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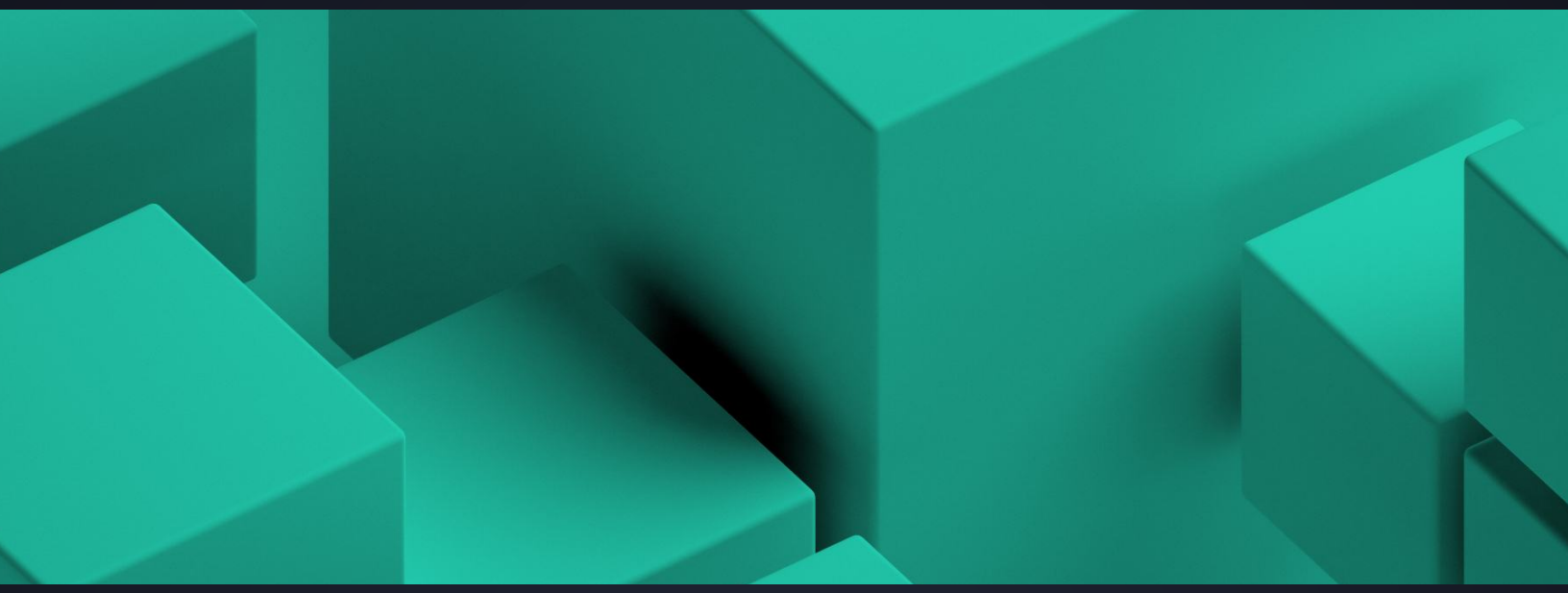
ANALYSIS

Systematic Trading of Crypto Assets with the SFRM



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Systematic Trading of Crypto Assets with SFRM

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Abstract

A risk model is a key component of systematic trading. In this paper, we demonstrate how the Serenity* Factor Risk Model (SFRM) for digital assets developed by Cloudwall* enables algorithmic trading and improves trading performance.

1 Introduction

In the short note [1], we briefly introduced systematic trading with SFRM, the first commercially available risk model built specifically for digital assets by Cloudwall. In this paper, we provide some more details on how to create a portfolio with SFRM, and study the impact of some parameters on performance. Given the complexity of systematic trading, it is not our intention to provide a comprehensive review, rather just some flavors of a simplified problem. For a more detailed treatment, please refer to [2, 3].

2 Alpha Signal Generation

Before we delve into the portfolio construction process, let's briefly explain how alpha signals are generated for this study. Alpha models are closely guarded trade secrets in trading firms. Since the purpose of this study is to illustrate the effect of the SFRM risk model, we will leave the actual alpha modeling to users and use synthetic purified alphas as inputs for the mean-variance optimization process. The synthetic alphas are created by combining random noise with forward-looking residual returns from cross-sectional regression:

$$\alpha = k_a \mathbf{r} + k_w \mathbf{w} \tag{1}$$

where:

- $\mathbf{r}$ = the residual return,
- $\mathbf{w}$ = random noise,
- k_a = the weight of residual return,
- k_w = the weight of random noise.

