OneRiver
ASSET MANAGEMENT

Lifting the Veil on Tail

4,000% Returns, Attachment Points, Certainty, Positive Carry, and Other Things You Don't Need For Long Volatility to Improve Your Portfolio

June 2026

Patrick Kazley

With special thanks to Eric Peters, Pascal Spielmann, and Stephen Prajna for their useful comments.

The Benefits of Long Volatility Are Simple, But the Industry Confuses Things

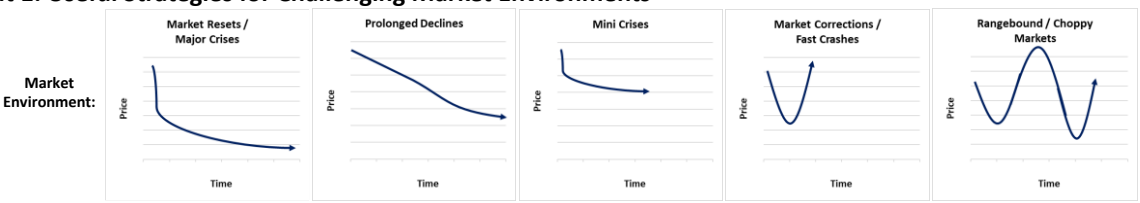
There's no such thing as certainty in payoff profiles, just like there is no such thing as "a" 10%, 15%, or 20% decline, but rather a myriad potential paths to get there. You may also have heard about some strategy that made 4,000% (or was it 6,000%?) in a month. That didn't happen. At least not in the way anyone would reasonably think about it. Lastly, the best way to construct a positive carry hedge is to add something to it that is procyclical, negatively skewed, and produces a positive average return. This aptly describes long equities, credit/duration risks, and/or levered carry, and is what you're protecting (and why you likely shouldn't add it to the hedge itself!).

The long volatility industry can't get out of its own way. At times, providers of such strategies unnecessarily complicate what should be a fairly simple premise. Drive fast (hold procyclical, negatively skewed assets, e.g., long equity beta and various forms of it), install good brakes (pair with highly asymmetrical, positively skewed highly capital-efficient, explicitly defensive strategies), and you might just win the race (maximize long-term compounded returns). Of course, there's nuance embedded within that metaphor – you should *drive faster* than you otherwise would (add more beta to the portfolio to compensate for beta drag), and ideally you should accelerate quickly after you've applied the brakes (rebalance convexity proceeds into risky assets along the way).

We've shown that this intuitive allocation theory is also supported empirically, which is why our firm's mission is to deliver lowly correlated, positively convex, capital-efficient solutions that are sufficiently liquid to be rebalanced with other betas to improve portfolios and generate superior long-term compounding.

Investors who explore risk mitigating strategies often begin by evaluating the various options (pun intended) for defensive strategies. We do our best to provide simple frameworks for defensive investing, namely by identifying the types of environments that would harm the return of an equity-centric portfolio and the types of strategies that can help fill in the potholes of foregone compounding **(Exhibit 1)**.

Exhibit 1: Useful Strategies for Challenging Market Environments



Outcomes	Market Resets / Major Crises	Prolonged Declines	Mini Crises	Market Corrections / Fast Crashes	Rangebound / Choppy Markets
++	Dynamic Convexity	Trend	Dynamic Convexity	Multi-Asset Protection	Systematic Macro
+	Multi-Asset Protection	Systematic Macro	Multi-Asset Protection	Systematic Macro	Multi-Asset Protection
neutral	Trend	Multi-Asset Protection	Systematic Macro	Dynamic Convexity	Dynamic Convexity
-	Systematic Macro	Dynamic Convexity	Trend	Trend	Trend
--					
Historical Examples:	• COVID Crash • 2008 Crash • 1987 Crash • Great Depression	• 2022 Decline • Tech Bubble Decline	• February 2018 Sell-off • August 2015 Sell-off • 2011 U.S. Debt Downgrade	• April 2025 • August 2024 • Q4 2018 • Euro Debt Crisis	• Mid 2018-2019 • Early 1990s • Late 1970s

Source: One River. For illustrative purposes only. Past performance does not guarantee future results.

