Monetization Matters: Active Tail Risk Management and the Great Virus Crisis

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LongTail Thinking

When considering actively managed tail risk hedging strategies, whether on the "left" or the "right" side, we believe investors are faced with two potential benefits. First, a portfolio with tail risk hedges may have a more attractive risk-return profile, ex-ante, than a simple buy-and-hold portfolio. This is because left and right tail hedging potentially cushion against large drawdowns and draw-ups, and also provides the "cover" to hold aggressive positions that might otherwise be forcibly liquidated at the wrong time, locking in losses or leaving gains on the table. Second, active management of hedges may provide liquidity that might be used to purchase cheap assets in periods of crisis, or generate excess returns in melt-ups, thus further improving the ex-ante long-term return potential of the portfolio.

Thus we believe that even though passively held tail hedges can improve the distribution of portfolio returns, when passive tail hedging is supplemented with active management, the overall performance of a tail hedging program can further improve long-term portfolio outcomes. It is important that when properly implemented, a tail hedging program simultaneously focuses on both the tail hedges and the underlying portfolio that the hedges are hedging.

Monetization refers to decision-making that results in the full or partial sale of a hedging position that has appreciated in price. Thus monetization implies both the presence of a degree of active management and an element of timing. Since tail hedging costs premium, the active management approach is essential to reducing the long-term cost of hedging, while at the same time potentially improving portfolio performance over time despite this cost. Properly implemented and managed, we believe that tail hedging can not only reduce the risk of permanent loss of capital in investment portfolios, but also improve performance, and indeed returns, if it is appropriately included in the portfolio construction process.

While we do not believe that we, or for that matter, other investors, have the ability to consistently forecast market direction, we do believe that for options portfolios, which consist of naturally time-decaying assets, partial or full monetization can add substantial value over time without having a crystal ball. Such value add can come either from cost reduction over time, or for the same cost, increased potential convexity of the hedges. This is primarily because options are time-decaying assets which obtain their value from both the movements in the underlying and change in volatility. In order for an option to deliver large, convex returns after a large move in the underlying or a large increase in volatility, appropriate

attention has to be paid for the increased time decay after such an event. This results in a very high hurdle to make the decision to hold an option after a substantial increase in value, because the time-decay is now a larger, competing drag on the value of the option.

To show the importance of these facts empirically, in a previous article titled "Offensive Risk Management II: The Case for Active Tail Hedging" (Bhansali [2010]), it was demonstrated with reference to a very long term history of the S&P 500 that monetization of left tail hedges was an attractive strategy to extract value from tail risk hedges. In that paper, the monetization rules were backfilled using an idealized, theoretical model for equity index options, including for periods when equity index options did not trade (e.g. in the 1930s). The main conclusion of that paper was that for a long historical period there is a tradeoff between systematic monetization thresholds, i.e. the "multiples" at which monetization is done, and the "waiting time", i.e. the time period one has to wait to recoup the tail hedging premium. That article was published in the present journal in the aftermath of the "GFC", the Great Financial Crisis of 2007-2009.

The current article extends the analysis of the second point to the latest financial market crisis, which some have labelled the "GVC", or the "Great Virus Crisis", and the subsequent rebound in the markets on the back of unprecedented monetary and fiscal stimulus. While in the previously mentioned article we showed that in the context of the almost 100 year history of the Standard and Poor's indexed market data, one can justify intuitive, systematic rules of thumb for monetization that are consistent with the cyclical behavior of the economy and the markets, in this article we further illustrate the actual experience from both the "rules of thumb", and systematic monetization strategies as actually managed[1].

Further, we do not believe tail hedging and active management ought to be limited only to the "left" side. In this paper, we also extend the concept of active monetization to the "right" side, i.e. the management of tail hedges when markets are "melting-up". The need for right side tail hedging was discussed in another paper in this very journal just a couple of years ago (Bhansali [2018]), and the sharp rebound following the melt-down of March 2020 shows the need for continued attention to the right tail as well. In a world of heightened volatility, dominant presence of electronic market makers, and surprises emanating both from monetary and fiscal policy, we anticipate increased jumps in markets, which lead us to the belief that risk management with options, and active management of these option positions is likely to become more important than it has been in the past.

In order to be transparent and illustrative, we have kept this paper empirically focused. Much of what we describe here can be theoretically validated by manipulation of standard option pricing formulas.

[1] While all data presented related to monetization strategies are from actual experience, in order to maintain confidentiality the size of the monetization strategies, exact timing and other details are not provided here.

1. Why Monetization Matters

To put this discussion in the proper context, and also to show why active management of tail hedges is quite similar to techniques already in use in asset allocation, we first emphasize that any tail hedging strategy should be thought of as both part of, and itself, a dynamic asset allocation decision. For tail hedges, all else being equal this means that hedges, just like other return seeking or diversifying assets, should be bought when they are cheap, and sold when they are expensive. There is nothing pristine about buying and holding hedges to expiry, just as there is nothing sacred about holding a bond to its maturity despite large fluctuations in yield levels.

Thus we think of monetization as a critical decision that allows investors to approach both their option portfolio in isolation, and as a part of the larger investment portfolio, as a decision that allows for a potentially increased "total return" of the portfolio over time.

For traditional asset allocation decisions, one may select from a plethora of metrics to improve the posture of the portfolio. For instance, one can use the simple rule that in order to change the asset allocation, total expected return after the change is higher than prior to the change. Another useful metric is that total volatility after the adjustment is lower than prior to the change. Combining these two, the most often used metric is one that targets an increase in the risk-adjusted return (or Sharpe ratio) of the portfolio after making the change.

For tail risk hedging, we can follow a parallel approach. Since the two key parameters of a tail hedge are the expected maximum payoff under various rare and severe scenarios, as well as the "premium" or time-decay of options (also known as the "burn" rate), we can optimize the portfolio by maximizing the maximum expected payoff for certain scenarios, minimizing the burn rate, or by maximizing the ratio of the maximum expected payoff per unit of time decay. If we think of the value of an options-based tail risk hedge as being driven by the "delta", (i.e. change in the option price due to the change in the underlying), and the "vega", (i.e. change in the option price due to the change in the implied volatility of the underlying asset), then we can see that such monetization rules can be designed as a function of the level of the market and the implied volatility.