Correlation of α signal and specific return $\mathbf{r}$ (IC level) could be configured with different weight of these two components.

Cloudwall and the technology behind its Serenity System were acquired by Talos in April 2024.

3 Mean-Variance Objective Function

Systematic portfolio managers commonly use an objective function that incorporates various terms, including forecasted return, portfolio risk, and transaction costs, among others, when constructing and rebalancing portfolios. The following represents a simplified portfolio optimization problem:

$$\mathbf{w} = arg\ min_{\mathbf{w}} : \mathbf{w^T}(\lambda_F \mathbf{E\Sigma E^T} + \lambda_S \mathbf{D})\mathbf{w} + c(\mathbf{w^T} - \mathbf{w_0^T})\mathbf{s} - \mathbf{w^T}\alpha, \tag{2}$$

where:

- $\mathbf{w}$ = the vector of target portfolio,
- $\mathbf{w_0}$ = the vector of portfolio as of t,
- $\mathbf{E}$ = the factor exposure matrix,
- $\mathbf{\Sigma}$ = the factor covariance matrix,
- $\mathbf{D}$ = a diagonal matrix representing specific risk,
- λ_F = the risk aversion coefficient for the common factors,
- λ_S = the risk aversion coefficient for specific risk,
- c = the transaction control coefficient,
- $\mathbf{s}$ = the vector of commission rate for each asset,
- α = the vector of asset excess returns (alpha).

In reality, practitioners may have much more complex objective functions, such as modeling market impact and liquidation costs. Additionally, they typically apply additional constraints, such as leverage ratios, maximum positions, and maximum trading volumes.

4 Model Performance with SFRM vs Benchmark

To illustrate performance changes, we create two portfolios: a benchmark portfolio without SFRM is constructed by taking long and short positions on the top and bottom 20% of assets sorted by alpha signal, using equal weighting. For the systematic strategy that leverages SFRM, we use mean-variance optimization as described earlier, by combining alpha signals with the SFRM model to control exposure to risk factors. To ensure comparability, both strategies use the same synthetic alpha, with IC level set to 0.2, and the portfolio is rebalanced daily. Trading universe includes roughly the top 100 tokens. Table 1 shows some basic metrics of the two strategies, while raw P&L is plotted in Figure 1.

To have a turnover close to the baseline approach, c is set to a very small number in this case. Although the turnover is high for these two settings, we could easily tell that the strategy with SFRM model does boost return and Sharpe ratio. In the following sections, we will use parameters such that the portfolios are closer to real life trading: such as making transaction cost more feasible and optimizing risk exposures, although our main goal is not to find the optimized parameters.

Metric	w/o SFRM	w SFRM
Sharpe Ratio	1.15	1.38
Annualized Return	42.8%	54.4%
Turnover	37.3%	36.9%

Table 1: Comparison of performance between strategies with and without SFRM.

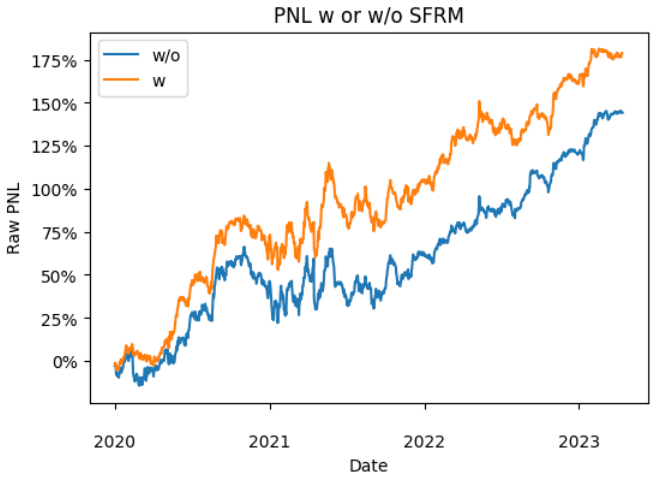

Figure 1: Performance with or without SFRM given similar turnover.

5 Factor Exposure Comparison

In this section, let's examine the factor exposure for portfolios constructed with SFRM, and compare with that of the benchmark portfolio.

