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TRADING & QUANTITATIVE RESEARCH REPORT

Momentum — Turnover II

New strategies, portfolio optimisation and the utilisation of static benchmarking for grouping

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Overview

Introduction

In this report, we will build on a preceding R&A report and further explore the relationship between share turnover and momentum for the S&P 500 universe. This will be done through the implementation of additional strategies and the incorporation of portfolio optimisation practices. For portfolio optimisation, the focus is implanted on equal risk weighting. For a closer evaluation of the performance of Jenks' natural breaks classification, comparisons against a static grouping benchmark (33.3%, 33.3%, 33.3%) will be employed throughout.

Data and method: foundational processes

As in the previous report, we look at two decades' worth of data. The data is presented in daily intervals, the starting date for the dataset is January 1, 2000 and the end date December 31, 2020. The data has been sourced from Bloomberg. Descriptions of the foundational iterative changes that we take, along with their underlying principles, are described in some detail within the preceding report that was referred to above. These processes stay the same.

Portfolio optimisation: equal risk weighting

With reference to portfolio optimisation, we make use of the equal risk contribution (ERC) mechanism. The mathematical theory behind the ERC mechanism that we employ is outlined below and the descriptions derive from Forseth and Tricker (2019).

The ERC mechanism is founded on one of the foremost concepts in portfolio management: the ability to quantify the risk of an individual component to the total portfolio risk – and vice versa. Mathematically speaking, the risk is a homogeneous function of degree one, meaning that $\sigma(c \cdot w) = c \cdot \sigma(w)$. By Euler's theorem, we can write any such function as an inner product $w^T = \nabla \sigma(w)$ – allowing portfolio risk decomposition

$$\sigma(\mathbf{w}) = \sqrt{\mathbf{w}^T \boldsymbol{\Sigma} \mathbf{w}}$$

via the following sum:

$$\sigma(\mathbf{w}) = \sum_i w_i \frac{\partial \sigma(\mathbf{w})}{\partial w_i}$$

The total risk of a portfolio can be written as a sum over the contributing constituents. The goal of the ERC mechanism is to find the appropriate weights w for each of the selected securities so that they satisfy the requirement of having the risk contribution from all assets be equal between each other, with the total portfolio risk being set to a desired threshold. If an element is relatively risky in comparison to other elements, then lower weight will be attributed to said element and less funds will consequently be allocated to the stock to reduce risk. The solution is found by numerically solving:

$$\min_{\mathbf{w}} \sum_{i,j} \left[w_i \left(\boldsymbol{\Sigma} \mathbf{w} \right)_i - w_j \left(\boldsymbol{\Sigma} \mathbf{w} \right)_j \right]^2$$

where:

$$w_i \geq 0 \text{ and } \textstyle\sum_i w_i = 1.$$

New momentum strategies

We consider three momentum strategies, each of which consists of one sub-strategy for long positions and one sub-strategy for short positions. A long portfolio, a short portfolio and a combined portfolio (i.e. long portfolio + short portfolio) are presented per strategy. These are further displayed separately for both grouping methods.

Strategy 1: Flash to the past
Long: Close > MA200 [High turnover]
Short: EMA25 > Close [Low turnover]

For the first strategy, we go back to the long sub-strategy that performed the best in our previous report and include a reversed version of the previously used short-term momentum strategy for the short sub-strategy.

Strategy 2: DEMA fever
Long: DEMA25 > DEMA100 crossing strategy [HT]
Short: DEMA25>Close [LT]

In the second strategy, we employ a crossing sub-strategy and generally make use of the double exponential moving average (DEMA). Serving as a variation on the exponential moving average (EMA), DEMA can help deal with the inherent lag that is associated with other moving average calculation techniques, as it firmly reduces the weight on recent values – more so than the EMA – by calculating an EMA of the EMA itself. There is thus an attempt to remove the weight on the slower part of the average that has built up over time, making it possible to capture trends earlier.

Strategy 3: The cornucopia
Long: DEMA25 > DEMA100 crossing strategy
& Close > EMA25 [HT]
Short: MA200 > EMA25 & DEMA25 > Close [LT]

In the third strategy, the first two strategies are combined into one larger strategy that draws from the principles of both priorly utilised strategies when constructing signals.

Results and Analysis (1)

Table 1. Annualised Sharpe ratios for the various portfolios, S&P 500, 2000-2020

Portfolio type	Type of the clustering method	Strategy 1: Flash to the past	Strategy 2: DEMA shock	Strategy 3: The cornucopia
Long portfolio	Jenks' natural breaks	0.376	0.359	0.418
Short portfolio	Jenks' natural breaks	-0.159	-0.538	-0.392
Combined portfolio	Jenks' natural breaks	0.305	0.086	0.232
Long portfolio	Static	0.331	0.444	0.400
Short portfolio	Static	-0.195	-0.566	-0.431
Combined portfolio	Static	0.226	0.109	0.120

Annualised Sharpe ratios of the long, short and combined portfolios are given in Table 1. Figure 1 shows the changes in portfolio values over the observed time period for strategy one, titled "flash to the past", wherein 100 is the starting value for all of the relevant portfolios. On the same note, Figure 2 and Figure 3 respectively describe the performances of strategy two, titled "DEMA shock", and strategy three: "the cornucopia". Figures 1 to 3 are displayed on page four.