The immediate benefit of looking at a tail risk hedging strategy from an asset allocation perspective is that all the knowledge of asset allocation and rebalancing gained by practitioners over the years can also apply to this (hedging) asset. The key qualitative difference is that since monetization rules are more a function of high severity, low probability events which happen rarely, the monetization rules become event driven, not time driven. The potential gain from the hedges may emerge both from the options going close to "in-the-money", which is rare given that we are working with catastrophic events, but also from the rising value of the tail risk asset as the perception of risk rises, i.e. from an increase in volatility.

A properly implemented tail hedging strategy is far from passive. First, the investor has to purchase the insurance when it is cheap, both in terms of its real-world value in the context of possible scenario shocks, and also relatively cheap with reference to other hedges from related markets. Second, the investor has to actively monetize and exchange hedges for cheaper hedges when they pay-off. Unless this is done, the existing hedge may rapidly lose

its value. When held to maturity without active management, the value of the hedge may go to zero if it is still out-of-the-money, so a purely passive tail hedging strategy would contribute nothing more than a negative return equal to the premium paid for the hedge. This is one reason why passively managed tail hedges continue to be demonized by many writers who routinely write papers looking only at passively implemented tail hedges.

In the not so distant past, bonds were also bought and held to maturity, in which case the maximum total return achievable on the bonds is no more than the yield to maturity. However, active bond managers discovered that by buying bonds when yields were very high and selling them when yields were very low, one could potentially generate returns in excess of the buy and hold yield. We find that actively managed tail hedging is undergoing a similar change in philosophy. *Monetization matters,* i.e. by actively managing tail risk hedges, the total return of underlying portfolios can be improved substantially.

To illustrate these results with a numerical example, let us revisit the investor initially discussed in Bhansali [2010] who purchases a tail risk hedge on a security whose current spot price is $100 and who buys a hedge against losses beyond 15% for the next year. Assume that the deposit rate is 1% and the Black-Scholes implied volatility is 20%. The price of the 15% out of the money "put" in the Black-Scholes world is $1.97.

In order to see the effects of increases in market risk-aversion on the value of the option, assume that a shock occurs before the expiration of the option. Suppose that one month following the purchase of the option the equity market trades down to $90. Because investors become increasingly risk averse as the equity market sells off, assume the implied volatility parameter rises from 20% to 30%. Following this equity market shock, assume that the market settles down at $90 for the remainder of the year, so that the put option expires worthless. Furthermore, since the equity market is assumed to settle at $90, let's assume that the implied volatility of the option slowly reverts back to its initial value of 20%.

The effect on price from implied volatility can be extremely large depending on the time left to maturity. When volatility jumps to 30%, the value of the put option doubles relative to the value of the put option when implied volatility is held at a constant 20% throughout. As the implied volatility slowly reverts to the initial level of 20%, the value of the put option decays rapidly and converges to the value of the constant 20% volatility put option. Finally, due to the fact that the option expires out-of-the-money, in both cases the value of the option converges to zero, despite having been worth more than four times the purchase price within the year. Clearly, in hindsight it would have made sense for the investor to sell the option when it was priced high and invest part of the proceeds in another option, and the remainder in the market. This would be a systematic "rebalancing" strategy, where the proceeds from monetization were redeployed into the equity markets at a cheaper price when the risk-premium was higher. If the market eventually reverted back to its pre-crash level, the portfolio would have realized additional return due to the rebalancing done near the lows. A more defensive strategy would have been to monetize the option when its value had increased, and keep the proceeds in cash, thus avoiding the time-decay incurred by holding the option to expiration.

2. Historical Performance of Monetization Strategies

We will first visit the impact of monetization during some past historical episodes in this section, and then discuss the experience during the most recent crisis surrounding the COVID-19 pandemic in the section to follow. Exhibits 1-3 are in the context of a left tail hedging strategy that purchases one-year 20% out of the money put options on the S&P 500 Index every quarter each on ¼ notional. Exhibits 4-5 are in the context of a right tail hedging strategy that purchases three-month 5% out of the money call options on the S&P 500 Index every month each on 1/3 notional.

In Exhibit 1 we examine the period surrounding the dotcom meltdown. There are two variables that are relevant in these charts. First, we need to define the monetization "threshold". We define this in terms of the multiple of the initial value of the option at which monetization occurs. For instance, "3x" means that the monetization occurs when the value of the options reach or exceed three times their original price. Second, we need to specify how much to monetize and what to do with the monetization proceeds. For the charts attached, we assume a 50% monetization, i.e. half of the positions are liquidated once the monetization threshold is hit, and the cash is re-deployed at that time. In the case of the left tail, the monetized cash is re-deployed into the equity markets, and in the case of the right tail, it remains in cash. While there is nothing sophisticated about the 50% monetization, this simple choice illustrates the tradeoffs between the no-monetization strategy and the strategy of monetizing at different payoff multiples, which is the main focus of this empirical study.

Comparing the no-monetization line with partial monetization at different multiples, we see that in the 1999-2003 "dotcom bust" period all monetization rules are better than no monetization, in terms of retaining value of the options. Of course, ex-ante monetization is not a free lunch since the market can continue to fall further after the monetization, but the reduction in peak multiple payoff realization from monetization in most cases is quite small relative to no monetization. This can be traced back to the fact that the time decay penalty of an appreciated option is much larger after the event than before the event, and also extremely sensitive to subsequent movements of the underlying.

