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Data-Driven Methods in Finance

Sign Flippers - Final Presentation

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Content

Strategy Overview

For first trading day of each month (day t):

Target

Day	Ticker	Momentum & Reversion	Fundamentals	Analyst recommendations	Next 21 day return
t-22	S1	Z-score (clipped[-3,3])			
	…				
	Sn				
…	…				
t-252	S1	Z-score (clipped[-3,3])			
	…				
	Sn				

Train Model (Lasso)

Rank On

Model Predict

Ticker	Momentum & Reversion	Fundamentals	Analyst recommendations	Expected 21 day returns
S1	Z-score (clipped[-3,3])			
…				
S40				
…				
Sn-40				
…				
Sn				

Long

Short

Long

Short

Portfolio Construction (Equal Weight, Risk Parity, Beta Neutral)

Hold till next month

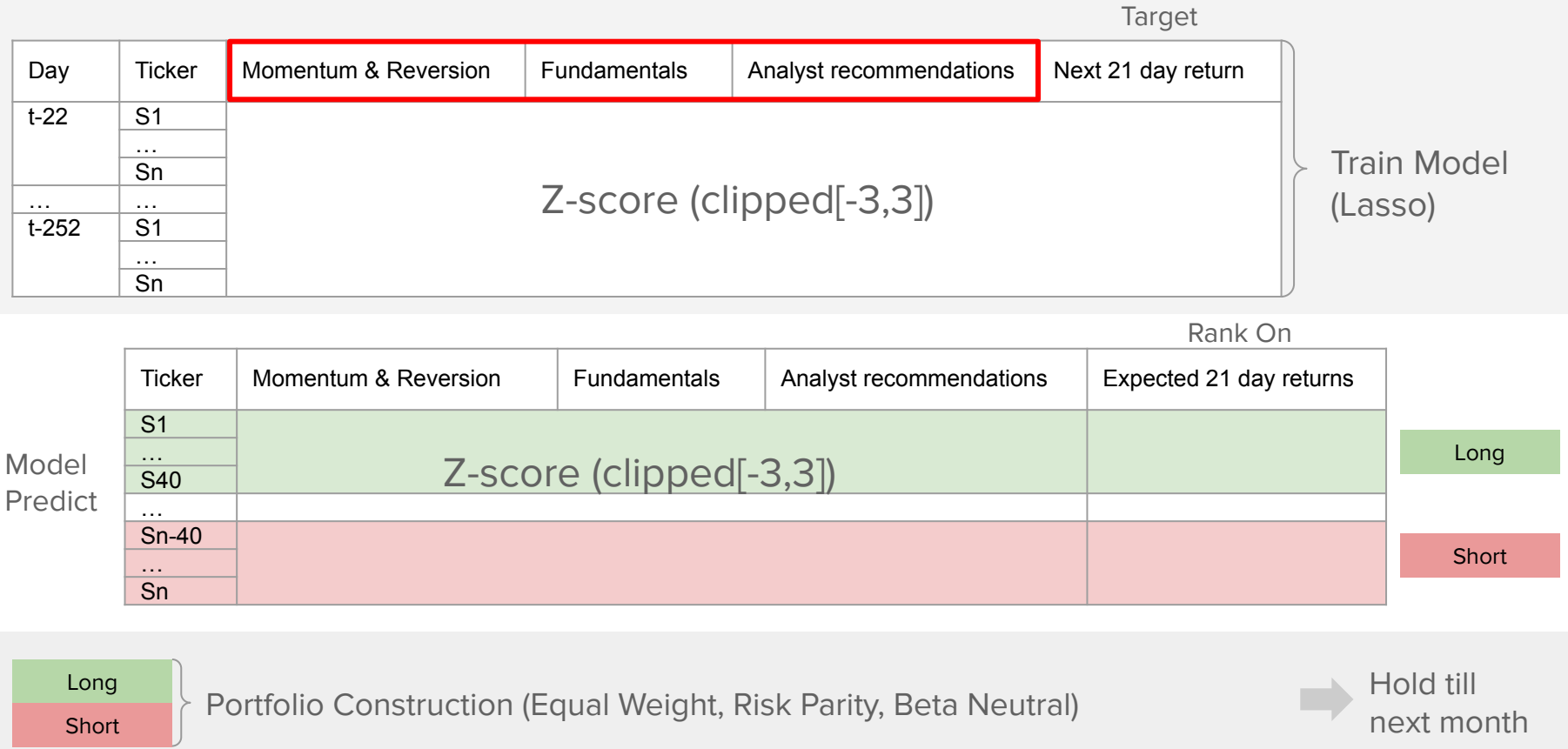
Sharpe:
EW: 1.74
RPP: 1.66
BN: 1.33
S&P: 0.02

