



Asset Allocation

Alternative asset allocation in 2018 and beyond – USD edition

Joachim Klement
Head of Investment Research

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We investigate the performance of alternative asset allocation strategies in 2018 and over the last twenty years. We find that while there is no strategy that works all the time, some alternative asset allocation strategies can significantly reduce downside risks compared to a traditional asset allocation while keeping return prospects intact. However, some alternative asset allocation strategies seem to ‘hide’ additional risks in the tails of the return distribution, as can be seen from the surprisingly high losses during the financial crisis and the market gyrations of late 2018. ”

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The mushrooming field of alternative asset allocations

After the traumatising experience of the Global Financial Crisis (GFC) institutional and private investors alike were disappointed by the apparent failure of diversification in traditional portfolios of stocks and bonds. This triggered two major trends:

- A search for alternative investments that could provide stable income and downside protection in times of market stress.
- A search for alternative methods of portfolio construction that would reduce downside risks while providing attractive long-term returns.

The search for alternative asset allocation schemes has created an entire zoo of different allocation methods, so much so that the webpage AllocateSmartly.com now allows investors to track 48 different asset allocation strategies from a US Dollar perspective.

In this report, we want to analyse eight of the most prominent alternative asset allocation strategies implemented by investors over the last ten years in order to assess whether these strategies have lived up to expectations and their benefits and risks. Most importantly, we will address the ability of these alternative asset allocation strategies to either reduce downside risks while leaving returns intact or the ability to enhance return for a similar level of risk to traditional asset allocation approaches.

Of course, the past is in the past, and investors want to know if these alternative asset allocation strategies can perform well in the future. In order to identify future risks and opportunities with these asset allocation strategies, we will investigate their sensitivities to fundamental drivers of financial markets, such as the business cycle, inflation and interest rates. This should allow investors to either select an alternative asset

allocation that is geared towards the expected macroeconomic developments over the coming years or alternatively prepare them for the potential weaknesses of a chosen strategy. Knowing the sensitivities or factor exposures of a chosen asset allocation helps investors understand when a portfolio should perform and when there is a major difference between the actual performance of a portfolio and the expected performance in each environment.

Because an examination of 48 different alternative asset allocation strategies would likely confuse investors more than enlighten them, we restrict our analysis to eight of the most popular alternative asset allocation strategies based on twelve different asset classes from 1998 to 2018. We chose four static asset allocation strategies with fixed asset class weights and four dynamic asset allocation strategies with variable asset class weights. Every one of these alternative asset allocation strategies is compared to a simple benchmark 60/40 stock/bond portfolio.

The four static asset allocation strategies are:

- An Equal-Weighted Portfolio where each asset class has the same weight in the portfolio.
 - Ray Dalio's All Weather Portfolio that aims to provide stable returns independent of the market environment.
 - Harry Browne's Permanent Portfolio that tries to do the same but with an equal-weighted asset allocation.
 - A simplified Ivy Portfolio that mimics the performance of the endowment funds of major Ivy League universities.
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The four dynamic asset allocation strategies are:

- A Dual Momentum Portfolio as designed by Gary Antonacci that invests in the four asset classes with the highest positive price momentum.
- A Global Tactical Asset Allocation (GTAA) Portfolio that invests in asset classes if they are above their 200-day moving average and in cash otherwise.
- The Minimum Variance Portfolio based on the covariance matrix of the last twelve months.
- A Risk Parity Portfolio based on the covariance matrix of the last twelve months.

All dynamic asset allocation strategies are calculated at the beginning of each month based on price data from the last trading day of the previous month. We also assume trading costs of 0.2% for rebalancing and changes in asset allocation weights. These transaction costs are based on the average annual transaction costs paid by institutional investors.

Details about the asset classes we use as well as the different asset allocation strategies can be found in the appendix of this report. In this report, we investigate these asset allocation strategies from a US Dollar perspective, while companion reports will repeat the same analysis from a Sterling and a Euro perspective.

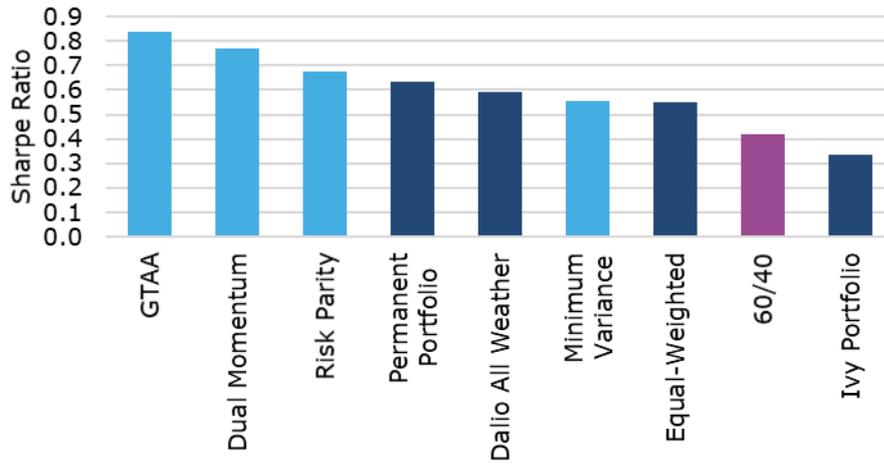
Two pathways to higher risk-adjusted returns

Looking back over the last twenty years, Fig. 1 shows why alternative asset allocation methodologies have become so popular. The risk-adjusted returns for all but one of the strategies we examine have been substantially higher than for the 60/40-portfolio. As a rule of thumb, the dynamic approaches that react flexibly to changing market environments fare better than the static approaches, even though the construction of these dynamic asset allocation strategies relies entirely on backward looking data. This shows that there are reliable market dynamics, like momentum and the low volatility anomaly, that can be exploited to generate higher risk-adjusted returns after costs.

While this observation is unsurprising, the size of the improvement may be bigger than

some investors deem possible. Momentum-driven strategies, for example, are often dismissed as creating too much portfolio turnover so that transaction costs eat up a large part of the potential outperformance. Using our transaction cost assumptions, the momentum-based asset allocation strategies deliver almost twice as much excess return over money markets per unit of risk than the benchmark portfolio. In order to reduce the Sharpe ratio of the Dual Momentum Portfolio to the level of the 60/40 benchmark, transaction costs would have to be as high as 1.15% per roundtrip – a realistic level for small retail investors but higher than what institutional investors pay. For the Global Tactical Asset Allocation to lose its advantage in risk-adjusted returns, transaction costs would have to be as high as 1.75%.

