

# Dynamic Asset Allocation

All investment portfolios have an asset allocation; whether intentional or not. However, dogmatically relying on any static long-term strategic asset allocation to ensure that investment objectives are achieved can be detrimental, especially where investors have multi-faceted objectives across a continuum of timeframes.

Market dynamics are continually changing and short-term risks can dominate news headlines and market volatility. Dynamic asset allocation continuously evaluates the investment market landscape to deliver additional returns and abate portfolio risks; such as tail events.

In this paper we delve into conceptual frameworks underlying dynamic asset allocation and put these in context. We also elaborate on the methodology we employ and why we believe that a disciplined qualitative approach is best suited to ensure quality of implementation and consistency with client objectives.

## What is Dynamic Asset Allocation?

Dynamic asset allocation (DAA) describes active portfolio management from a macro, or top-down, perspective. The process aims to generate additional returns, or abate portfolio risks, by reallocating capital when capital markets deviate from 'fair value'. DAA bridges the divide from strategic asset allocation (SAA) which uses equilibrium assumptions to provide long-term policy weights by introducing a more flexible framework to increase exposure to under-valued opportunities while reducing exposure to overvalued assets.

## Motivations

Market dislocations across capital markets appear to be increasing in frequency. The 2008 equity and credit market meltdown provided a stark reminder to market participants of the fickleness of long-term fundamental valuations when financial markets are stressed. Contrary to stressed markets, the dot-com and Japanese real estate and stock bubbles are examples of investors' hubris when it comes to rational expectations and fair market value.

The SAA framework is ill-equipped to respond to these market dislocations due to its inherent long-term nature, whereas DAA can capture shorter-term market opportunities and market inefficiencies.

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## Capital markets are not completely efficient.

Academics and practitioners have been quick to point out the shortcomings in the efficient market hypothesis by providing evidence of temporary, or structural, mispricing by capital market participants. It would be unrealistic to assume that all investors are unconstrained and rational.

Constraints such as home biases, regulations, liquidity and cash flow requirements, supply and demand imbalances, forced hedging and behavioral biases all lead to deviations from fair-market value; creating market inefficiencies.

Numerous investment strategies have been devised and published to exploit these constraints and biases. Valuation strategies, in the broadest definition, represent the most widely understood and cited trading rationales. Academics such as Basu 1977, Rosenberg, Reid and Lanstein 1984 and Fama 1992 provided early evidence that value strategies such as buying low price-to-earnings and low book-to-market companies produce superior investment returns to their counterparts. These metrics have become common valuation jargon amongst investors. DeBondt, Werner and Thaler 1985, 1987 shows that 'losers' over the last three to five years tend to outperform past 'winners' over the following three to five years. This is commonly assumed to be due to the overreaction of market participants.

Momentum investment strategies pose the most significant challenge to the efficient market hypothesis. While hypotheses have been proposed<sup>1</sup>, no consensus has been reached as to why this investment strategy should generate 'alpha'. Over shorter time periods of up to a year Jegadeesh 1993 and Rouwenhorst 1998 provide evidence of the existence of short-term momentum returns within equities where past 'winners' continue to outperform past 'losers'. More recently Asness, Clifford, Moskowitz and Pedersen 2013 expands on this research and shows evidence of value and momentum excess returns across individual stocks, equity indices, government bonds, currencies and commodities.

The well-known and documented valuation and momentum strategies discussed above primarily relate to relative strategies within an asset class such as commodities, currencies and equities. However existing literature also provides methodologies to determine absolute return expectations. Bogle 1991, 1995 and Benson, Bortner and Kong 2011 have provided earnings and dividend valuation methods to determine the expected return from equities markets over longer-term horizons. Shiller 2000 and Campbell 2001 show how longer-term valuations (known by the moniker: cyclically adjusted price-to-earnings ratio or CAPE) is useful in forecasting future stock price changes. Both of these methodologies can be utilized within dynamic asset allocation to determine the attractiveness of equities vs. other asset categories available.

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<sup>1</sup> The two most commonly cited reasons that momentum generates additional returns are: 1) that it assumes additional risk; or 2) it is exploiting behavioural biases such as investor herding, overreactions and investor confirmation bias.

