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Quantitative Investment Strategies | Global

Hedging 2.0 – A Brief Introduction to 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 dynamic exposure 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 dynamic exposures of hedges in particular, and how this can improve the return-risk profile.

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Introduction to 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.

This section focuses on an introduction to our defensive framework and a specific example 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.

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

When we accept that strategies have 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 (or styles):

- Hedging
 - Category contains strategies that exhibit an option-driven 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.
- 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.

- 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.

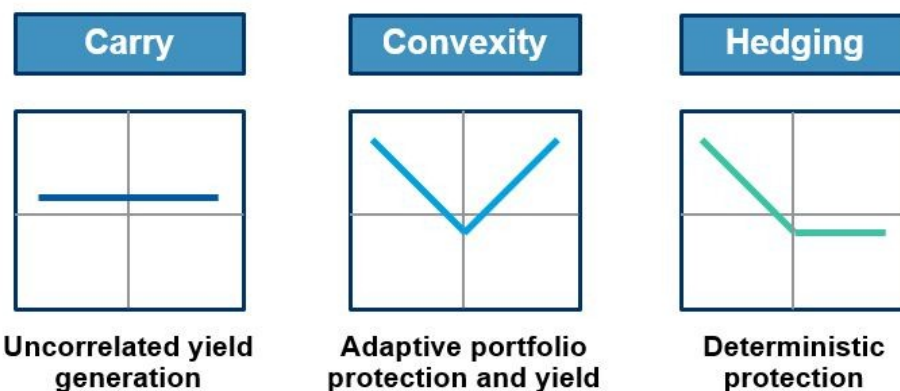
When we classify strategies in those three styles – hedging, convexity, and carry – we apply a systematic framework. While this classification is systematic, we would like to stress that fundamental characteristics of strategies should also be taken into account.

Construction of style portfolios

After selecting and 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



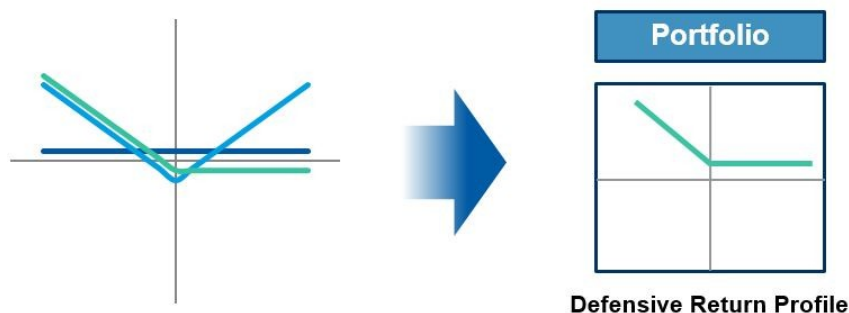
Source: Morgan Stanley Research

For the convexity and carry buckets, we chose a risk-based portfolio allocation, which ensures a maximum degree of diversification. For the hedging bucket, we use the more deterministic option-based return profiles and combine strategies to obtain a hockey-stick type payoff with a minimum degree of carry. Note that for the hedging portfolios we can adapt the profile to any structured payoff which is attainable with derivatives. We illustrate those three profiles in idealized form in [Exhibit 1](#), where the x-axis shows equity market returns and the y-axis strategy performance.

Combining style portfolios to the top-line defensive portfolio

Next we define a specific desired defensive return profile. We can use statistical methods to weight the carry, convexity, and hedging style portfolios to achieve this wished-for profile. This step benefits from the robustness our clustering step provides for the style portfolio return characteristics. This weighting of style portfolios can be done either through (1) calibrating to historical returns or (2) scenario analysis.

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



Source: Morgan Stanley Research

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. This approach is effective due to the robustness we observe in defensive characteristics over time. Furthermore, the dynamism of strategies which adapt weights in response to market behavior is hard to simulate efficiently, making an empirical approach more suitable to capture return characteristics.

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.

