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Quantitative Investment Strategies

Hedging 2.0 – Designing a Defensive Portfolio

We introduce a framework for the construction of systematic strategy portfolios providing reliable diversification in equity drawdowns. In backtesting our approach does not suffer from negative carry as option hedges do. Clustering, strategy modulations and hedge monetization accentuate the profile.

Our defensive framework allows investors to achieve a return profile that diversifies in equity market drawdowns. Our strategy has a negative downside beta to equities of -0.24, illustrating that it delivers on average positive returns when equity markets draw down. A particularly attractive feature of our approach is that it achieves this defensiveness together with positive long run returns (+1.7% per annum). This puts our framework in stark contrast to more traditional option hedging programs, which also provide defensiveness but come with a negative carry.

The framework can be described in three main steps: (1) clustering of strategies, (2) construction of style portfolios, and (3) combining those style portfolios to achieve a prescribed defensive return profile. We develop a proprietary algorithm that screens a large range of systematic strategies for their usefulness in our framework. The selected strategies are classified into three buckets: hedge, convexity, carry. The strategies selected in each bucket are combined using a portfolio construction approach specific to the respective bucket. The results of this approach are three style portfolios that show distinct risk-return profiles. We can combine such style portfolios to achieve a specific defensive return profile tailored to provide diversifying returns to an underlying portfolio. The diversifying return profile is generally built to deliver positive returns when equity markets draw down. However, our approach is flexible and can provide diversification versus any reference portfolio.

Modulations to strategies can help accentuate the defensive return profile. We look at the selection of signals, investment universe and portfolio construction in strategies to enhance their return profile and make them more useful building blocks in the style portfolios. In this publication we also look into the monetization of hedges in particular, and how this can reduce the strong return reversals that option hedging strategies tend to experience in market recoveries.

QUANTWISE

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QuantWise highlights research that incorporates a robust quantitative approach in our investment analysis.

Introduction

In this publication, we give an overview of our defensive framework. The objective of this framework is to achieve through the combination of systematic investment strategies a defensive return profile with a flat to positive carry in upwards drifting equity markets. We highlight how modulations to popular systematic investment strategies can help accentuate this defensive return profile. A particular focus of this report is on the benefits to the monetization of hedges, which are part of our defensive framework.

Recent years saw investors extend traditional systematic hedges to more elaborate frameworks for defensive overlays (i.e., overlays providing positive expected returns when markets sell off). The motivation for this step has frequently been the desire to reduce the negative carry of traditional hedging programs while still being able to have a reliable protection in market drawdowns. This evolution in the construction of protection strategies is based on the insight that there is a more gradual tradeoff between the responsiveness/reliability of a protection strategy and its cost. When constructing portfolios of defensive strategies we can trade off the responsiveness/reliability of hedges for a reduction in drag by adding non-option-based diversifying strategies. Defensive frameworks provide investors a tool to pick and choose strategies to deliver a carry-defensiveness trade-off optimal for them.

Our work concentrates on delivering a portfolio of strategies which is defensive compared to equity market drawdowns. While this view on defensiveness may be narrow, we show that the resulting portfolio works well as an overlay to balanced portfolios as well (e.g., 60% equities, 40% rates). Furthermore, the design of our framework allows us to calibrate the construction and weighting of systematic strategies to provide defensiveness versus a large array of comparables from different asset classes.

From a more practical angle, our defensive framework screens and clusters strategies from a broad strategy universe according to metrics measuring returns and defensiveness. Based on these screens we allocate strategies to buckets that are used to define style portfolios. Those portfolios deliver a more reliable return profile and characteristics than individual strategies. This makes the style portfolios useful building blocks in a proprietary algorithm designed to achieve a specific defensive return profile. Investors can define the input parameters to this profile to achieve a large array of outputs specific to the objective of individual investors.

Next to the construction of defensive frameworks with systematic strategies we are also interested in modulations to such strategies. We find two avenues for such modulations that are impactful. For one we adapt signals, investment universe and portfolio construction of systematic strategies in ways that make them more reliable and responsive when used in defensive settings. For example, equity quality systematic strategies tend to have defensive characteristics, but we can make them even more reliable diversifiers in risk-off events by allowing sector biases and choosing specific types of quality signals. We have already published extensively on such modifications in the past (compare our publications here and here). Thus, this report concentrates on another angle to modulate strategies for the defensive framework. This second type of

modulation focuses particularly on the monetization of hedging strategies. It is common knowledge that hedging strategies exhibit a strong diversification effect when markets draw down. However, often those gains are given back quickly when markets recover, and there is no lasting value for investors. We intend to remediate some of these hedging-strategy shortcomings through the monetization of hedges (i.e., selling hedge positions before expiration). One can integrate these monetization algorithms systematically in the strategy design and we outline a couple of considerations that are important in this context.

Thus, we set out in the remainder of this article (1) how our defensive framework is constructed, (2) how the monetization of hedges which are part of this framework can enhance performance, and (3) some concluding considerations.

We would like to thank Victor Kochemirovskiy, a Vice President in Morgan Stanley's IED Financial Engineering group, and Michael Lootgieter, an Analyst in Morgan Stanley's IED Financial Engineering group, for their contributions to the analyses in this report. Please note that Mr. Kochemirovskiy and Mr. Lootgieter are not members of Morgan Stanley's Research department.

Defensive framework

This section focuses on an introduction to our defensive framework. We concentrate on the discussion of a specific implementation of our framework, which is constructed to deliver diversification against equity market drawdowns. However, it is important to highlight that our framework can be calibrated to be defensive versus any portfolio an investor may have in mind (e.g., traditional 60% equity and 40% bonds, bonds only, etc). Furthermore, we can modulate the degree of certainty and responsiveness of diversification in market sell offs to obtain either more or less carry and market upside capture. Most calibrations we look at achieve a high degree of reliability in defensiveness while achieving flat to positive carry.

Our defensive framework essentially consists of three steps – (1) classification of strategies, (2) construction of style portfolios, and (3) combination of style portfolios to achieve a defensive return profile. We provide in the following sections more detail on each one of these steps.

Classification of strategies

Over recent years market participants have gained an ever-deeper understanding of the systematic risk-return characteristics of systematic investment strategies. Seasonalities, cyclical patterns, and diversification characteristics to other asset classes tend to be rather robust over time for some strategies. This can be driven by their technical characteristics (e.g., trend following leaning into a market sell-off), signals (e.g., indicators for market sentiment) or traded instruments (e.g., option based strategies). Where we find robust patterns in strategy behavior, we can use them to build portfolios of strategies with specific return characteristics, such as the defensive portfolios we are interested in here.