Fig 1: Sharpe ratios of alternative asset allocation strategies 1998 - 2018



Source: Fidante Partners. Data as at end of 2018. Static strategies in dark blue, dynamic strategies in light blue and 60/40 benchmark in purple. Past performance is not a reliable indicator of future outcomes.

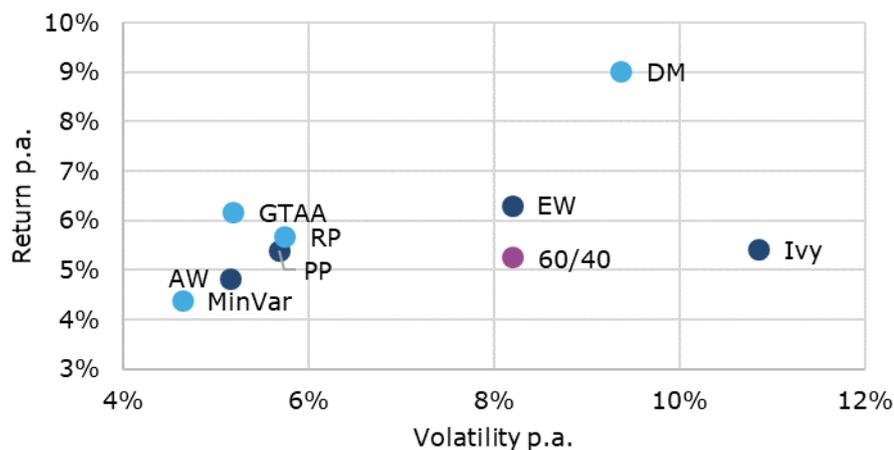
Higher risk-adjusted returns can be achieved by reducing portfolio volatility while keeping returns stable or by increasing returns while keeping volatility stable (or a mix of the two). Fig. 2 shows that the majority of alternative asset allocation strategies that are popular these days dramatically reduce volatility compared to a 60/40-portfolio while achieving similar returns. This is not surprising given that these alternative asset allocation strategies became popular in reaction to the seemingly excessive losses of traditional portfolios during the GFC. It is also not surprising given that regulators have adopted a Value-at-Risk (VaR) driven approach to assessing investment risks. This means that a portfolio with lower volatility and similar returns is usually preferable for an insurance company to a portfolio with higher returns and similar volatility.

The alternative asset allocation strategies we examine here can roughly be split into two groups. The Equal-Weighted Portfolio and the

Ivy League portfolio are static portfolios that tend to have higher returns with similar volatility to the benchmark 60/40-portfolio. That the Ivy League Portfolio had lower returns and substantially higher volatility in the last 20 years is mostly a result of the dismal performance of commodities, which are 20% of the portfolio – a much larger allocation than in any other strategy. The third strategy in this group is the Dual Momentum Portfolio that managed to outperform the 60/40-portfolio by 3.65% per year over twenty years with a volatility that was only one percentage point higher than the volatility of the 60/40-portfolio.

The remaining five alternative asset allocation strategies all fall into the second group of risk-reducing strategies that managed to achieve annual returns of 5% to 6% while reducing the volatility of the portfolio to 5% to 6% per year – substantially below the 8.2% annual volatility of the 60/40-portfolio.

Fig 2: Annualised volatility and return of alternative asset allocation strategies 1998 - 2018



Source: Fidante Partners. Data as at end of 2018. Static strategies in dark blue, dynamic strategies in light blue and 60/40 benchmark in purple. Past performance is not a reliable indicator of future outcomes. Note: EW = Equal-Weighted Portfolio; AW = Dalio All Weather Portfolio; PP = Permanent Portfolio; Ivy = Ivy League Portfolio; DM = Dual Momentum Portfolio; GTAA = Global Tactical Asset Allocation; MinVar = Minimum Variance Portfolio; RP = Risk Parity Portfolio.

2018 was a miserable year

In recent weeks, we have heard several investors complain about alternative asset allocation strategies after they failed to live up to expectations in 2018, particularly during the market corrections in the fourth quarter. Fig. 3 shows that with the exception of the Minimum Variance Portfolio and the Permanent Portfolio, the risk-reducing strategies all suffered calendar-year losses that were similar in magnitude to the 60/40-portfolio. The return-enhancing strategies, on the other hand, suffered losses that were a multiple of the 60/40-portfolio. While the 60/40-portfolio declined 2.4% in 2018, the Equal-Weighted Portfolio declined 4.4%, the Ivy Portfolio, 6.2% and the Dual Momentum Portfolio got whipsawed into a 8.4% decline in 2018.

The momentum-driven strategies (Dual Momentum and GTAA) suffered from the classic weakness of momentum investing. Thanks to the great performance of equity markets between April and September, these strategies had a large exposure to risky assets at the beginning of the correction. At the beginning of October, the Dual Momentum Portfolio had allocated 25% of assets to US equities, international equities, US REITs and high yield bonds. By the end of the year, this strategy was exclusively invested in money markets and government

bonds, missing all of the recovery of January. And while the GTAA Portfolio was not invested in international equities at the beginning of October it was invested in US equities, high yield bonds and US REITs, though to a lesser extent.

What saved the Minimum Variance Portfolio and the Risk Parity Portfolio in 2018 was that they ran relatively high allocations to bonds throughout the year due to the construction method of these strategies. At the beginning of October, the Minimum Variance Portfolio was invested 43% in government bonds, while the Risk Parity Portfolio allocated 24% to government bonds and 11% to high grade corporate bonds. Only one month into the correction, both strategies also increased the allocation to gold from c. 6% to c. 12% simply because of the rapidly declining correlation between gold returns and the returns on risky assets.

