Multi-Asset Solutions

Portfolio Construction –
Fresh Perspectives on Signal
Weighting Methodology

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First Sentier
Investors

Contents

Executive Summary

In 2019 we implemented a substantial upgrade to our portfolio construction capabilities relating to our Investment Signals ('Signals'). Specifically, we upgraded the portfolio construction process, as well as improved the modularity of our models and tools in the process. Previously, our portfolio construction technique adopted an inverse volatility methodology to determine Signal weightings, which we determined could be improved.

The enhanced portfolio construction approach does still begin with the inverse volatility weights to provide an anchor position for portfolio optimisation; however, the Signals are then optimised towards target risk weights, with tolerance bands applied around the anchor point.

We believe this provides a distinctive solution that improves on more widely used and available techniques. In addition, our tools allow for a more generic and flexible approach to weighting Signals. The advancement of tools and capabilities allows a high degree of portfolio construction customisation and risk budgeting.

Background
Investment Signals

Signals, in our parlance, provide quantitatively measurable attractiveness indicators within a specified investable universe. The attractiveness ranking generated by a Signal is updated periodically, depending on the underlying frequency of the data, and is then grouped according to rank. A notional long/short portfolio is created out of these groups, with one group being the long positions and the other group the shorts. First Sentier Investors (2014)[1] covers the research and validation process in detail. As part of our research guidelines, Signals are required to deliver an annualised information ratio of at least 65% over the researched in-sample period.

> ### How can Signals be used within your portfolio?
>
> Signals provide uncorrelated return sources that can improve the likelihood of your portfolio meeting its investment objectives. Implementation of these views can be through a direct overlay via derivatives, used to adjust the physical asset allocation weights, or inform rebalancing decisions. By using an explicit risk budget, Signals are scaled to provide the appropriate positions based on your investment objectives.

Portfolio Construction

We aim to find the optimal weightings scheme for a portfolio of Signals, with each Signal representing a long/short portfolio.

The model portfolio targets a constant 10% volatility. Regardless of market conditions, we do not qualitatively vary Signal risk weightings over time. We believe this approach efficiently harvests the returns of the Signals, while also providing greater transparency and better risk control.

Requirements

The optimal portfolio construction maximises the information conveyed in the Signals and maximises risk-adjusted returns. Consideration needs to be given to the impact of trading costs and turnover on the portfolio. We also need to incorporate the following constraints:

1. Investment Signal weightings must be positive.
   - All Signals should be represented within the portfolio; providing a balance of economic drivers across a broad investment universe.
   - We do not want to invert the information within the signal.
2. Scaling of positions 'per unit of risk' must be possible to be universally applicable to any portfolio.

Potential Weighting Methodologies

We note a variety of potential portfolio construction weighting options, which we elaborate on below, along with illustrative figures that demonstrate the scaling of nine Signals as a representative subset of our Signal universe[2]. These Signals are scaled to a target risk contribution of 10% under various portfolio construction techniques.

[1] First Sentier Investors. (2014). "Dynamic Asset Allocation".
[2] As at September 2021, 22 approved Signals are used in our Dynamic Asset Allocation process.

Equal Weight (1/n)

While an equal weight approach has limitations[3] it is widely used in some areas, including equities and corporate credit, due to its simplicity. This approach is appropriate where expected returns, volatilities and correlations may be similar or completely unknown.

The main drawback of this approach is that it is agnostic to the risk of the investment[4], implying that the diversification benefits achieved are likely to be minimal.