When examining asset allocation it is also important to understand how the individual ingredients within the portfolio will perform in various market environments. This can be as simple as looking at the cross section of returns where GDP growth or inflation has been above or below the historical average. Kritzman, Page and Turkington 2012 provides a more sophisticated technique to determine regime changes<sup>2</sup> and demonstrates how this can be incorporated into a DAA process to create 'alpha'.

These studies provide examples of both top-down (asset class) and bottom-up (individual bonds, commodities, currencies or equities) market inefficiencies. Markowitz 1952 suggested that a probabilistic estimation of expected returns and volatility would be a better method of portfolio construction. So wouldn't it be optimal to incorporate all return expectations, absolute or relative, into the asset allocation of the portfolio? Being cognizant of the information contained within investment market allows for 'intelligent' portfolio positioning.

## An overlay on the long-term investment strategy

The vast majority of investors have a long-term SAA that is constructed based on their specific return objectives and risk criterion. The SAA is of fundamental importance in the determination of their portfolio's return distribution. However the long-term nature of an SAA requires long-term assumptions around return distributions. Due to lengthy forward assumptions the SAA doesn't lend itself to taking advantage of short-term opportunities. This is where a DAA process plays an integral role in achieving portfolio objectives.

DAA forms an alpha-generating and risk management component in the management of investment portfolios which complements the SAA framework. DAA can be effectively applied within the traditional benchmark-relative or objective oriented portfolios.

**Figure 1: Investment Decision Making Hierarchy**



DAA<sup>3</sup> refers to the investment process which seeks to generate alpha from a top-down, global, cross-asset perspective. DAA is used to make investment decisions across asset categories (e.g. equities versus bonds) and within asset categories (e.g. countries, sectors, styles, credit exposure, duration, market cap, etc.). This allows for a very wide investable universe with a multitude of investment decisions.

The typical time horizon for DAA strategies sits between one month and a year. Timeframes shorter than a month descend into high turnover trading strategies, whereas looking past the one year horizon starts to blend into medium term asset allocation. This latter point is important as there is a natural grey area between the well-defined concepts of DAA at one end, and the medium and strategic asset allocations at the other end. This makes DAA an integral part of the wider asset allocation gamut, which stretches from short-term DAA timeframes to very long term SAA and even Asset-Liability Management (ALM); the latter can have forward-looking horizons in excess of a decade. The overlap and reconciliation between the short and the long term asset allocation is addressed later in this document.

Aside from alpha generation the DAA process also serves to provide integrated risk management. The top-down perspective and the close link with the investment objectives makes DAA a natural means of integrating risk management in a manner that is highly relevant and responsive.

<sup>2</sup> Examples of regimes include growth, inflation and turbulence.

<sup>3</sup> DAA can also be referred to as Global Tactical Asset Allocation (GTAA) or Tactical Asset Allocation (TAA). The moniker used for the investment process is based on the scope for implementation and the skew between return generation and risk mitigation.

## Global Scope

The global scope of DAA is the principal reason that DAA is effective. Global markets are not completely efficient due to liquidity requirements, regulatory constraints, mandatory hedging and even simple home biases allow dislocations to exist and to be exploited. Moreover risk premia are not necessarily at their long-term equilibrium values at all times, opening another avenue for alpha generation.

Given the breadth and scope of the investable universe there is an ineluctable need for quantitative rigor to cover this vast expanse of assets and markets. An ancillary but nonetheless important consideration is the role quantitative analysis plays in counteracting cognitive biases that often overwhelm purely qualitative considerations.

In order to create such alpha requires both the use of macro and microeconomic inputs and their aforementioned quantitative processing. Casting the net widely also imports diversification of performance drivers into the DAA process.

Not all relevant data can be quantified and there will always be events, expectations and developments that cannot be captured by quantitative means in a timely manner, and in some cases, cannot be thusly captured at all. Purely quantitative processes are therefore susceptible to shocks and dislocations, and have had a long track record of working well for a protracted period of time before giving up all of the gains, or even more, in a short, spectacular cataclysm.