The performance of 2018, and the fourth quarter of 2018 in particular, teaches investors the eternal lesson that there is no panacea in asset allocation. No portfolio can protect investments in every scenario (not even the All Weather Portfolio) and short-term performance can be substantially worse than a traditional asset allocation approach, even though long-term results are superior. In other words, once an institution has

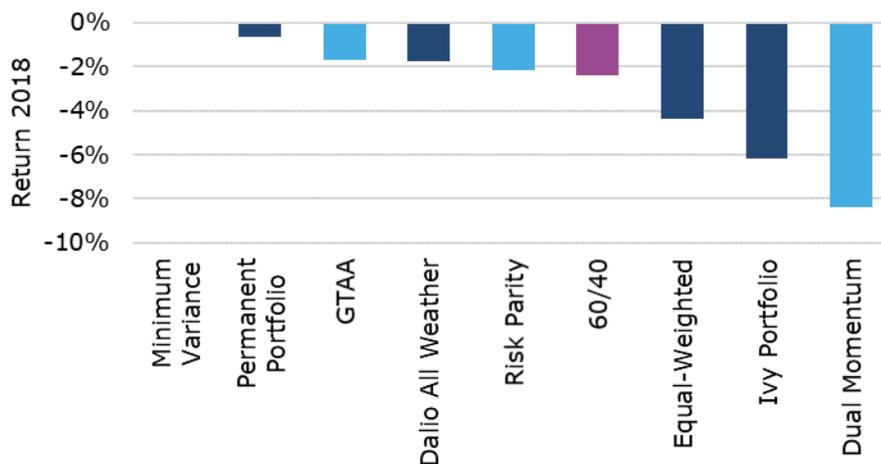
decided to follow an alternative asset allocation strategy it needs to commit at least to the following practices:

- Since we are dealing with strategic asset allocation approaches, the success or failure of an alternative asset allocation strategy is likely to become visible only over investment periods of five years or more that span both bull and bear markets. It makes no sense to assess the performance of alternative asset allocation strategies even over time periods of seven to ten years if this period was dominated by markets going in the same direction, as has been the case since the GFC. And in some respects, as we will see below when we examine economic sensitivities, not even decades of data will be enough to assess the true risks of an alternative asset allocation strategy.
- A commitment to an alternative asset allocation strategy exposes the CIO of an institution, as well as her investment team and the trustees, to career risk because the performance of the portfolio will inevitably be compared to peers (most of which run a more traditional asset allocation) or some form of a traditional portfolio like our

60/40 benchmark. As we have seen in 2018, performance differences over shorter time periods can be extreme and result in undue pressure on the investment team to change the asset allocation strategy – often at the worst possible point in time. Trustees and beneficiaries of the investment portfolio need to be educated and fully informed about these short-term risks before an alternative asset allocation strategy is implemented. Trustees and beneficiaries also need to fully buy into these strategies. A half-hearted commitment quickly becomes full-throated opposition to an investment strategy once performance disappoints for a year or more.

It is this psychological hurdle that makes the successful implementation of alternative asset allocation strategies in institutions so difficult in practice. It requires a high-quality board full of patient and well-informed trustees as well as a high-quality investment team with equally patient individuals that can communicate well to trustees and beneficiaries, in good times and bad times alike, to make these strategies a success.

Fig 3: Performance 2018



Source: Fidante Partners. Data as at end of 2018. Static strategies in dark blue, dynamic strategies in light blue and 60/40 benchmark in purple. Past performance is not a reliable indicator of future outcomes.

The major benefit: Reduced downside risks, but there is a but...

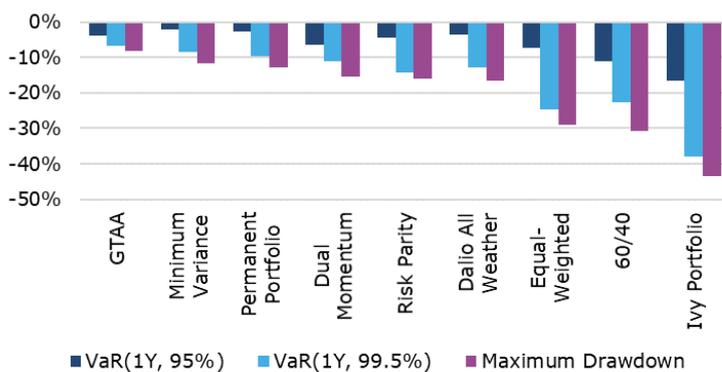
The prize for those institutions that successfully commit to an alternative asset allocation strategy is above all a reduced drawdown risk and thus on average less pain in times of market stress. Fig. 4 shows the Value at Risk (VaR) for a time horizon of one year for the strategies examined here. We show the 95% probability level as a common risk measure used by pension funds and the 99.5% measure as a measure preferred by insurance regulators in Europe. We also show the maximum drawdown suffered by the different strategies in the last 20 years. Several observations stand out:

- The dynamic asset allocation strategies tend to have lower VaR and a smaller maximum drawdown than static asset allocation strategies. This is driven by the ability of these strategies to adapt to changing market environments.
- The “return enhancing” strategies of an Equal-Weighted Portfolio and the Ivy League Portfolio have similar or higher VaR and drawdowns than the 60/40-portfolio.
- Remarkably, the Dual Momentum Portfolio has significantly lower VaR and drawdown than the 60/40-portfolio. With a VaR(1Y, 95%) of 6.6% vs. 11.0% for the 60/40-portfolio and a maximum drawdown of 15.4% vs. 30.7% for the 60/40-portfolio, the Dual Momentum Portfolio protects the downside of the investment portfolio almost as well as it captures the upside. This example also shows how useless volatility can be as a measure of investment risk. The volatility of the Dual

Momentum Portfolio is one percentage point higher than the volatility of the 60/40-portfolio, yet the downside risks are just about half as big. What the Dual Momentum Portfolio captures is upside volatility, while limiting downside volatility.

- For several alternative asset allocation strategies, loss risks are hidden in the extreme tail of the distribution. In other words, when things go wrong in these strategies, they go really wrong. This can be seen by comparing the VaR(1Y, 95%) with the VaR(1Y, 99.5%) or the maximum drawdown. For the GTAA Portfolio and the Dual Momentum Portfolio the ratios of VaR(1Y, 99.5%) to VaR(1Y, 95%) are 1.8 and 1.7, respectively. For the 60/40-portfolio it is 2.0. For all the other alternative asset allocation strategies, this ratio is higher, and in many cases above 3.0. The Minimum Variance Portfolio, the All Weather Portfolio and the Permanent Portfolio all have extreme tail risks with a ratio of 3.6 or higher. While these portfolios may behave rather calmly most of the time, they can suddenly create much higher losses than anticipated if the circumstances are right, or rather, wrong. This was the case in October 2008 at the height of the GFC, when the Minimum Variance Portfolio dropped 6.25% in one month, a 4.6 standard deviation event, while the GTAA Portfolio and the Dual Momentum Portfolio only experienced two standard deviation drops and were thus much better behaved in these extreme circumstances.

Fig 4: Downside risks of different asset allocation strategies



Source: Fidante Partners. Data as at end of 2018. Past performance is not a reliable indicator of future outcomes.