Figure 1: Equal Weight (1/n) - Signal Weights and Risk
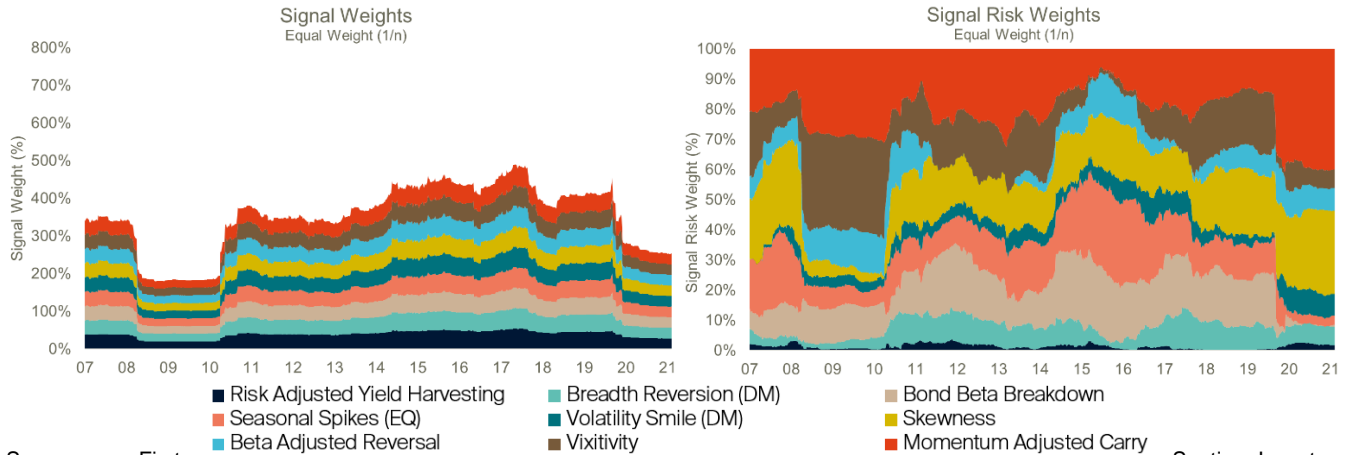
Source: First   Sentier Investors,
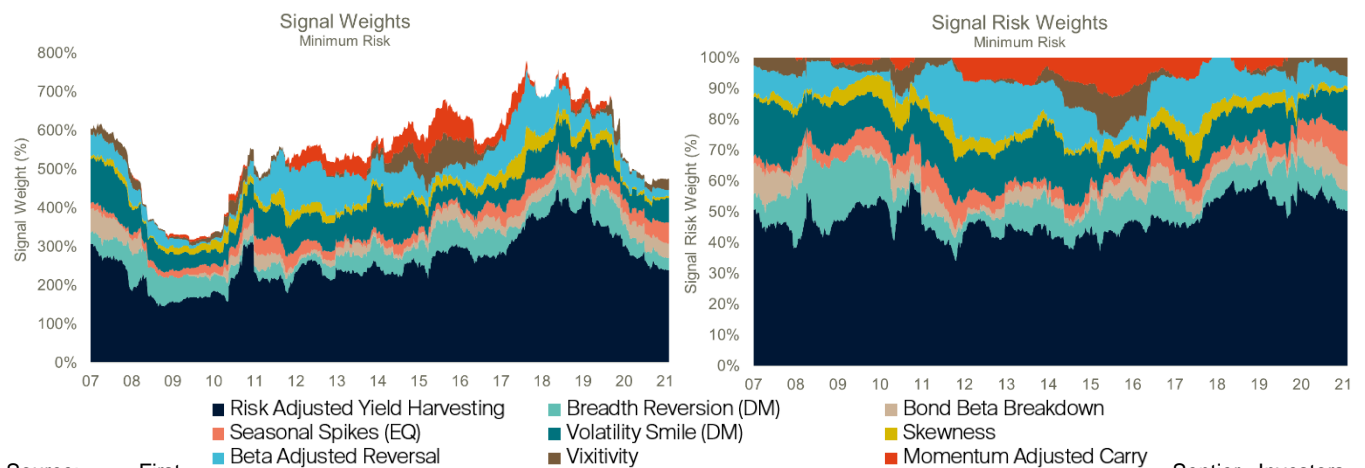Internal Proprietary Models, weekly data from 6 July 2007 to 13 August 2021.