Sharpe:
EW: 1.08
RPP: 1.44
BN: 1.44
S&P: 1.08

Sharpe:
EW: ???
RPP: ???
BN: ???
S&P: ???

Feature Engineering & Selection

For first trading day of each month (day t):

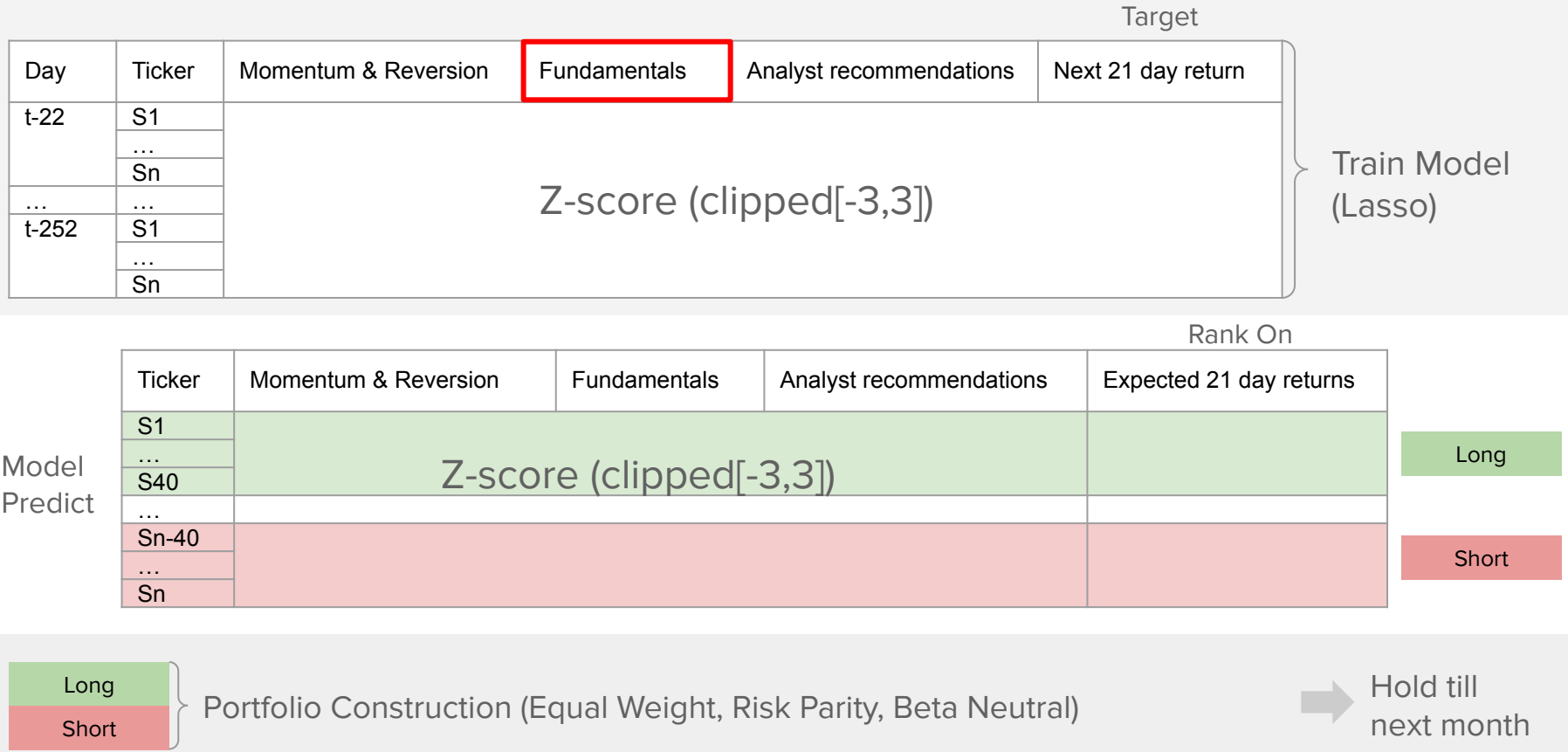


Data

- Investment universe: NYSE
- Data source:
  - Compustat and IBES from WRDS
  - Gather data from 1998 onwards
- Data used:
  - Stock prices, company fundamental factor, S&P 500 index (Compustat)
  - Analyst recommendations (IBES)
- Point-In-Time:
  - Shifted data as appropriate to ensure no look-ahead bias
  - Smoothing and percent change

Feature Engineering & Selection

For first trading day of each month (day t):