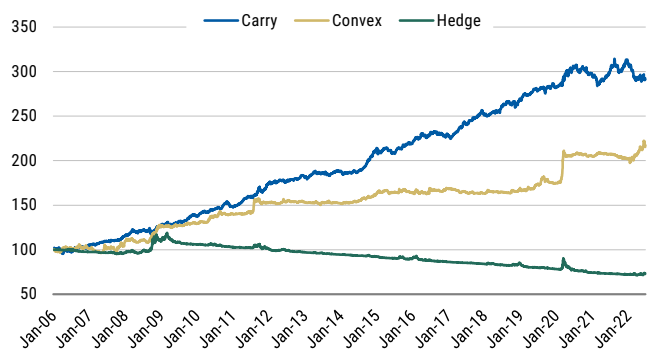
We first take a broad universe of systematic strategies in various asset classes (equities, commodities, rates, credit, FX) and styles (carry, value, momentum, quality, low risk, volatility, and others). Amongst this broad universe, our framework selects and classifies a subset of strategies into the 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 our objectives in framework design (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 (i.e., positive average returns when equities are down) 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

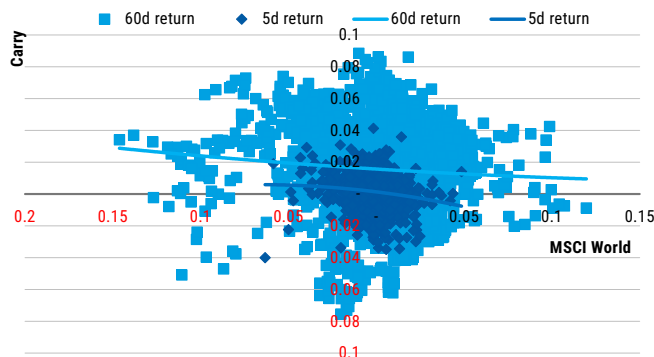
between price of the underlying derivatives and the equity market returns. Thus, while the hedge portfolio has a negative carry (CAGR of -1.8%, post in-sample volatility scaling to 5% annualized), it delivers reliability. Our convexity style portfolio has positive carry (CAGR of 4.7%, post in-sample volatility scaling to 5% annualized) 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.

Exhibit 3: Cumulative performance



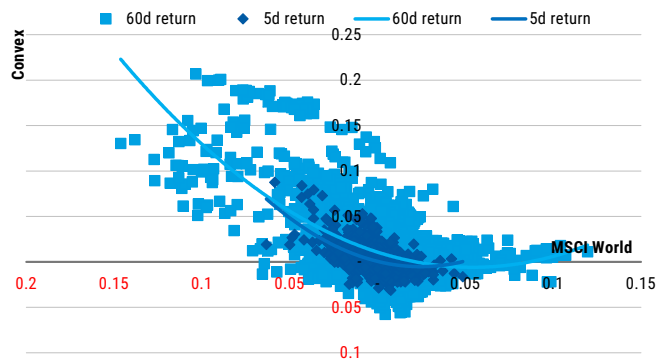
Source: Morgan Stanley Research, Bloomberg

Exhibit 4: Convexity chart for carry portfolio



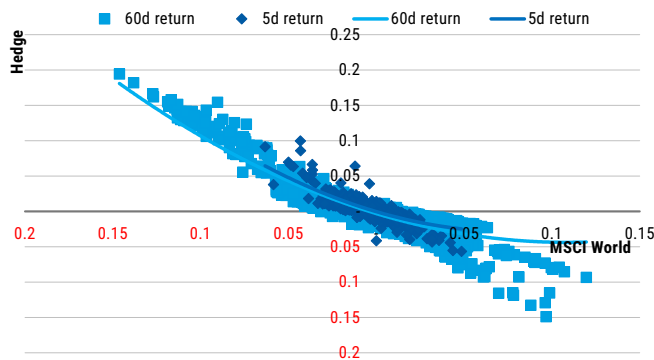
Source: Morgan Stanley Research, Bloomberg

