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The Art of Hedging

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INVESTOR HEDGING BEHAVIOR HAS EVOLVED OVER THE LAST FIVE YEARS, FROM AN INTENSE FOCUS ON BUYING TAIL RISK PROTECTION AT ANY PRICE TO A MORE NIMBLE APPROACH IN RECENT YEARS. But in one form or another, hedges continue to be bought as institutional investors remain hesitant about the sustainability of the bull market. While VIX is at the low end of its historical range (although certainly not the lowest on record), that does not necessarily mean hedges are cheap. Implied volatility continues to trade above realized volatility, and downside options are more expensive than ATM volatility would suggest.

For many investors, systematically buying puts month after month is not a viable strategy. This has been particularly true over the last several years, when market pullbacks have been shallow and short, and payouts on hedges have been compressed. But despite the challenges, hedging and risk management remains critical to an efficient portfolio design.

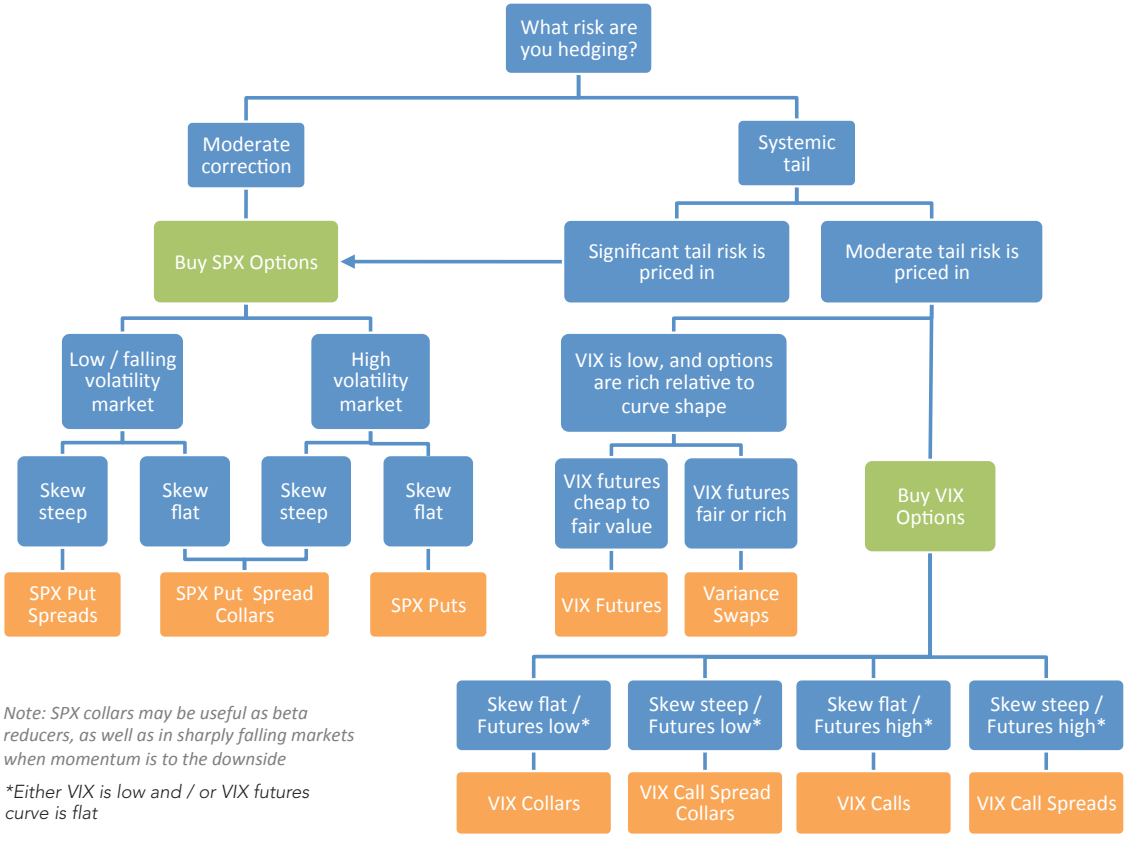
Institutional investors seeking to hedge have no shortage of choices, and need the right framework to manage the different risks in portfolios as they arise. After studying the performance of over 100 different strategies using S&P 500 options, variance swaps, VIX futures, and VIX options during the last 15 years, we think institutional investors should consider a hedging framework such as Exhibit 1 that takes into account:

1. The ***type of risk being hedged*** (systemic large tail versus a fundamental moderate correction).

2. ***Fundamental views*** of the balance of risks and likely scenarios in the market,

3. Current ***market pricing of protection***.

Exhibit 1: A Framework for Hedging



Note: SPX collars may be useful as beta reducers, as well as in sharply falling markets when momentum is to the downside

**Either VIX is low and / or VIX futures curve is flat*

Source: Morgan Stanley Quantitative and Derivative Strategies

While much of the time spent designing a hedging program ends up being spent on selecting the right option expiry, strike, etc., perhaps the most important decision is a more basic one—what risk are you trying to hedge? ***We find that if your view is for a large and systemic selloff—greater than what is priced by the market—then a volatility-based hedge can potentially make more sense. For smaller and more-fundamentally driven selloffs, directional hedges via equity options may be the more appropriate choice.***

The simple backtest of 1-month 30-delta SPX puts and 30-delta VIX calls in Exhibit 2 highlights the differences between the two strategies (this is scaled using a 1 point change in volatility: 1 percent SPX return assumption). Performance is broadly similar, but ***VIX calls have a larger—and faster—payoff in tail events*** such as the 2008 Credit Crisis, 2010 Flash Crash and 2011 US downgrade, while SPX puts outperformed in more recent moderate corrections. This is the key behavior of a volatility based hedge—volatility rises disproportionately more with larger moves down in the S&P 500 than it does for small selloffs.

However, this convexity is not free—it is priced into VIX options. In normal markets, ***VIX call options expire in-the-money less often than S&P 500 options***—see Exhibit 3. VIX calls also do not capture some of the more moderate drawdowns as well as S&P 500 hedges—if an event is not one that precipitates forced liquidation and a rush to buy more hedges, volatility hedges will typically underperform equity options. But the profit on VIX calls when they are in-the-money is typically higher than it is for SPX puts (i.e., VIX can double or triple, while the SPX cannot fall by more than 100 percent).

Exhibit 4 shows the rolling average returns of VIX calls and S&P 500 puts, as well as which trade was the most effective hedge for the S&P 500 in a given month (hedge effectiveness = zero cost SPX ATM put less the P/L of the hedge, with a lower number meaning a better hedge)[1]. ***In calm markets the costs tend to be similar between the two instruments***—2012 happened to favor SPX puts,

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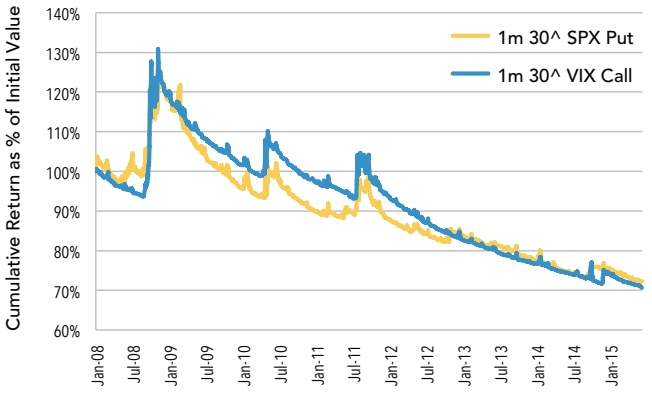
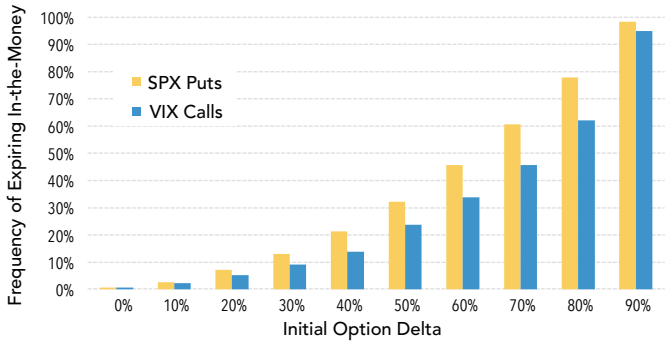
Exhibit 2: VIX Calls versus SPX Puts, Beta-Neutral (1% Vega)



Note: 1% vega based on a 1 point move in VIX for every 1% change in SPX.
Source: Morgan Stanley Quantitative and Derivative Strategies