Thus an important element of a DAA process will be the economic rationale behind the quantitative processing of inputs as well as a qualitative overlay for the quantitative position output. A qualitative overlay is required for interpretation and implementation of the model output as well as taking into account regime and paradigm shifts.

## Investment Universe

The investible universe for implemented portfolios covers both liquid and illiquid assets, as the latter are often an important component of longer-term institutional portfolios. However illiquid assets are largely static long-term allocations, which are formulated within the SAA or ALM phases of the construction of an investment strategy.

For an asset category to be used in DAA it has to fulfill certain criteria:

- It has to be sufficiently liquid to allow for relatively swift reallocations.
- Transaction costs have to be low enough not to erase the alpha potential.
- There has to be a certain discernible beta component to the asset class.

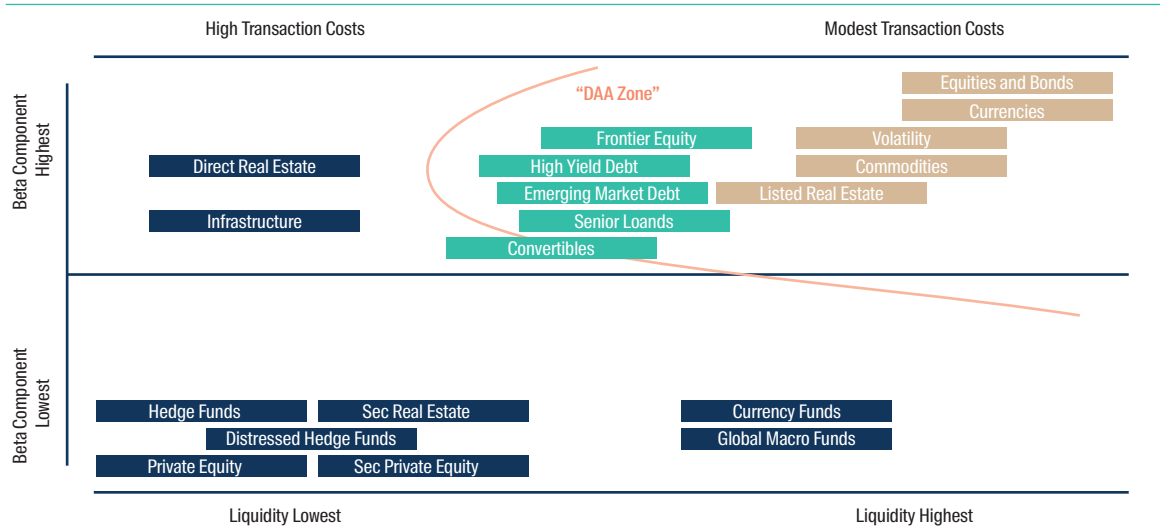
The last point is important because there is little fundamental sense to trying to allocate dynamically to hedge funds, CTAs or other alpha-streams. If such funds are market neutral and run accordingly then the alpha stream they deliver should be uncorrelated to capital markets, and also show no autocorrelation<sup>4</sup>. For asset categories such as bonds, commodities, currencies and equities there are well documented reasons as to why a structural beta could and should exist, and moreover we can implement such beta exposure relatively easily and cost effectively<sup>5</sup>. Figure 2 shows the investible universe grouped conceptually by liquidity and beta.

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<sup>4</sup> Stale pricing within hedge funds often does result in a significant autocorrelation, but that is a topic unto itself.

<sup>5</sup> Implementation will be dependent on the portfolio objectives and constraints. Deeply liquid and cost effective futures contracts are available for government bonds, individual commodity exposures and country equity allocations.

Figure 2: Dynamic Asset Allocation Zone



The “DAA Zone” is depicted in the upper right of Figure 2 where we see the confluence of high liquidity, modest trading costs and structural beta.