When we accept that strategies have such persistent characteristics, it makes sense to start the design of a defensive portfolio framework by classifying strategies by those characteristics. Once we have groups of strategies with similar characteristics we can start building portfolios of them.

While there are different ways to classify strategies for a defensive framework, we believe it is instructive to categorize systematic strategies into three main categories:

- Hedging
    - Category contains strategies that exhibit a hockey-stick-type return profile: fairly certain protection in market drawdowns over shorter or longer periods. However, this comes at the price of negative returns in the long run. Generally, strategies in this bucket are based on option-type instruments. Craftsmanship in the construction of these strategies is key to finding efficient structures to deliver the protection profiles one seeks, while limiting the negative carry common to hedging strategies.
    - Example: A systematic put-buying strategy that delivers a certain hedge when equity markets are drawing down

- Convexity
  - Category contains strategies that show a U- or V-shaped return profile. It contains strategies that tend to do well in times when underlying markets move significantly – positive or negative moves – but defensiveness is based on economic links and not as reliable as hedging strategies. The advantage over hedging strategies is that the returns are expected to be positive in the long run.
  - Example: A trend-following strategy that tends to lean into strong positive and negative price trends in assets, providing diversification when equity markets draw down
- Carry
  - Category contains strategies which exhibit a return profile that shows consistent positive returns over time. Selected systematic strategies tend to have negligible exposures to market drawdowns. The consistent and strong risk-adjusted returns of this style of strategy can be used to drive overall portfolio carry or finance exposure to hedging strategies.
  - Example: An FX volatility carry strategy which tends to earn a carry premium when equity markets draw down and which does not show co-skewness

The usage of modulated strategies in the construction of style portfolios helps to accentuate return profiles. Thus, we apply a range of such changes to our usual baseline investment strategy universe before we run the categorization.

When we classify strategies in those three buckets – hedging, convexity, and carry – we apply a systematic framework. Based on the reliability of diversification in drawdowns over different time windows and severities, the degree of defensiveness, as well as the ability to generate carry-type income, strategies are categorized systematically in a stepwise process. While this classification is systematic, we would like to stress that fundamental characteristics of strategies should also be taken into account.

Construction of style portfolios

After classifying a large range of strategies by their characteristics, we build portfolios for each one of the three style categories.

Building portfolios of strategies with similar characteristics – so-called style portfolios – is a step which helps accentuate the return profiles of this group of strategies. By combining a range of strategies with similar return profiles noise will be reduced and the systematic characteristics these strategies share will become more consistent. This effect makes our style portfolios more reliable tools in the construction of specific defensive return profiles compared with using individual strategies.

Exhibit 1: Idealized payoff profiles of the carry, convexity and hedging style portfolio

Source: Morgan Stanley Research

Once we have categorized strategies into their respective styles, we need to decide how to weight them to construct the style portfolios. Depending on the strategies in question this step can take various shapes. For the convexity and carry bucket we chose a risk-based portfolio allocation, which ensures a maximum degree of diversification. For the hedging strategy we leverage the fact that derivatives profiles are deterministic and combine the respective screened strategies to obtain a hockey-stick type profile with a minimum degree of carry. Note that for the hedging portfolios we can adapt the profile to any structured payoff an investor might be interested in, and which is attainable with derivatives.

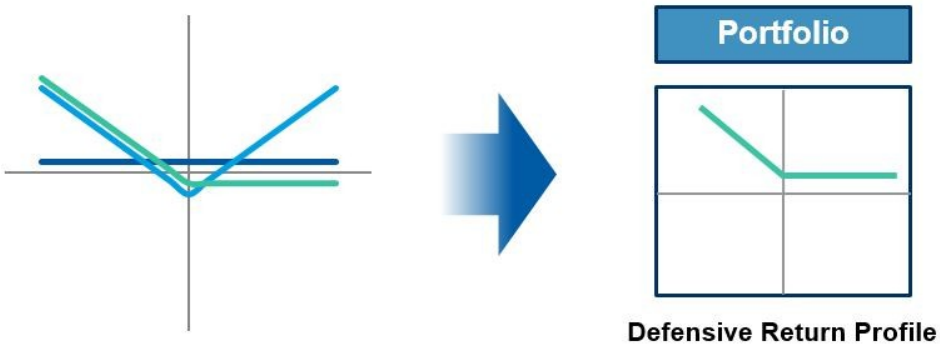
We illustrate those three profiles in an idealized form in Exhibit 1, where the x-axis represents equity market returns and the y-axis strategy performance. At this point we would like to reiterate that the benchmark versus which we define defensiveness does not have to be equities. Our framework is flexible enough to be adapted to be defensive versus a large range of underlying comparables. Effectively, the reference point to define defensiveness (e.g., equities, fixed income, balanced portfolio, etc.) is a parameter of the framework.

We generally identify two more categories of style portfolios – pro-cyclical and alpha strategies. However, the former is out of scope due to its co-movement with equity market sell-offs and a lack of defensive characteristics. The latter is not part of the framework as it consists of more complex alpha strategies with less persistent return profiles.

Combining style portfolios to the top-line defensive portfolio

Deriving style portfolios from clustering of similar strategies helps make the return profiles more reliable and predictable. This is a requirement for the next step, which is a precise definition of the defensive return profile. Once this defensive profile is defined, we can use statistical methods to weight the carry, convexity and hedging style portfolios to achieve the wished-for defensive return profile. This weighting can be achieved through two approaches: calibrating to historical return data or scenario analysis.

Exhibit 2: Combining style portfolios to achieve the desired defensive return profile



Source: Morgan Stanley Research

Let us start with our preferred approach. We weight style portfolios based on historical return data to achieve a specific empirical defensive return profile. We favour this approach as return profiles of style portfolios tend to be robust over time and an empirical approach implicitly tests the efficacy of our defensive portfolio over various market cycles. The downside of the empirical approach is that it relies on history repeating itself and it may be misguided if style portfolio profiles change over time. Furthermore, the approach assumes that the relevant scenarios we want to protect ourselves against have all occurred in our parametrization period.

Alternatively, we could use scenario analyses for the weighting of the three style portfolios as well. However, this comes with the challenge of defining the right scenarios and modelling their relative relevance. Furthermore, scenario analyses struggle with accounting for the dynamism of the various strategies in a drawdown where positions adapt to the market behavior dynamically – which is captured in the historical data approach.

