A good time to be long protection?

**S&P 500 3-month at the money implied vol**
(last 10 years until end of august)

- S&P 500 3m implied volatility at 13.6 vol on August 30th
- 15th percentile over past 10 years!

Source: Morgan Stanley Iris
S&P 500 vol is lower, not necessarily cheaper

S&P 500 3-month at the money implied vol vs. 2-month realized vol
(last 10 years until end of august)

- 2 months realized vol at 6.5 – 6 vols below implied!
- Over 10-year period, implied 2 vol premium to realized
- How to be long vol while minimizing this cost of carry?

Source: Morgan Stanley Iris
Structural inefficiencies create opportunities in vol products

**Supply**
- Low yield environment creating large demand for yield enhancement through structured products

**Demand**
- Regulations limiting ability of banks to take on inventory of derivative risk

Creating imbalances in supply and demand of volatility cheapening vols

BUT these effects differ massively across various regions and indices
Long vol can be a positive carry strategy

- Capture of this realized volatility through variance and vanilla structures hedged daily
- Intensive position management required

* Average over the period of difference between 9m implied vol and 3m realized vol
Source: Morgan Stanley IRIS
What about VIX? Efficiency as a hedge in sell-offs has varied

VIX index since Jan 2015

<table>
<thead>
<tr>
<th>Series</th>
<th>Last</th>
<th>Min</th>
<th>Max</th>
<th>Avg</th>
<th>Z-Score</th>
<th>%-tile</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIX Index Spot Price</td>
<td>15.37</td>
<td>11.34</td>
<td>40.74</td>
<td>16.53</td>
<td>-0.28</td>
<td>53.35</td>
</tr>
</tbody>
</table>

Oct '14
- SPX peak to trough: -5.5%
- SPX 1m vol move: + 8.3
- VIX move: + 11

Aug '15
- SPX peak to trough: -11.3%
- SPX 1m vol move: + 19.5
- VIX move: + 28

Jan-Feb '16
- SPX peak to trough: -10.5%
- SPX 1m vol move: + 11
- VIX move: + 11.4

Source: Bloomberg
What VIX strategy to pick? Long VIX future

**Structure**
- Long front-month VIX future

**Cost of carry** (nothing happens)
- VIX roll down
- 5y avg 1.5 vol points per month!
- today 3 vol points

**Payout profile**
- Linear with VIX

**When to use**
- When vol of vol is high or curve is flattish
- Use for easiest implementation

Source: Bloomberg
What VIX strategy to pick? Long VIX call

Structure
- Long ATM 1 month VIX call

Cost of carry (nothing happens)
- Option premium
- 5y avg: 1.6 vol points
- today: 1.3 vol points

Payout profile
- Linear with VIX

When to use
- When vol of vol is low – usually the case when VIX is low
- Compare call premium to future roll down

Source: Morgan Stanley IRIS
What VIX strategy to pick? Short put vs. long call spread

**Structure**
- Short 1m 15 delta put (here 13)
- Long 1m 40 delta call (here 17)
- Short 1m 15 delta call (here 23)

**Cost of carry** (nothing happens)
- Premium + VIX roll down effect on the put
- Premium worth 40c
- VIX roll down effect on the put: 1$

**Payout profile**
- Protection between 17 and 23

**When / How to use**
- Best when vol is very low (selling 12 put) and skew on VIX is steep
- Buy back put if near zero

Source: Bloomberg
What VIX strategy to pick? Short call ratios

**Structure**
- Short 1x 1m 40d Call (here 17)
- Long 2.5x 1m 15d Call (here 22)

**Cost of carry** (nothing happens)
- You lose only premium
- cost 16-26c on average last 12m, now at 18c

**Payout profile**
- Protection if vol explodes
- Path dependency with risk zone between 17 and 25

**When / How to use**
- Use for highly convex exposure – hedging for tail event
- Best profile when VIX upside skew is low
- Complex management

Source: Bloomberg
Recapping a few hedging strategies mentioned today

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Short Delta</th>
<th>Long Vol</th>
<th>Long Convexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Long Put</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Long Put spread</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Long hedged straddle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Long VIX calls</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>5. Short VIX call ratios</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>6. Long Var vs. Vanilla</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

- **Short Delta**: Make money as market moves down
- **Long Vol**: Make money as volatility ticks up
- **Long Convexity**: Make money on severe down moves – explosive returns on crash
Complexity of these hedges differ widely

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Overall Complexity</th>
<th>Structuring Product</th>
<th>Structuring Strike/ mat</th>
<th>Management Hedging</th>
<th>Management Rebal</th>
<th>Management Liquidity*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Put</td>
<td>V. Low</td>
<td>V. Low</td>
<td>V. Low</td>
<td>V. Low</td>
<td>V. Low</td>
<td>V. Low</td>
</tr>
<tr>
<td>Put spreads</td>
<td>V. Low</td>
<td>V. Low</td>
<td>Low</td>
<td>V. Low</td>
<td>V. Low</td>
<td>V. Low</td>
</tr>
<tr>
<td>Hedged straddle</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Medium</td>
<td>V. Low</td>
</tr>
<tr>
<td>Vix futures/ calls</td>
<td>Low</td>
<td>V. Low</td>
<td>Low</td>
<td>V. Low</td>
<td>Low</td>
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<td>Medium</td>
<td>Low</td>
<td>High</td>
<td>V. Low</td>
</tr>
<tr>
<td>Variance vs vanilla</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>V. High</td>
<td>V. High</td>
<td>Medium</td>
</tr>
<tr>
<td>Best of puts</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>V. High</td>
</tr>
</tbody>
</table>

- Structuring and management of the trades require various level of monitoring and systems to manage
- Liquidity can be an issue on more complex structures

* Reversed scale. Low means low liquidity constraints
How do they perform?

**Hedging strategy returns**  
in % of capital over given period

<table>
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<th>Strategy Type</th>
<th>Cost of carry*</th>
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<tr>
<td>Puts (1m, 90%)</td>
<td>-5.3%</td>
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<td>Put Spread (2m, 90-87%)</td>
<td>-5.1%</td>
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<tr>
<td>Hedged straddle SPX (6m, atm)</td>
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<td>Hedged straddle NKY (6m, atm)</td>
<td>+10%**</td>
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<td>VIX calls (1m, atm)</td>
<td>-5.2%</td>
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<tr>
<th>Event</th>
<th>SPX move</th>
<th>VIX move</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lehman Sep-Oct '08 (2 mo)</td>
<td>-24.5%</td>
<td>+39.2</td>
</tr>
<tr>
<td>Euro crisis Apr/Mai '10 (1 mo)</td>
<td>-10.5%</td>
<td>+28.5</td>
</tr>
<tr>
<td>Q3 2011 Jul-Sep '11 (3 mo)</td>
<td>-15.5%</td>
<td>+27.1</td>
</tr>
<tr>
<td>CNH depeg Aug '15 (1 we)</td>
<td>-11.2%</td>
<td>+23.0</td>
</tr>
</tbody>
</table>

* Strategies sized to cost 5% of capital per year during 2013-14 period
** NKY straddles sized as SPX. Cost of carry measures in 2014 only would have been -1%

Source: Morgan Stanley IRIS, Argentière Capital analysis
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