### Dynamic to Medium Term Allocations

Before we delve into the DAA process we need to address the interaction between the longer end of the DAA time horizon and the progression into SAA. There is no clear boundary between the two. However the grey area in the centre is an important facet in successfully meeting longer term investment objectives. Any investment strategy must be aligned with the longer term strategy of the portfolio so the day-to-day management of portfolios must be aligned to the longer-term SAA. As part of our process we use our propriety Long-Term Asset Return Model (LTARM)<sup>6</sup> which provides stochastic estimates of distributions of risk premia for various asset classes. By using the setting of a longer term economic climate with broad parameters for macro developments allows abstraction from having to provide point estimates for expected returns and instead can model the environment more broadly, taking into account its sensitivities and correlations. Although investors may use their own methodology for setting long-term return expectations and risk premia; or may utilize the expertise of their investment consultant.

While the primary purpose of the LTARM is providing expected return assumptions for construction of an SAA it also provides an output for use in portfolio management. The LTARM estimates for longer term equilibria are based on rational expectations. For instance a fair valuation of the equity risk premium depends on the discounted future cash flows, dividend payments, earnings growth and macroeconomic factors that also have an influence. However we can also input intermediate assumptions which are blended into equilibrium expectation to bridge investment horizons between DAA and SAA.

### Investment Process

DAA processes can be solely qualitative or quantitative; or a combination of both. Relying on a qualitative or quantitative process has benefits and deficiencies. For example qualitative processes have the advantage of being able to incorporate changing paradigms, however are susceptible to cognitive biases. Whereas quantitative processes provide numerical evidence of historical results, but they require careful formulation to ensure that the results are not the outcome of data mining.

<sup>6</sup> See Baars, Kocourek, van der Lende and Somaia (2013) for a description of the Long Term Asset Return Model (LTARM).

At this stage of the paper we delve into our DAA investment process. Our approach consists of qualitative idea generation which are discussed and investigated, and, where possible, quantitatively substantiated.

There are three major components to the investment process, with their respective sub-components:

1. Investment Signal Generation
  - a. a.research to identify new alpha sources
  - b. b.testing to assess their solidity
  - c. c.validation to decide on the inclusion of potential new alpha sources
  - d. d.continual validation and enhancement
2. Portfolio Construction
  - a. a.volatility scaling of a signal-based quantitative model portfolio
  - b. b.“Common Sense Overlay” to include qualitative insights
3. Quality Control
  - a. a.risk management
  - b. b.performance attribution

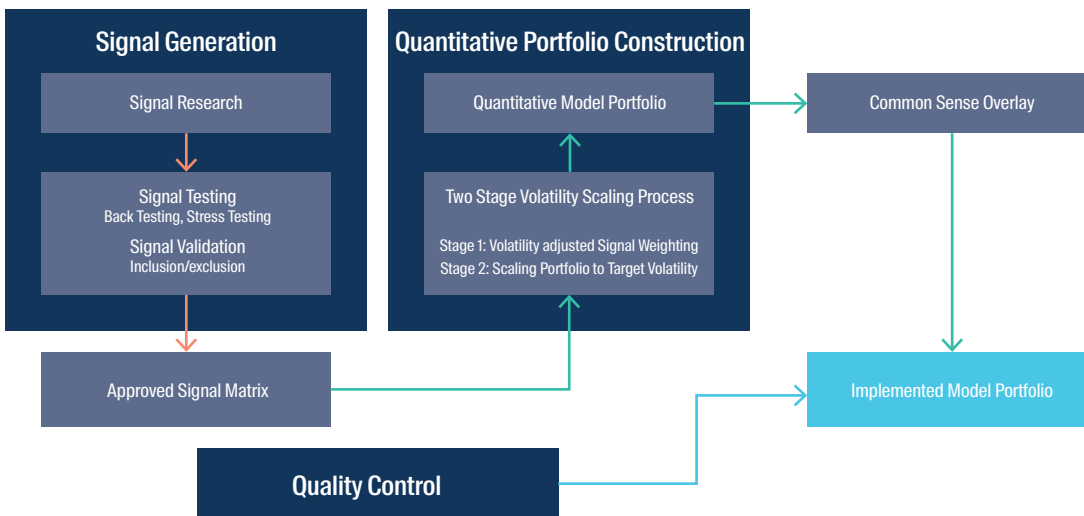
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## Qualitative ideas are quantitatively validated where possible.

