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A spectrum investing approach can improve
information ratio | UBS Asset Management

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Rethinking core-satellite strategies

– Equity asset allocators who are seeking outperformance at a moderate relative risk often use a so-called core-satellite approach, investing the majority of assets in passive strategies that replicate market capitalization-weighted indices, with a smaller allocation to a high active risk (HAR) strategy with high expected outperformance.
– Our analysis of returns over the last 15 years of enhanced, or low active risk (LAR) strategies and HAR strategies supports the approach of reallocating a portion of passive market-cap indexed equity holdings to an LAR allocation while maintaining an HAR allocation.
– This "spectrum" approach to investing may provide the most efficient way to realize better risk-adjusted relative returns.
– UBS Asset Management recommends a multi-factor approach, which tends to perform in a variety of market environments.

Equity asset allocators have to juggle a number of objectives. Chief amongst them are the goals of generating superior after-cost relative returns and keeping relative risk low, two goals that are not entirely compatible.

Many asset allocators try to address this concern with a so-called core-satellite approach, dividing their equity allocation into two main categories: The majority of the funds are invested passively to replicate broad market indices and achieve market returns at low relative risk and low cost. A smaller portion – the satellite – is invested in highly active strategies (HAR) with high relative risk and high expected outperformance.

This approach may rest on a critical and perhaps mistaken assumption: That HAR strategies on average use their risk budgets more efficiently and produce higher risk-adjusted returns than low active risk (LAR) strategies and therefore, there is no benefit to the overall portfolio from diversifying across the active risk spectrum of passive, LAR and HAR strategies. Our research indicates this assumption is incorrect, and that particularly for an asset allocator with an overall tracking error budget of between 1% and 3%, adding LAR strategies with moderate tracking error may result in higher information

ratios for the overall portfolio than core-satellite strategies that rely entirely on HAR to generate alpha. We recommend adding LAR strategies to the equity portfolio rather than an over-reliance on pure passive strategies and thus combine passive, LAR and HAR for better results.

Seeking alpha at moderate levels of relative risk
In their 2003 paper "A Spectrum Approach to Active Risk Budgeting," Andrew Alford, Robert C Jones and Kurt D Winkelmann noted that institutional investors gravitated to a core-satellite approach that paired a large allocation to passive strategies with a smaller HAR allocation with the goal of hitting "an active risk target that lies somewhere in the middle."[1] They concluded it would have been far more effective to diversify the active risk budget across a range of LAR and HAR strategies. To demonstrate, they analyzed 12 years of HAR and LAR strategy performance compared to the S&P 500 benchmark from 1989 – 2001. They found that HAR strategies had a median active return just one basis point higher than LAR, at 53 bps for HAR compared to 52 bps for HAR strategies during the time period studied. LAR strategies produced better information ratios, at a median of 0.28, compared to 0.07 for HAR.[2]

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[1] Andrew Alford, Robert C. Jones, and Kurt D. Winkelmann, "A Spectrum Approach to Active Risk Budgeting," The Journal of Portfolio Management, Fall 2003, 30 (1), 49-60.
[2] Ibid, p 51.

Is the spectrum approach the most efficient route to maximize information ratio in all markets?

The UBS Asset Management Quantitative Investments team decided to look at more recent performance data over a variety of equity market scenarios over the last 15 years, including the Global Financial Crisis, to clarify the relative performance of HAR and LAR strategy investing in all market scenarios.

Our evaluation used the following parameters:

– Using a 36-month investment horizon over a 15-year total investment history, we compare the realized relative performance and active risk at the end of each 36-month period.

– Active portfolios (HAR and LAR) comprise three portfolios of the pure active and the enhanced strategy group, respectively, each equally-weighted at the beginning of the period. Based on our experience, many institutional investors apply a multi-manager approach to asset allocation. Too few subportfolios would increase lump risk while too many would produce a profile that is too close to the market average. Three seems to us the ideal amount of subportfolios to balance both objectives.

– Should one of the three strategies in any of the groups be closed, for instance due to poor performance, the allocation of this strategy is equally redistributed to the remaining two strategies. If two strategies are closed, the weights are redistributed to the remaining strategy. If all strategies are closed, the entire allocation goes to the passive investment.

– The combination of passive investment and HAR portfolio is called a core-satellite approach while the combination of passive investment, HAR and LAR portfolios is called a spectrum approach.

Is the core-satellite approach efficient? – Comparison of pure active strategies (HAR) versus enhanced strategies (LAR)

Our team examined 15 years' worth of monthly returns[3] of Global Equity strategy managers applying various approaches and differing tracking error budgets during the period between July 2002 and June 2017. The available universe comprises 379 strategies that published returns at some point during the period of our review, of which 240 were still active at the end of June 2017.