Minimum Risk (Volatility)

The minimum risk optimisation is simple and achieves maximum diversification by providing a solution on the efficient frontier[5]. Similar to a long-only optimisation we constrain the Signal weights to be positive. The optimised Signal weights scheme can be implemented by scaling up (or down) the positions to the target risk through the use of leverage.

The significant drawback of this approach is that portfolio outcomes can be concentrated. Commonly, only a subset of Signals will be represented in the portfolio, which does not fulfil the requirement that all signals should be represented within the portfolio. As such, this is not deemed an appropriate weighting scheme for the Signals.

Figure 2: Minimum Risk - Signal Weights and Risk Weights

Source: First   Sentier Investors,
Internal Proprietary Models, weekly data from 6 July 2007 to 13 August 2021.

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[3] While unlikely, if the assets have the same expected returns, volatilities, and correlation the equally-weighted portfolio is a unique portfolio on the efficient frontier.
[4] Signals that contain assets with higher (lower) volatility, such as equities (bonds), typically have higher (lower) risk when aggregated into a long/short portfolio.
[5] We assume that the expected return of each signal will be a 0.65 multiple of Signal volatility. This is in line with the Signal research approach and information ratio requirements.

Principal Component Analysis

Principal component analysis (PCA) can be used to isolate the independent sources of risk. A couple of difficulties in implementing PCA for portfolio optimisation is that we need to impose a positive weight constraint, as well as determine the number of the principal components to utilise or a threshold for the meaningful explanation of variance. The significant disadvantage of this approach is that the outcomes are more difficult to intuitively understand. Since our Signals are long/short, an intuitive mapping to economic factors is problematic.

Additionally, PCA suffers from the same drawbacks as minimum risk, i.e. concentration. As such it is not ideal for the application to our Signals.

Inverse Volatility

As the name suggests, inverse volatility weights Signals within the portfolio based on the inverse of their volatility. It is a very intuitive way of reducing portfolio risk through diversification, but it does not take into account the correlation between the Signals. Where expected correlations are close to zero, this approach will generate similar results to equal risk (see below). This was previously our approach given the long/short nature of Signals and the thoroughness of the research process.

Figure 3: Inverse Volatility - Signal Weights and Risk Weights
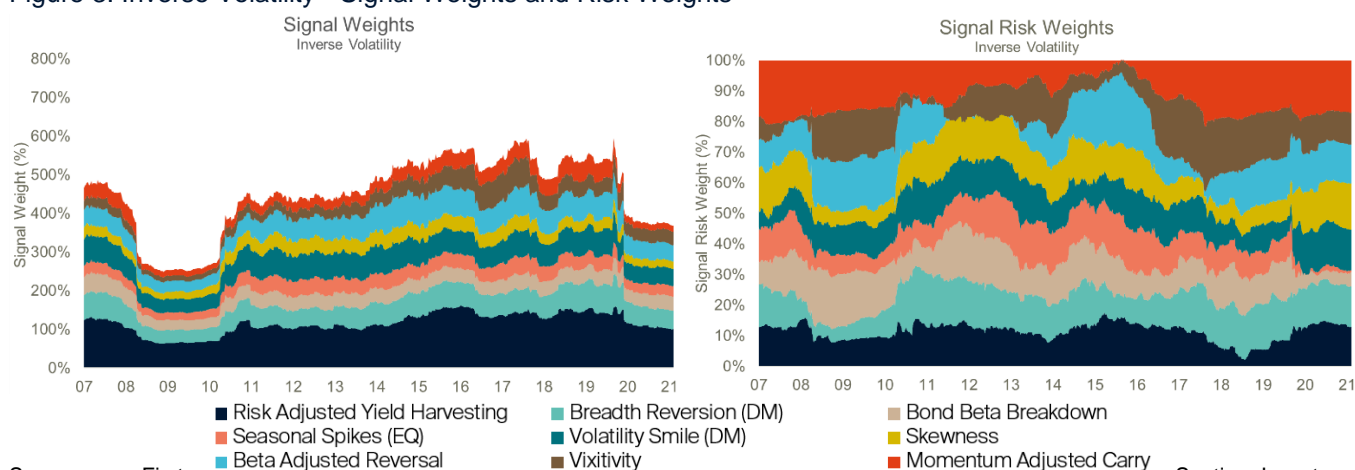
Source: First Sentier Investors, Internal Proprietary Models, weekly data from 6 July 2007 to 13 August 2021.