Differences in economic sensitivities

While our analysis spans two full business cycles that allow us to assess the differences between alternative asset allocation strategies in most market environments, some trends are so long-term in nature that one would need many decades of data to assess the impact on the strategies should these secular trends change. One example is that of interest rates, which have been on a secular decline at least since the mid-1980s. While the turn of the interest rate cycle has been falsely predicted many times, there is a distinct possibility that at some point in the next five to ten years, long-term interest rates will indeed enter a secular uptrend. It is impossible to predict when and if this will happen, but we can try to assess the vulnerability of alternative asset allocation strategies to such shifts. In this report, we do this by looking at the correlation between portfolio returns and changes in different macroeconomic and financial market drivers.

Fig. 5 provides an overview of the correlations between annual returns of different alternative asset allocation strategies with annual changes in different macroeconomic and financial indicators.

Fig 5: Correlation between asset allocation strategies and macroeconomic variables

	Growth	Inflation	10-year rates	Expected inflation	Real interest rates	US Dollar	Oil price
60/40	0.47	0.38	0.44	0.59	0.01	-0.24	0.31
Equal-Weighted	0.59	0.46	0.28	0.78	-0.31	-0.55	0.59
Dalio All Weather	0.43	0.52	0.13	0.65	-0.37	-0.53	0.56
Permanent Portfolio	0.38	0.45	0.07	0.59	-0.39	-0.51	0.53
Ivy Portfolio	0.54	0.51	0.41	0.72	-0.12	-0.49	0.56
Dual Momentum	0.34	0.28	0.28	0.40	-0.01	-0.58	0.52
GTAA	0.53	0.34	0.30	0.62	-0.16	-0.56	0.51
Minimum Variance	0.34	0.26	-0.17	0.46	-0.55	-0.44	0.38
Risk Parity	0.57	0.40	0.08	0.72	-0.47	-0.61	0.56

Source: Fidante Partners. Data as at end of 2018. Past performance is not a reliable indicator of future outcomes.

Fig. 5 shows that stronger economic growth (measured here as a rising Manufacturing PMI) and a rising oil price lead to higher returns for all asset allocation strategies. The range of correlation is quite wide and there is no clear trend visible between strategies. Similarly, a stronger US Dollar tends to be detrimental for the performance of all strategies as indicated by the negative correlation. However, Fig. 5 shows that all

Before we summarise these results, it is worth noting, however, that correlation is a very crude measure of the link between two variables. First, it infamously does not establish causation, which is of lesser importance for this report since we are taking the pragmatic view that even if there is no causation, a significant correlation that is stable over time will still have a significant impact on portfolio returns and is thus important to keep in mind.

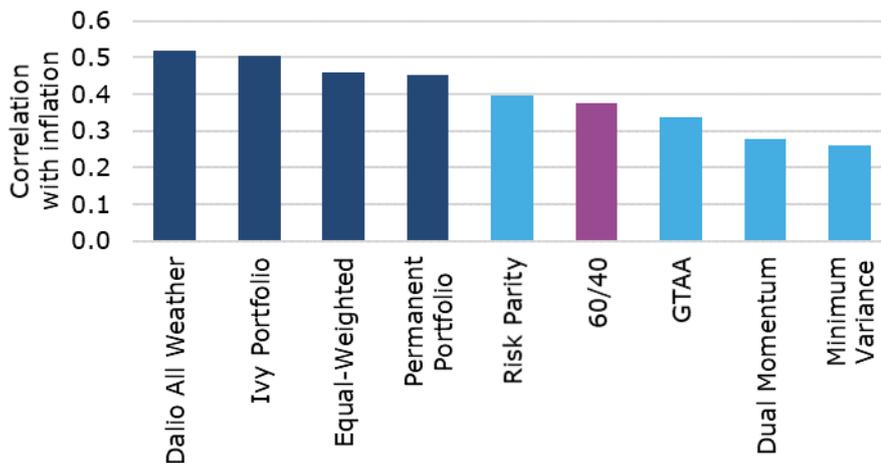
Second, correlation is a linear measure that is often misleading when there are nonlinear relationships between different variables or if there are "threshold effects" beyond which the relationship between two variables changes significantly. We have thus investigated each of the pairs of variables reported in Fig. 5 for such nonlinear or threshold effects. The results of our investigations showed no significant nonlinear effects except in very rare and extreme cases that may as well be due to random variation. We thus conclude that for our purposes, measuring correlation as the relevant indicator is sufficient.

the alternative asset allocation strategies examined in this report have a higher sensitivity to the US Dollar than the 60/40-portfolio. This is simply the result of the choice of our benchmark portfolio which is invested exclusively in domestic assets. Thus, all the alternative asset allocation strategies have a higher allocation to international assets which decline in value if the US Dollar strengthens.

The most interesting results in Fig. 5 are the correlations with inflation (or expected inflation) and changes in 10-year interest rates. Fig. 6 shows the ability of the different strategies to protect against inflation. The higher the correlation in Fig. 6 the better the protection against rising inflation. The chart shows a clear advantage for the four static asset allocation strategies tested in this report. This advantage stems from the higher allocation to the three real assets used in our report (US REITS, commodities and gold). Because these real assets have higher volatility than most asset classes, they are underrepresented in the Minimum Variance and the Risk Parity Portfolios.

What is surprising, though, is the relatively low correlation between the Dual Momentum and GTAA Portfolios, and rising inflation. This might be the case because in our sample – as indeed most of the twentieth century – inflation typically spiked briefly before settling down to more normal levels. This makes it difficult, if not dangerous, for investors to try to protect against rising inflation with these momentum-driven strategies. If inflation spikes, these strategies are often not very much geared towards real assets and once the strategies adjust towards higher allocations in real assets, inflation is often already declining again. In effect, these momentum-driven strategies face similar whipsaw risks as they did with their exposure to risky assets in 2018. As long as central banks aim for stable inflation as their main policy goal and do not fall systematically behind the curve as they did in the 1970s, the GTAA and Dual Momentum Portfolios are poor inflation hedges.

Fig 6: Correlation between asset allocation strategies and changes in inflation



Source: Fidante Partners. Data as at end of 2018. Static strategies in dark blue, dynamic strategies in light blue and 60/40 benchmark in purple. Past performance is not a reliable indicator of future outcomes.