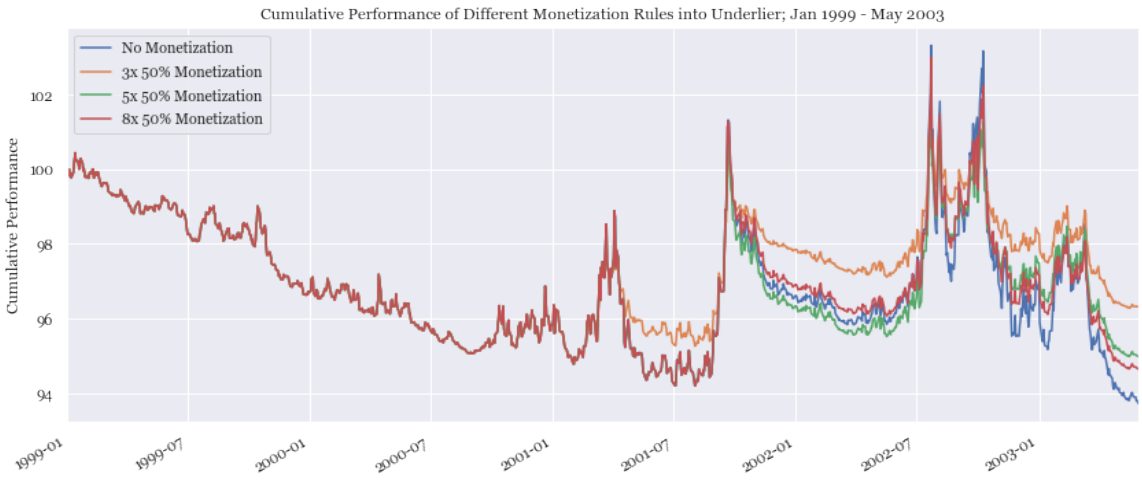

Exhibit 1: Impact of partial monetization of left tail hedging strategy during the dotcom bust.
Source: LongTail Alpha, OptionMetrics.

A slightly different pattern emerges when looking at the impact of monetization during 2008-2009 (GFC), where the 8x monetization retains more of its value than the 5x monetization, which retains more of its value than the 3x monetization. In contrast, the episodes that followed the XIV inverse ETN blowup of February 2018 and the pivot by the Fed in December 2018 are displayed in Exhibit 3 and shows that monetizing at 3x resulted in much better retention of tail hedging values than the 5x, 8x or no moentizations. This highlights the fact that higher monetization thresholds tend to do better in prolonged market routs, but on the flip side, run the risk of not getting triggered in shorter corrections.

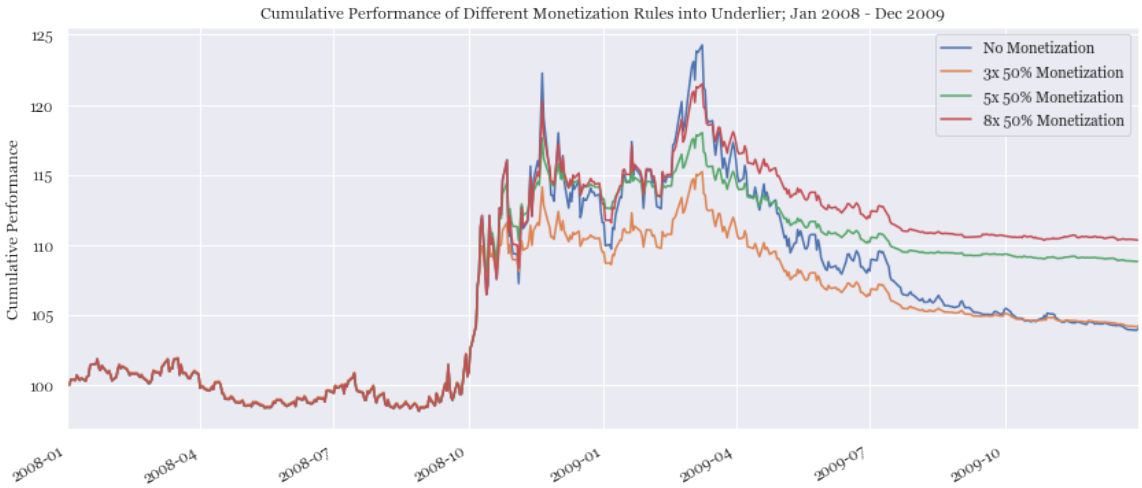

Exhibit 2: Impact of partial monetization left tail hedging strategy during the GFC of 2008-2009. Source: LongTail Alpha, OptionMetrics.

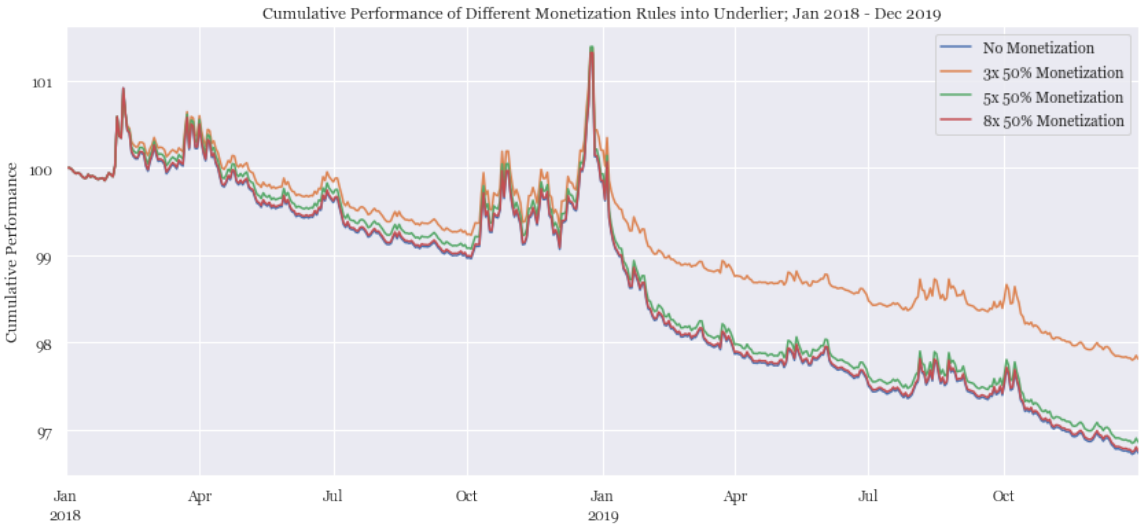

Exhibit 3: Impact of partial monetization left tail hedging strategy during 2018-2019 which included the XIV inverse ETF debacle and the Fed "Pivot." Source: LongTail Alpha, OptionMetrics.