Exhibit 1: Low active risk vs. high active risk strategy information ratios 2002-2017
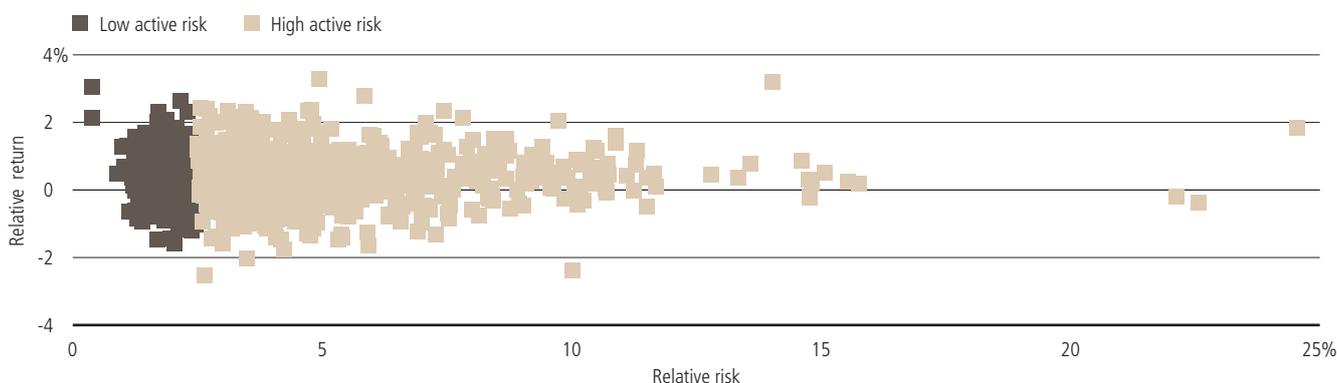
Source: UBS Asset Management and eVestment

If only asset allocators could see into the future, they could pick the HAR and LAR strategies that would go on to have the best performance over the investment horizon, which would significantly improve outcomes.

We divided the universe into three categories: passive, defined as those with a tracking error up to 0.3%; LAR, which we defined as those with a tracking error between 0.3% and 2.5% calculated against the MSCI World index; and HAR, which consisted of those with a tracking error of more than 2.5%.[4] Because tracking error is calculated versus the MSCI World, a non-market cap index is unlikely to be LAR.

We first analyzed which category of strategies historically exhibited better risk-adjusted relative returns by comparing the annualized information ratios for five periods between July 2002 and June 2017, each consisting of 36 months. In order to mitigate survivorship bias, we include strategies that were closed within the 3-year period if they had up to 12 months return history. Strategies with fewer than 12 months returns were excluded as a low number of observations could lead to distorted tracking errors. That said, survivorship bias should not have an adverse effect on the validity of this study as it would tend to affect all types of strategies in an unbiased fashion.

Passive strategies should by definition achieve an information ratio near zero, so we will leave passive strategies out of our comparison for now. As for non-passive strategies, over the five periods tested, LAR strategies exhibited a superior average information ratio of 0.413 overall compared to an average information ratio of 0.308 for HAR strategies. The median indicates a similar conclusion with 0.402 for LAR and 0.306 for HAR strategies, respectively. Exhibit 1 plots the various strategies' information ratios for the two groups and graphically illustrates that LAR strategies on average exhibit higher information ratios than pure active strategies. Both LAR and HAR exhibited outperformance on average and LAR strategies' higher information ratios are primarily due to their lower relative risk. All results shown are gross of fees.

What does skill have to do with it? Testing a variety of skill assumptions

If only asset allocators could see into the future, they could pick the HAR and LAR strategies that would go on to have the best performance over the investment horizon, which would significantly improve outcomes. Instead, many allocators look at past performance to help them choose. This method of manager selection, as introduced by Cagan (1956)[5] and Friedman (1957),[6] generally goes by the name Adaptive Expectations, and is well accepted as a sound approach.

We also tested a 'high skill' scenario in our model portfolios, which assumes the asset allocator was capable of selecting in advance the top-performing strategies of the following 36 months. We achieved this high skill selection by calculating the returns and active risks for all HAR and LAR strategies that had a track record between July 2014 and June 2017, ranking them according to their information ratio. Only strategies with top quartile information ratios were eligible for inclusion in the

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[4] Tracking error is calculated ex post over 3 years with monthly data.
[5] Cagan P., 1956, The monetary dynamics of inflation, in: M. Friedman, ed., Studies in the quantity theory of money (University of Chicago Press, Chicago) 25-117.
[6] Friedman, M., 1957, Theory of the consumption function (Princeton University Press, Princeton).

high skill core-satellite and spectrum portfolios. Within HAR strategies, the top quartile consisted of the best-performing 46 out of the total universe of 186 strategies. Within LAR strategies, it was 13 out of 53 strategies.