Exhibit 5: Convexity chart for convexity portfolio



Source: Morgan Stanley Research, Bloomberg

Exhibit 6: Convexity chart for hedge portfolio



Source: Morgan Stanley Research, Bloomberg

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

- Flat to positive carry
- Reliable compensation for equity market losses in deep sell-offs

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. 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 (see Exhibit 7). Adding an overlay of 100% to the balanced portfolio significantly

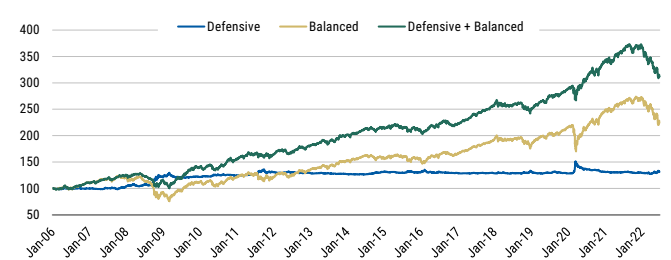
improves the reward-risk ratio (from 0.47 to 0.84). Furthermore, we see a substantial improvement of the maximum drawdown to volatility metric, which reduces in magnitude from -3.76 for the balanced portfolio to -2.66 when including the overlay.

Exhibit 7: 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 8: Cumulative return chart of defensive portfolio as overlay to an equity-bond base portfolio



Source: Morgan Stanley Research, Bloomberg

Exhibit 9: 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

In Exhibit 9, we find that the defensive portfolio has reliable positive returns in stress periods. 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. Nevertheless, this performance stands in stark contrast to the negative drift of traditional hedge portfolios in the long run. In fact, our framework is rather flexible and allows to 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 summary, this section illustrated how clustering can help achieve style portfolios with persistent return profiles. Backtesting shows that these style portfolios can be combined to achieve reliable defensive return profiles with positive carry.

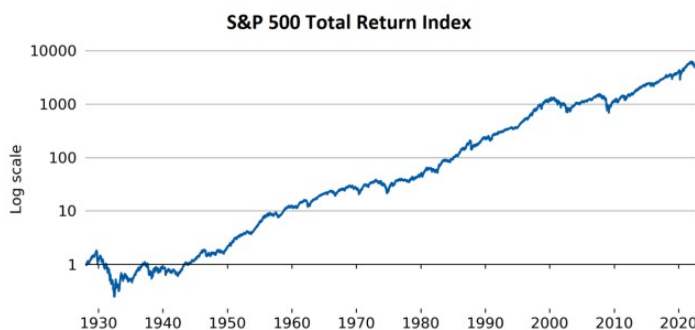
A note about backtesting: The performance data provided is a hypothetical illustration of mathematical principles, it does not predict or project the performance of an investment or investment strategy. Past performance is no guarantee of future results.

Dynamic hedging strategies

Empirical characteristics of equity market sell-offs

Investors may still be wondering if we can reduce the negative drift to hedging strategies (compare [Exhibit 3](#)). We find that a dynamic modulation of hedging exposures over time can help reduce the negative drift. We outline the process in this section.