The second set of correlations investors should pay attention to are the correlations between asset allocation strategies and changes in long-term bond yields. In Fig. 7 we show the correlation between portfolio returns and changes in 10-year bond yields over a 12-month time period, with positive correlations implying higher returns when bond yields rise. It is striking that the 60/40 portfolio has the highest positive correlation

with rising bond yields, indicating that the alternative asset allocation strategies discussed in this report likely have systematically benefitted from the secular downtrend in interest rates. Investors who want to position their portfolios for a secular trend of rising interest rates should thus think twice as to whether alternative asset allocation strategies are suitable for this purpose. They may well be, but investors

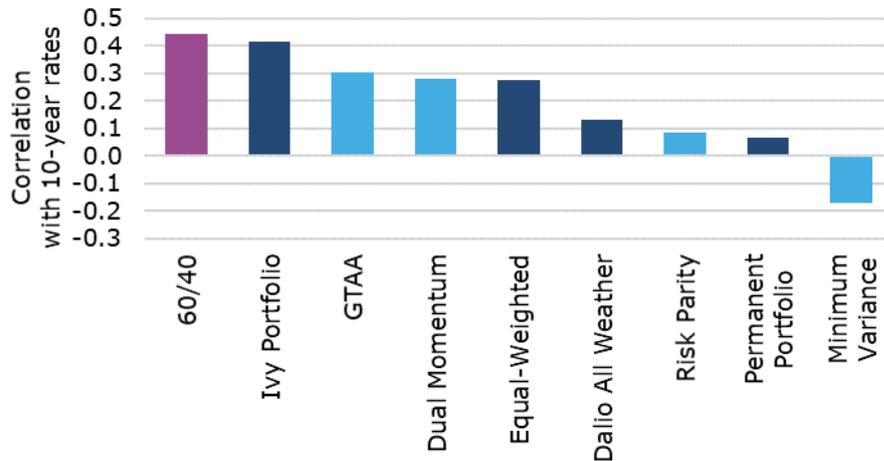
need to be selective and choose strategies that are more flexible and can adjust to such changes in trend like the GTAA and the Dual Momentum Portfolios which have reasonably high positive correlation with rising interest rates.

Fig. 7 also shows the biggest systematic risk for Minimum Variance and Risk Parity Portfolios. Because of the way they are constructed, these asset allocation strategies invest large parts of the portfolio in (nominal) bonds, which suffer the most when interest rates rise. It is likely that during an extended period of rising interest rates, these asset allocation strategies will underperform a 60/40-portfolio as well as other alternative asset allocation strategies. Of course, it is entirely possible that long-term interest rates will remain at or around current levels for many years to come, as

the example of Japan shows. In this case, investors need to be aware that bonds will only produce returns commensurate with current (very low) yield levels. As a result, even in an environment of stable interest rates, the Minimum Variance and Risk Parity Portfolios are unlikely to produce outsized returns.

This does not mean that these approaches cannot be useful in an environment of rising rates. For example, one could follow these asset allocation strategies within risky assets or within equities alone and allocate to fixed income investments based on a different allocation rule. In this case, the weakness of the Minimum Variance and the Risk Parity Portfolios would be reduced at the cost of higher complexity on the overall portfolio level.

Fig 7: Correlation between asset allocation strategies and changes in 10-year interest rates



Source: Fidante Partners. Data as at end of 2018. Static strategies in dark blue, dynamic strategies in light blue and 60/40 benchmark in purple. Past performance is not a reliable indicator of future outcomes.

Summary and conclusions¹

As we have seen throughout this report, none of the alternative asset allocation strategies examined are always superior to a traditional asset allocation. Every one of the alternative asset allocation strategies discussed – with the possible exception of the Ivy League strategy – does a good job in either reducing downside risks or enhancing returns, but they all come with some trade-offs that investors need to keep in mind. In essence, investors need to have clear goals for their strategic asset allocation and ideally a view on the coming secular trends in inflation, interest rates and economic growth before selecting a specific allocation. If they can formulate these views and goals, then there are clear advantages from selecting specific alternative asset allocation strategies:

- Dynamic asset allocation strategies tend to do a better job in protecting the downside and increasing risk-adjusted returns because they can adjust to changing market environments. The drawback of these strategies is that portfolio turnover is higher and so investors need to keep costs under control. As we have shown, the momentum-driven GTAA and Dual Momentum Portfolio strategies can be implemented even with high transaction costs while risk parity and minimum variance approaches require lower transaction costs to create superior performance.
- While reducing drawdown risks in “normal circumstances” most alternative asset allocation strategies display much higher losses during extreme “tail events” than a traditional asset allocation. The Minimum Variance Portfolio, the Permanent Portfolio and the All Weather Portfolio all suffered from particularly severe losses during the height of the GFC than could have been anticipated beforehand. The momentum-driven GTAA and Dual Momentum Portfolios, on the other hand, managed to limit drawdowns even in these extreme circumstances.
- While the dynamic asset allocation strategies can protect against downside

risks better than the static strategies, the static strategies all provide better inflation protection than the dynamic ones, mostly because of their higher allocation to real assets and because inflation traditionally appears in spikes. Thus, dynamic asset allocations strategies are often unprepared for a sudden uptick in inflation and by the time the allocation has changed, inflation is already receding again.

- The Minimum Variance Portfolio and Risk Parity Portfolio tend to have outsized allocations to low volatility assets, which tend to be fixed income investments. Thus, these alternative asset allocation strategies should underperform other strategies in times of rising interest rates.

Another drawback of alternative asset allocation strategies is that they can become very concentrated in a few asset classes depending on the market circumstances or the design of the strategy. Depending on the institution, it might be unrealistic for practical (lack of liquidity or potential price impact on markets) or political reasons to shift portfolios by that much.

Finally, as we have seen in 2018, even the best dynamic and static asset allocation strategies can fail to protect investors in the short run. As a result, investors cannot expect perfect protection with these asset allocation strategies and should assess their performance only over longer time frames that consist of at least a full business cycle. The short-term deviations in the performance of alternative asset allocation strategies also mean that investment managers and trustees of institutions must be prepared to live through extended periods when the portfolio of the institution may underperform other institutions with a more traditional asset allocation approach. This requires an above-average level of knowledge, discipline and patience from the stakeholders in the investment process. If this level of knowledge, discipline and patience can be maintained, however, the long-term benefits of alternative asset allocation strategies can be large.

¹ Past performance is not a reliable indicator of future outcomes.

Appendix: Alternative asset allocation methodologies

Indices used in the study

For our calculations we use a comprehensive set of twelve asset classes ranging from money markets to alternative investments like commodities and gold. Because we are investigating dynamic strategies that are adjusted every month as well as static strategies, we do not include hedge funds, private equity and other illiquid asset classes in our study and restrict ourselves to asset classes that can easily be implemented with funds that trade daily.

Index data is downloaded from Bloomberg and we use monthly data from December 1998 to December 2018. The indices we use are summarised in Fig. 8 together with the average annual return, volatility and Sharpe ratio for the covered time period. All indices are calculated in US Dollars (total return) without currency hedge.