Switching now to the right tail, the impact of monetization rules in relatively "quiet" markets (the "New-Normal") is shown in Exhibit 4. In such markets, the 5x monetization rule was best able to retain tail hedging value on the upside, but when compared to the left tail

hedging results above, showed less of an improvement over the no monetization rule. Similarly, and as shown in Exhibit 5 covering mid-2016 to late 2019, the 8x monetization rule was a small improvement to the no monetization rule. In contrast to the left tail, these results suggest that active monetization of right tail hedges should be used sparingly and only in extreme market environments. Again, this can be traced to the fact that for up-jumps, the main driver of increased value is the movement in the underlying, and increase in volatility is a much smaller contributor, which makes time-decay relatively less punitive.

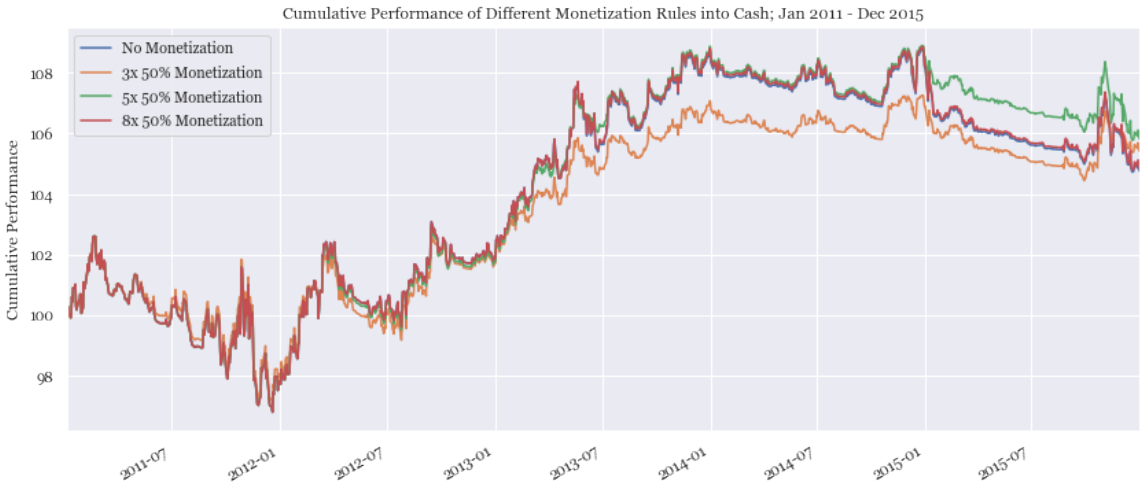

Exhibit 4: Impact of partial monetization of right tail hedging strategy during the post GFC period of 2011-2015.
Source: LongTail Alpha, OptionMetrics.

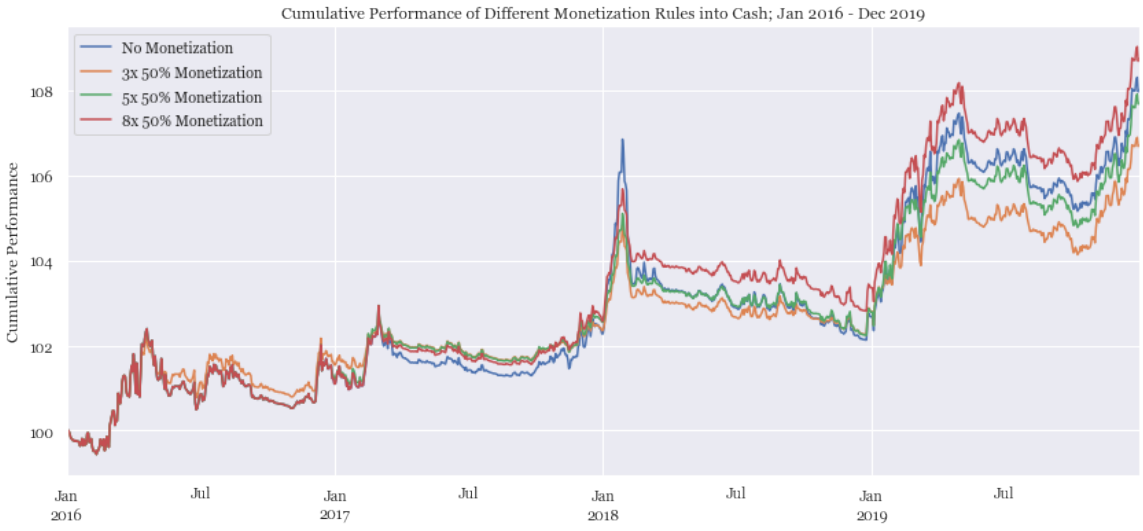

Exhibit 5: Impact of partial monetization of right tail hedging strategy during the pre-COVID period of 2016-2019.
Source: LongTail Alpha, OptionMetrics.

To summarize, what we see from the historical experience prior to the most recent crisis episode is that even partial monetization has generally resulted in better retention of value of tail hedges than no monetization, albeit a little bit less so in the case of the right tail.

There can be exceptions to this rule. For instance, if a catastrophic selloff in the markets lasts for an extended period of time, clearly no monetization would seem to be better than any monetization rules. But even in that situation, it seems that the increased time decay of options (which is proportional to the value of the options), makes it profitable to consider some, even partial monetization, rather than no monetization. Given our lack of perfect foresight, and given the tradeoffs between prospective payoffs and the cost of holding time-decaying assets, we have developed some simple heuristic monetization rules, the results of whose systematic implementation during the COVID-19 crisis are discussed next.

3. Monetization Strategies in the COVID-19 "Great Virus Crisis" of 2020

The previous section provides some evidence that active monetization is generally a good thing if we want to retain the value of the options, rather than simply passively buying and holding tail hedges. How do these conclusions hold up when applied to the experience of 2020?

In the charts that follow, the left axis is the level of the S&P 500, which is displayed as a dotted line on the charts. The right axis corresponds to the implied volatility of the options. Each blue line corresponds to a particular option contract specified by its underlying, strike, and expiration, with the line displaying the time-series of implied volatility of that option. All options used in this paper are "listed" contracts, and the source of the option pricing data is from OptionMetrics. The red triangles display sample monetization multiples realized on that specific option.