We believe that the historical and scenario-based approach for the sizing of the three style portfolios are complementary. However, weighing the pros and cons we put most weight on the historical component as long as we can use a long enough history. Practical experience tells us that 15-20 years of history is enough for an efficient calibration of a defensive framework.

Concrete example for an implementation of the described framework

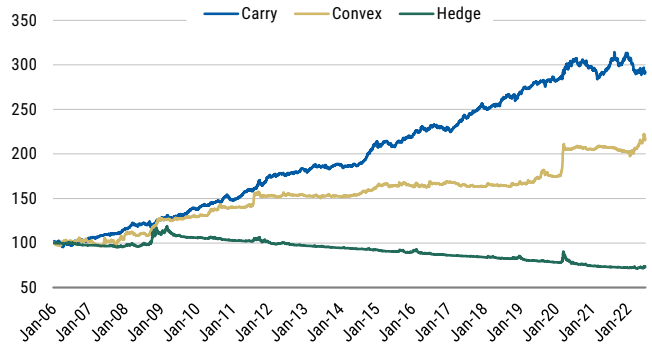
The described process can be implemented in a variety of ways. We present here a specific simplified example to illustrate the empirical characteristics of the outlined defensive framework. Our backtest runs from January 2006 until June 2022.

We first take a broad universe of systematic strategies and screen them according to the described approach. The starting universe contains a broad array of strategies in various asset classes (equities, commodities, rates, credit, FX) and styles (carry, value, momentum, quality, low risk, volatility and others). Amongst this broad universe our framework selects and classifies a subset of strategies into the three buckets using a statistical approach.

Exhibit 3 to Exhibit 6 show the cumulative return and convexity charts of the resulting style portfolios. The performance of carry, convexity and hedging strategies is roughly in line with what we intended to achieve when we designed the framework (compare Exhibit 1).

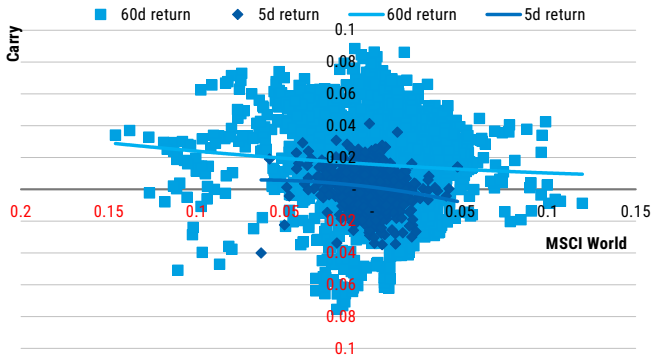
We find a resilient return of the carry portfolio in equity market drawdowns, which is indicated by the flat second-degree polynomials in Exhibit 4. Defensive characteristics are shown for the convex and hedge style portfolios. However, we observe a much closer "tracking" of the fitted second-degree polynomial for the hedge strategies due to the mathematical link between price of the underlying derivatives and the equity market returns. Thus, while the hedge portfolio has a negative carry (CAGR of -1.8% in Exhibit 7), it delivers reliability. Our convexity style portfolio has positive carry (CAGR of 4.7%) while still delivering defensiveness - although not as reliable as the hedge style portfolio. The trade-off in choosing allocations to convex and hedge style portfolios is one related to weighing reliability in defensiveness versus a negative return drift on the portfolio. Clearly, the usage of the convex style portfolio alone would undermine the reliability of our approach which is provided by adding the hedge style portfolio.

Exhibit 3: Cumulative performance



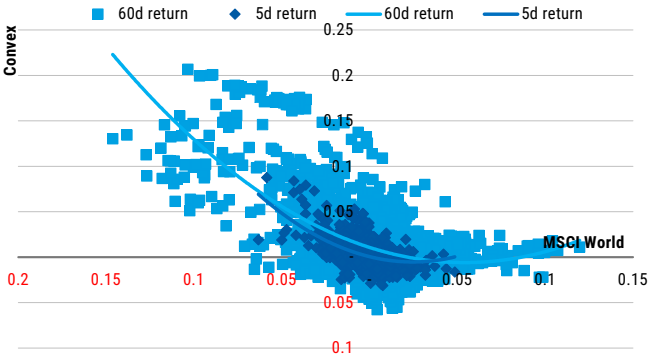
Source: Morgan Stanley Research, Bloomberg

Exhibit 4: Convexity chart for carry portfolio



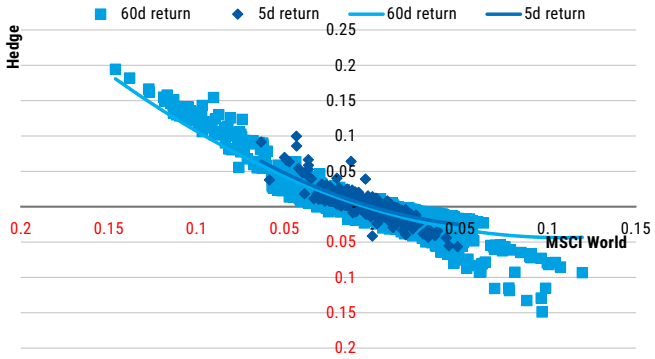
Source: Morgan Stanley Research, Bloomberg

Exhibit 5: Convexity chart for convexity portfolio



Source: Morgan Stanley Research, Bloomberg

Exhibit 6: Convexity chart for hedge portfolio



Source: Morgan Stanley Research, Bloomberg

Exhibit 7: Performance overview of style portfolios

Statistics	Carry	Convex	Hedge
CAGR	6.6%	4.7%	-1.8%
Annualized Vol	5.0%	5.0%	5.0%
CAGR / Vol	1.33	0.94	-0.37
Max DD	-8.1%	-9.3%	-40.0%
Max DD / Vol	-1.63	-1.86	-8.01
Calmar Ratio	0.82	0.51	-0.05
Sortino Ratio	1.87	1.53	-0.57
VaR (1%, Monthly)	-3.1%	-2.6%	-3.5%
CVaR (1%, Monthly)	-4.2%	-3.3%	-4.9%
Hit Rate (Monthly)	67.3%	53.9%	26.8%
Skewness	-0.61	1.51	3.27
Excess Kurtosis	4.26	17.82	96.20

Source: Morgan Stanley Research, Bloomberg

On the basis of these building blocks we can now construct a defensive portfolio whose aim is to deliver:

- Flat to positive carry
- Diversifying returns that compensate for about 75% of the losses made in an equity market drawdown

We achieve this objective by allocating to our style portfolios, where the weights are determined through our systematic defensive framework algorithm.