Figure 3 shows the interaction between these components and we shall address them in turn.

**Figure 3: Dynamic Asset Allocation Process**

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## 1. Investment signal Generation

Investment signal generation requires idea innovation. So the first step in the investment process is qualitative. For any investment signal there needs to be a fundamental investment rationale to the signal, be it in the form of market linkages and dynamics, economic factors or academic literature. This requirement exists to avoid spurious correlations being mistaken for causal effects. Investment signals in our parlance are quantitatively measurable attractiveness indicators within a specified investable universe. For instance, this could be in its simplest form a listing of equity markets by country and ranked by trailing price-to-earnings ratios as suggested by Basu 1977. While this could potentially be a signal, it would be a naïve one in its current form as it would lend itself to structural positions<sup>7</sup>. Typically to find an investment signal that produces alpha it requires a more robust rationale. The attractiveness ranking generated by a signal is updated periodically (typically weekly or monthly), depending on the underlying frequency of the data, and is then grouped according to rank<sup>8</sup>.

A notional long/short portfolio is created out of these groups, with one group being the long positions, another group being the shorts. An example, using sample data from the aforementioned example of equities markets ranked by trailing price-to-earnings ratios, is shown in Table 1.

**Table 1: Attractiveness Ranking Example**

Price-to-Earnings Valuation – Developed Markets Equities Data as of DD-MM-YYYY						
Rank		Weight	Weight Change	Rank Change	Signal Value	Signal Value Change
1	Greece	11.11%	0.0%	0	5.85	0.050
2	Russia	11.11%	0.0%	0	6.10	-0.050
3	Czech Republic	11.11%	0.0%	0	10.00	0.200
4	Turkey	11.11%	0.0%	0	10.10	0.050
5	Hungary	11.11%	0.0%	0	10.40	0.100
6	China	11.11%	0.0%	0	10.75	-0.150
7	Hong Kong	11.11%	0.0%	0	11.85	-0.100
8	Singapore	11.11%	0.0%	0	12.80	0.050
9	Norway	7.41%	1.9%	0	13.50	0.100
10	Poland	3.70%	-1.9%	0	13.60	0.200
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23	Portugal	-1.85%	0.0%	-1	17.35	-0.300
24	South Africa	0.00%	0.0%	+1	17.35	0.150
25	Denmark	-3.70%	1.9%	0	17.85	-0.050
26	Canada	-5.56%	-1.9%	0	18.20	0.250
27	France	-11.11%	0.0%	0	18.35	0.150
28	Finland	-11.11%	0.0%	0	18.85	0.250
29	Spain	-11.11%	0.0%	-2	19.10	-0.150
30	US	-11.11%	0.0%	-2	19.20	-0.100
31	Australia	-11.11%	0.0%	+2	19.25	0.150
32	Switzerland	-11.11%	0.0%	+2	19.45	0.200
33	Mexico	-11.11%	0.0%	0	19.80	0.050
34	Italy	-11.11%	0.0%	0	20.80	-0.650

<sup>7</sup> Structural positions resulting from this signal would likely include a tilt to emerging markets vs. developed markets as well as lower allocations to countries that have large weightings to sectors with higher price-to-earnings ratios such as healthcare.

<sup>8</sup> Examples of grouping methods include percentile (e.g. quartiles or quintiles), "top/bottom n," or manually created ranking-groups.

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## The robustness of the investments signal qualitative rationale is of utmost importance.

The process of signal validation should allow the assessment of validity, stability and robustness of the signals in a backtesting environment. For an investment signal to be accepted into the investment process the most important element is the qualitative fundamental investment rationale. Without a sound fundamental rationale a signal should not be included in the investment process; regardless of the performance in backtesting or within sample. Once the signal's rationale has been endorsed the signal is quantitatively validated on the following criteria:

- Reasonably consistent performance historically, either throughout history or within well-defined sub-periods, with statistically highly significant positive performance.
- It has to be stable in its performance in the sense that the performance needs to be harvested over time, rather than coming in massive one-off spurts.
- It has to be robust with regard to its construction parameters. For instance, a signal that works well on a 4-week time frame should also work somewhat well on a 3-week and 5-week time frame.
- The resulting allocation should avoid structural positions and biases; a model that always underweights Japanese equities may not be providing information that could not have been gleaned from the input directly.
- Equally the performance generated should not come from a small subset of asset categories but from the universe as a whole.
- All performance numbers need to be evaluated after trading costs.
- Behavior under multiple stress<sup>9</sup> tests needs to be robust.