For instance, Exhibit 6 shows that as the S&P 500 declined sharply in a very short period in March of 2020, the value of short-dated put options rose significantly, e.g. in one case increasing to over 70x its value. As the expiry lengthens, the increase in value were smaller given the lower gamma of longer expiry option contracts as compared to shorter expiry ones. The cost of the tradeoff between this explosive payoff in shorter dated options relative to longer dated ones arises from the fact that ex-ante the excess volatility premium paid on shorter dated options is much higher than on longer dated options. Thus, conditional on no market crisis occurring, longer dated hedges are likely to retain their value better over time.

In Exhibit 7, rules-based monetization of longer expiry options is illustrated. While there is nothing sacred about 3x and 5x monetization rules displayed here, in practice we find that such heuristic rules have empirically provided a reasonable balance between retention of value over time, while also harvesting sufficient gains that can be re-deployed into risk markets as part of a systematic rebalancing strategy. In Exhibit 8 we illustrate the performance of other strikes to show that qualitatively the performance of various hedges was quite similar. In summary, what mattered for the performance of left tail hedges was the sharp fall in the equity markets and a simultaneous rise in the implied volatility levels of the options.

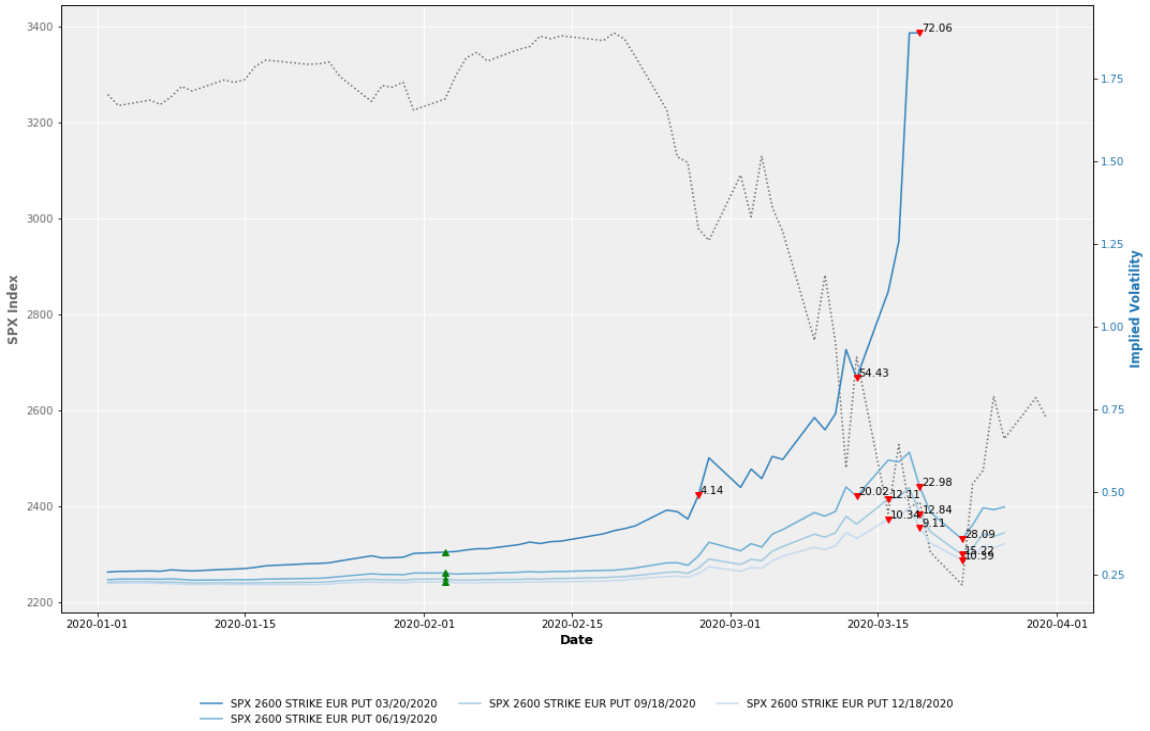

Exhibit 6: Increase in value of options with different expiries from the COVID-19 crisis during Q1 of 2020.
Source: LongTail Alpha, OptionMetrics.