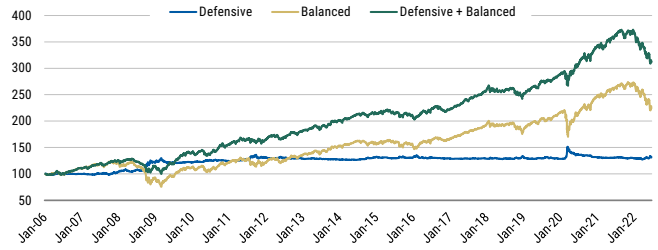
Our approach gives us a portfolio with strong defensive characteristics and good diversification power versus a common 60:40 portfolio – which is dominated by equity market performance. We see in Exhibit 8 the performance of our defensive portfolio as well as the comparable. The defensive portfolio itself achieves an average annual return of +1.7%, which will add to the performance of the balanced portfolio we are overlaying. Adding an overlay of 100% to the balanced portfolio significantly improves the reward-risk ratio (from 0.47 to 0.84). Furthermore, we see a substantial improvement of the maximum drawdown to volatility metric, which reduces in magnitude from -3.76 for the balanced portfolio to -2.66 when including the overlay.

Exhibit 8: Performance statistics of defensive portfolio as overlay to an equity-bond base portfolio

Statistics	Defensive	Balanced	Defensive + Balanced
CAGR	1.7%	5.0%	7.0%
Annualized Vol	4.5%	10.5%	8.4%
CAGR / Vol	0.37	0.47	0.84
Max DD	-15.8%	-39.3%	-22.3%
Max DD / Vol	-3.51	-3.76	-2.66
Calmar Ratio	0.11	0.13	0.32
Sortino Ratio	0.59	0.65	1.22
VaR (1%, Monthly)	-2.8%	-9.9%	-5.9%
CVaR (1%, Monthly)	-3.8%	-14.7%	-7.3%
Hit Rate (Monthly)	48.7%	63.3%	65.2%
Skewness	2.53	-0.54	-0.05
Excess Kurtosis	53.07	11.61	8.05

Source: Morgan Stanley Research, Bloomberg

Exhibit 9: Cumulative return chart of defensive portfolio as overlay to an equity-bond base portfolio



Source: Morgan Stanley Research, Bloomberg

Exhibit 10: Performance in market stress periods

Crisis event	Start	End	Defensive	Balanced	Defensive + Balanced
GFC 2008	3/13/2008	10/10/2008	9.6%	-24.9%	-17.1%
Flash Crash 2010	5/5/2010	5/25/2010	1.9%	-5.7%	-4.0%
Greek Debt Crisis 2011	7/22/2011	8/9/2011	5.0%	-7.8%	-3.1%
Taper Tantrum 2013	5/22/2013	6/24/2013	0.7%	-4.9%	-4.2%
Chinese Stock Market Turbulence 2015	8/17/2015	8/25/2015	1.3%	-5.3%	-4.1%
Brexit 2016	6/23/2016	6/27/2016	1.9%	-4.3%	-2.4%
VIX Crash 2018	1/26/2018	2/9/2018	1.2%	-5.8%	-4.7%
Q4 2018	10/3/2018	12/24/2018	3.2%	-10.1%	-7.2%
COVID-19	2/19/2020	3/24/2020	15.1%	-18.4%	-5.4%
Mean			4.4%	-9.7%	-5.8%
Median			1.9%	-5.8%	-4.2%
Std			4.9%	7.2%	4.5%

Source: Morgan Stanley Research, Bloomberg

When we look at market stress periods in Exhibit 10, we find that the defensive portfolio has reliable positive returns in all periods we study. Combining an investment in the Balanced portfolio with an allocation of equal size to the defensive overlay, increases average returns in market distress from -9.7% to -5.8%, significantly reducing the pro-cyclicality of the Balanced portfolio. The effects are the most pronounced in the global financial crisis and the COVID-19 market sell-off where the losses of the balanced portfolio are reduced by 7.7% and 13.0%, respectively.

One note about performance in H1 2022. While an equity and rates market sell-off drove losses in the balanced portfolio, we saw some diversification benefits from the defensive portfolio. Overall, the defensive portfolio added +2% in returns in H1 2022. However, compared to the -18% drawdown in the balanced portfolio this is less defensiveness than we have seen in other market drawdowns over our backtesting period.

This performance stands in stark contrast to the negative drift of traditional hedge portfolios. In fact, our framework is rather flexible and allows a wide array of alternative parametrizations. We can target specific levels of drawdown mitigation, upside, and carry. The individual style portfolios give us indications of the boundaries of what the approach can achieve.

In our analysis so far we have demonstrated how we can classify strategies to achieve style portfolios with a persistent return profile. We also showed how a defensive portfolio based on these style portfolios delivered in backtesting a reliable diversification in market drawdowns.

Designing strategies for defensive frameworks

In our defensive framework we have a clearly defined objective – diversify market drawdowns while limiting the negative carry common to traditional hedging strategies. We previously outlined how to screen systematic strategies and construct portfolios to achieve those objectives. Another important angle to examine to achieve those return profiles is a modulation of the construction of commonly used systematic strategies to accentuate their defensive return profile.

These modulations concern the chosen signals, traded investment universe and portfolio construction of individual systematic strategies. We have published in the past extensively on how this can be achieved. Compare, for example, our work in equity Quality strategies, which shows how the screening of suitable signals and sector particularities can accentuate the defensive return characteristics of Quality (here and here). These changes concern mainly strategies in the convex style portfolio and to a lesser extend in carry or hedge.

For the hedge style portfolio we think another angle is relevant. Hedge strategies give back parts of the diversifying returns they earn in drawdowns when markets recover. We think that the monetization of hedges can help improve the return profiles of hedging strategies – although this does not come without its own risks. The next section is dedicated to a deep dive into this topic.