Equal Risk

Equal risk weights the Signals in such a way that they contribute equally to the risk of a portfolio. This can improve returns on a risk-adjusted basis, taking into account the expected co-movements between the Signals.

Equal risk does not require any return assumptions. That may be a drawback in some use cases, but since our Signals are researched based on information ratios, it is a realistic assumption to assume they have similar, if not equal, expected returns per unit of risk. Equal risk approaches are especially suitable for strategies where the long-term returns may be similar, but short-term returns are less predictable.

This approach reduces concentration risk by automatically reducing weights when volatility or correlations rise and is a strong candidate for use in our Signal portfolio construction.

The downside of this approach is that it may be necessary to invert the Signal weights to ensure that the Signals have an equal risk contribution, which does not fulfil the requirement of not having to invert the information within the Signal. Accordingly, this is not a viable weighting scheme for our Signals.

Customisable Target Risk

A customisable target risk is an approach that we believe is robust, methodical, and provides practical portfolio construction outcomes. We have built our proprietary risk scaling tool to incorporate the superior elements of inverse volatility and equal risk portfolios.

Our approach begins by taking the inverse volatility weightings as an anchor. The inverse volatility weights will ensure that all Signals are represented with a positive weight. We then specify a tolerance (for example up/down parameters of 75%) for potential movement from that anchor towards the target risk portfolio, where our default position is an equal risk contribution. The next step is to optimise the Signal weights based on the objective, which incorporates the anchored (inverse volatility) starting point, target risks, and tolerance bands. The specified tolerance band of up/down 75% around the anchor, represents a signal weight that is optimised within a band of 25% to 175% of the Signal anchor weight. Notably, using our default tolerance, a customisable target risk approach leads to similar results as the equal risk approach except during periods of high market stress.

Figure 4: Customisable Target Risk - Signal Weights and Risk Weights
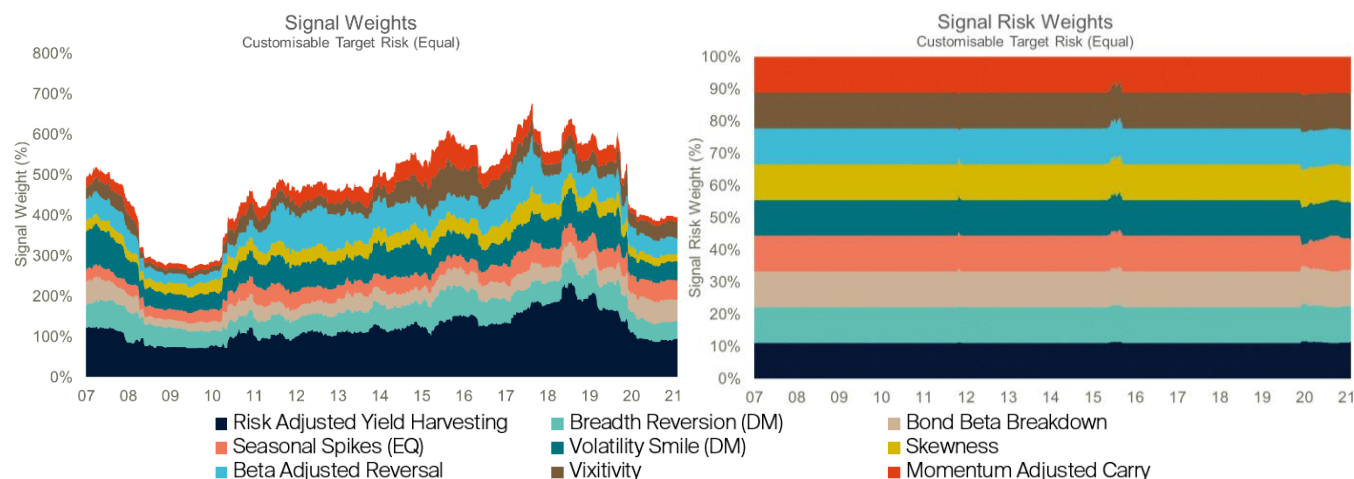
Source: First Sentier Investors, Internal Proprietary Models, weekly data from 6 July 2007 to 13 August 2021.