Under the Adaptive Expectations scenario, we used past performance as an indicator for future performance. Therefore, we identified strategies in the top information ratio quartile for the period of July 2011 to June 2014 to include in model portfolios for the period of July 2014 to June 2017. Within HAR strategies, we have 43 (41) out of 172 (142) to choose from, while it is 11 (11) out of 46 (37) for LAR strategies.[7] The number of eligible strategies is lower than with High Skill, as some strategies that had performed well from 2011 to 2014 (test period 1) might have performed poorly and were closed in the performance evaluation period from 2014 to 2017 and were therefore excluded from the sample. In this test, both periods – 2011 to 2014 and 2014 to 2017 – were bull markets. We conducted another test using time periods where there was a regime shift between the strategy selection and the evaluation period. For this scenario, we used July 2005 to June 2008 (test period 2) to select the top quartile strategies and ran the portfolios for the period of July 2008 to June 2011, covering the Global Financial Crisis. Within HAR strategies, we have 29 (27) out of 117 (107) to choose from, while it is 8 (7) out of 31 (28) for LAR strategies.[8]

We then calculated an efficient frontier for asset allocators who consider the core-satellite approach and for asset allocators who consider spectrum approach, both under the assumption of High Skill and Adaptive Expectations – in the latter case for 2 periods, in order to cover different market regimes – leading to six scenarios in total.

For each scenario, the starting point is the same. Both HAR and LAR subportfolios are built by randomly drawing three strategies from their respective investment universe. In order to smooth results and avoid outliers potentially leading to false conclusions, we repeated this process many times. For the core-satellite scenarios, we constructed 100 portfolios, derived from combining the passive benchmark with 100 randomly generated HAR subportfolios (1x100). For the spectrum scenarios, we built 5,000 portfolios, derived from combining the passive benchmark with 100 randomly generated HAR subportfolios and 50 randomly generated LAR subportfolios (1x100x50). As the next and last step, we optimized each portfolio, maximizing the relative return for a given active risk level, and calculated again the average outperformance within each of the scenarios for various realized active risk levels. These optimizations led to efficient frontiers for all six of the aforementioned scenarios.

Under the Adaptive Expectations scenario, we used past performance as an indicator for future performance.

[7] Numbers in brackets refer to the strategies that were still active at end of June 2017.
[8] Numbers in brackets refer to the strategies that were still active at end of June 2011.

The result – adding strategies with low to moderate tracking error can improve information ratios

We find that for an asset allocator with an overall tracking error budget in a range of 1% to 3%, adding LAR strategies with moderate tracking error led to higher information ratios for the overall portfolio, under both High Skills and Adaptive Expectations scenarios. Exhibit 2 demonstrates the comparative results.

Unsurprisingly, the relative return and thus the information ratio were higher with High Skills than with Adaptive Expectations. Also, we observed that with Adaptive Expectations, the improvement of the information ratio was predominantly prevalent in the range of 0.5% to 3% tracking error for the overall portfolio. As asset allocators increase the tracking error, more highly active strategies need to be added to the mix and the positive effect tapers off. Eventually, we observed that going higher than 3% tracking error, the overall information ratio became worse. However, given that there are fewer strategies with an active tracking error large enough to push the portfolio's tracking error above 3%, the averages beyond 3% tracking error is in our view less representative.

Another interesting observation is that the information ratio decayed more quickly for LAR strategies versus HAR strategies in Adaptive Expectations test period 1 when the markets by and large only experienced a bull market. In Adaptive Expectations test period 2, though, when the observation period 2005 – 2008 with the Global Financial Crisis is included, the relationship is inverse as shown in tables 1 and 2 below. During that test period, which covers significant market regime shifts, the Adaptive Expectations alpha of HAR

strategies were less persistent. Hence, the value-add of spectrum versus core-satellite approach was larger in test period 2 than in test period 1.

This leads us to the conclusion that it is sensible to allocate a portion of the portfolio to LAR strategies when striving to improve information ratio. The question that suggests itself now is whether there is an optimal allocation towards LAR strategies and how the allocation changes according to tracking error targets. For this purpose, we plotted the following in Exhibits 3-8: the allocation of assets in Passive, LAR and HAR by tracking error for the above mentioned scenarios High Skill, Adaptive Expectations under test period 1 and Adaptive Expectations under test period 2 for both core-satellite and spectrum approaches.

The outcome from the core-satellite approach under all scenarios is straightforward; the higher the risk budget in terms of tracking error, the higher the share in HAR strategies. The weight in HAR is by and large monotonically increasing as a function of tracking error. The same applies to the HAR weights in the spectrum approach. The LAR weights on the other hand are not monotonically increasing but reach a maximum around 1% and 2% tracking error. This is consistent with prior findings that a) for moderate tracking error levels, LAR strategies help to achieve better information ratio, and b) in order to make full use of larger risk budget, LAR strategies should not replace HAR strategies due to their lower tracking error.