Fig 8: Historical data used in this study

Asset class	Index	Return p.a.	Volatility p.a.	Sharpe ratio
Money market	USD 3-month LIBOR	1.8%	0.6%	0.00
Government bonds	Bloomberg Barclays US Govt. Bond	4.2%	4.3%	0.55
Inflation-linked bonds	Bloomberg Barclays US TIPS	5.3%	5.7%	0.61
Corporate bonds	Bloomberg Barclays US Corporate	5.3%	5.3%	0.65
High yield USD	Bloomberg Barclays US High Yield	6.8%	9.0%	0.55
Em. market debt USD	Bloomberg Barclays EM USD Aggregate	9.1%	9.0%	0.81
Equities USA	MSCI USA	5.9%	14.6%	0.28
Equities EAFE	MSCI EAFE	4.8%	16.3%	0.19
Equities em. markets	MSCI Em. Markets	10.6%	21.8%	0.40
US REITs	GPR 250 REIT USA	11.9%	20.8%	0.49
Commodities	Bloomberg Commodity Index	3.0%	16.0%	0.08
Gold	Price of 1 oz. of gold in USD	8.9%	16.8%	0.42

Source: Bloomberg, Fidante Partners. Past performance is not a reliable indicator of future outcomes.

Asset allocation methodologies

Domestic 60/40 benchmark portfolio

This portfolio is a static portfolio that invests 60% of its assets in domestic equities and 40% in domestic government bonds. This portfolio is the workhorse for wealth management applications and the most commonly used benchmark against which to measure the benefits and drawbacks of the different alternative asset allocations.

Equal-Weighted Portfolio

The Equal-Weighted Portfolio is inspired by the paper "Optimal Versus Naïve Diversification: How Inefficient is the 1/N Portfolio Strategy?" by Victor DeMiguel and his colleagues² where they showed that an equal-weighted portfolio performs extremely well and is hard to beat by traditional portfolio optimisers, even with decades of data. The basic premise of the portfolio is that the investor is completely ignorant about the future risk and return of different asset classes and thus decides to split her wealth evenly amongst the different investment options.

Dalio All Weather Portfolio

Ray Dalio is the founder of the world's largest hedge fund firm Bridgewater Associates and manages in excess of \$160bn in assets. One of his main innovations in the world of asset allocation is to create an "all weather" portfolio that is designed to perform well in periods of rising as well as falling economic growth, inflation and deflation. The portfolio allocation we use here is the one popularised by Tony Robbins in his book "Money; Master the Game: 7 Simple Steps to Financial Freedom" and can be found in Fig. 9. Essentially, this portfolio invests 30% of the assets in stocks, 55% in bonds and 15% in commodities and gold.

Permanent Portfolio

The Permanent Portfolio is another static portfolio that was designed to perform well in any kind of economic and market environment. It was designed in the 1980s by Harry Brown and popularised in the eponymous book by Craig Rowland and J.M. Lawson.³ The basic idea behind it is an equal allocation to domestic stocks (in order to provide high returns during times of strong economic growth), to long-term government bonds (to protect against recessions and deflation), to cash (to protect against recession and credit crunches) and to gold (to protect against inflation). The exact allocation is again summarised in Fig. 9.

Ivy Portfolio

The last of our static portfolios is a simplified Ivy League endowment portfolio that tries to mimic the investment approach and performance of renowned endowment funds like the ones from Harvard or Yale University. Popularised by Yale CIO David Swensen in his book "Pioneering Portfolio Management" it relies heavily on alternative investments and access to first class alternative investment managers. Since most institutional and private investors do not have access to these top tier fund managers, Meb Faber tried to create a simplified version in his book "The Ivy Portfolio" that can be replicated at low cost by any investor. The asset allocation of the portfolio is essentially 40% equity, 40% real assets (real estate and commodities) and 20% bonds (Fig. 9). Thus, this portfolio is by its nature very aggressive and growth oriented.

² DeMiguel, V., L. Garlappi, and R. Uppal (2007). "Optimal Versus Naïve Diversification: How Inefficient is the 1/N Portfolio Strategy?" *The Review of Financial Studies*, vol. 22 (5), 1915 – 1953.

³ Craig Rowland and J. M. Lawson (2012). "The Permanent Portfolio: Harry Browne's Long-term Investment Strategy" John Wiley & Sons.

Fig 9: Asset allocation of static portfolios

Asset class	60/40	Equal-Weighted	Dalio All Weather	Permanent Portfolio	Ivy Portfolio
Money market	0.0	8.3	0.0	25.0	0.0
Government bonds	40.0	8.3	55.0	25.0	20.0
Inflation-linked bonds	0.0	8.3	0.0	0.0	0.0
Corporate bonds	0.0	8.3	0.0	0.0	0.0
High yield USD	0.0	8.3	0.0	0.0	0.0
Em. market debt USD	0.0	8.3	0.0	0.0	0.0
Equities USA	60.0	8.3	30.0	25.0	20.0
Equities EAFE	0.0	8.3	0.0	0.0	20.0
Equities em. markets	0.0	8.3	0.0	0.0	0.0
US REITs	0.0	8.3	0.0	0.0	20.0
Commodities	0.0	8.3	7.5	0.0	20.0
Gold	0.0	8.7	7.5	25.0	0.0

Source: Fidante Partners.

Dual Momentum Portfolio

The Dual Momentum Portfolio is the first of our dynamic asset allocation strategies. It was developed by Gary Antonacci and popularised in his book "Dual Momentum Investing: An Innovative Strategy for Higher Returns with Lower Risk". The title of the book says it all. The idea is to invest in different asset classes in such a way that one benefits from high returns during times of rising markets but reduces downside risks by selling assets while they are declining in price. Sounds simple and indeed, Antonacci's methodology is deceptively simple. For every asset class, we calculate the twelve-month price momentum and sort asset classes by trailing twelve-month returns. If the trailing twelve-month return of an asset class is positive and amongst the best third of all twelve-month returns, the asset class is included in the portfolio for the coming month. If the trailing twelve-month return of an asset class becomes negative, or it is still positive but not in the top third of all asset classes, it drops out of the portfolio. The process is repeated at the beginning of each month based on prices of the last trading day of the previous month.