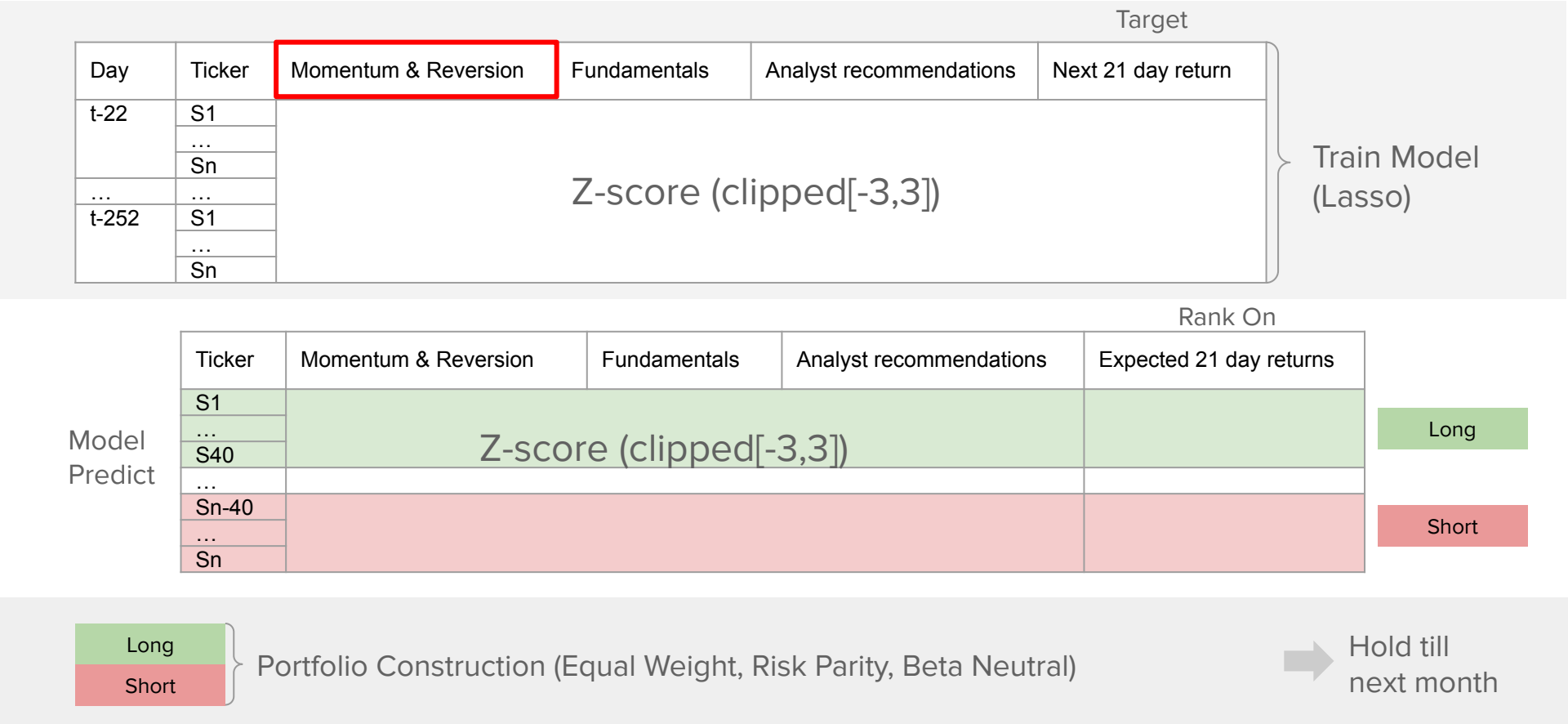


Identified 9 significant factors out of 158 available

1. Retrieved 79 fundamental factors from WRDS and calculated their monthly change.
2. Calculated correlation of each factor with monthly returns and kept factors with correlation > 0.01.
3. Ran individual regressions between returns and each factor and kept only factors whose sign made economic sense and are not strongly correlated to any other factor.
4. Ran multivariate regression of remaining factors with monthly returns and kept only factors with larger coefficients and small p-values.
5. Integrated nine factors with RSI and analyst recommendations in our model: R&D/S, S/P, B/M, B/M change, ROA, Accrual/Assets, S/E, Asset Turnover change, S/E change

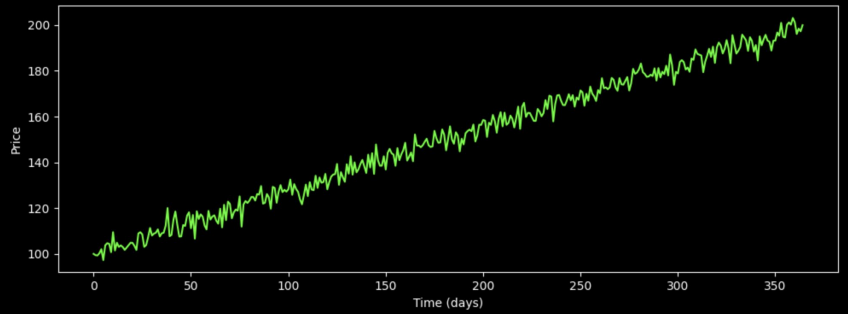
Feature Engineering & Selection

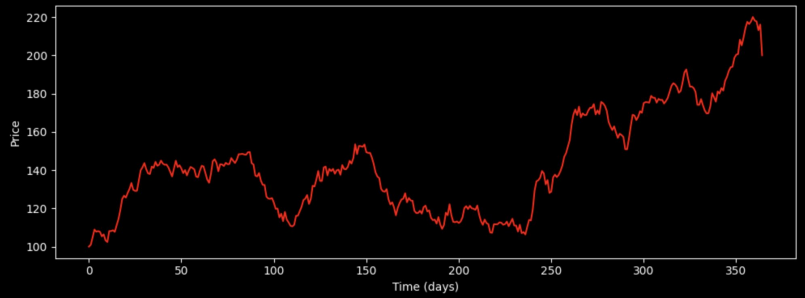
For first trading day of each month (day t):



Engineering Momentum Feature

Incorporating the ‘trend’ of the momentum





Engineering Momentum Feature

Incorporating the ‘trend’ of the momentum

Idea: “If investors engage in trend-chasing, a clear trend would induce more of such behavior due to the reduced cognitive load required to process that information” [1]

Portfolio Construction

For first trading day of each month (day t):

Target

Day	Ticker	Momentum & Reversion	Fundamentals	Analyst recommendations	Next 21 day return
t-22	S1	Z-score (clipped[-3,3])			
	…				
	Sn				
…	…				
t-252	S1				
	…				
	Sn				

Train Model (Lasso)

Model Predict

Rank On

Ticker	Momentum & Reversion	Fundamentals	Analyst recommendations	Expected 21 day returns
S1	Z-score (clipped[-3,3])			
…				
S40				
…				
Sn-40				
…				
Sn				

Long

Short

Long

Short

Portfolio Construction (Equal Weight, Risk Parity, Beta Neutral)