Table 1: Test period 1 – Information ratio of LAR vs HAR (strategies selected from median top quartile in period from July 2011 to June 2014)

	Bull market Jul 11 - Jun 14	Bull market Jul 14 - Jun 17
LAR	1.33	0.53
HAR	0.66	0.53

Source: UBS Asset Management and eVestment

Table 2: Test period 2 – Information ratio of LAR vs HAR (strategies selected from median top quartile in period from July 2005 to June 2014)

	Bear market Jul 05 - Jun 08	Bear market Jul 08 - Jun 11w
LAR	1.54	0.40
HAR	1.66	0.05

Source: UBS Asset Management and eVestment

Exhibit 2: Efficient frontier scenarios – Core-satellite vs. spectrum approaches

High Skill scenario
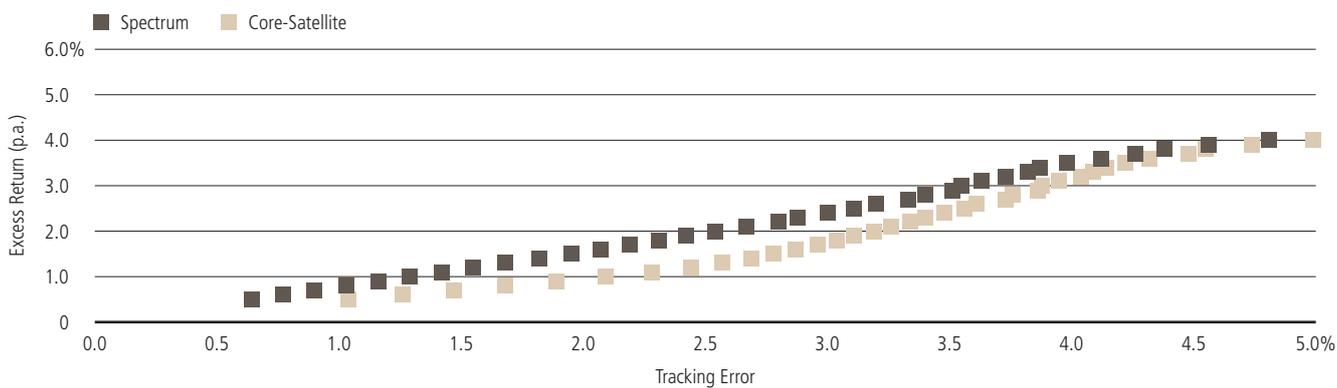
Adaptive Expectations test period 1 - 2011 to 2014.
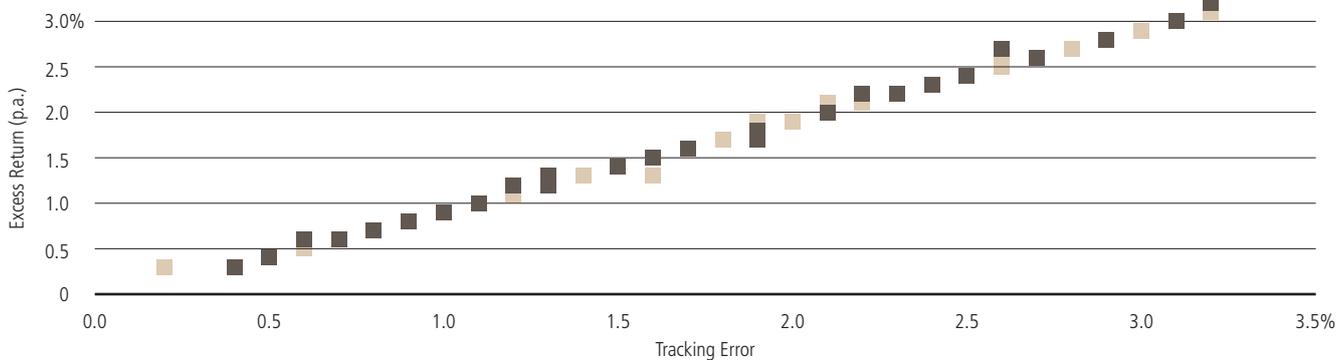
Adaptive Expectations test period 2 (July 2005 to June 2008)