The insistence on positive price momentum means that only asset classes with rising

prices are included in the portfolio. Because momentum tends to be persistent in the short run, chances are that what has gone up in the past will go up one more month. Because different academic studies show that the chances of outperformance are better for assets with strong price momentum, the methodology invests only in the top third of all asset classes. This means that the portfolio is only invested in a maximum of four asset classes in an equal weighted fashion (i.e. 25% of assets in each asset class). This creates very concentrated portfolios that change rapidly if market environments change. Hence, trading costs can be substantial in times of volatile markets and we thus calculate returns net of trading costs, assuming round trip costs of 0.2% - a value close to the average cost for pension funds.

One advantage of the Dual Momentum Portfolio is that in times of extreme market crisis, the majority if not all the asset classes may exhibit negative absolute price momentum (i.e. they may all decline at the same time). If the model cannot find four different asset classes with positive absolute price momentum, it will invest 25% in those asset classes that do have positive price momentum and put the rest in money

market investments. In extreme cases, this means that the dual momentum portfolio can be 100% invested in cash.

Global Tactical Asset Allocation (GTAA) Portfolio

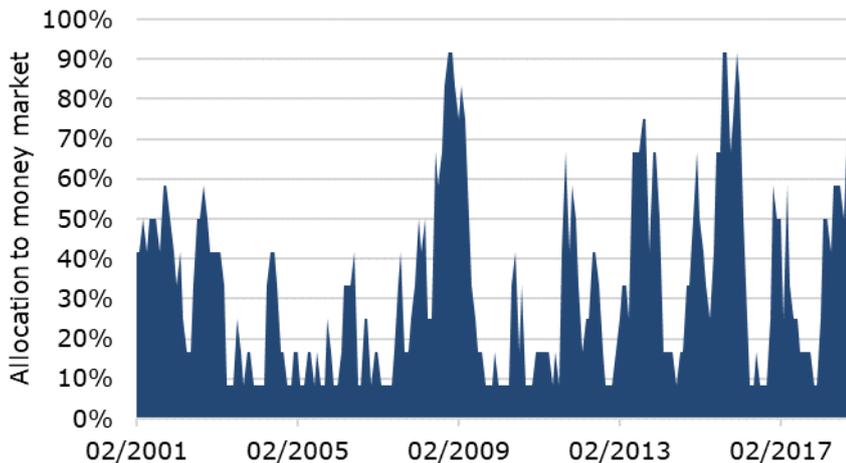
The Global Tactical Asset Allocation (GTAA) approach was developed by Meb Faber and described in his paper "A Quantitative Approach to Tactical Asset Allocation". The methodology is similar in nature to the dual momentum approach, but uses moving averages as buy and sell signals and creates portfolios that are more diversified than the dual momentum approach.

The basic idea behind the GTAA Portfolio is to check if the current price of an asset class is above or below its 200-day moving average (or alternatively, its 10-month moving average). If the current price is above the 200-day moving average, the asset class is included in the portfolio and if it is below, the investment is moved into money market investments. As with the dual momentum portfolio we calculate the new

asset allocation at the beginning of each month based on closing prices on the last trading day of the previous month.

The GTAA Portfolio invests equal amounts of money in each asset class (in our case 8.3% of the portfolio because we have twelve asset classes). However, during market downturns, asset classes that drop below their 200-day moving average are replaced by money market investments so that the allocation to money markets varies between 8.3% and 100% depending on market circumstances. Fig. 10 shows how the allocation to money market investments varied over time, rising above 90% of the portfolio at the height of the financial crisis in 2008 and early 2009 and again during the market correction in late 2015 and early 2016. At the end of 2018, the portfolio was invested 75% in money markets in reaction to the strong correction in risk assets in the fourth quarter of 2018. The only remaining asset classes were government bonds, US stocks and US REITs at that point.

Fig 10: Allocation to money markets over time in GTAA asset allocation technique



Source: Fidante Partners.

Minimum Variance Portfolio

The Minimum Variance Portfolio is the portfolio on the efficient frontier that has the lowest variance/volatility. As such, it is unique, because the investor does not need to predict future returns to calculate the optimal asset allocation. The minimum variance portfolio is defined only by the volatility and correlation between the

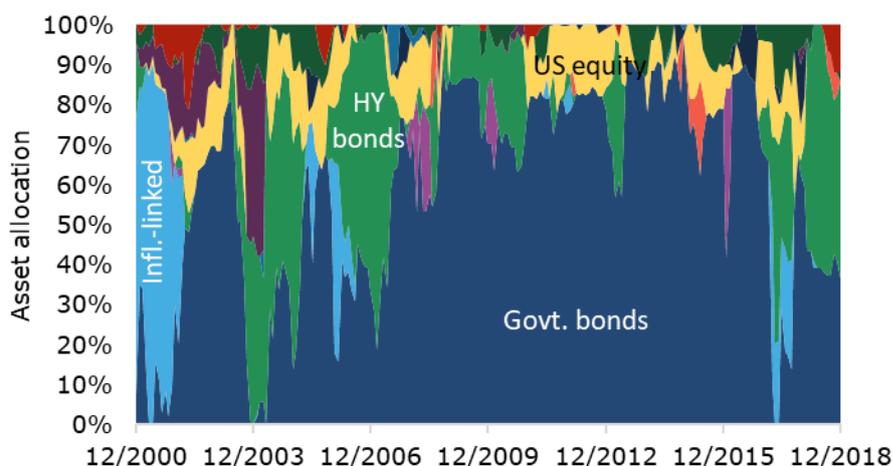
different asset classes. This has distinct advantages because future returns have the highest estimation uncertainty and at the same time the biggest influence on the asset allocation in a classical mean-variance portfolio optimisation. It is because of this extreme sensitivity to estimated returns that mean-variance optimised portfolios tend to

perform poorly out of sample.⁴ The Minimum Variance Portfolio eliminates this main source of uncertainty and thus creates more stable allocations that outperform in real life applications. Furthermore, low volatility stocks have been shown to outperform the overall stock market in more than 33 countries and over very long time periods.⁵ There are several possible explanations for this phenomenon that we cannot go into here.⁶

In our study we calculate the Minimum Variance Portfolio without leverage at the beginning of each month based on the trailing 12-month volatility and correlation of all twelve asset classes in our study. We omit money market investments because if they were included, the Minimum Variance

Portfolio would simply be 100% money market. Our lookback period is rather short and in practice, most investors would probably use rolling three- or five-year periods to calculate the Minimum Variance Portfolio, but our methodology has the advantage that it accentuates the benefits and drawbacks of the minimum variance portfolio at minimally higher turnover. As in the case of the Dual Momentum and the GTAA Portfolio we assume transaction costs of 0.2% per roundtrip. Fig. 11 shows the asset allocation of the Minimum Variance Portfolio throughout our sample period. Most of the time, the portfolio is heavily invested in government bonds, adding high yield bonds and from time to time US equities to the mix while other asset classes play a minor role.