Hold till next month

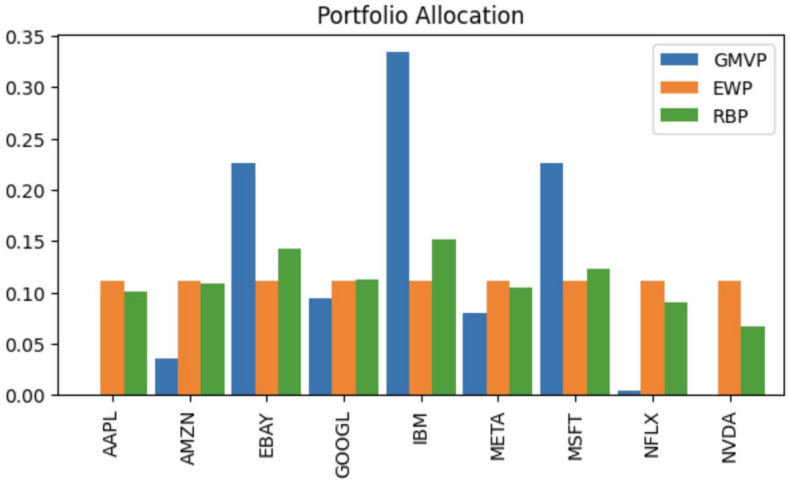
Risk Parity

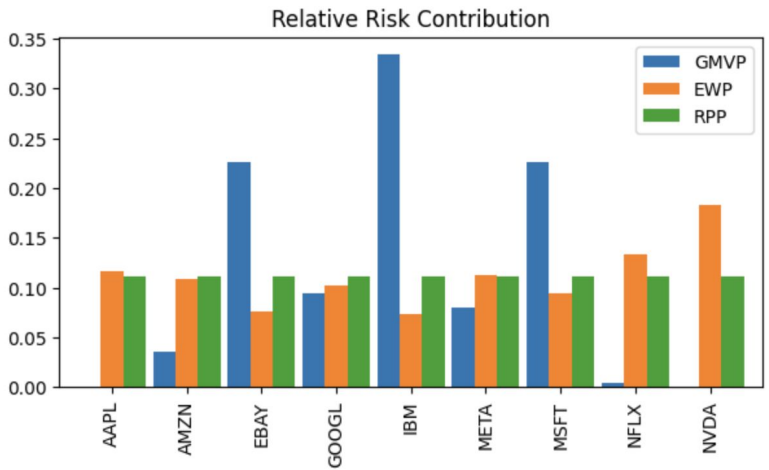
Goal: Diversify Risk among selected stocks

Risk Contribution: $\mathrm{RC}_i = w_i \frac{\partial \sigma}{\partial w_i} = \frac{w_i (\mathbf{\Sigma w})_i}{\sqrt{\mathbf{w}^T \mathbf{\Sigma w}}}$

Risk Budgeting Portfolio:

Allocate asset according to desired Risk Contribution of each asset





GMVP: Global Minimum Variance Portfolio; EWP: Equal Weight Portfolio; RBP: Risk Budgeting Portfolio

Beta Neutral

Goal: Portfolio Uncorrelated to Market

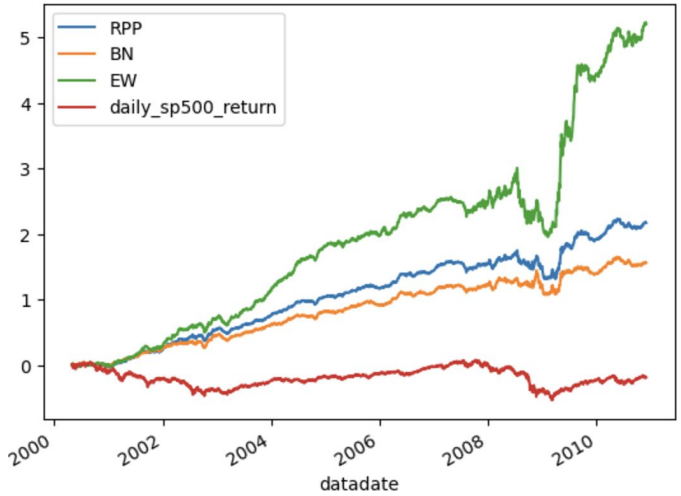
```
#solve optimization problem
x=cp.Variable(n)
formula=cp.quad_form(x, mat)/2
constraints= [
    x >= 0,
    betas @ x == 0, #market neutral constraint
    cp.sum(x) == 1
]

problem=cp.Problem(cp.Minimize(formula), constraints)
problem.solve()
w=x.value
```