Monetization of hedges

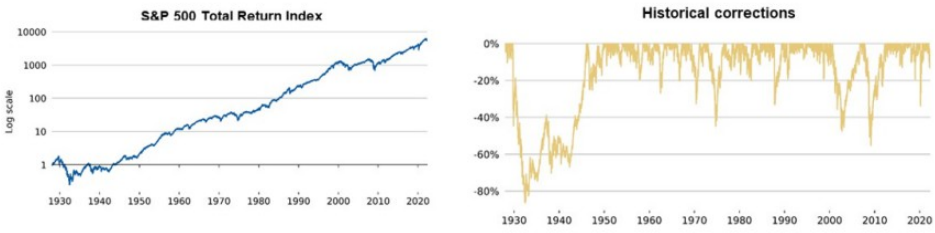
Empirical characteristics of equity market sell-offs

While our defensive framework has overall shown attractive characteristics in our backtest, investors may still be wondering if we can reduce the negative drift to hedging strategies (compare Exhibit 3).

One avenue to achieve this goal is the monetization of hedges. In other words, we can sell put options (or other derivatives) that are held as part of a hedge against market risk to lock in gains driven by underlying drawdowns. Such a monetization is used to help mitigate the negative drift to hedge portfolios. This approach would also lead to a reduced degree of protection for incremental losses once we monetize. Thus, the trigger of such a monetization needs to be set carefully. While this sounds generally like an attractive proposition, one word of caution: monetization occurs in times of highly volatile markets and it may take time until the diversification across multiple market drawdowns crystalizes benefits in realized performance. Thus, as with many other aspects of our framework, hedge monetization is a design option which is suitable for some investors but may carry too many risks for others.

The starting point to formulate monetization approaches is to look at historical equity market drawdowns. We start our analysis by concentrating on the S&P 500 as it is one of the broad financial market indices with the longest history. In Exhibit 11 we provide an overview of S&P 500 performance since 1927, and highlight the drawdowns we observe during this period.

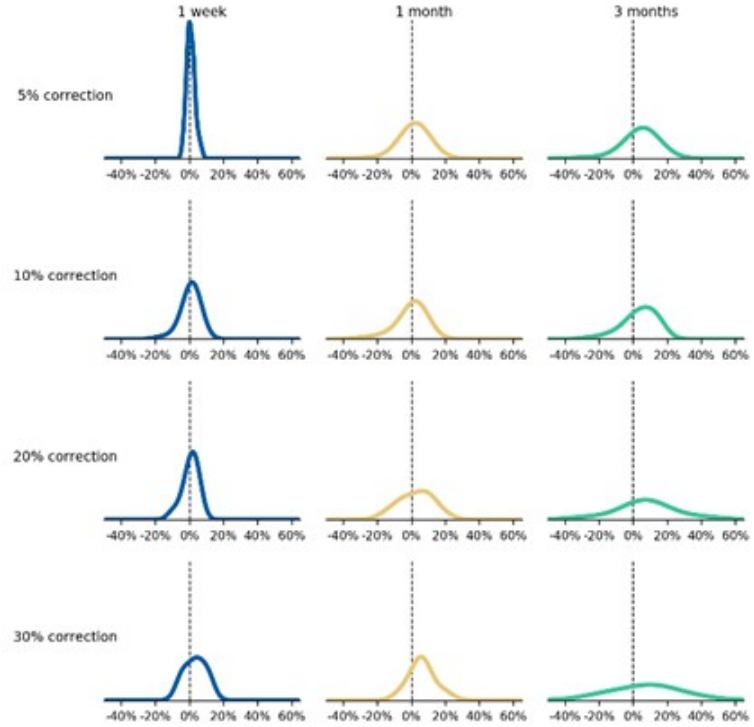
Exhibit 11: Long-run performance and drawdown characteristics of the S&P 500 index



Source: Morgan Stanley Research, Bloomberg

We used this information to fit conditional kernel distributions to the historical return series. We want to know how the expected future returns of the S&P 500 change conditional on the index being subject to previous drawdowns of various depths. We model this expected return distribution for various time windows to give further information on the recovery path that one can expect. The results of this analysis are reported in Exhibit 12 (see our report When to Trim Your Hedges: A Systematic Approach for more details).

Exhibit 12: Conditional return distributions of the S&P 500 over different holding periods



Source: Morgan Stanley Research, Bloomberg

These conditional distributions are relevant as they allow us to calculate the expected returns of an S&P 500 hedge after a drawdown of the respective index has happened. We can do this for delta one future hedges as well as option-based strategies. Exhibit 13 contains the respective results for an outright market investment. In order to obtain the trade-offs for a delta one future hedge, one just needs to reverse the respective sign. Exhibit 14 contains the results of a representative options-based strategy.

Exhibit 13: Expected S&P 500 market returns and incremental drawdown

Expected market return

	5 days	10 days	21 days	63 days	126 days
Unconditional	0.2	0.4	0.9	2.8	5.6
2%	0.4	0.4	0.9	2.7	6.0
5%	0.8	0.9	1.6	4.4	7.8
10%	0.5	-1.1	-0.2	3.8	6.8
20%	0.6	1.3	2.7	7.6	10.2
30%	3.4	3.5	6.2	7.4	11.0
40%	3.7	2.5	7.8	6.0	14.6
50%	12.6	13.2	8.7	7.2	9.6

Maximum incremental market drawdown

	5 days	10 days	21 days	63 days	126 days	# points
Unconditional	-27.7	-32.6	-42.6	-49.5	-53.7	23710
2%	-6.5	-14.8	-24.0	-32.4	-27.0	222
5%	-3.9	-7.8	-32.3	-29.6	-17.4	91
10%	-16.7	-17.9	-28.1	-24.5	-12.8	33
20%	-9.4	-22.3	-14.7	-26.4	-28.2	11
30%	-5.0	-6.7	-4.7	-17.9	-21.6	7
40%	-4.9	-0.4	2.5	-2.0	-4.2	4
50%	6.0	9.7	1.2	3.6	-3.5	2

Source: Morgan Stanley Research, Bloomberg

Exhibit 14: Expected returns of an S&P 500 put hedge after an equity market drawdown

Expected options return

	5 days	10 days	21 days
2%	-0.0	0.1	0.3
5%	-0.2	-0.3	1.0
10%	0.7	1.6	1.3
20%	-0.3	-0.0	-2.7
30%	-3.0	-3.4	-6.5
40%	-3.6	-2.5	-7.5
50%	-12.6	-13.0	-8.3

Options return for maximum incremental market drawdown

	5 days	10 days	21 days	# points
2%	0.8	6.5	15.7	222
5%	0.8	2.5	26.4	91
10%	13.9	15.1	25.3	33
20%	8.3	21.2	13.6	11
30%	4.7	6.3	4.4	7
40%	4.9	0.4	-2.3	4
50%	-6.0	-9.6	-0.9	2