Fig 11: Allocation of the minimum variance portfolio over time



Source: Fidante Partners.

Risk Parity Portfolio

The Risk Parity Portfolio was born out of the observation that in a 50/50 stock/bond portfolio more than 80% of the portfolio risk is equity risk, while bonds contribute only a small part of the overall risk. In order to create portfolios that are more balanced from a risk perspective, a Risk Parity

Portfolio chooses asset allocation weights in such a way that the contribution of each asset class to the overall portfolio risk is identical. The basic idea is to create a portfolio that can withstand all kinds of market environments without excessive drawdowns. In its static form it leads to Dalio's All Weather Portfolio discussed above.

⁴ Klement, J. (2006). "Portfolio Construction and Uncertainty" UBS Wealth Management Research, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1447257.

⁵ Baker, N. L. and R. A. Haugen (2012). "Low Risk Stocks Outperform within All Observable Markets of the World" Available at SSRN:

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2055431.

⁶ Interested readers can find a short overview here:

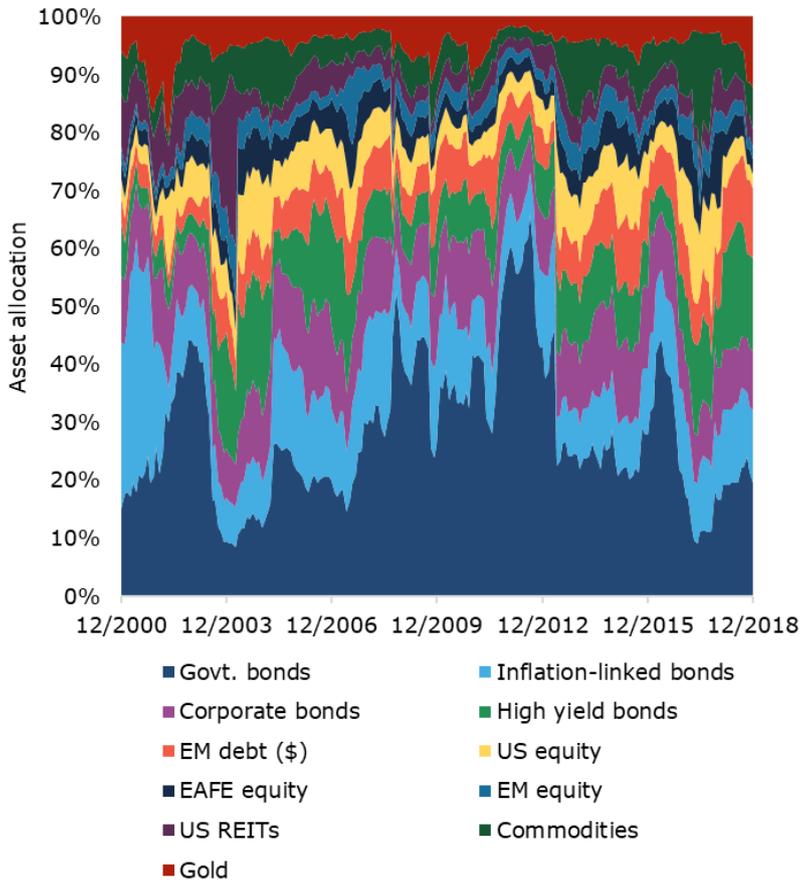
<https://alphaarchitect.com/2018/07/12/deconstructing-the-low-volatility-low-beta-anomaly/>.

Risk parity investment approaches have become one of the most popular approaches to alternative asset allocation in the institutional investment world and many hedge funds and quantitative asset managers have launched products that follow this methodology. Because there are so many different approaches to risk parity, it is impossible to model them in all their complexities. We use a simple Risk Parity Portfolio approach that is calculated similarly to the approach we use for the Minimum Variance Portfolio. At the beginning of each month we use trailing 12-month data to calculate the asset allocation of a risk parity portfolio including eleven out of the twelve asset classes we use in this report. Just like minimum variance portfolios we have to exclude money markets from the asset allocation because otherwise the portfolio would be virtually 100% invested in money markets. Because we are dynamically

adjusting the Risk Parity Portfolio every month, we simulate transaction costs of 0.2% per roundtrip for the changes in asset allocation over time.

Fig. 12 shows the asset allocation of the Risk Parity Portfolio over time. Compared to the Minimum Variance Portfolio, the asset allocation of the risk parity portfolio is more diversified with all asset classes playing a significant role in the portfolio. The Risk Parity Portfolio does have a preference for fixed income investments, with on average 70% of the portfolio allocated across fixed income asset classes. But allocations can vary substantially. The fixed income allocation of the portfolio varies between 40% and 88%, while the equity allocation varies between 5% and 32%, depending on the market environment.

Fig 12: Allocation of the risk parity portfolio over time



Source: Fidante Partners.

RESEARCH

Joachim Klement
+44 20 7832 0956
jklement@fidante.com

Martin McCubbin
+44 20 7832 0952
mmccubbin@fidante.com

MARKET MAKING

STX 79411 79412

Mark Naughton
+44 20 7832 0991
mnaughton@fidante.com

Anthony Harmer
+44 20 7832 0995
aharmer@fidante.com

UK SALES

Daniel Balabanoff
+44 20 7832 0955
dbalabanoff@fidante.com

Max Bickford
+44 20 7832 0934
mbickford@fidante.com

Hugh Ferrand
+44 20 7832 0935
hferrand@fidante.com

Mike Rumbold
+44 20 7832 0929
mrumbold@fidante.com

Justin Zawoda-Martin
+44 20 7832 0931
jzawodamartin@fidante.com

INTERNATIONAL SALES

Ian Brenninkmeijer
+46 8 1215 1361
ibrennikmeijer@fidante.com

Adam Randall
+1 212 897 2807
arandall@fidante-us.com

Yves van Langenhove
AAMYS* (Fidante Partners)
+34 468 29 08 04
yvanlangenhove@fidante.com

PRODUCT DEVELOPMENT

Nora O'Mahony
+44 20 7832 0961
nomahony@fidante.com

Tom Skinner
+44 20 7832 0953
tskinner@fidante.com

CORPORATE FINANCE

John Armstrong-Denby
+44 20 7832 0982
jdenby@fidante.com

Nick Donovan
+44 20 7832 0981
ndonovan@fidante.com

Will Talkington
+44 20 7832 0936
wtalkington@fidante.com

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