Minimum Variance Portfolio (Markowitz)

Beta Neutral

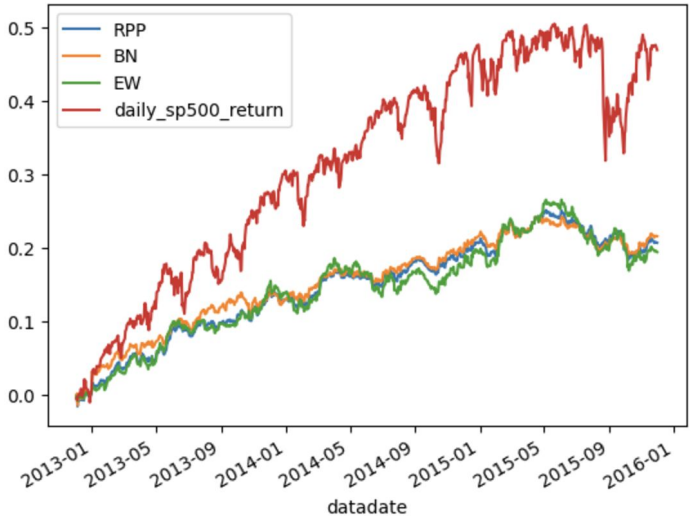
Results: Train & Validation Returns

Cumulative Return (2000-2010)



	EW	RPP	BN	S&P
Sharpe	1.7352	1.6594	1.3368	0.0189
Beta	0.0186	-0.0171	-0.0152	-

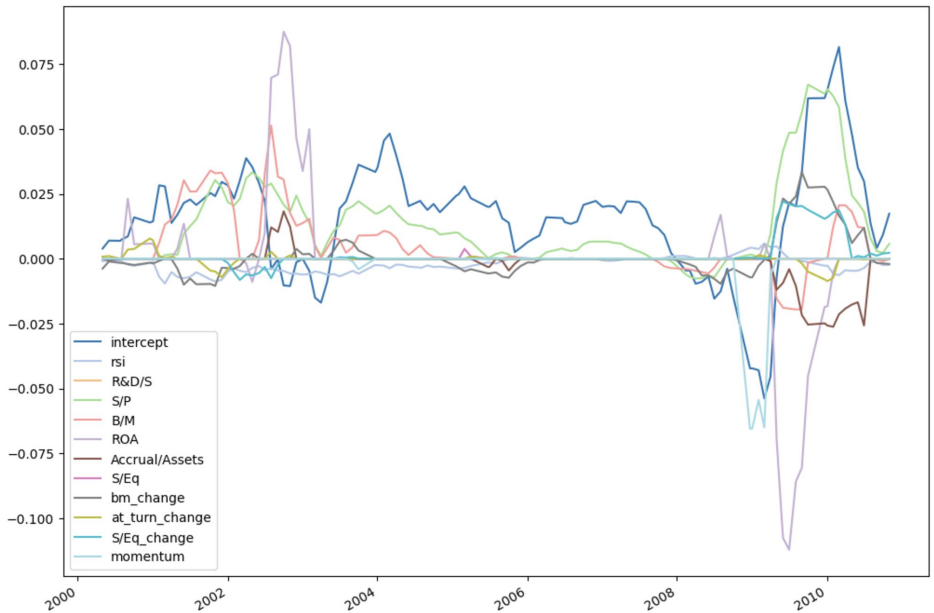
Cumulative Return (2013-2016)