The long volatility industry needlessly confuses the topic of hedging by not accurately addressing its expected benefit. Too often, allocators are forced to evaluate line items on a standalone basis instead of through the lens of how the Total Portfolio can benefit from it. This leads to the incomplete treatment of long volatility as an insurance policy with a defined cost, versus as a source of portfolio return enhancement. Rather than undergo the work of helping recalibrate expectations by explaining how long volatility can improve compounding through the addition of highly asymmetrical, convex, capital-efficient returns (in spite of potentially negative carry in non-crisis periods), many providers instead adopt this framework. However, because markets **do not offer** fully deterministic, explicit portfolio insurance at a viable cost, accommodating this mental framework does more harm than good.

The desire for long volatility to meet standalone return criteria, have an expected Sharpe ratio, or have attractive recent returns can prevent a sober analysis of its long-term expected total portfolio benefit. Evaluating long volatility should be simple: **does the total portfolio perform better with or without it over the long term?**

Ineffective Accommodations: The Distortion and Dilution of Long Volatility Objectives

To accommodate the desire to evaluate long volatility on a standalone basis (versus at the total portfolio level), long volatility managers are often forced to alter the way they would otherwise represent their value proposition. Specifically, we highlight three common accommodations in the long volatility industry that don't need to be made:

1. **Unrealistic Certainty** – "Attachment points", payoff profiles, and overconfident projections
2. **Unreasonable Returns** – +4,000 / -100% returns, arbitrary denominators, abandonment of compounding
3. **Counterproductive Additions** – Adding the problem to the solution, to engineer artificially positive carry

Unrealistic Certainty

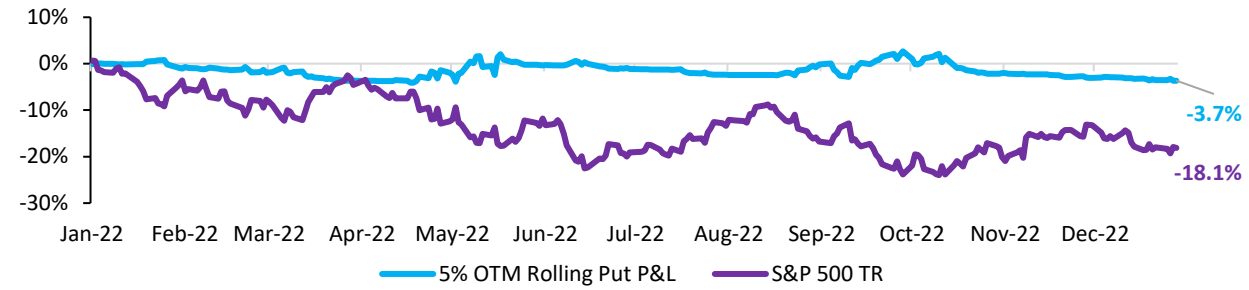
Years ago, we paraphrased Voltaire: *uncertainty* is an uncomfortable condition, but *certainty* is a ridiculous one.

Investors are necessarily confronted with uncertainty at all times, and ignoring it doesn't make it go away. It's also absurd to suggest that uncertainty has ever been fully removed from return-seeking behaviors.

Options fit well within the insurance metaphor for long volatility, in that investors pay a premium to secure a long option position (max loss = premium), and there is "certainty" in the payoff profile. Except, it's not certain at all.

Take for instance **Exhibit 2** below. This portfolio only buys and rolls monthly 5% out-of-the-money (OTM) S&P 500 put options, and yet declined nearly -4%, when the S&P 500 itself fell -18%. This is because when one buys an option, the payout is only guaranteed if the option is in-the-money *at the time of expiry*. Even if an underlying market moves in-the-money enough to also cover the premium spent on an option tied to it, the option may still be marked at a loss if there is time left to expiry. The various "Greeks" (delta, gamma, vega, theta, etc.) help describe the relationship between options pricing and the multi-faceted impacts of changes in price, volatility, and time.