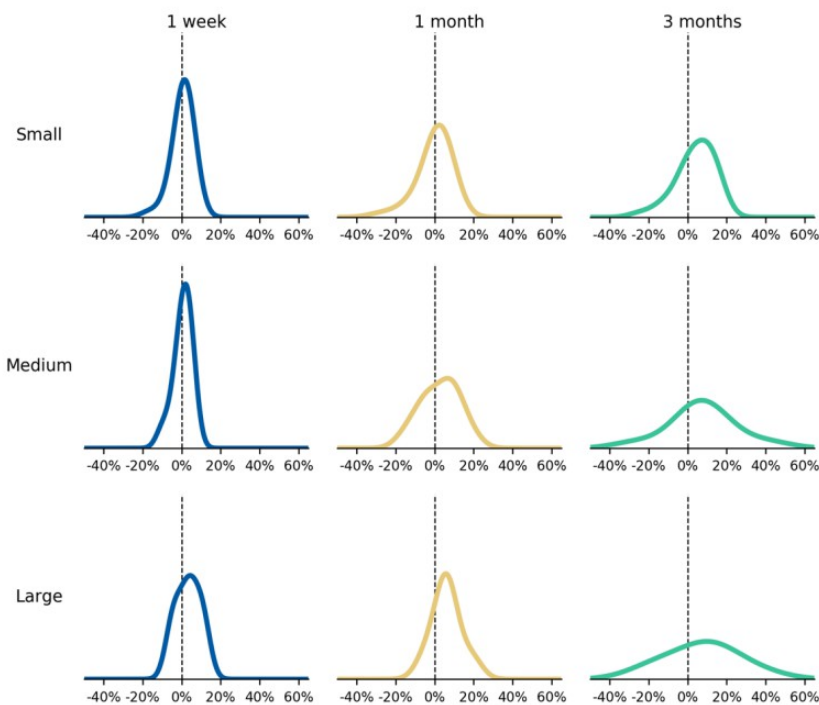
Exhibit 10: Long-run performance characteristics of the S&P 500 index



Source: Morgan Stanley Research, Bloomberg

Our starting point is the analysis of almost 100 years of S&P 500 performance (see [Exhibit 10](#)). We find that we can use past S&P 500 price action to construct conditional kernel distributions for expected returns of the index (see [Exhibit 11](#)).

Exhibit 11: Conditional return distributions of the S&P 500 over different holding periods



Source: Morgan Stanley Research, Bloomberg

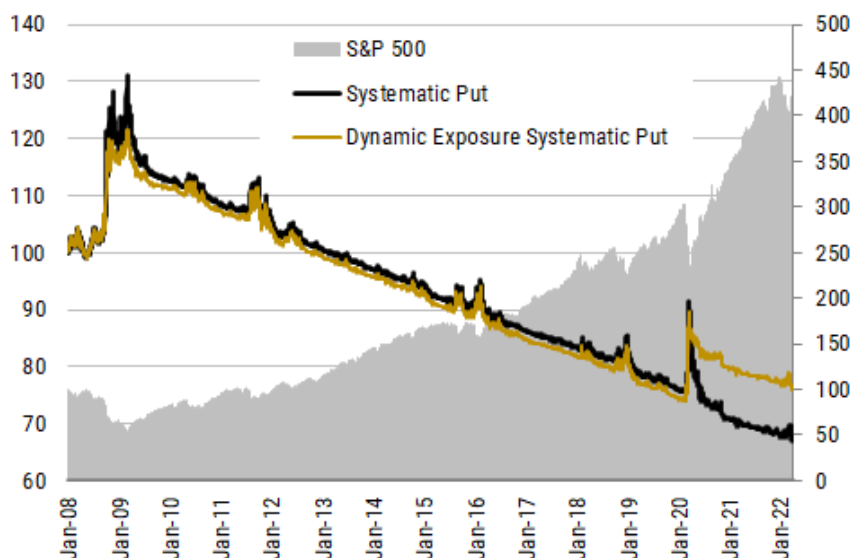
These conditional distributions are relevant as they allow us to change the exposures of our put hedges systematically to choose the right balance between defensiveness and negative carry. We note that these results hold generally for various equity indices and can be used as orientation points to think about hedges in equity markets across the globe.

Constructing dynamic systematic hedge strategies based on this information

Based on these insights, we modify a standard systematic put-buying strategy to dynamically adjust exposures. We use this modified put-buying strategy in our hedge style portfolio.

As illustrated in [Exhibit 12](#), using a systematic put buying strategy with dynamic exposures helps improve the overall performance of our hedge style portfolio. However, we want to emphasize that the backtesting period is rather short, as data availability constraints prevent us from backtesting further back. That said, running longer backtests with proxies confirms the benefits of dynamic exposures.