Source: Morgan Stanley Research, Bloomberg

With our better understanding of conditional return distributions after market drawdowns, we can now think about the best paths towards monetization of hedges. In this assessment we concentrate on two metrics in particular. On the one side, we are interested in the expected returns at different points in time after a market drawdown of a particular size. On the other side, we are concerned about the maximum incremental drawdown. This is the historical worst-case scenario for an investor who took off the hedge *after* a drawdown. The metric represents the worst incremental loss an investor would have had to bear historically. What we see in both cases is that at about 30% loss to the S&P 500 the odds are quite clearly in favour of monetizing the hedges. At that point the historical incremental drawdown over the following 21 business days was small (-4.7%) compared to the average loss an investor would have to bear from continuing to hold the hedge through the market recovery (the market on average recovers 6.2%, which would mean a loss of similar size for a future hedge). The numbers clearly illustrate a monetization strategy around a drawdown of 20-30% would be profitable. However, while the benefits of hedge monetization are clear in the long run, market volatility may lead in individual cases to suboptimal decisions. Investors may need to have enough longevity to see the benefits of such a monetization strategy come through.

We also note that these results hold generality for various equity indices and can be used as orientation points to think about hedge monetization in equity markets across the globe.

Constructing systematic hedge monetization based on this information

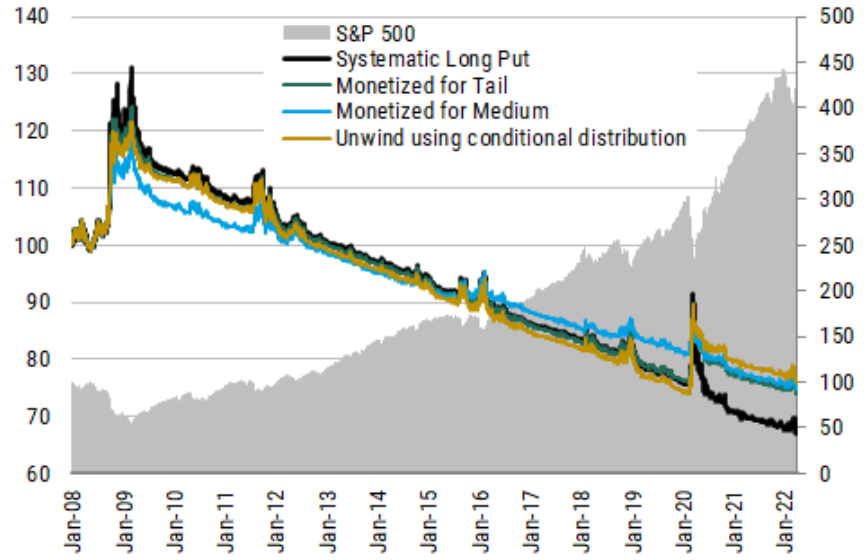
Based on these insights, we are modifying the baseline systematic put-buying strategy. This is one of the option-based strategies which make up the hedge portfolio.

For illustrative purposes, we run an equity put-buying strategy which monetizes its hedges continuously as equity markets deliver negative returns based on conditional forward distributions ("Monetize on Conditional Distribution"). This approach is based on information similar to what we outline in Exhibit 12. As an alternative to a monetization based on realized market drawdown depth, we can monetize based on the gains generated by the put hedges. We run such a put strategy version, which looks at monetization when the hedge strategy has delivered strong returns ("Monetized for Tail"). Some investors may also consider monetization of hedging strategy gains more

incrementally. Particularly in market scenarios where there are gaps down but markets recover swiftly, investors may want to monetize in a more incremental fashion. We run this more continuous monetization of positions in option strategies ("Put Monetized for Medium") as third alternative.

As illustrated in Exhibit 15, these monetization strategies deliver better overall performance. However, we want to emphasize also that the backtesting period is rather short, as data availability constraints prevent us from backtesting further back.

Exhibit 15: Payoff profiles of a hedge style portfolio with different forms of monetization for systematic long put component



Source: Morgan Stanley Research, Bloomberg

The modified strategies also lead to improved performance statistics (see Exhibit 16). Average returns increase from -2.4% per year for our base hedge portfolio to -1.7% for the monetization based on market drawdown, -1.9% for a tail-based monetization and -1.8% when we choose a more incremental path to monetization. Thus, the negative carry is reduced significantly. On the other side, we do give up some of the defensiveness. Particularly as we look at the 2008 period, where a more continuous monetization reduced hedges earlier, leaving a portfolio exposed to more downside risk. For the monetization approaches, which are more focused on deeper corrections, we see not much reduction in defensiveness in the backtest. These changes in defensiveness of the put-buying strategy are also evident in the statistics. As illustrated in Exhibit 16, we increase the positive skewness of the strategy when monetizing for more extreme events (from 3.27 for the standard put-buying to 5.39 for the conditional distribution approach and 3.50 for the tail approach). For the medium monetization we arrive at a lower skewness of 0.71.

Exhibit 16: Performance statistics for hedge style portfolio containing systematic put-buying with different forms of monetization

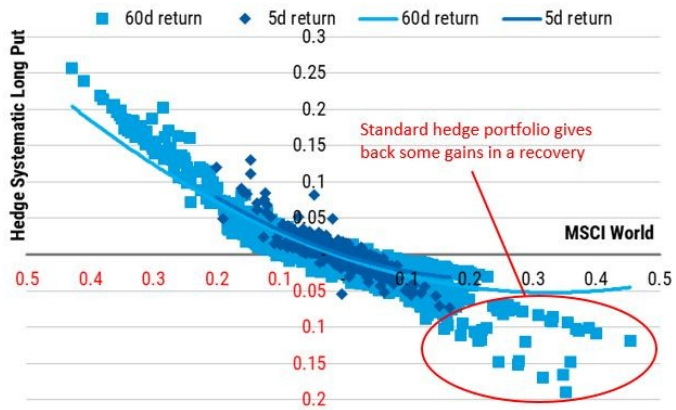
Statistics	Systematic Long Put	Monetize on Conditional	Monetized for Tail	Monetized for Medium
CAGR	-2.4%	-1.7%	-1.9%	-1.8%
Annualized Vol	6.5%	5.8%	5.1%	4.1%
CAGR / Vol	-0.37	-0.29	-0.36	-0.44
Max DD	-48.7%	-39.1%	-40.5%	-36.8%
Max DD / Vol	-7.52	-6.70	-7.98	-8.99
Calmar Ratio	-0.05	-0.04	-0.05	-0.05
Sortino Ratio	-0.58	-0.47	-0.58	-0.65
VaR (1%, Monthly)	-4.6%	-3.3%	-3.4%	-2.8%
CVaR (1%, Monthly)	-6.3%	-4.3%	-4.3%	-3.3%
Hit Rate (Monthly)	26.8%	27.0%	27.0%	27.5%
Skewness	3.27	5.39	3.50	0.71
Excess Kurtosis	96.20	154.98	87.55	23.82