Exhibit 2: 2022 Rate Hike Decline vs. 5% OTM Rolling Put Option P&L

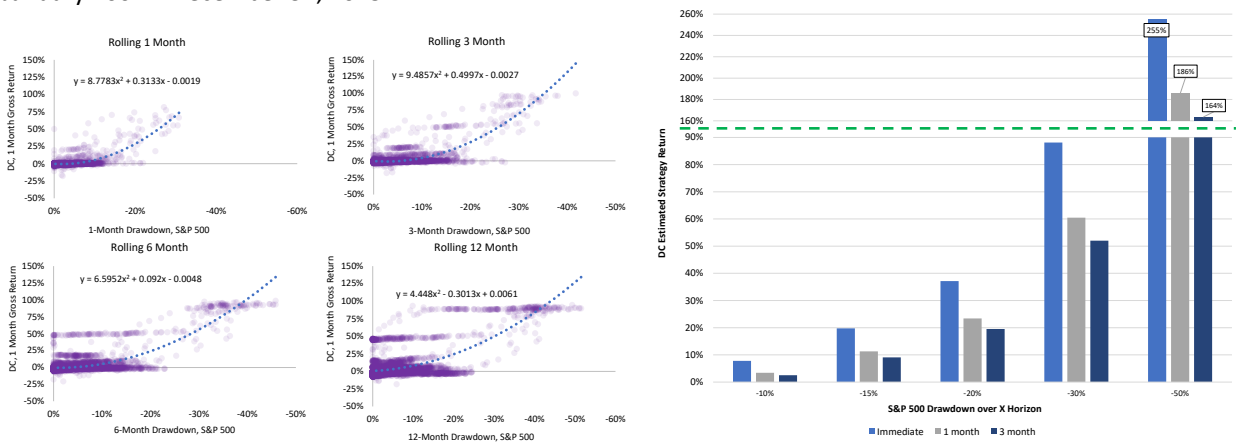


Source: One River, Bloomberg, CBOE. 5% OTM Put P&L is the PPUT Index minus the S&P 500 return. For illustrative purposes only. Past performance does not guarantee future results.

When explaining this path dependence risk and methods to mitigate it (e.g., a strip of options at different tenors, strikes, futures contracts, etc.), the allocation community instead anchors long volatility strategies to "attachment points", or the level of equity decline when a manager expects positive P&L. The issue with succinct answers to such questions is that they necessarily convey a false sense of certainty. The answer for any approach is that one can look backward and report historical attachment points (which aren't predictive), or one can make a host of assumptions as to the depth, breadth, and cadence of the future market declines and provide precisely incorrect estimates. Boards and CIOs categorically prefer precise estimates anyway, and so the market supplies them. The fewer caveats supplied, the higher the assumed reliability of the hedge.

In lieu of high certainty and attachment points, how does one develop expectations for convexity / defensiveness for a given market decline? First, it helps to understand what *types* of crises a given hedge should protect against (refer to **Exhibit 1** above), and then one can combine that qualitative understanding with empirical observations, accepting that there is inherent uncertainty. We often display something like **Exhibits 3 and 4** below to faithfully represent both our estimate and the necessary uncertainty surrounding it.

Exhibits 3 and 4: Dynamic Convexity (DC) Historical Convexity Generation Over Historical Market Declines
Left: Scatter Plots with Polynomial Best Fit Lines | Right: Discrete Bar Charts
January 2007 – December 31, 2025



One River, Bloomberg. S&P 500 uses the S&P 500 Total Return Index. This is a hypothetical illustration and does not constitute advice. The return simulation uses live returns when possible, and backtested returns when necessary. The below takes our live net-of-fee track record (which spans to April 2015), and our net-of-fee backtest (which goes until Jan 2007), and uses a polynomial regression of our process to various equity declines to estimate the return profile of -10%, -15%, -20%, -30%, and -50% declines across immediate, 1-month, and 3-month time frames. Past performance does not guarantee future results.