Exhibit 12: Payoff profiles of a hedge style portfolio with dynamic exposure for systematic long put component



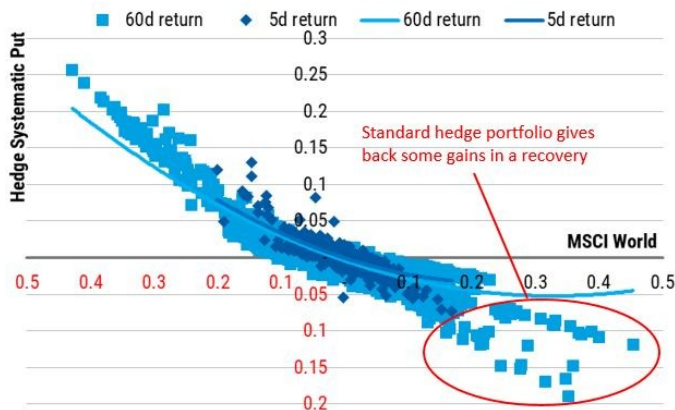
Source: Morgan Stanley Research, Bloomberg

From a visual angle, we find that in 2008 the performance of the hedge style portfolio with the dynamic hedge exposure is less defensive as markets draw down but gives up less when markets recover. After the COVID sell-off, the strategy preserves more of its gains with the dynamic approach. *While this improved performance is mainly driven by these two drawdown periods, approximations of the strategy further into the past confirm the benefits versus traditional hedge portfolios in the long run.*

Average returns increase from -2.4% per year for our base hedge portfolio to -1.7% for the dynamic strategy. The positive skewness of the strategy improves further when choosing a dynamic exposure approach (from 3.27 to 5.39). We show in [Exhibit 13](#) and

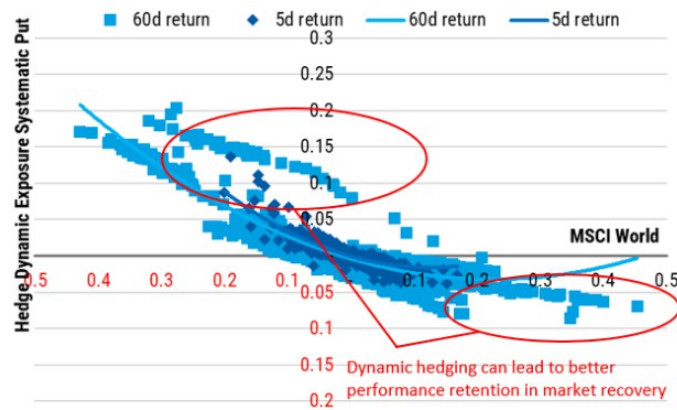
Exhibit 14 the convexity charts for our hedge style portfolios. For extreme negative market returns, we see that dynamic hedge exposures lead to loss in defensiveness: for equities down about 40% we gain in excess of 25% for the base hedge style portfolio but less than 20% for the dynamic hedge style portfolio. However, the dynamic strategy significantly outperforms in market recoveries where we lose the negative right tail from the base strategy. Furthermore, we preserve more returns in the mid ranges of MSCI returns. Thus, there is a trade-off between the negative drag and hedge reliability.

Exhibit 13: Convexity profile of hedge style portfolio: Base hedge portfolio



Source: Morgan Stanley Research, Bloomberg

Exhibit 14: Convexity profile of hedge style portfolio: Hedge portfolio with dynamic exposures



Source: Morgan Stanley Research, Bloomberg

This positive impact of the dynamic exposure also feeds through into the performance of the overall defensive framework (compare Exhibit 15). A dynamic hedge exposure leads to better Sharpe ratio (0.37 versus 0.47) and higher average returns (1.7% versus 2.1%). It has also a lower magnitude of maximum drawdown by volatility (-3.51 versus -1.94), while defensiveness in periods of equity market drawdowns is only marginally affected (MSCI downside beta changes from -0.24 to -0.26 for the dynamic approach).