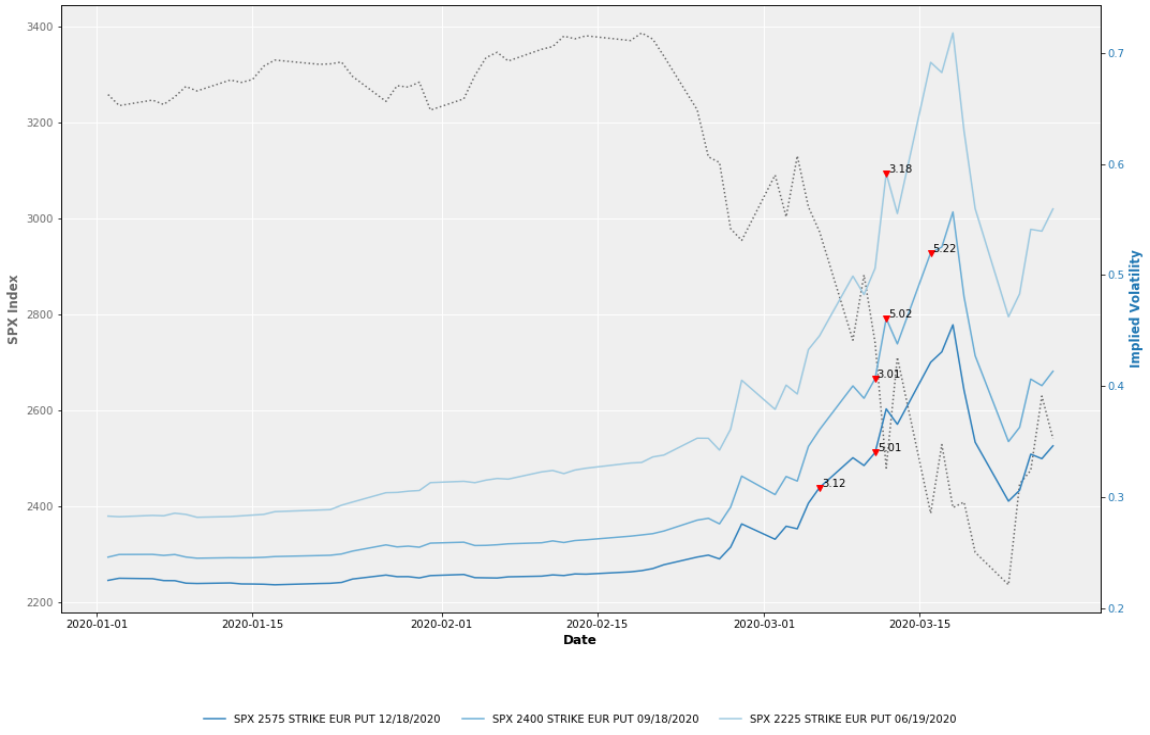

Exhibit 7: Rules based monetization from the COVID-19 crisis during Q1 2020.
Source: LongTail Alpha, OptionMetrics.

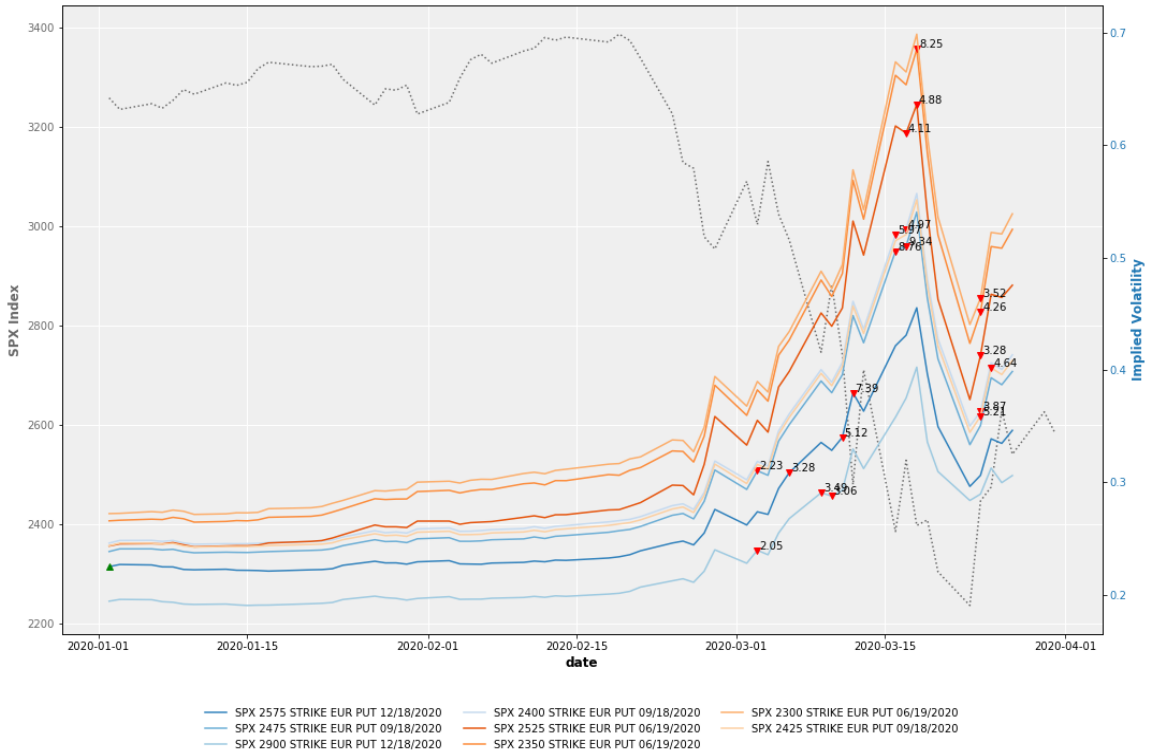

Exhibit 8: Value increase of out of the money put options with different strike prices from the COVID-19 crisis during Q1 of 2020. Source: LongTail Alpha, OptionMetrics.

In Exhibit 9 we illustrate similar results for options on the EFA exchange traded fund, which tracks developed market stocks excluding stocks in the US and Canadian markets. This illustrates that qualitatively the results discussed previously for the S&P500 held across other developed market equity indices as well. This close similarity in performance is to be expected, since tail hedges by their construction target systemic market shocks, and such shocks usually are felt across markets and geographies.