Source: UBS Asset Management and eVestment

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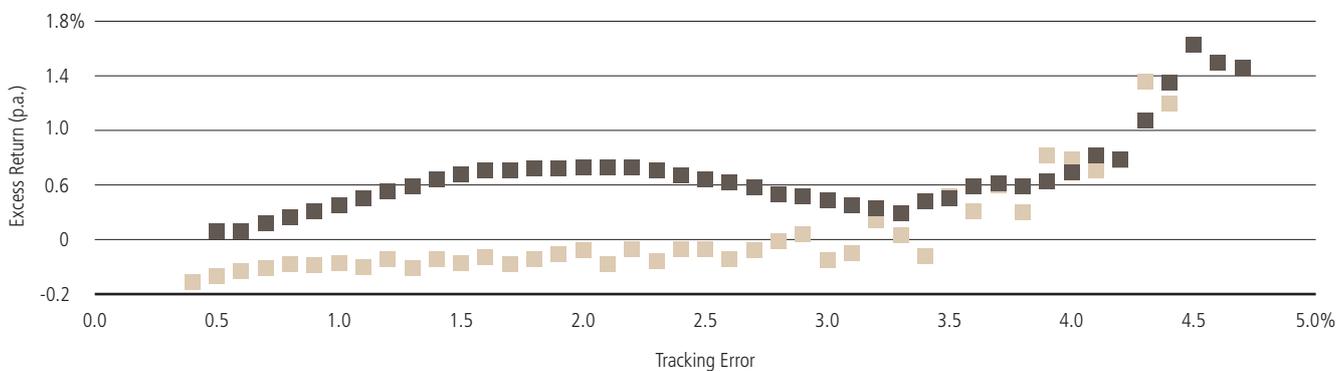
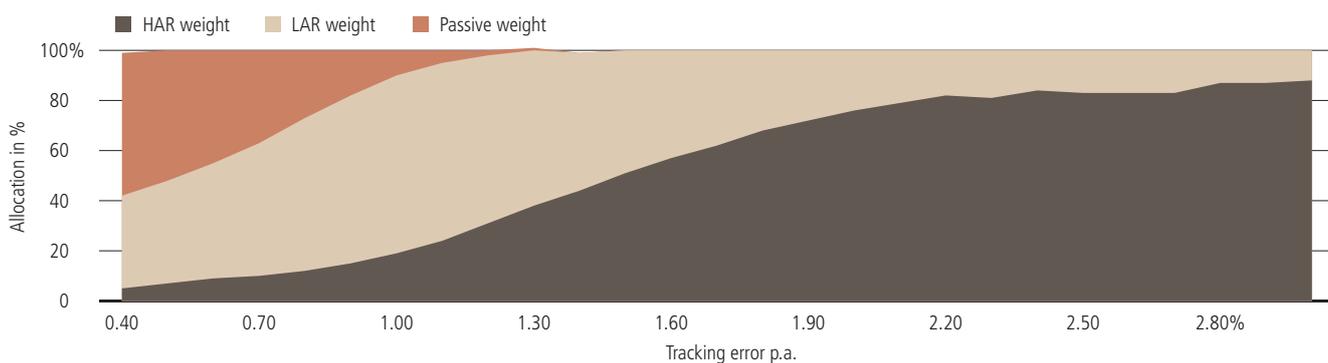## Exhibit 3: Allocation of assets by tracking error under core-satellite approach