Source: Morgan Stanley Research, Bloomberg

Another thing we are curious to study is return convexity, as per the charts in Exhibit 17 to Exhibit 20. We are interested to learn how these charts change once we monetize hedges. The first thing to highlight is that in those very large drawdowns, where equity markets drop over 60 days by about -40%, we see the standard hedging style portfolio return just above +25%. As we monetize our hedges, this strong return is not achieved anymore. For the tail monetization we come closest to the standard version, with a return of +20%. An interesting change we note is when we concentrate on return data points for equity returns between (about) -20% and +20%. Here, we observe for monetization with the conditional distribution (Exhibit 18), and to a lesser extent for the tail monetization (Exhibit 19), a cluster of datapoints that significantly outperform the base hedging strategy. Those points relate to periods of market recovery where standard hedges give back returns, while monetized strategies can hold on to more of their gains. We also see that the monetization reduces the losses marked at the lower right corner for the base hedge convexity chart (see Exhibit 17). Some of those base hedging strategy return data points represent the losses in market recoveries after a large drawdown. We do not find similar return observations for the monetized hedge strategy convexity charts. These are the return characteristics that highlight the key benefits of hedge monetization.

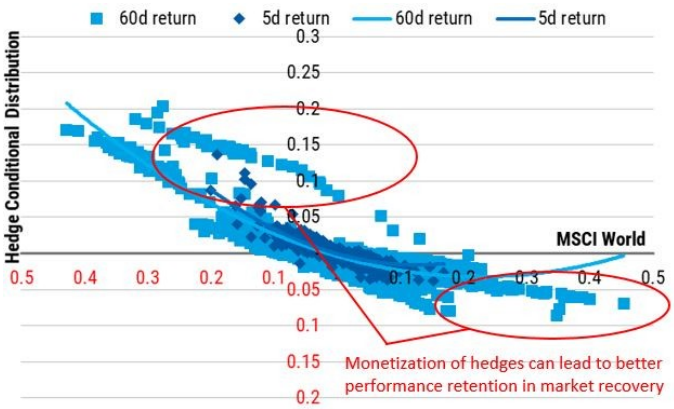
For a medium degree hedge monetization we find a generally less convex return profile (see Exhibit 20). These medium monetization hedging strategies are, therefore, less suited for situations where convexity and protection in large market drawdowns is required. However, in range-bound markets with a negative drift these strategies may be well suited to drive portfolio diversification.

Exhibit 17: Convexity profile of hedge style portfolio: Base hedge portfolio



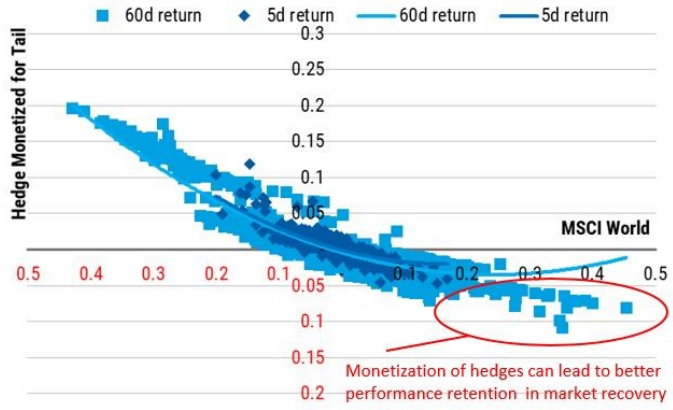
Source: Morgan Stanley Research, Bloomberg

Exhibit 18: Convexity profile of hedge style portfolio: Hedge portfolio with monetization based on conditional distribution



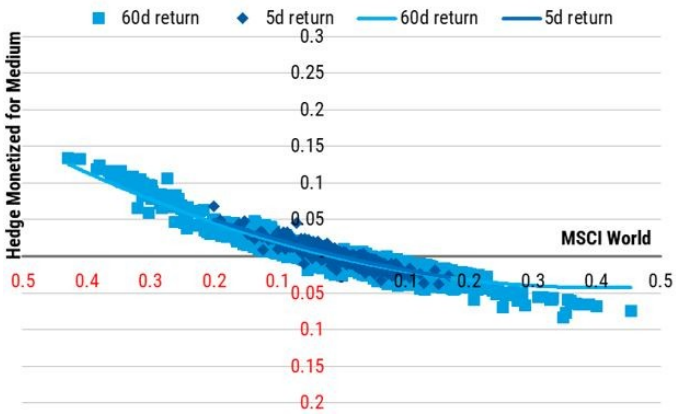
Source: Morgan Stanley Research, Bloomberg

Exhibit 19: Convexity profile of hedge style portfolio: Hedge portfolio with tail monetization



Source: Morgan Stanley Research, Bloomberg

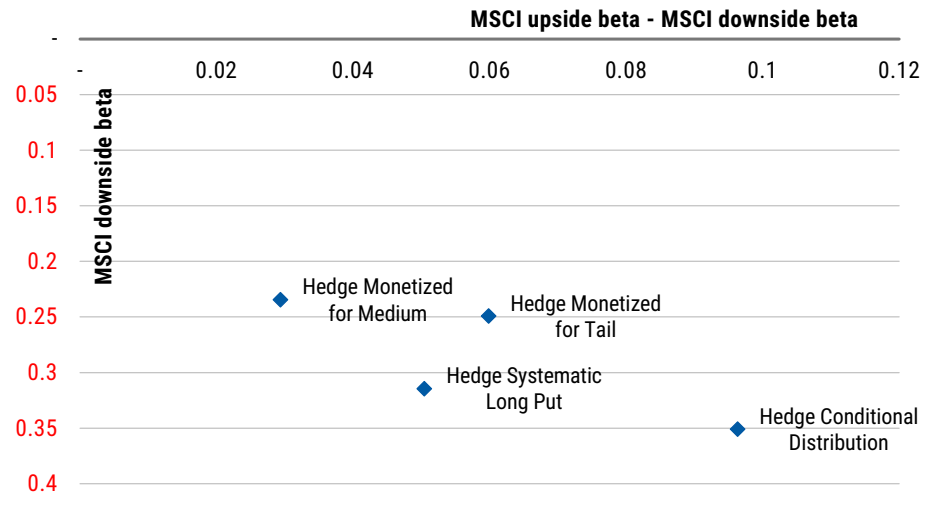
Exhibit 20: Convexity profile of hedge style portfolio: Hedge portfolio with medium monetization