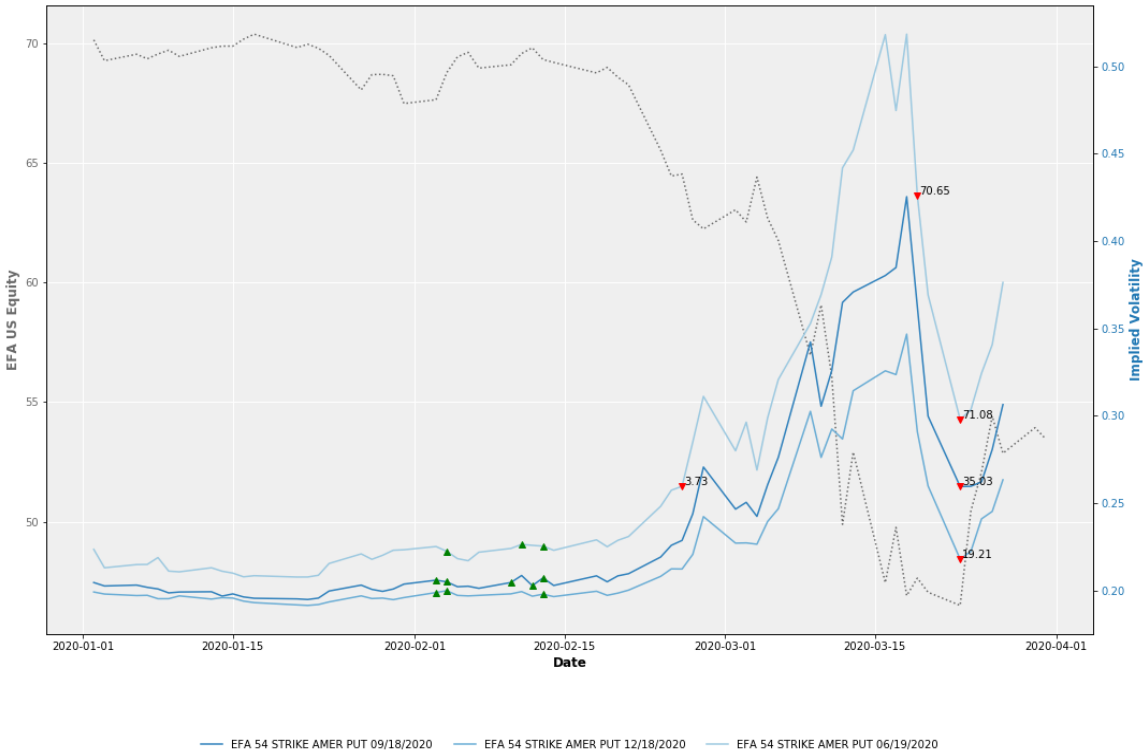

Exhibit 9: Out of the money put options on the EFA ETF during the COVID-19 crisis in Q1 of 2020.
Source: LongTail Alpha, OptionMetrics.

Following the sharp equity market crash of the first quarter of 2020, monetary and fiscal authorities pumped in a record amount of stimulus into the economy and the financial markets. Combined with this stimulus, an outright buying of risk assets resulted in a massive rally in US and global equity markets. In such an environment, "right-tail" strategies as discussed in Bhansali[2018] resulted in the opportunity to participate in the sharp rebound in asset prices. In Exhibits 10, 11, and 12 we show the performance of out of the money call options and volatility during the market crash and subsequent rebound. As discussed in the introduction, the prices of call options are a complex function of both the level of the underlying market and implied volatility. As the equity markets fell, call option volatilities rose as the whole volatility surface shifted upwards, increasing all volatilities. Subsequently, as the markets begain to rebound, the implied volatility started to fall, but the delta of the options started to rise, resulting in an increase in the value of the call options. Given this complex interaction between the "vega" and the "delta" effects in a volatile market environment, we believe it is important to implement monetization of even right tail strategies to extract gains from large upside moves in the markets. But since the correlation between the direction of the underlying markets and implied volatility is empirically observed to be negative, the importance of monetization is usually more critical for put options, because a higher implied volatility results in larger time decay.

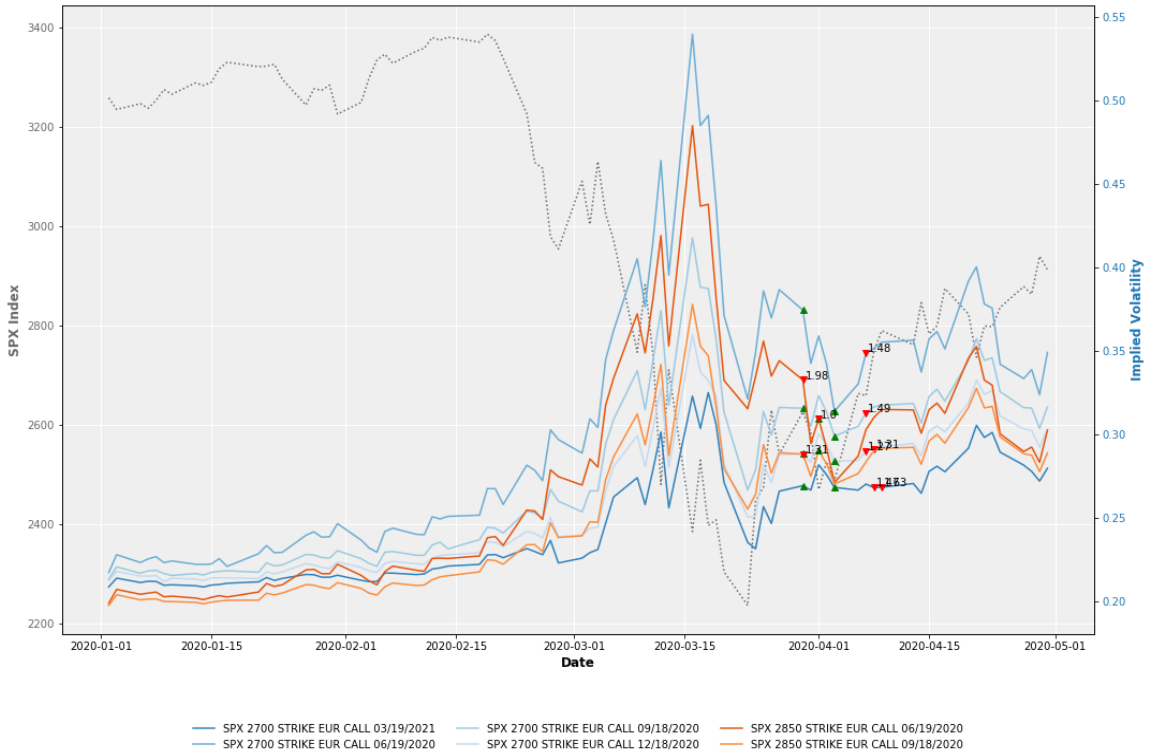

Exhibit 10: Prices of out of the money call options and implied volatility on the S&P500 during the COVID-19 crisis in Q2 of 2020. Source: LongTail Alpha, OptionMetrics.