Unreasonable Returns

Month 1: -60%, Month 2: +4,000%, Month 3: -100% return. Total return= -100%.

Many providers who generate return streams that look like the above claim to provide return-enhancing characteristics. While we don't challenge the benefits that positive convexity, positive skewness, and negative equity correlation can deliver to a portfolio, we do question such a methodology for reporting realized returns.

The capital-efficiency of options and derivatives is mostly to blame. The episodically high compensation that defensive derivatives deliver more than compensates for their long-term cost, and they tend to expand meaningfully more than equities contract. If one were to perfectly time entry into a defensive strategy like long volatility and buy it the day before a major market disruption, the return on encumbered cash per time invested would be comically high. Of course, no one is that skilled, nor is it likely they are that lucky. A longer-term analysis shows a far tougher journey of long periods of small losses (hopefully compensated at the total portfolio level by a higher exposure to equity risk elsewhere), until a chaotic disruption occurs.

Setting aside nuance in return reporting, for managers running a fund with audited financial statements, the denominator is generally the AUM of the strategy, and the numerator is the cash P&L. As shown in **Exhibit 5** below, a single 15% OTM option with a 40% return on notional produces a 6,900% return on initial premium spend. Of course, the same option in a multi-period context with premium in the denominator routinely delivers -100%. While the dollar P&L over time might still sum positively, there is no circumstance in which reporting the 6,900% return provides additional clarity on strategy efficacy. But it certainly garners attention, which is likely the intention.

These defensive strategies may still provide meaningful portfolio benefit, although sorting through such unique reporting methodologies makes that determination quite difficult. This table also highlights an additional point regarding the unreasonable uncertainty mentioned above. The concept of "Equity Notional Protected" is typically synonymous with "if every option in the portfolio teleports to expiry and prices fall by X%, then a portfolio of $Y size is "protected". As seen below, this concept also falls victim to many generous assumptions and lack of clarity. Even though it's convenient to conclude below that a **$5k premium** spend fully protects **$845k** of equity notional below, that summary doesn't accurately capture the (almost all) paths where that isn't the case.

Exhibit 5: Simple Put Option P&L by Option Notional vs. Premium Spend at Time of Expiry

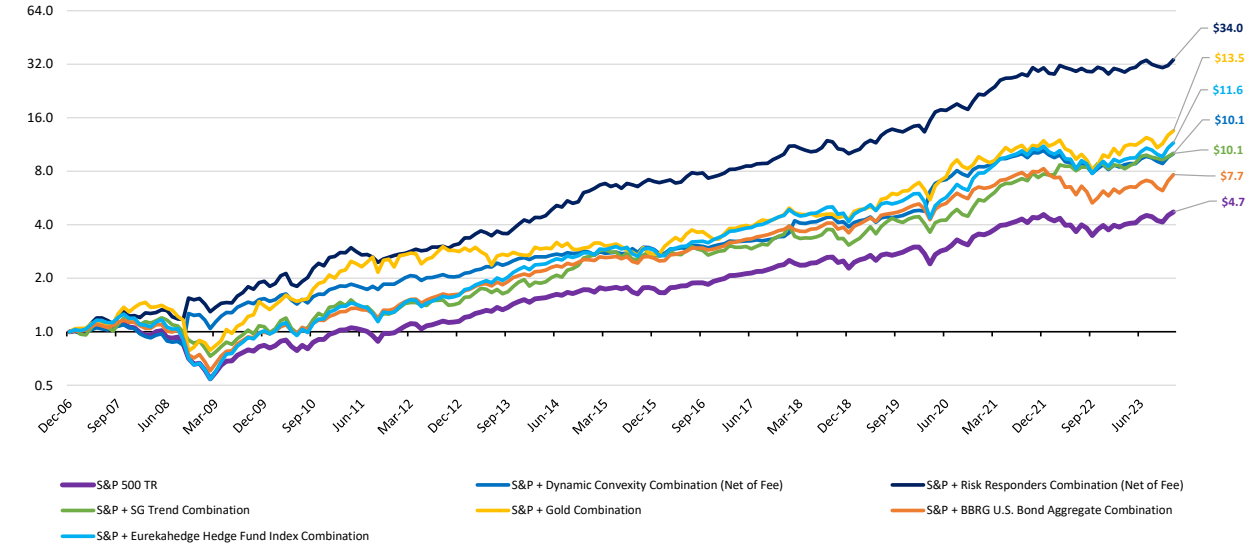
(A) Equity Last PX	(B) Strike	(C) Lots / Contract	(D) # of Options	(E) Premium Cost	Initial Moneyness = (B/A)-1	Premium Cost = (C*D*E)	Unadj.Option Notional = (B*C*D)
$1,000	$850	100	10	($5.0)	-15%	($5,000)	$850,000