A signal has to typically go through a number of discussions in which further refinements are proposed and investigated. Before any investment signal is included in the investment process a peer review will be conducted to validate all data sources and outcomes.

To avoid excessive conceptual or methodological concentrations of signals they are categorized into thematic sets. The objective is to diversify signals across the thematic sets to glean diversified information and to avoid any style biases. Thematic sets include:

- Valuation: how expensive or cheap is the instrument?
- Carry: structural asset pricing differentials created by forced hedging and supply demand imbalances.
- Momentum: trending epochs have persistence.
- Macro: supply and demand, structural drivers of asset class valuations.
- Technical: volatilities, correlations, liquidity, turbulence, brittleness.

Reviewing signals within the investment process is as important, if not more so, than new signal discovery. The investment signal's performance and risk metrics, along with performance attribution, is reviewed for the universe of signals. This helps provide indications for which investment signals may need to be formally reviewed for potential removal from the alpha generation set. Mere periods of underperformance typically would not warrant removal from the investment process as every investment signal will have periodic performance drawdowns; this is mitigated by having a diversified set of investment signals. The main criteria for a signal to be removed from the investment process are:

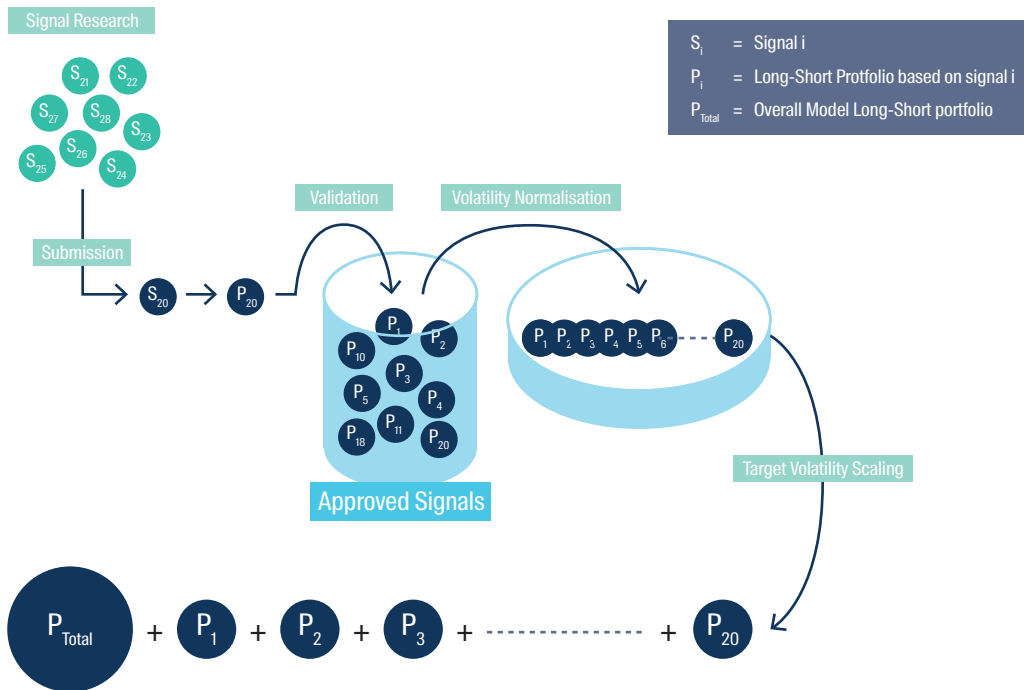
- Switch in economic/market regimes to an environment in which the signal has historically performed poorly.
- Significantly different behavior by the signal relative to its own history, but both backtested and realized. If the signal is no longer responding to its fundamental underlying drivers this may indicate that a structural change has occurred in the markets invalidating the signal's investment rationale.