**High skills – core-satellite**
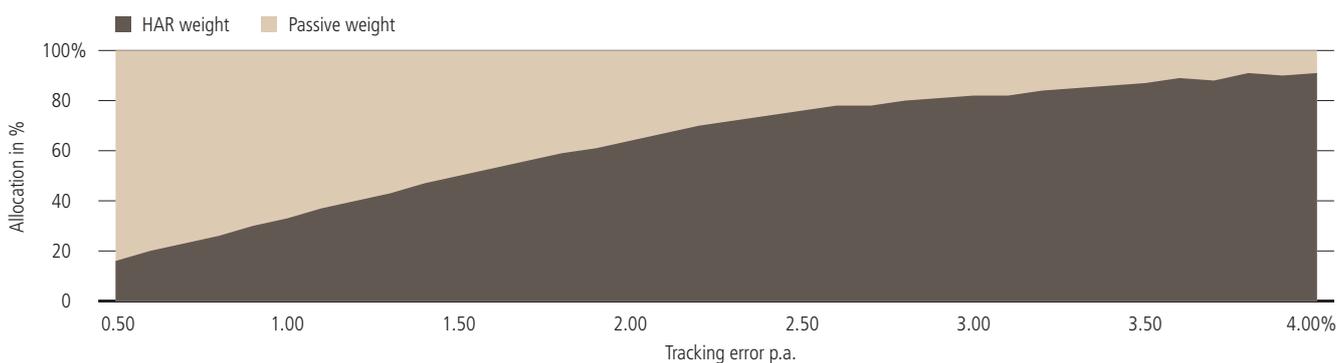
Source: UBS Asset Management and eVestment

Exhibit 4: Allocation of assets by tracking error under spectrum approach

High skills – spectrum
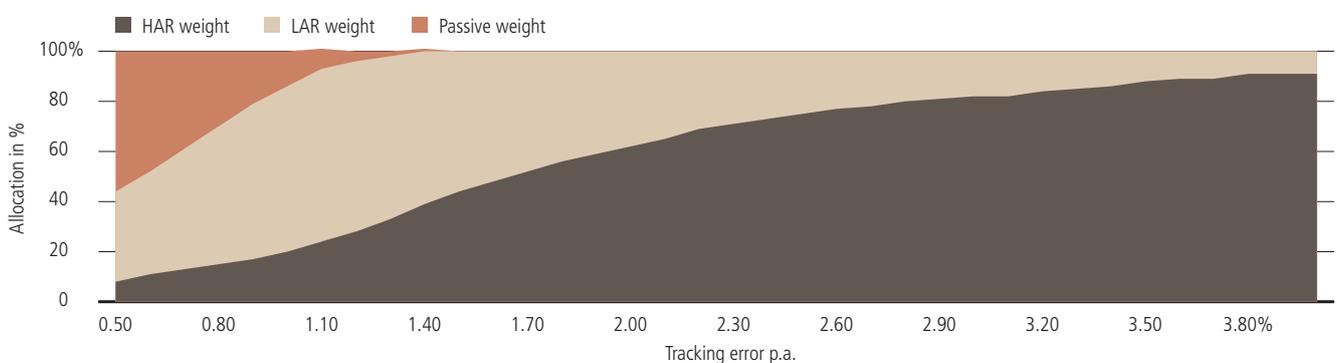
Source: UBS Asset Management and eVestment

Exhibit 5: Allocation of assets by tracking error under core-satellite approach

Adaptive expectations period 1 – core-satellite
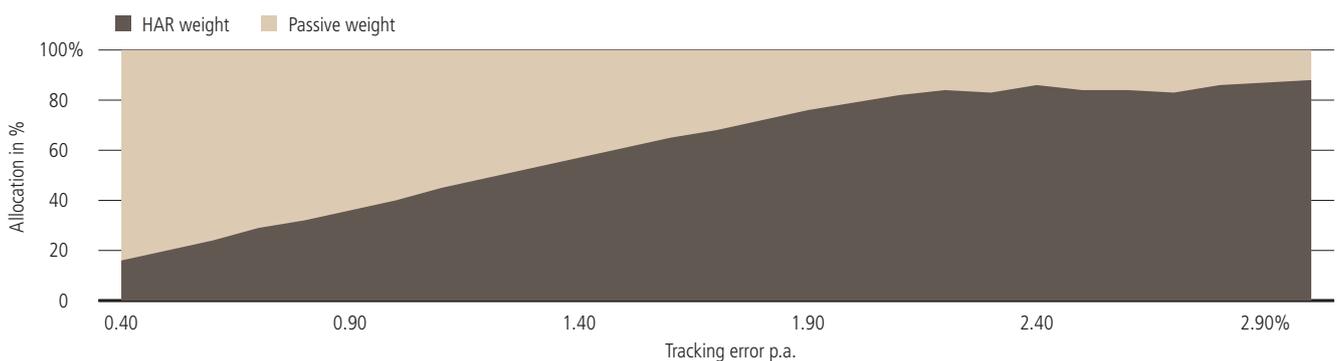
Source: UBS Asset Management and eVestment

Exhibit 6: Allocation of assets by tracking error under spectrum approach

Adaptive expectations period 1 – spectrum

Source: UBS Asset Management and eVestment

Exhibit 7: Allocation of assets by tracking error under core-satellite approach

Adaptive expectations period 2 – core-satellite
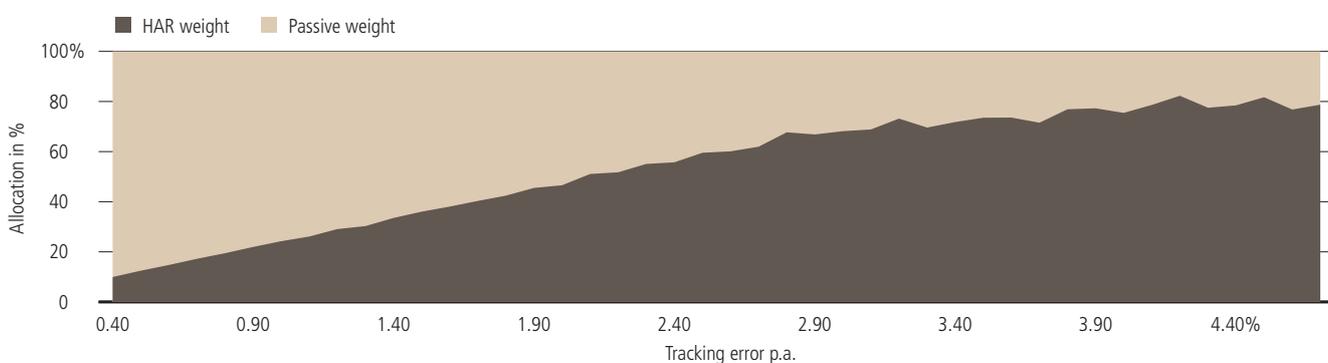
Source: UBS Asset Management and eVestment