% Move in Underlying	$ Price of Underlying	Premium Cost	$ Option P&L	% Return on Premium Spend	% Return on Option Notional	Equity Notional Hedged?	Equity Notional Protected?
20%	$1,200	($5,000)	($5,000)	-100%	-0.6%	$0	$845,000
15%	$1,150	($5,000)	($5,000)	-100%	-0.6%	$0	$845,000
10%	$1,100	($5,000)	($5,000)	-100%	-0.6%	$0	$845,000
5%	$1,050	($5,000)	($5,000)	-100%	-0.6%	$0	$845,000
0%	$1,000	($5,000)	($5,000)	-100%	-0.6%	$0	$845,000
-5%	$950	($5,000)	($5,000)	-100%	-0.6%	$0	$845,000
-10%	$900	($5,000)	($5,000)	-100%	-0.6%	$0	$845,000
-15%	$850	($5,000)	($5,000)	-100%	-0.6%	$0	$845,000
-20%	$800	($5,000)	$45,000	+900%	+5.3%	$225,000	$845,000
-25%	$750	($5,000)	$95,000	+1,900%	+11.2%	$380,000	$845,000
-30%	$700	($5,000)	$145,000	+2,900%	+17.1%	$483,333	$845,000
-35%	$650	($5,000)	$195,000	+3,900%	+22.9%	$557,143	$845,000
-40%	$600	($5,000)	$245,000	+4,900%	+28.8%	$612,500	$845,000
-45%	$550	($5,000)	$295,000	+5,900%	+34.7%	$655,556	$845,000
-50%	$500	($5,000)	$345,000	+6,900%	+40.6%	$690,000	$845,000
-55%	$450	($5,000)	$395,000	+7,900%	+46.5%	$718,182	$845,000
-60%	$400	($5,000)	$445,000	+8,900%	+52.4%	$741,667	$845,000
-65%	$350	($5,000)	$495,000	+9,900%	+58.2%	$761,538	$845,000
-70%	$300	($5,000)	$545,000	+10,900%	+64.1%	$778,571	$845,000
-75%	$250	($5,000)	$595,000	+11,900%	+70.0%	$793,333	$845,000
-80%	$200	($5,000)	$645,000	+12,900%	+75.9%	$806,250	$845,000
-85%	$150	($5,000)	$695,000	+13,900%	+81.8%	$817,647	$845,000
-90%	$100	($5,000)	$745,000	+14,900%	+87.6%	$827,778	$845,000
-95%	$50	($5,000)	$795,000	+15,900%	+93.5%	$836,842	$845,000
-100%	$0	($5,000)	$845,000	+16,900%	+99.4%	$845,000	$845,000

One River. Past performance does not guarantee future results. This is a hypothetical illustration and does not constitute advice.