Figure 2 shows the portfolio's exposure to all factors is close to zero for the mean-variance strategy with SFRM. For the benchmark method without SFRM, portfolio exposure to all factors is significantly higher, except for the market factor, which is zero by construction. This is expected and explains why mean-variance method results in lower risk.

6 Transaction Cost Control

In this section, we demonstrate how the transaction control coefficient (c) affects the turnover. It should be noted that our assumption on the commission rate is 5 basis points for all asset classes. This is a simple estimation, the absolute transaction cost also depends on the transaction control coefficient (c). Table 2 shows how increasing the transaction cost coefficient (c) reduces turnover rate.

Figure 3 presents portfolio performance with different transaction coefficient.

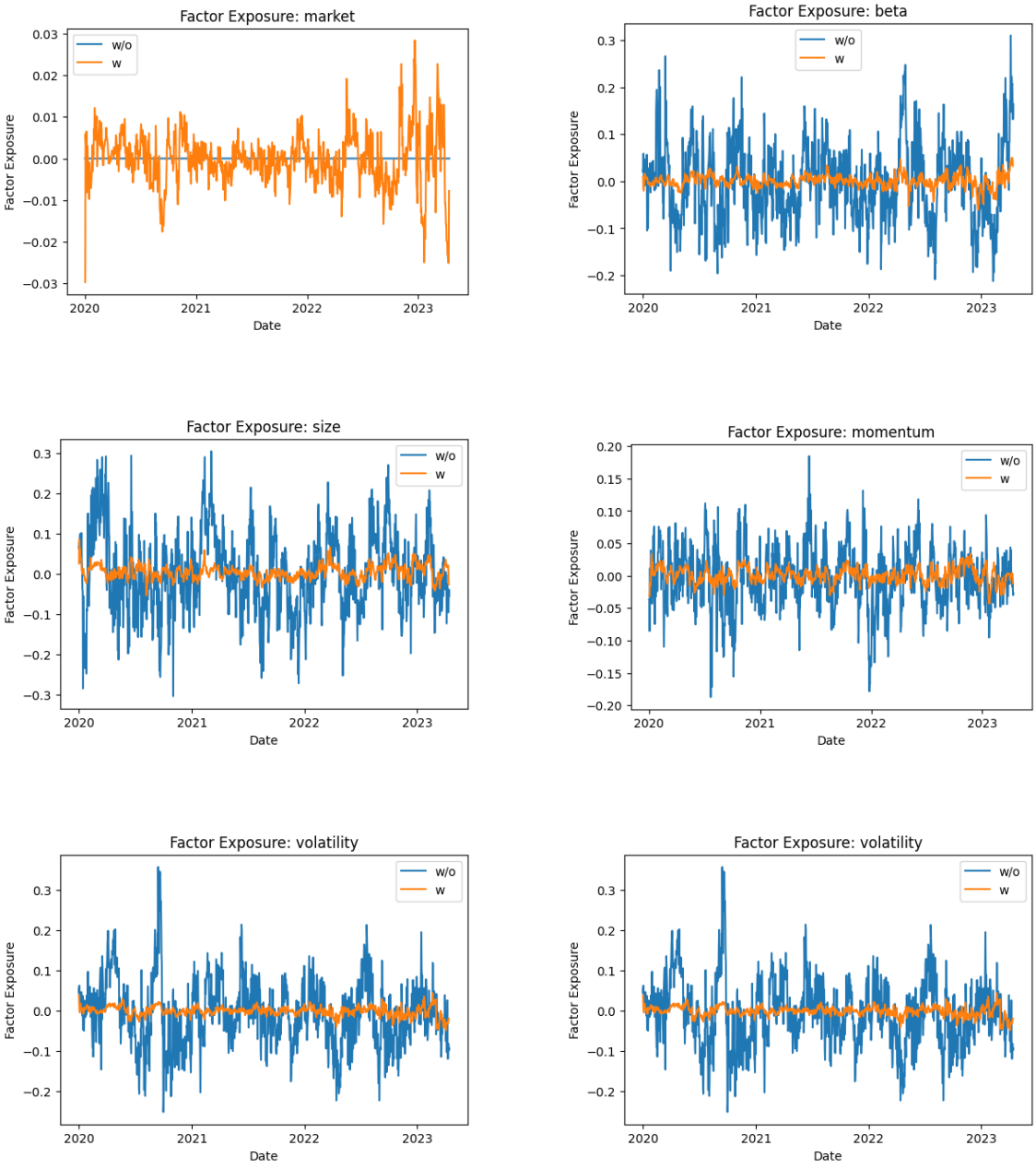

Figure 2: Exposure to market and style factor with or without SFRM.

