

Corner Rank: Portfolio Optimization with Minimal Turnover and Alpha Persistence

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Strategy Outline

Basic Methodology:

- ▶ Select candidate alphas, prioritizing extreme alphas with values closest to their next period returns.
- ▶ Optimize portfolio weights with a turnover preference parameter and constraints that limit changes in weights.
- ▶ Rebalance weekly with each update in alpha data.

Benefits:

- ▶ Low transaction costs.
- ▶ Preservation of alpha signals in the portfolio.

Asset Selection

Focuses on extreme alpha values versus their next-period returns:

1. Organize alpha versus next-period return into a grid.
2. Define the selection area as a product of the distance from the center of the grid and the distance to the diagonal.
3. Select the top (bottom) 30% from each corner on the diagonal.

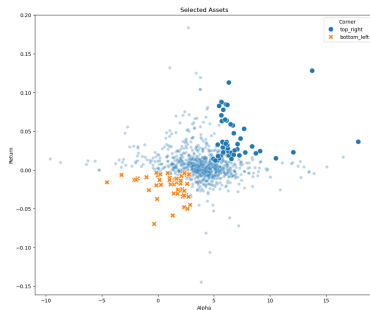


Figure: Example of selected assets.

Optimization Function

$$\min_{\mathbf{w}} \quad \frac{1}{2} \mathbf{w}^T \boldsymbol{\Sigma}_t \mathbf{w} + \lambda_{L1} (\mathbb{1}' \mathbf{w}_{i,+} + \mathbb{1}' \mathbf{w}_{i,-}) \quad (1)$$

Following Chitsiripanich et al. (2024) [1] with additional constraints:

- \mathbf{w} : the vector of portfolio weights for each asset in the universe.
- $\mathbf{w}_{i,+}$ and $\mathbf{w}_{i,-}$: the positive and negative weight deviations, respectively.
- $\boldsymbol{\Sigma}_t$: the asset return covariance matrix, defined as:

$$\boldsymbol{\Sigma}_t = \beta \boldsymbol{\Sigma}_f \beta^T + \sigma_r^2 \quad (2)$$

where β is the factor loadings, $\boldsymbol{\Sigma}_f$ is the factor covariance matrix, and σ_r^2 is the diagonal matrix of residual variance.

- λ_{L1} : the L1 regularization parameter which controls turnover preference.

Basic Weight Constraints

1. Portfolio weights must sum to zero:

$$\sum_i^n w_i = 0$$

2. Positive weights must sum to one:

$$\sum_i^n \max(w_i, 0) = 1$$

3. Total change in weights is greater than or equal to zero: \mathbf{w}^* :

$$\mathbf{w} + \mathbf{w}_+ - \mathbf{w}_- = \mathbf{w}^*$$

4. Weights must meet minimum threshold:

$$w_i \geq \tau \quad \vee \quad w_i \leq -\tau \quad \vee \quad w_i = 0$$

Asset Weight Constraints

1. New long assets have positive weights:

$$0 \leq w_i \leq 1, \quad \forall i \in I_{t+1}^+ \setminus A_t^s$$

2. New short assets have negative weights:

$$-1 \leq w_i \leq 0, \quad \forall i \in I_{t+1}^- \setminus A_t^l$$

3. Previous portfolio assets must have weights between 0 and their previous weight:

$$w_{t,i}^* \leq w_i \leq 0, \quad \forall i \in A_t^s \setminus (I_{t+1}^+ \cup I_{t+1}^-)$$

$$0 \leq w_i \leq w_{t,i}^*, \quad \forall i \in A_t^l \setminus (I_{t+1}^+ \cup I_{t+1}^-)$$

4. Assets changing direction are removed:

$$w_i = 0, \quad \forall i \in (I_{t+1}^+ \cap A_t^s) \cup (I_{t+1}^- \cap A_t^l)$$

In-Sample

| Description | Annualised Return | % of Return |
|--------------------------------|-------------------|---------------|
| Portfolio Returns % (Gross) | 5.50% | 100.00% |
| Transaction & Shorting Costs % | -0.14% | -2.46% |
| Portfolio Returns % (Net) | 5.36% | 97.40% |
| Portfolio Factor Returns (Net) | 0.66% | 11.94% |
| Implied Portfolio Alpha (Net) | 4.68% | 84.95% |

Table: In-Sample Performance, 2017-12-27 to 2024-07-31

Out-of-Sample

| Description | Annualised Return | % of Return |
|--------------------------------|-------------------|----------------|
| Portfolio Returns % (Gross) | 1.91% | 100.00% |
| Transaction & Shorting Costs % | -0.21% | -11.09% |
| Portfolio Returns % (Net) | 1.70% | 88.76% |
| Portfolio Factor Returns (Net) | -0.44% | -23.27% |
| Implied Portfolio Alpha (Net) | 2.15% | 112.26% |

Table: Out-Sample-Performance, 2014-08-13 to 2021-06-09

Distribution of Alphas In-Sample

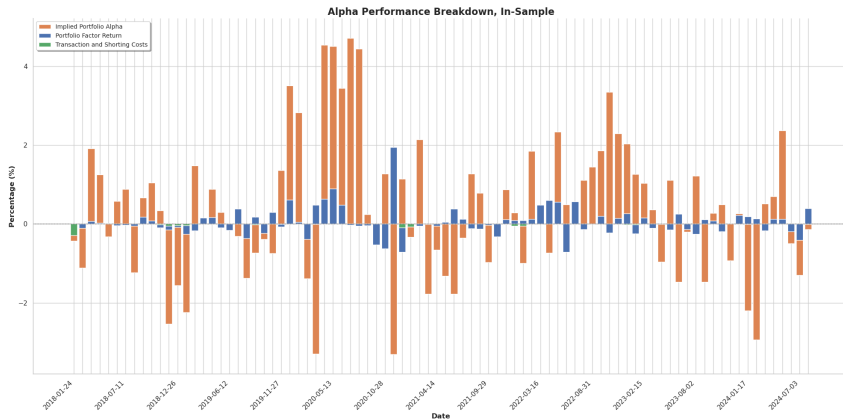
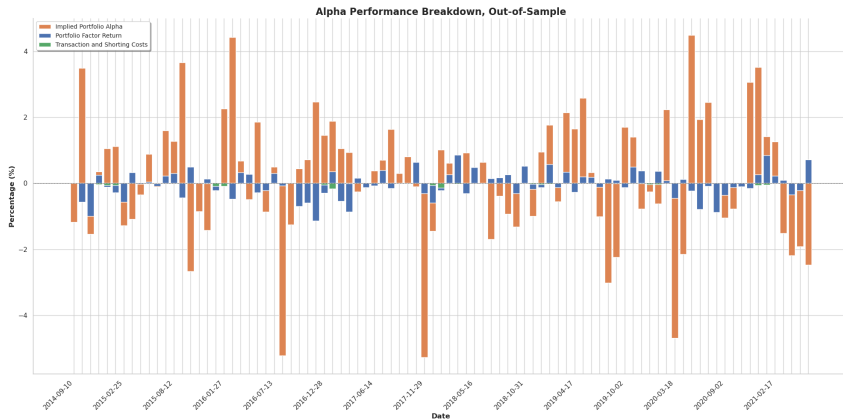


Figure: In-Sample Alpha Breakdown, 2017-12-27 to 2024-07-31

Distribution of Alphas Out-of-Sample



References

- [1] S. Chitsiripanich, M. S. Paolella, P. Polak, and P. S. Walker. Smoothing Out Momentum and Reversal, Aug. 2024.

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