There are also benefits to using a defensive overlay with dynamic hedge exposures when combining with a balanced portfolio. Dynamic exposure leads to stronger returns (from 7.0% to 7.5%). The return-risk ratio increases to 0.93 from the 0.84 baseline. The only downside is that the maximum drawdown to volatility ratio deteriorates when using the dynamic exposures – although results remain better than using no overlay.

Exhibit 15: Impact of dynamic exposures in a systematic long put strategy on the performance of a defensive framework

Statistics	Balanced	Defensive		Defensive + Balanced	
		Base Hedge	Hedge with Dynamic Exposure	Base Hedge	Hedge with Dynamic Exposure
		CAGR	5.0%	1.7%	2.1%
Annualized Vol	10.5%	4.5%	4.4%	8.4%	8.0%
CAGR / Vol	0.47	0.37	0.47	0.84	0.93
Max DD	-39.3%	-15.8%	-8.6%	-22.3%	-26.1%
Max DD / Vol	-3.76	-3.51	-1.94	-2.66	-3.25
Calmar Ratio	0.13	0.11	0.24	0.32	0.29
Sortino Ratio	0.65	0.59	0.78	1.22	1.37
VaR (1%, Monthly)	-9.9%	-2.8%	-2.3%	-5.9%	-5.9%
CVaR (1%, Monthly)	-14.7%	-3.8%	-2.9%	-7.3%	-8.1%
Hit Rate (Monthly)	63.3%	48.7%	49.5%	65.2%	65.4%
Skewness	-0.54	2.53	4.14	-0.05	0.30
Excess Kurtosis	11.61	53.07	87.75	8.05	9.25

Source: Morgan Stanley Research, Bloomberg

Conclusion

In this publication, we discuss 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.

In order to isolate the trade-off investors face more clearly, we classify 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 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: dynamic exposures in hedging strategies. This feature allows investors to trade off certainty in systematic hedges versus an improved carry characteristic. Our introduction to the topic showed attractive return features to a dynamic hedging approach. Please refer to our publication [Hedging 2.0 – Designing a Defensive Portfolio](#) for a deep dive.

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STOCK RATING CATEGORY	COVERAGE UNIVERSE		INVESTMENT BANKING CLIENTS (IBC)			OTHER MATERIAL INVESTMENT SERVICES CLIENTS (MISC)	
	COUNT	% OF TOTAL	COUNT	% OF TOTAL IBC	% OF RATING CATEGORY	COUNT	% OF TOTAL OTHER MSC
Overweight/Buy	1366	39%	318	42%	23%	593	39%
Equal-weight/Hold	1559	44%	357	47%	23%	708	46%
Not-Rated/Hold	0	0%	0	0%	0%	0	0%
Underweight/Sell	613	17%	91	12%	15%	226	15%
TOTAL	3,538		766			1527	

Data include common stock and ADRs currently assigned ratings. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months. Due to rounding off of decimals, the percentages provided in the "% of total" column may not add up to exactly 100 percent.

Analyst Stock Ratings

Overweight (O or Over) - The stock's total return is expected to exceed the total return of the relevant country MSCI Index or the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis over the next 12-18 months.

Equal-weight (E or Equal) - The stock's total return is expected to be in line with the total return of the relevant country MSCI Index or the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis over the next 12-18 months.

Not-Rated (NR) - Currently the analyst does not have adequate conviction about the stock's total return relative to the relevant country MSCI Index or the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Underweight (U or Under) - The stock's total return is expected to be below the total return of the relevant country MSCI Index or the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Unless otherwise specified, the time frame for price targets included in Morgan Stanley Research is 12 to 18 months.

Analyst Industry Views

Attractive (A): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be attractive vs. the relevant broad market benchmark, as indicated below.

In-Line (I): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be in line with the relevant broad market benchmark, as indicated below.

Cautious (C): The analyst views the performance of his or her industry coverage universe over the next 12-18 months with caution vs. the relevant broad market benchmark, as indicated below.

Benchmarks for each region are as follows: North America - S&P 500; Latin America - relevant MSCI country index or MSCI Latin America Index; Europe - MSCI Europe; Japan - TOPIX; Asia - relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

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