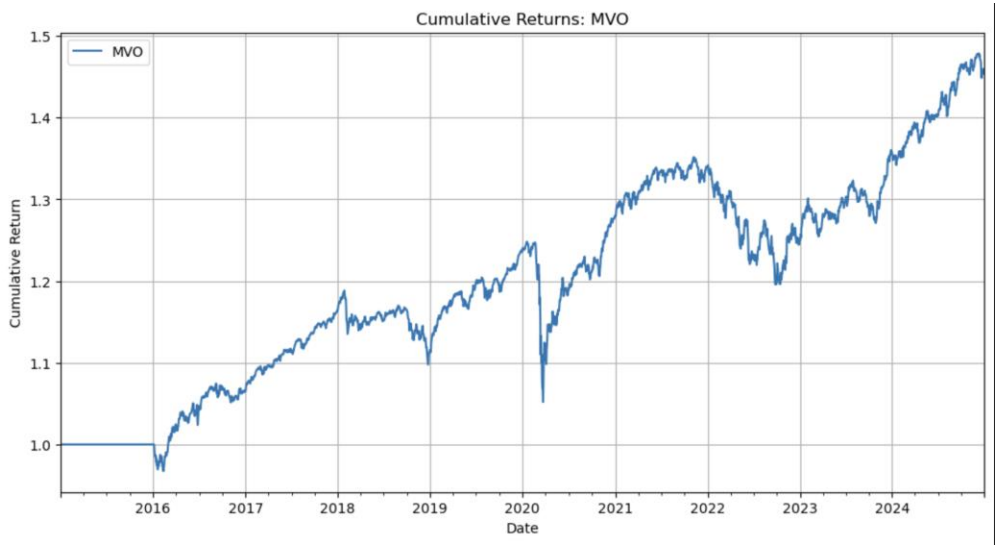
Strategy 4: Enhanced Mean Variance Optimization

Press F for efficient Frontier

Creation of ETF

1. Check rebalancing month. If weights are the same, don't rebalance
2. Build returns matrix using updated data
3. Estimate Covariance matrix using Ledoit-Wolf Shrinkage
4. Solve for minimum variance portfolio weights

Performance



Features

- Estimates covariance matrix of the last 252 days' returns, then solve for min-variance portfolio optimisation.
- Sample covariances can be noisy when N is large relative to T. Shrinkage improves out-of-sample stability.
- Fallback to equal weights if volatility is singular or when all raw weights hit the cap
- max_weight: maximum allowed weight per ETF (default 5%)

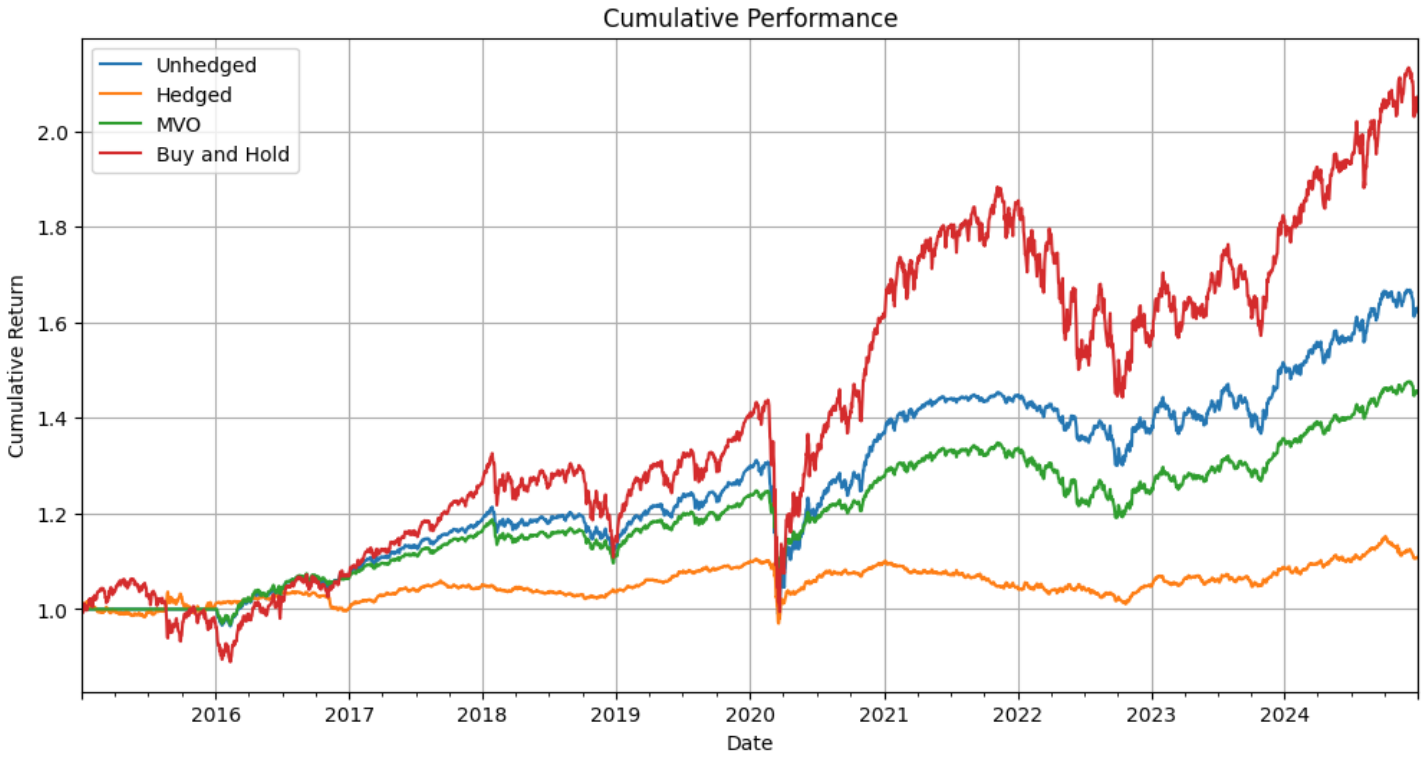
Advantages and Drawbacks

Diversified, low volatility
Higher Sharpe ratio
Realistic weight constraints
Out of sample stability

Requires computational power
Large rebalancing may occur
Prone to noise (N > T)
Tends to overweight low-vol ETFs

Overall Performance

Some images to show off



	Unhedged Portfolio	Hedged Portfolio	MVO Portfolio	Benchmark Portfolio
cumulative_return	0.620952	1.101586e-01	0.451604	1.038855
max_drawdown	-0.252422	-1.216815e-01	-0.158502	-0.308491
annualized_sharpe	0.643246	2.985230e-01	0.698543	0.569468
beta_MKT	0.362707	-2.192257e-05	0.254834	0.725729
beta_SMB	0.073188	1.523677e-04	0.060213	0.147449
beta_HML	0.105569	9.037321e-05	0.039596	0.075090
beta_RF	0.647983	6.479830e-01	0.940034	0.851505
beta_MOM	-0.003302	-1.690246e-05	-0.011902	-0.006642
treynor_ratio	0.135435	-1.813646e+14	0.143039	0.105788
jensen_alpha	0.006913	1.116892e-02	0.006998	-0.008806
information_ratio	-0.388733	-5.008268e-01	-0.459365	NaN
m_squared	0.088522	4.108216e-02	0.096132	0.078369

I hope your career search continues to be a successful one as you grow into “computationally fluent, mathematically sound quants”

Please have mercy