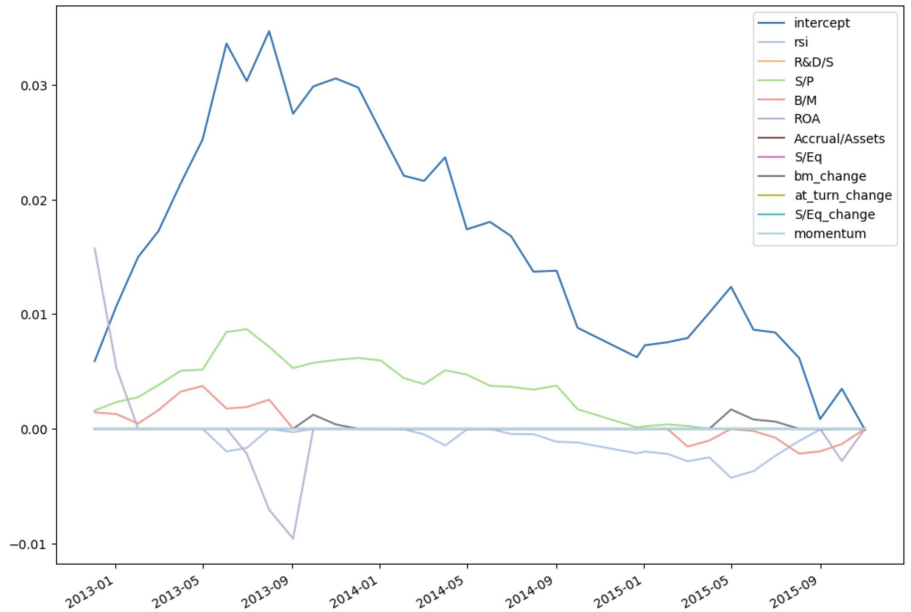
	EW	RPP	BN	S&P
Sharpe	1.0755	1.4398	1.4401	1.0841
Beta	0.0185	0.0112	0.0192	-

Results: Feature Stability

Feature Weights (2000-2010)



Validation(2013-2016)



Results: Test (RPP)

To the Notebook

Key Takeaways

Feature Stability:

Some features only remained stable for a few years → More more frequent feature selection would be needed

Features with 0 weights:

A number of features are assigned 0 weights consistently by Lasso. → Perform hedging on selected features

Inconsistent Data Frequency:

Features such as analyst recommendation are posted rarely. → Time decay instead of forward fill

Stock Ranking Framework

Factors

Rank On

Ticker	Relative Strength Index	Fundamental factors	Analyst recommendations	Trend Clarity	Expected returns
S1					
…					
S40					
…					
Sn-40					
…					
Sn					

Long

Short

- Calculate expected returns by identifying factor premia of significant factors. Factor premia are computed with monthly Lasso regressions.
- Rank stocks based on expected returns and pick 40 highest and 40 lowest.
- Construct risk parity/ beta neutral portfolio.
- Hold portfolio for a month and rebalance based on new ranking at the beginning of next month.

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	Sn				
…	…				
t-252	S1				
	…				
	Sn				

Train Model (Lasso)

Rank On

Model Predict

Ticker	Momentum & Reversion	Fundamentals	Analyst recommendations	Expected 21 day returns
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…				
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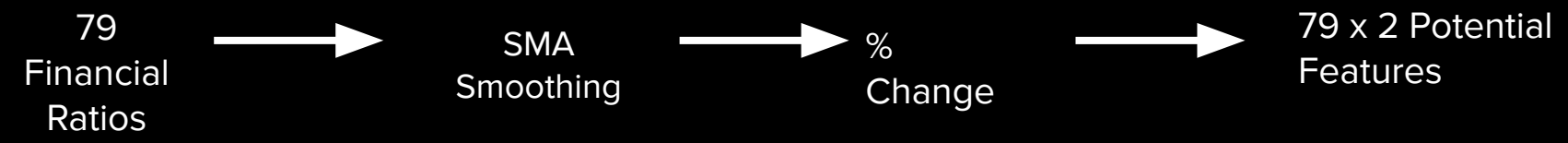
Portfolio Construction (Equal Weight, Risk Parity, Beta Neutral)

Hold till next month

Engineering Fundamental Features



Selecting Fundamental Factors

79 Potential Features → Simple Linear Regression → 5 Features