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<sup>9</sup>This includes evaluating drawdowns, periods of lackluster returns and various market regimes.



Figure 4



In order to blend the signals into an overall portfolio the signals are normalized for volatility, such that no single signal is dominant in terms of risk contribution while also ensuring that all signals are represented in the final portfolio. Each of the approval signals  $S_i$  generates its own long/short portfolio  $P_i$  which is then scaled to unit volatility. This allows for the creation of the overall model long/short portfolio  $P_{total}$  which is the sum of the individually scaled portfolios  $P_i$ , and which can be scaled in a second step to the desired target volatility (see Figure 4)<sup>10</sup>.

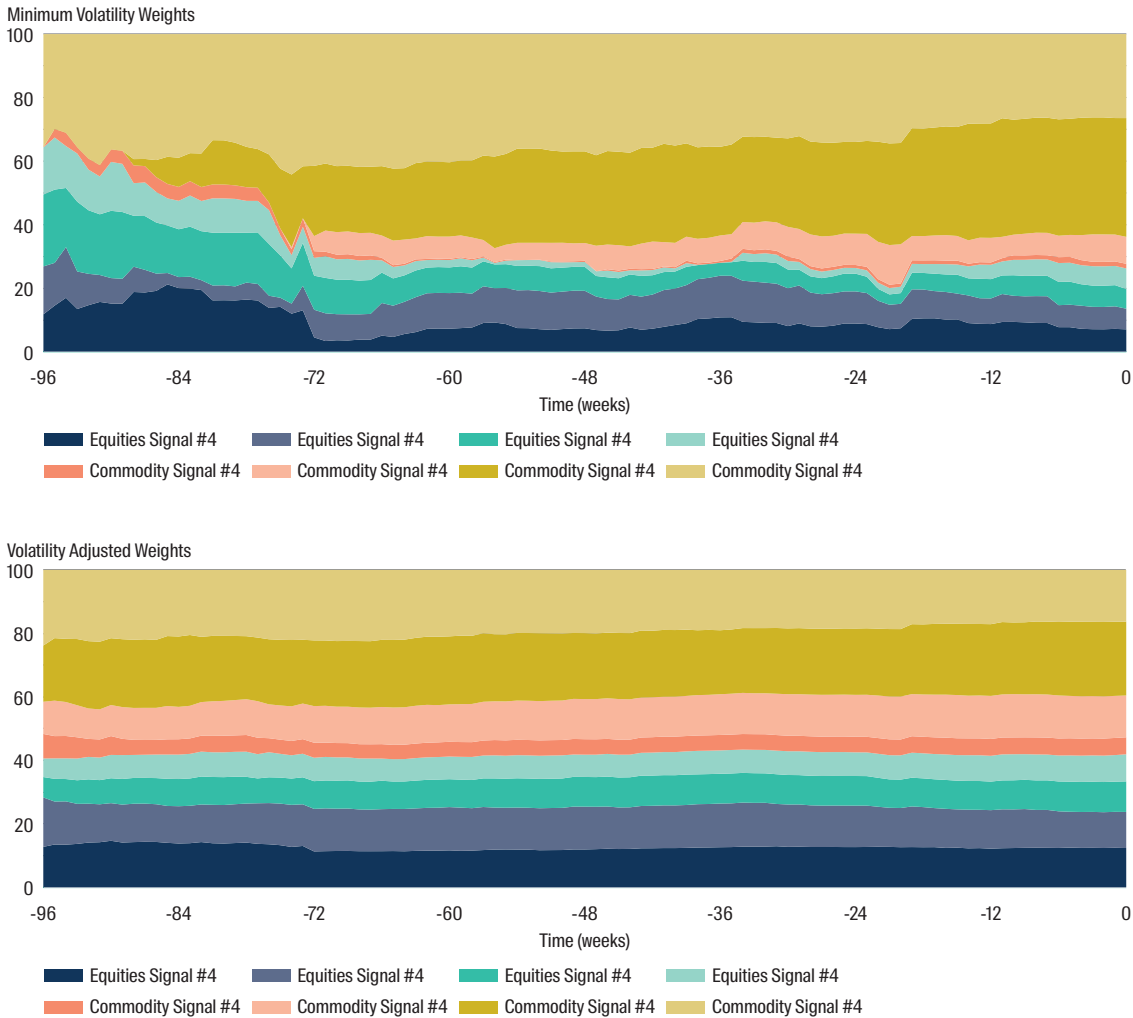
Figure 5 shows an illustrative example<sup>11</sup> of signal weights when they are scaled<sup>12</sup> by minimum volatility and volatility-adjusted signal portfolio. Within our investment process we utilize volatility adjusted weights to ensure that all investment signals are represented within the portfolio; which aims to maximize the information content.