Transaction Cost Coefficient	Turnover	Sharpe ratio	Annual return	Drawdown
0.8	6.8%	1.18	40.8%	29.4%
1	5.1%	1.57	52.5%	22.9%
1.2	3.9%	1.40	45.0%	33.7%

Table 2: Comparison of performance with differenct transaction cost coefficient.

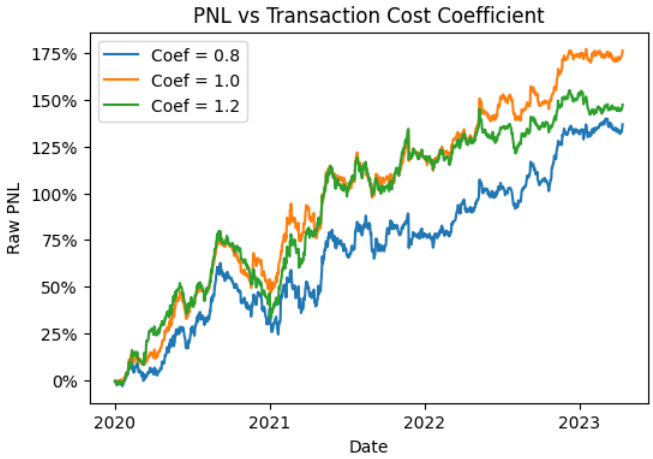

Figure 3: Performance with different transaction cost coefficient.

7 Risk Aversion Coefficient

Another important parameter to check is the risk aversion coefficient, which sets the relative importance of the risk terms in the optimization problem. Table 3 compares portfolio performance for different risk aversion coefficient level.

Model performance does not change much when risk aversion level is in a reasonable range. Figure 4 compares portfolio performance at different risk aversion level.

8 Conclusions

In summary, we demonstrated that as a first commercially available risk model developed specifically for digital assets, SFRM enables systematic trading of digital assets and helps control risk exposure and turnover. Additionally, it improves performance of a systematic trading strategy.

Although this is not a comprehensive study of quantitative trading, we wanted to share our early results and receive feedback from the community. What would you like to understand better? Any questions this raised you'd like us to answer? We appreciate your comments.

9 Authors

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Risk Aversion Coefficient	Turnover	Sharpe ratio	Annual return	Drawdown
3	5.0%	1.52	51.2%	24.0%
6	5.1%	1.60	52.5%	21.9%
12	5.1%	1.57	52.5%	22.9%

Table 3: Comparison of performance with differenct risk aversion coefficient.

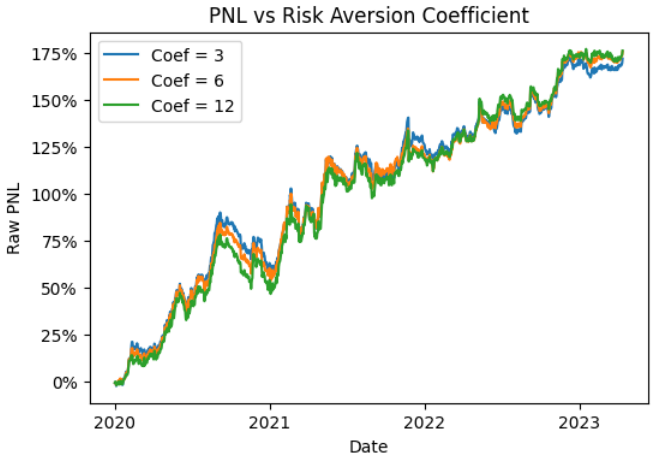

Figure 4: Performance with different risk aversion coefficient.

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References

[1] C Xia, *Systematic Trading with SFRM*, www.talos.com/insights

[2] R Grinold, R Kahn, *Active Portfolio Management*

[3] E Qian, R Hua and E Sorensen, *Quantitative Equity Portfolio Management: Modern Techniques and Applications*

*Cloudwall and the technology behind its Serenity System were acquired by Talos in April 2024.

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