While we have conducted extensive Signal research and have strict guidelines around the expectations regarding out-of-sample performance characteristics, it may still be prudent to impose restrictions, or adjustments, at predefined levels to avoid unintended over-concentration. This would effectively dilute the risk-smoothing benefits of this strategy. We would typically apply this to Signals within a set, such as belonging to a particular 'asset class' or 'return driver'.
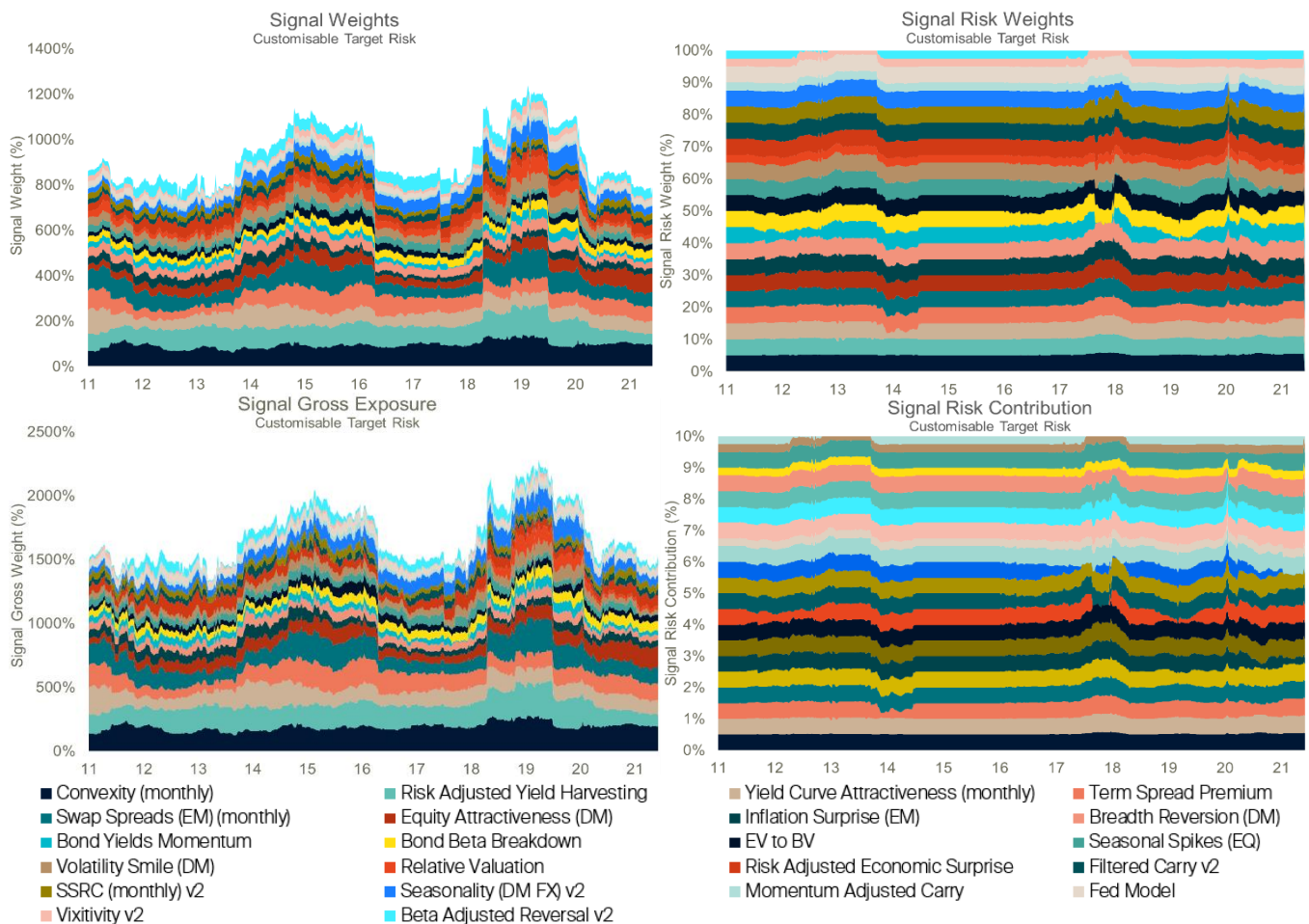
Signals in Practice