The solution to reporting results is simple – report them the same way you do for everything else. AUM is the denominator (for an SMA, a normalized "trading level" that represents an AUM works just as well), and report a normal asset-based return on that trading level or AUM. This makes geometric returns (i.e., multi-period returns) calculable, and puts all return sources in the portfolio on an apples-to-apples basis. **Exhibit 6** below is taken from our Convexity, Correlation, and Compounding piece. Returns presented in such a manner are interpreted the same way any line item is: cash in, cash out.

Exhibit 6: Cumulative Growth of $1 of S&P 500 vs. Combination Portfolios (S&P 500 + Overlay), Log-Scaled
January 1, 2007 – December 31, 2023



Source: One River, Bloomberg. The S&P 500 returns used are the S&P 500 Total Return Index. The Gold returns used are the SPDR Gold Shares ETF. U.S. Bonds returns used are the Bloomberg U.S. Aggregate Bond Index. The One River returns use live gross returns when possible, and backtested gross returns when necessary. The Risk Responders strategy combines Systematic Trend, Systematic Alternative Markets Trend, and Dynamic Convexity. The Systematic Trend fund begins live returns in April 2015, the Dynamic Convexity begins live returns in April 2015, and Alternative Markets Trend begins live performance in November 2019. Performance before those strategy inception dates is backtested, and subject to normal backtest limitations. Please see important disclaimers in the appendix. Past performance is not a guarantee of future results.

Counterproductive Additions

Explicit hedges don't need to carry positively to help the portfolio. That's different than saying a hedge can't have a long-term positive average return (which often we have observed). Carry is defined by nothing happening, *except for the passage of time.* An explicit hedge tends to pay off *if something divergent from expectations occurs,* and tends to cost something if it doesn't. With skill, one can limit losses and embed extreme asymmetry in those respective outcomes (reflected in positive return skew, such as Dynamic Convexity's ~20+ daily return skew). The opposite of the above is true for procyclical assets like equities, which have positive expectancy unless something divergent happens, and thus deliver negatively skewed returns (larger magnitude of losses versus gains, when they occur). The skill in hedging therefore lies in generating sufficient asymmetry, such that the combination of your hedge and equities can outperform equities standalone – what we refer to as the Long Volatility Premium.

Negative carry doesn't mean negative long-term compounded return – nor does it mean something isn't expected to make money for the portfolio. The lack of appreciation for this distinction is one of the reasons why long volatility works. Investors overly fixate on frequency of returns, and tend to overlook the skewness and magnitude of returns. In the wake of this inefficiency lies a category of strategies that are positively convex, positively skewed, negatively correlated, perhaps negative carry, and yet help generate higher returns at the total portfolio level.

Such returns necessarily tend to carry negatively in benign environments, even if they make enough in other periods to fully compensate for the frequent negative observations. **Not that it matters if they do** - one doesn't need a positive return from long volatility in order for the portfolio to make money from it. As we have shown, provided there is sufficient convexity, negative correlation, capital-efficiency, (and ideally rebalancing) one can improve portfolio compounding even if that return is negative returning on a standalone basis!

Allocators with the longest time horizon, even those in possession of truly permanent capital, tend to have a 3-to-5-year evaluation horizon for allocations. **No amount of empirical evidence, paper writing, or thoughtfulness will materially extend this horizon, as it is part of the fabric of what makes us human.** More practically, investment

professionals managing capital often derive compensation formulaically from a specific return period. There's not a single allocator we've met that is paid on rolling 20-year outcomes, nor on maintaining the best ex-ante allocation.

To help long volatility survive such rolling windows of scrutiny, allocators and managers alike often overlay dynamic volatility selling, levered carry, or other market neutral strategies with a negative skew profile atop their explicit defense. In theory, **this could be fine** if one still achieves their desired total portfolio weight to explicit forms of defense, but in practice, we often see the defensiveness reduced to make room for more negatively skewed carry, which can directly impede (and can fully offset!) the intended benefits of defensive investing.