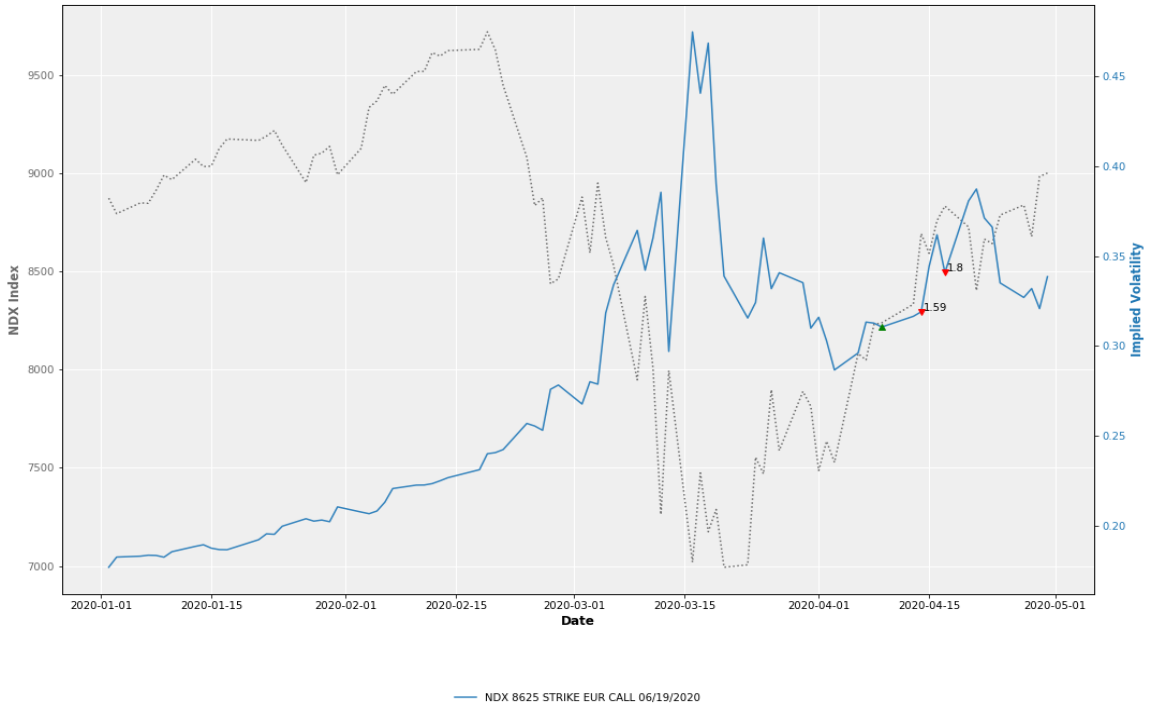

Exhibit 11: Prices of out of the money call options and implied volatility on the NDX 100 during the COVID-19 crisis in Q2 of 2020. Source: LongTail Alpha, OptionMetrics.

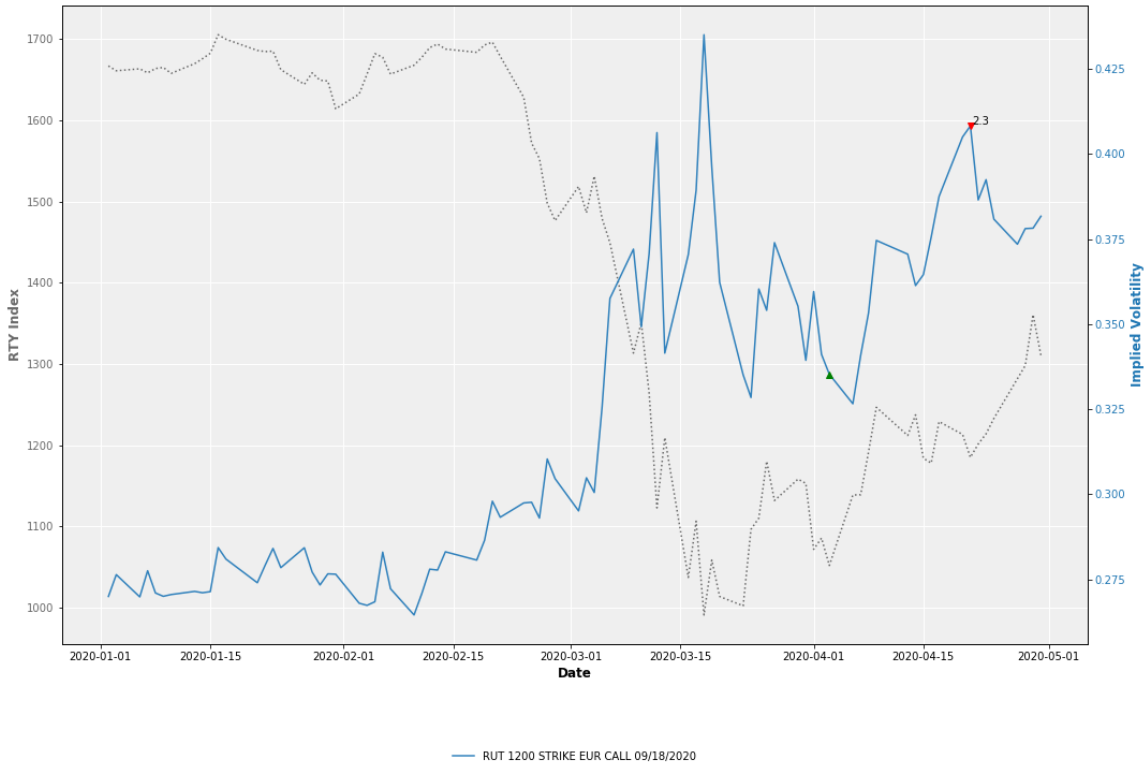

Exhibit 12: Prices of out of the money call options and implied volatility on the Russell 2000 index during the COVID-19 crisis in Q2 of 2020. Source: LongTail Alpha, OptionMetrics.

Conclusions

While there is a healthy increase in discussion and debate in both academic and practitioner circles of the importance of tail hedging for robust portfolio construction, we find that much of this discussion has so far been incomplete. In our view, the primary reason for the significant shortcoming of the debate is that most authors writing on the topic have treated tail hedging as a passive activity, without paying much attention to the significant and consequential impact of active management of tail hedges. In this paper we hoped to have demonstrated the benefits of active tail risk management by extending our previously documented theoretical and empirical work to both left and right tail hedging, by including the most recent experiences during the sharp selloff and rebound in equity markets surrounding the COVID-19 pandemic. Our conclusion is simple: monetization of hedges matters, and investors in tail hedging strategies should understand the benefits of monetization when designing an appropriate tail hedging program.

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Several processes, assumptions and data sources were used to create the charts and exhibits presented herein. It is possible that a different methodology may have resulted in a different outcome. This paper may not reflect the effect of all material economic and market factors that warrant consideration. General analysis contained within this paper

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