While **inverse volatility** weights will achieve equal stand-alone risk from Signals, in practice we know that our 22 Signals contain a degree of known, and somewhat predictable, co-movement patterns. This results in the Signals contributing non-equally to overall portfolio risk. As such, it is important to ensure that Signals are scaled to achieve an **equal contribution to overall risk** by taking into account expected co-movement. That said, it may not be possible to ensure all Signals have an equal risk contribution with the constraint of non-negative Signal weights. To address this issue we apply a **tolerance band of up/down 75%** from the inverse volatility weights, which provides an anchor when moving towards an equal risk target.

In practice, we find that the performance history of some Signals is not a true reflection of potential risk and exposures. We have therefore incorporated the ability to target a nominated risk contribution and apply a volatility adjustment to each Signal. For our **Cross-Asset Signals, we halve the risk budget** compared to Signals that only contain a single asset class. We have taken this approach as Cross-Asset Signals rotate the asset classes[6] that are long/short and thus change their expected volatilities. This approach provides a practical implementation and sensible risk approach to a **customisable target risk** portfolio of long/short Signals.

The following figures show our **customisable target risk** approach on the full set of 22 Signals over the last decade.

Figure 5: Customisable Target Risk – Signal Weights and Risk Weights (All
Signals)

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[6] Cross-Asset Signals are expected to rotate between asset classes. As such, this is a positive feature, and we take the prudent approach of adjusting the expected outcome of Cross-Asset rotational Signals.

Signal Weights — Customisable Target Risk

Signal Risk Weights — Customisable Target Risk

Signal Gross Exposure — Customisable Target Risk

Signal Risk Contribution — Customisable Target Risk

Legend:
- Convexity (monthly)
- Risk Adjusted Yield Harvesting
- Yield Curve Attractiveness (monthly)
- Term Spread Premium
- Swap Spreads (EM) (monthly)
- Equity Attractiveness (DM)
- Inflation Surprise (EM)
- Breadth Reversion (DM)
- Bond Yields Momentum
- Bond Beta Breakdown
- EV to BV
- Seasonal Spikes (EQ)
- Volatility Smile (DM)
- Relative Valuation
- Risk Adjusted Economic Surprise
- Filtered Carry v2
- SSRC (monthly) v2
- Seasonality (DM FX) v2
- Momentum Adjusted Carry
- Fed Model
- Vixitivity v2
- Beta Adjusted Reversal v2

Source: First Sentier Investors, Internal Proprietary Models, weekly data from 11 March 2011 to 13 August 2021.

Conclusion

Our customisable target risk approach to portfolio construction provides robust, methodical, and practical outcomes for our Signals. It significantly enhances the ability to customise desired outcomes for our portfolios.

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