Fix the Evaluation Criteria, Remove the Confusion

Allocators are the coaches of their portfolio – they decide who is on the field, and how much playing time each player gets. Explicit hedges are like a goalie in soccer. If you evaluate a goalie by number of goals scored, you don't understand the game. But if you're watching closely, it's easy to see the value of having a goalie. It may not always reflect in the score, but if you removed the goalie and played the same game, the benefit would become apparent.

The more dominant the attackers and midfielders become over stretches of time (i.e., periods of tremendous equity strength), the less useful the defenders and goalie seem to the objective of winning the game. The knowledgeable observer of the game understands that eventually every great offense needs defensive tools, even if just to push the ball back up the field to the goal-scoring players (rebalance convexity proceeds into equities).

You don't need to come up with advanced metrics to justify the inclusion of the goalie, you just need to ensure that your defense and goalie are equipped to handle a wide array of potential attacks. You have little idea heading into the next game how much that goalie will be tested. You also wouldn't ask a goalie that hasn't seen many shots on goal recently to practice taking shots of his own to keep him on the roster – you have different players for that[1].

In investing, it's even easier than this. There's no restriction or rulebook preventing you from playing with more than 11 players at a time through prudent portfolio leverage. One can add an additional defender without removing a player from an offensive position. And we argue that one should do exactly that.

Defensive investing is under-allocated to for psychological, and not investment reasons. Luckily, that means the "room" one needs to create in their portfolio for defensive investing is more of a mindset and less of an investment compromise. Long volatility investing in particular isn't an insurance policy – it's a form of alpha delivered in the form of asymmetry that is extracted from the market at times of greatest stress for other procyclical bets.

To evaluate success over time, one simply needs to observe their portfolio's long-term return without defensive overlays, and compare it to a portfolio with such overlays.[2] If the protected portfolio outperforms the unprotected portfolio, then you've clearly benefitted from defensive investing. Changing the evaluation criteria for long volatility to this type of **total portfolio lens** is how one avoids the common pitfalls of requiring unrealistic certainty, unreasonable returns, and counterproductive additions from strategies that don't need them.

[1] And yet, we commonly observe allocators pivoting long-term long volatility allocations into beta-enriched solutions or multistrategy solutions, which typically increase procyclicality without a commensurate increase in long volatility exposure. This ends up reducing long volatility exposure at the total portfolio level.
[2] **Exhibit 6** demonstrates such an analysis. The compounding impact can be profoundly additive to a portfolio over time. In one of our papers, we demonstrate that even a 0% full sample return from Dynamic Convexity delivered a ~+100% return premium above equities from 2007-2023 when rebalanced alongside equities.

Disclaimers

Past performance is not necessarily indicative of future results.

The information contained in this presentation is intended for use by accredited investors and qualified eligible clients. Futures, forward and options trading is speculative, involves substantial risk of loss and is not suitable for all investors. This information is not a solicitation for investment. Such investment is offered on the basis of information and representations made in the appropriate offering documentation. To the extent that this presentation contradicts the offering documentation, the offering documentation will govern in all respects.

The information and opinions contained in the material (the "Information") includes various forms of performance analysis, security characteristics and securities pricing estimates for the securities addressed as well as credit reports relating to underlying securities. Please read and understand this entire statement before using this Information. The Information is illustrative and is not intended to predict actual results which may differ substantially from those reflected in the Information. Any performance analysis contained herein is based upon assumptions about future market values which may prove to be different from the assumptions. You should understand the assumptions and evaluate whether they are appropriate for your purposes. Results are based upon mathematical models that use inputs to calculate results. As with all models, results may vary significantly depending on the value of the inputs given. Inputs to these models include, but are not limited to, interest rate assumptions, collateral assumptions and default assumptions. Please contact the investor relations team for detailed explanations of any modeling techniques employed in the Information.