Exhibit 8: Allocation of assets by tracking error under spectrum approach

Adaptive expectations period 2 – spectrum
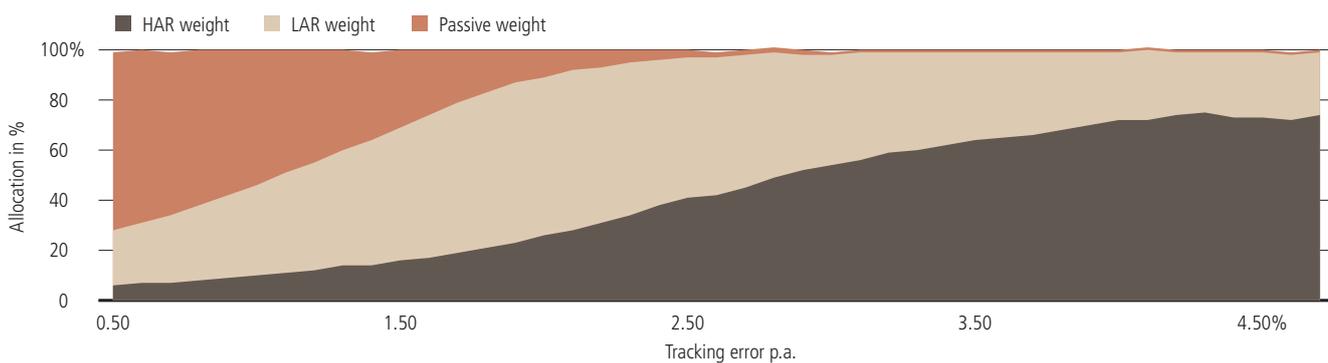
Source: UBS Asset Management and eVestment

The last question we want to address is to compare the allocation change in HAR and Passive from Core-Satellite to Spectrum for a given level of tracking error. This tells us at which assets' expense the weights in LAR are coming from. The results are plotted in Exhibits 9-11 and illustrate two noteworthy observations: Firstly, LAR weights were mainly increased by decreasing Passive investments. Secondly, for low tracking error targets, HAR weights to a lesser degree were also decreased because the LAR strategies adds the most value, especially in the lower tracking error range. The higher the tracking error budget, the less the HAR portion of the portfolio was affected.

Exhibit 9: Changes in weights by including enhanced strategies (LAR) to the portfolio, core-satellite as base scenario under High Skill scenario
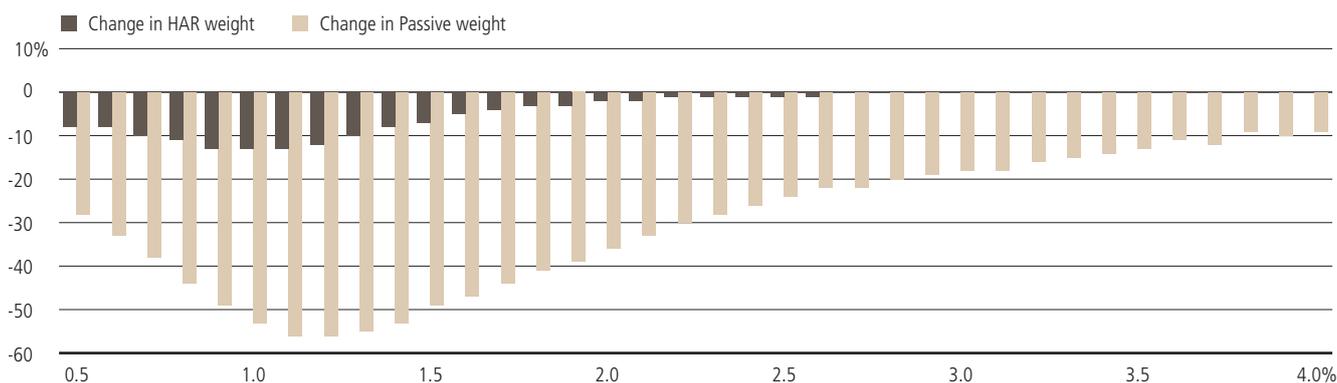
Source: UBS Asset Management and eVestment