The first notable aspect that could be discerned from the graphs concerns the prominence of volatility for the long portfolios of all three strategies. Strategy one appears to be the most volatile but more so regarding the extent of volatility than the patterns of volatility themselves. While it can be inferred that the overall volatility becomes more pronounced with reference to the most significant macroeconomic events within the observed time period, marked volatility nonetheless appears to be a rather consistent feature throughout the two decades. A general coherence with the market trends of the observed time period seems to be present for the three strategies but some vital observables could be considered to diverge from what the standard expectations would likely be. As can be seen in the figures, the short legs appear to have virtually no impact on performance in the last decade of the observed time period. It could herein be hypothesised that certain extreme positions are notably skewing the results, with reference to the marked volatility.

For combined portfolios, strategy one can be seen to produce the best Sharpe ratio in relative terms, but this seems to derive only from the negative impact of the short portfolio being, once again in relative terms, curiously reduced. In terms of the Sharpe ratio, the long portfolios for strategies two and three can be seen to outperform the long portfolio of strategy one for static grouping but not for Jenks. Whether the emergence of this ranking for static grouping results more from including the crossover strategies, the DEMA or whether both were impactful may be open for debate. The reversed situation with regard to both groups' short portfolios may however hint that the incorporation of DEMA served its purpose of allowing for a faster capturing of trends. This theorisation would be built on – what could be a fairly evident notion – that the short strategies are simply not working and going against expectations there would therefore paradoxically improve the situation. The flaw(s) for the short strategies could derive from the inadequacy of the strategies, the fact that we do not include past constituents in the backtest (survivorship bias) or the notion that our low turnover group is simply too large to reconcile the idea of shorting low turnover stocks seen in Medhat and Schmeling (2021). Relying on a visualisation in the preceding report, which shows how many securities are allocated to the arbitrarily chosen number of three turnover groups for Jenks, the latter idea could be particularly likely.

Results and Analysis (2)

Due to the methodical incentive to match the number of static turnover groups to the number of Jenks groups, this issue regarding the size of the low turnover group would then expectedly also feature for the static groups. In contrast to the striking similarity of all of the short portfolios across the three strategies, and to a somewhat lesser extent the long portfolios for static grouping, the behaviour of the long portfolio for Jenks in strategy two stands out for its divergence from strategies one and three. This seems likely to have its source in the crossover sub-strategy, which can not provide heightened returns from the latest bull run on its own. On another interesting note, once again with reference to the preceding report, the patterns of the Jenks portfolios have shifted, inching somewhat closer to the high turnover buy-and-hold benchmark seen in the previous report but with some additional, fairly discernible changes that were previously not present around the 2007-09 financial crisis. How the incorporation of equal risk weighting brings forth the profitability of Jenks around that period is of high interest.

Concluding remarks

As in the previous report, certain opportunities for generating returns by exploiting the relationship between momentum and share turnover may have potentially been located in the S&P 500 for long strategies. Incorporating the ERC mechanism can be inferred to have influenced outcomes. Our employed short strategies were, in contrast, not successful. We argue that this outcome is based on the premise of faulty short strategies, the survivorship bias present in the backtest, the overly large size of the low turnover groups or a combination of all three factors. Comparisons against a static grouping benchmark cast some shadow on the efficacy of Jenks' data classification for the purposes of grouping but this may not be fully clear until other arbitrary or non-arbitrary numbers of turnover groups are tested. Although we do not explore this due to the matter of limited time, we propose employing constrained optimisation for the number of turnover groups traded and the number of groups constructed with reference to the Sharpe ratio. It may be that optimal results for Jenks could emerge when, for example, five highest or lowest groups out a total of 19 are traded.

Figure 1. Results for strategy one: "flash to the past", S&P 500, 2000-2020

Figure 2. Results for strategy two: "DEMA shock", S&P 500, 2000-2020

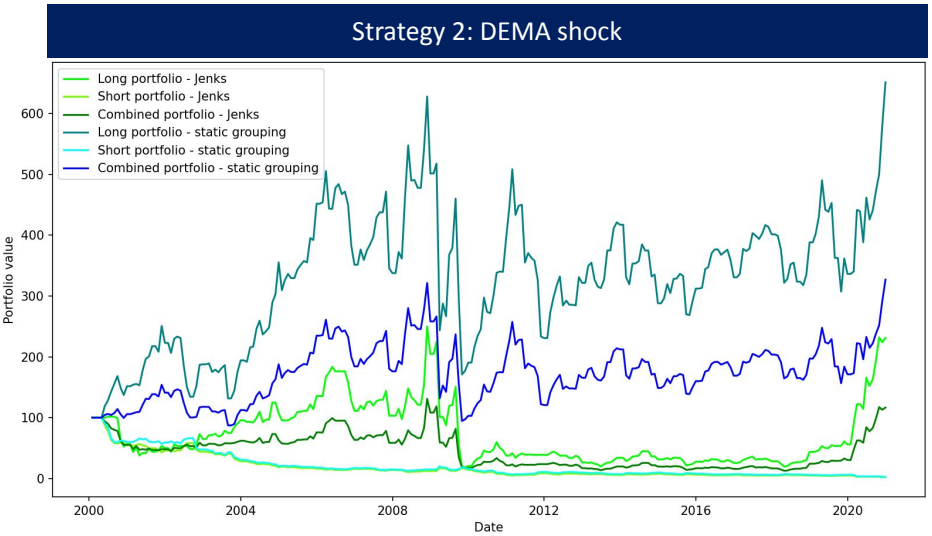

Figure 3. Results for strategy three: "the cornucopia", S&P 500, 2000-2020

References

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