Source: Morgan Stanley Research, Bloomberg

One way to evaluate the characteristics systematically is to look at the conditional betas. More precisely, we plot in Exhibit 21 the MSCI downside beta versus the difference between upside and downside MSCI beta. The former gives us an indication for pure defensiveness. The latter is a metric for convexity – the higher it is, the more likely we will find a convex return profile. The graph reveals that the medium monentization delivers the lowest degree of convexity and defensiveness overall, as it delivers the smallest magnitude for both metrics. The hedge with monetization on conditional distributions delivers an interesting profile. It is similarly defensive to the standard hedge strategy delivering a conditional downside beta of -0.35 (compared to -0.31 for the standard hedge style portfolio). However, we see a substantial pick up in convexity (0.10 compared to 0.05 for the standard hedge style portfolio). This analysis strengthens our previous results pointing towards benefits of monetization, particularly for the version where we use the historical conditional distribution to monetize the put hedge.

Exhibit 21: Convexity profile of hedge style portfolio



Source: Morgan Stanley Research, Bloomberg

This also feeds through into the performance of the overall defensive framework. To illustrate this point, we leave the overall parameters unchanged to the previous iterations but use the monetizing put-buying strategies in the hedging portfolio. This reduces the overall drag of the hedging portfolio while preserving the defensiveness of this sleeve. We summarize the impact of the hedge monetization iterations in Exhibit 22. For the overall defensive framework the monetization approach is reflected in a better overall Sharpe ratio (0.37 versus at least 0.47), higher average returns (1.7% versus at least 2.0%), lower magnitude of maximum drawdown by volatility (-3.51 and -2.68 or better) while the defensiveness in periods of equity market drawdowns is only marginally affected (MSCI downside beta changes marginally from -0.24 to -0.26 / -0.20 / -0.19 for the monetization using conditional distribution / tail / medium).

Looking at the efficacy of the overlay in combination with the balanced portfolio results are also encouraging. Monetization leads in all cases to stronger returns (from 7.0% to at least 7.3%). We find similar results for the risk-return ratio which increases in all variations compared to the 0.84 baseline. The only downside we find is that the maximum drawdown to volatility ratio deteriorates when using the monetization although we still remain in all cases significantly better than the -3.76 we observe for the balanced portfolio without defensive overlay.

Exhibit 22: Benefits of monetization in a defensive framework

Statistics		Defensive				Defensive + Balanced			
	Balanced	Base Hedge	Monetization on conditional distribution	Tail Monetization	Medium Monetization	Base Hedge	Monetization on conditional distribution	Tail Monetization	Medium Monetization
CAGR	5.0%	1.7%	2.1%	2.0%	2.0%	7.0%	7.5%	7.3%	7.3%
Annualized Vol	10.5%	4.5%	4.4%	3.9%	3.6%	8.4%	8.0%	8.6%	8.4%
CAGR / Vol	0.47	0.37	0.47	0.51	0.56	0.84	0.93	0.85	0.88
Max DD	-39.3%	-15.8%	-8.6%	-10.4%	-8.4%	-22.3%	-26.1%	-25.0%	-27.3%
Max DD / Vol	-3.76	-3.51	-1.94	-2.68	-2.34	-2.66	-3.25	-2.89	-3.26
Calmar Ratio	0.13	0.11	0.24	0.19	0.24	0.32	0.29	0.29	0.27
Sortino Ratio	0.65	0.59	0.78	0.80	0.86	1.22	1.37	1.23	1.27
VaR (1%, Monthly)	-9.9%	-2.8%	-2.3%	-2.3%	-2.1%	-5.9%	-5.9%	-6.1%	-6.5%
CVaR (1%, Monthly)	-14.7%	-3.8%	-2.9%	-2.9%	-2.5%	-7.3%	-8.1%	-8.1%	-9.7%
Hit Rate (Monthly)	63.3%	48.7%	49.5%	49.2%	51.0%	65.2%	65.4%	65.4%	65.8%
Skewness	-0.54	2.53	4.14	2.21	1.02	-0.05	0.30	0.02	0.05
Excess Kurtosis	11.61	53.07	87.75	41.22	19.63	8.05	9.25	8.59	9.23

Source: Morgan Stanley Research, Bloomberg

Overall these results paint a rather positive picture of the monetization of hedges. It helps in our backtesting with the retention of hedge gains while a careful parametrization leads to limited loss in defensiveness. However, some investors may not want to take the risk of being exposed to incremental market drawdowns after hedge monetization and may prefer a more classic hedging strategy. Thus, hedge monetization is another lever at our disposal that allows us to tailor return profiles of hedging strategies to investment objectives.

Conclusion

In this publication, we introduce our defensive framework. The goal of this framework is to identify specific levers investors can pull to tailor the characteristics of a portfolio of systematic strategies to specific investment objectives. Put differently, we aim to identify trade-offs investors can make to target a specified return profile by combining systematic strategies. In our study, we try to achieve a reliable positive return on our defensive framework when equity markets draw down, while keeping carry flat to positive.

One set of such levers lies in the classification of systematic strategies into three style portfolios: hedge, convexity and carry. The resulting style portfolios show a characteristic and distinct return profile. We utilize these characteristics to combine the three style portfolios in order to obtain a target return profile, which shows reliable defensive return behaviour while not suffering from the same drag a pure options-based hedge does.

The reliability of the defensive portfolio return profile can be enhanced further by a careful construction of the individual strategies that make up the portfolio. We have previously published on how one can make systematic strategies more defensive through signal selection, investment universe choice, and asset weighting approaches (compare here, for example). This construction step allows investors to regulate strategy characteristics.

We discuss in this publication another lever investors might want to consider: monetization of hedges. We show that a careful monetization strategy can reduce the negative carry to a hedge portfolio, while at the same time sacrificing only a limited amount of defensiveness. However, in light of the strong benefits, investors need to be careful: hedge monetization occurs in time periods of highly volatile markets where the outcomes of a single monetization event may vary widely. Investors may need longevity to experience the long-term benefits of monetization with a high degree of certainty. Thus, hedge monetization is a choice that may be suitable for some investors but not for others.