Exhibit 10: Changes in weights by including enhanced strategies (LAR) to the portfolio, core-satellite as base scenario under Adaptive Expectations test period 1
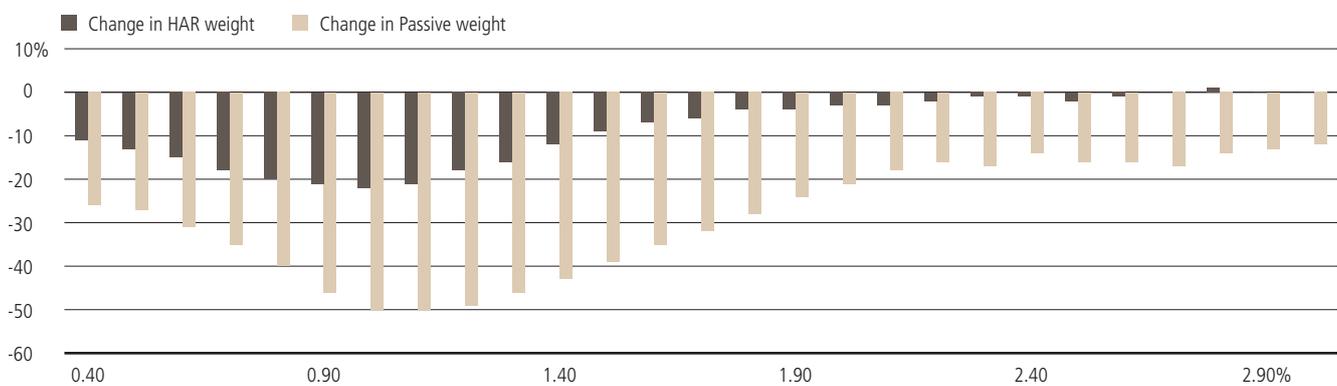
Source: UBS Asset Management and eVestment

Exhibit 11: Changes in weights by including enhanced strategies (LAR) to the portfolio, core-satellite as base scenario under Adaptive Expectations test period 2
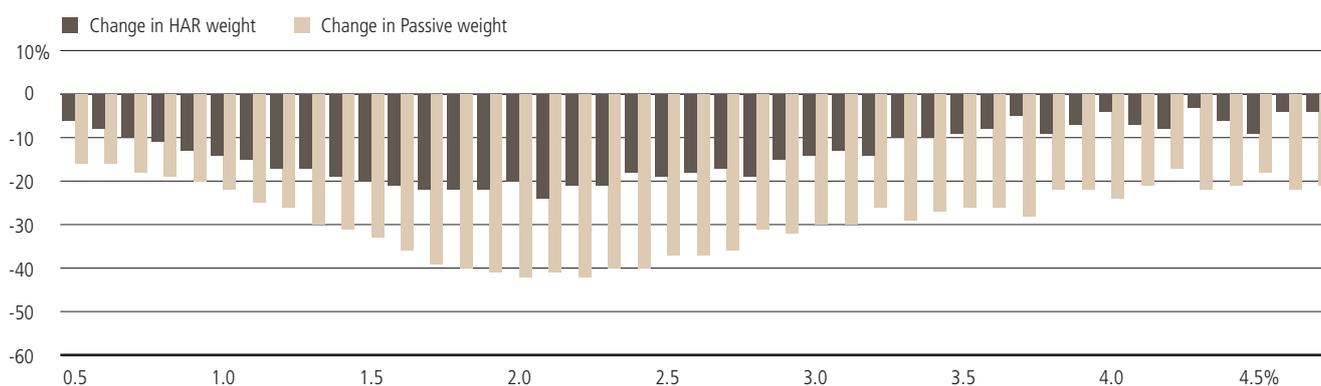
Source: UBS Asset Management and eVestment

Conclusion: A spectrum approach works

Equity asset allocators have to balance a number of potentially conflicting objectives, often including outperforming a benchmark, keeping relative risk low and doing so at low cost.

In this paper, we examined how different ways of mixing passive investments with active strategies of varying relative risk will affect the relative return for a given tracking error. We find that adding LAR strategies to the mix of passive and purely active equity strategies may yield better results. It did so both under the assumption of High Skill in terms of manager selection as well as under the scenario of Adaptive Expectations where past performance is used as a signal for potential inclusion into the portfolio. Under Adaptive Expectations, the value-add of LAR strategies compared to just using high alpha strategies was even larger when the observation period for past performance displayed significantly different behavior than in the subsequent investment period.

The positive effect of including LAR strategies was particularly prevalent in the overall portfolio's tracking error range between 1% and 2% which we believe is a realistic range for asset allocators who are currently invested with a Core-Satellite approach of passive and active strategies.

Next steps for asset allocators:

– We recommend a spectrum investment strategy, with allocations to passive, LAR and HAR strategies, which we believe is superior to core-satellite in virtually all market environments.
– The portion of LAR should be determined through an optimization process but by and large depends on the investor's risk budget (tracking error). For a very low tracking error budget, the share should be small because only a large passive allocation will meet this requirement. The same should be true for an investor with a very high tracking error, because only a large allocation to highly active strategies will generate a high tracking error. Hence, the proportion of LAR should be highest somewhere in the mid-range of tracking error budgets.
– LAR allocations should predominantly come from current passive allocations.
– Our team favors a multifactor investment approach for consistent performance in a variety of market environments.