<sup>10</sup> In the purest sense this would be an implementable long/short portfolio, potentially highly leveraged. In practice it can also become a relative overweight/underweight portfolio with an overall tracking error rather than a volatility target.

<sup>11</sup> Within a robust investment process each asset category would require multiple investment signals.

<sup>12</sup> Potential weighting methodologies for investment signals include minimum volatility, volatility adjusted weights, minimum conditional value at risk, equal risk weight and equal principal component weightings.

Figure 5: Signal Weighting Methodologies



As can be seen in the charts above the two risk weighting methodologies result in differing portfolio compositions over time. Minimum volatility weights are more responsive to changing correlation structures; whereas volatility adjusted weights remain more stable. In Figure 5 the bond and currency signals receive larger weightings due to the lower volatility of their return profiles, while the commodity equity signals have low weights in the portfolio due to the high volatility of their performance.

### Qualitative investment views are overlaid on the model portfolio.

A critical step in portfolio construction is the qualitative overlay. As we described previously, there are many non-quantifiable considerations that need to be taken into account when constructing portfolios. On the other hand investment decisions must be made with discipline and due consideration. In order to override the quantitative signal output qualitative views have to be time sensitive, relevant and significant. Each of these criteria will have to be continually defended if an investment position or investment signal is to be overwritten due to qualitative views. This avoids complacency and anchoring biases. The final DAA portfolio, with all relevant quantitative and qualitative input combined will have to satisfy the relevant risk parameters before implementation.

### 3. Quality Control

Quality control covers a range of processes and tools that are used to ensure optimal translation of quantitative outputs into client portfolios. Efficient implementation is a crucial element of any investment decision. As different portfolios will have different beta exposures, constraints and liquidity requirements implementation is qualitative in nature. The most suitable instrument for implementation will be based on the portfolio constraints, risks involved (such as counterparty and other risks in addition to market risks) and the cost of using each instrument (both explicit and implicit). Criteria for choosing which instruments to use depend on the portfolio and any client restrictions, but liquidity, trading and other costs play a major role in determining the efficiency of any allocations. Market conditions, term structures, pricing variables such as implied volatilities are also inputs in our decision making as to which instruments, being either physical or derivatives, are chosen.

Quality control is a continuous process which covers a variety of activities. These activities broadly fall into the category of risk management, implementation or performance attribution and measurement. The key objective is to ensure that realized performance at all times is within expectations based on market conditions and consciously chosen portfolio positioning<sup>13</sup>.

#### Summary

As the outlook for investment markets is continuously changing, investors need to ensure that they maximize the likelihood that they will meet their investment objectives. DAA takes into account the current state of investment markets and uses a structured approach to evaluate opportunities using fundamental investment rationales.

DAA is a natural extension of an SAA process as it aims to generate additional returns, and act as an ongoing risk control, by reallocating capital when capital markets deviate from 'fair value'. The quality control process also ensures that performance contributions and attribution are closely monitored to ensure that the portfolio allocations behave as intended. Any deviations can prompt a review of the assumptions used in the SAA process.

We believe that using a disciplined DAA process over time produces superior risk-adjusted investment outcomes, which complements the SAA, increasing the likelihood of achieving the portfolio's investment objectives.

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<sup>13</sup> Inconsistencies in realized portfolio performance vs. investment signal performance can be due to portfolio restrictions, constraints or differences in implementation methodologies such as cash vs. synthetic.

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