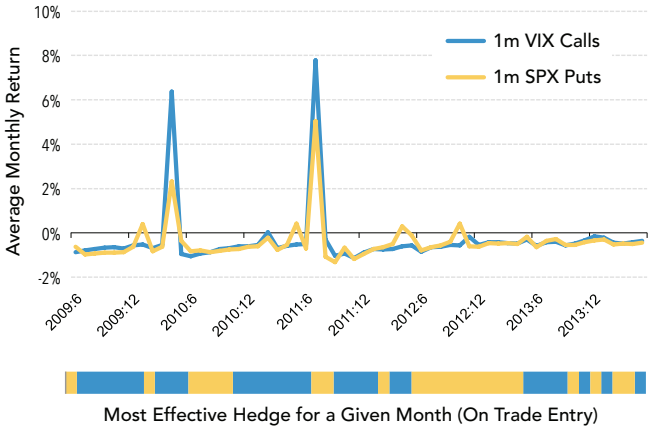
Exhibit 3: VIX Calls Expire ITM Less Often than SPX Puts



Frequency of options with 10-60 days left to expiry expiring in-the-money since June 2009

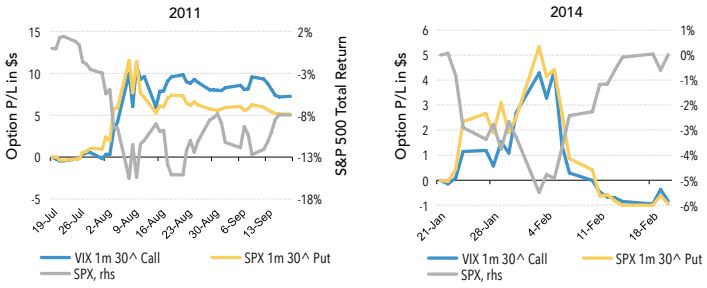
Source: Morgan Stanley Quantitative and Derivative Strategies

Exhibit 4: VIX Call versus SPX Put Hedge Effectiveness



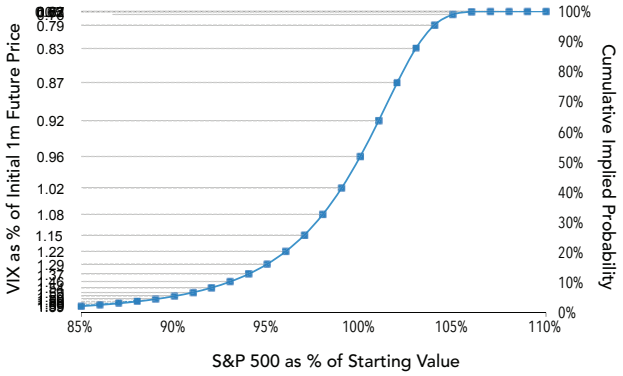
Source: Morgan Stanley Quantitative and Derivative Strategies

Exhibit 5: Selloff Performance ($1 Premium Spent on Each Option)



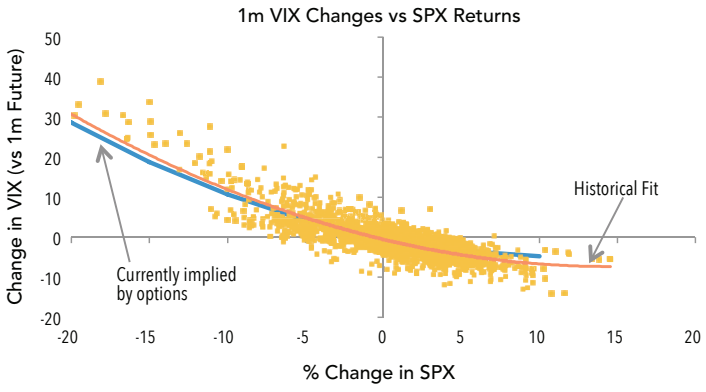
Source: Morgan Stanley Quantitative and Derivative Strategies, Bloomberg

Exhibit 6: Aligning the Distributions



Source: Morgan Stanley Quantitative and Derivative Strategies, Bloomberg

Exhibit 7: Market Pricing of Tail Convexity



Source: Morgan Stanley Quantitative and Derivative Strategies, Bloomberg

late 2013 VIX calls, but in general the trades are similar. But in selloffs they can diverge—***VIX calls outperformed in 2011 and 2010, while the modest declines in 2012 favored SPX puts***.