The Information has been obtained from sources that we believe to be reliable. It is provided to assist interested parties in making a preliminary analysis of the Information and does not purport to be all-inclusive or to contain all of the information that a prospective investor may require to make a full analysis of the Information. We have not verified any of the Information and assume no responsibility for the accuracy or completeness thereof. The Information is for discussion purposes only and it does not constitute either an offer to sell or the solicitation of an offer to buy any security or other financial instrument. Any such offer or solicitation may only be made by means of offering documentation, which will be made available upon request. The Information does not purport to identify or suggest all of the risks (direct and indirect) that may be associated with any proposed investment. The Information is qualified in its entirety by the information to be contained in the offering documentation, which will supersede, in its entirety, the Information. Please note that the Information is being provided to you because we believe (based on statements and other indications you have provided) that (i) you have sufficient knowledge, experience and professional advice to understand and to make your own independent evaluation of the merits, risks and suitability of making an investment of these types, (ii) you are not relying on ONE RIVER ASSET MANAGEMENT for information, advice or recommendations of any sort, except factual information, about the terms of any proposed investment, and (iii) you have sufficient financial wherewithal to accept the risks of the transaction. ONE RIVER ASSET MANAGEMENT does not give any tax, accounting, legal or regulatory advice to you and you should satisfy yourself in this regard and ensure that you consult with appropriate advisors to assist in understanding the transactions contemplated by this document.

Use of indices: Any indices and other financial benchmarks shown are provided for illustrative purposes only, are unmanaged, reflect reinvestment of income and dividends and do not reflect the impact of advisory fees. Investors cannot invest directly in an index. Comparisons to indexes have limitations because indexes have volatility and other material characteristics that may differ from the One River Funds.

Prior to December 2019, the Dynamic Convexity Strategy returns reflect the actual returns of the strategy within a One River managed SPC (Segregated Portfolio Company). Returns for the SPC are available upon request. Prior to December 2019, operating expenses are excluded for the net return calculation. The Dynamic Convexity SP caps expenses at 35 bps if AUM is above USD 250 million.

HYPOTHETICAL PERFORMANCE RESULTS HAVE MANY INHERENT LIMITATIONS, SOME OF WHICH ARE DESCRIBED BELOW. NO REPRESENTATION IS BEING MADE THAT ANY ACCOUNT WILL OR IS LIKELY TO ACHIEVE PROFITS OR LOSSES SIMILAR TO THOSE SHOWN. IN FACT, THERE ARE FREQUENTLY SHARP DIFFERENCES BETWEEN HYPOTHETICAL PERFORMANCE RESULTS AND THE ACTUAL RESULTS SUBSEQUENTLY ACHIEVED BY ANY PARTICULAR TRADING PROGRAM. ONE OF THE LIMITATIONS OF HYPOTHETICAL PERFORMANCE RESULTS IS THAT THEY ARE GENERALLY PREPARED WITH THE BENEFIT OF HINDSIGHT. IN ADDITION, HYPOTHETICAL TRADING DOES NOT INVOLVE FINANCIAL RISK, AND NO HYPOTHETICAL TRADING RECORD CAN COMPLETELY ACCOUNT FOR THE IMPACT OF FINANCIAL RISK IN ACTUAL TRADING. FOR EXAMPLE, THE ABILITY TO WITHSTAND LOSSES OR TO ADHERE TO A PARTICULAR TRADING PROGRAM IN SPITE OF TRADING LOSSES ARE MATERIAL POINTS WHICH CAN ALSO ADVERSELY AFFECT ACTUAL TRADING RESULTS. THERE ARE NUMEROUS OTHER FACTORS RELATED TO THE MARKETS IN GENERAL OR TO THE IMPLEMENTATION OF ANY SPECIFIC TRADING PROGRAM WHICH CANNOT BE FULLY ACCOUNTED FOR IN THE PREPARATION OF HYPOTHETICAL PERFORMANCE RESULTS AND ALL OF WHICH CAN ADVERSELY AFFECT ACTUAL TRADING RESULTS.