The case studies in Exhibit 5 show in greater detail how large tail and moderate tails could unfold; the first is August 2011, the second is the early 2014 EM-led selloff. In 2011 the VIX calls outperformed as fear persisted in the marketplace. In the early 2014 selloff, however, S&P 500 puts where the better performer—although as markets rallied back both hedges ended up performing similarly.

Key to any effective trading strategy, however, is not just knowing the right product—it is knowing what the market is pricing in. One approach for determining this is to ask the question "What are the options markets saying VIX could do if the SPX sells off?" To tease that information out of market pricing, we use the fact that VIX and SPX typically move very closely together, and make a simplified assumption that changes in the S&P 500 map perfectly to VIX (i.e., ignore the chance that VIX may move in a different direction than the S&P 500). We then take the option implied distribution of future SPX returns and line it up versus the option implied distribution of VIX returns (Exhibit 6).

For example today the market prices that the S&P 500 in one month will be below 95 percent of the current price with a 15 percent probability, while also pricing that the VIX will be more than 129 percent of today's futures level with a 15 percent probability[2]. Taken together, we can say the market estimates VIX will move 29 percent—roughly 4 points—for a 5 percent decline in the SPX.

Applying these matches across the full spectrum of possible returns in the S&P 500, we obtain a market-implied VIX versus SPX relationship (the blue line in Exhibit 7), and compare this to what occurred historically (the red best-fit line). This gets at the key consideration when looking at relative value of VIX versus SPX options: ***how much does the market expect VIX to rise if the S&P 500 falls***?

Options markets currently imply that VIX futures should rise ~11 points if the S&P 500 is down 10 percent over a month, slightly cheap versus the historical average.

We can evaluate the performance of hedges under these VIX vs SPX scenarios—both implied and historical—and compare to fundamental views to determine the best hedge. Exhibit 8 shows the payouts as a percent of S&P 500 notional for a 1-month 30-delta SPX put and a premium-equivalent amount of 1-month 30-delta VIX calls (roughly 0.2x contracts). ***If the future unfolds as priced by the market today, VIX options are a better hedge for anything greater than a 8 percent decline in the S&P 500 over a month. If the future repeats the historical average, VIX calls would be more efficient if the market drops by more than 6 percent over the next month***.

The above scenario focuses on hedges held for a month or longer. But an increased focus on risk management following the financial crisis has driven many institutional players, both on the sell side and buy side, to have to protect against overnight or rapid intraday gaps lower—a la 1987 or the Flash Crash. To compare SPX puts to VIX calls in these scenarios we use a combined implied / historical approach—factoring in that in a selloff volatility will roll along the existing skew, and then estimating how the implied volatility surface could shift based on historical relationships (Exhibit 9).

In addition to estimating how the underliers change, we also estimate how implied vol for both instruments might evolve as the market falls, based on historical changes in fixed strike implied volatility relative to S&P 500 returns / VIX futures changes. Compared to SPX, VIX vol-of-vol is much less reactive to changes in the underlying price. In addition, VIX skew tends to flatten (calls get cheaper) as VIX rises. This occurs because VIX is mean reverting, and implied vol and skew reflect this dynamic.

Applying all of these (admittedly rough) estimations produces the scenario analysis in Exhibit 10, demonstrating that for big moves down in the S&P 500, the

CONTINUED ON PAGE 20

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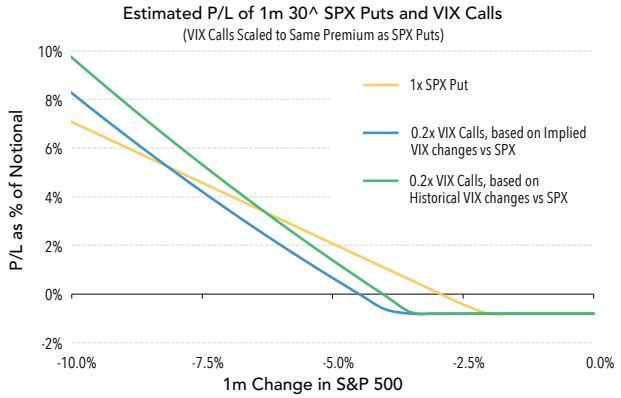
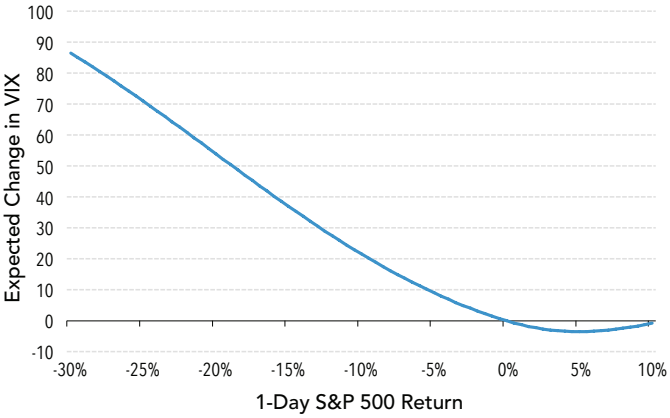
Exhibit 8: VIX 1m Calls Priced to Outperform at -7 to -8% on the SPX



Source: Morgan Stanley Quantitative and Derivative Strategies, Bloomberg

Exhibit 9: Estimated VIX Change for 1-Day SPX Gap



Source: Morgan Stanley Quantitative and Derivative Strategies

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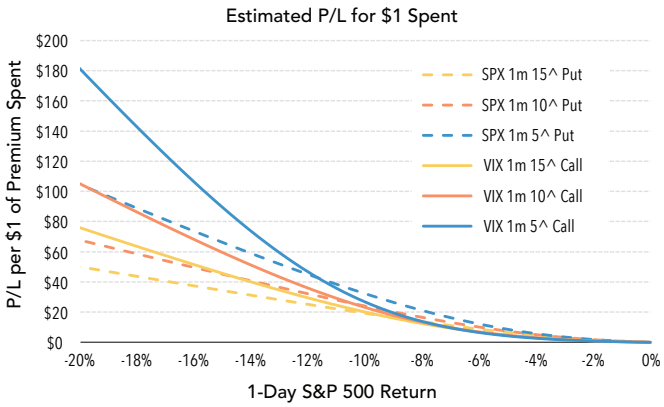
Exhibit 10: VIX Screens Better for Large Gap Risks on Current Pricing



Source: Morgan Stanley Quantitative and Derivative Strategies, Bloomberg

Exhibit 11: Current Premium Spent to Hedge $1,000,000: Cheapest for a Given Decline Highlighted

1-Day Return	SPX 1m 15^ Put	SPX 1m 10^ Put	SPX 1m 5^ Put	VIX 1m 15^ Call	VIX 1m 10^ Call	VIX 1m 5^ Call
-5%	154,986	140,741	125,650	216,567	219,119	239,615
-10%	52,068	44,080	35,688	50,047	43,478	37,584
-15%	29,136	23,735	18,137	21,954	16,851	11,217
-20%	19,964	15,927	11,782	13,196	9,538	5,529
-25%	15,134	11,925	8,652	9,352	6,570	3,581
-30%	12,170	9,513	6,816	7,336	5,077	2,685

Source: Morgan Stanley Quantitative and Derivative Strategies, Bloomberg

convexity of VIX instruments yields the greatest P/L. This assumes $1 of premium is spent on each option.

Given a steep VIX call skew, and the fact that most of the convexity in VIX comes from convexity in the underlying, not convexity in vol-of-vol ***for small declines in S&P 500 it is generally cheaper to hedge using OTM SPX puts. For one day gaps down larger than -10 percent, low delta VIX calls would be a more efficient hedge.***

The table in Exhibit 11 shows the estimated premium that would need to be spent to generate a $1 million profit in given gap risk scenarios. Within each of the VIX and SPX, moving further OTM is always more efficient for these types of moves, and strike selection should only be limited by liquidity.

Investors need to consider the types of risks they are trying to hedge as well as market pricing. When relatively moderate, fundamentally driven corrections are the concern, option based hedges are often the best choice to protect against portfolio drawdowns. But when large systemic tail events are the focus—and market expectations of future volatility are not onerous—volatility based hedges can offer more efficient protection. ■

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ENDNOTES

[1] All 1m term, average of 20, 30, and 40-deltas, scaled to 20-delta on open, scaled so the notional of the VIX calls is 1 percent of the SPX (i.e., one percent vega, consistent with a 1 VIX point move: 1 percent move in SPX)

[2] Option implied probabilities and related charts in Exhibits 6 and 7 are based on SPX and VIX option prices from June 26, 2015.