Volatility Exposure for Strategic Asset Allocation

M. Brière, Credit Agricole Asset Management

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Volatility Exposure for Strategic Asset Allocation

- Volatility: A relatively new asset class
- How to gain structural exposure to volatility?
- 2 difficulties dealing with volatility as an asset class
- Volatility opens up multiple perspectives for investors
Volatility: An asset class?
- Portfolio diversifier, hedging the downside risk of equities
- Earning average positive volatility risk premium

A recent development
- Standardized instruments now give access to a wide range of volatility strategies

Only a few academic research papers on the subject
- Volatility risk premium: Leippold et al. (2007), Hafner and Wallmeier (2008)
How to gain structural exposure to volatility?

- **Long volatility exposure (LV)**
  - Buy and hold of VIX Futures during 1 month
  - Exposure decreasing with implied volatility level to profit from the mean-reverting pattern of volatility

- **Investing in the volatility risk premium (VRP)**
  - 1-month short position in S&P500 variance swaps
  - Allows to catch positive “volatility risk premium”
  - Risk of infinite loss if realized volatility > implied volatility
How to gain structural exposure to volatility?

- Long volatility exposure (LV)

Source: Datastream, Bloomberg, authors’ calculations
How to gain structural exposure to volatility?

Investing in the Volatility Risk Premium (VRP)

Source: Datastream, Bloomberg, authors’ calculations
Two difficulties dealing with volatility as an asset class

- Returns of volatility strategies are strongly non-normal
- Volatility/Normal VaR insufficient measures of risk
  - “Modified” VaR takes into account skewness/kurtosis of the distribution

Source: Datastream, Bloomberg, authors’ calculations

For professional investors only
Two difficulties dealing with volatility as an asset class

- Volatility: A potentially leveraged asset class

- Reduced capital needs for volatility strategies
  - Deposit, margin requirements for futures
  - Collateral for variance swaps

- Need to calibrate properly the maximum risk allowed for volatility strategies
  - VaR (95%)=6% like equities
Volatility exposure in a portfolio: Performance

Performance of US equities, government bonds, and 2 volatility strategies (LV and VRP), Feb 1990 – Aug 2008

<table>
<thead>
<tr>
<th></th>
<th>Geometric Mean</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
<th>Std. dev</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Ann. Down. dev</th>
<th>Mod. VaR</th>
<th>Sharpe Ratio</th>
<th>Success Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bond</td>
<td>7.68%</td>
<td>0.61%</td>
<td>-5.55%</td>
<td>5.38%</td>
<td>5.84%</td>
<td>-0.31</td>
<td>3.54</td>
<td>2.97%</td>
<td>2.27%</td>
<td>0.53</td>
<td>68%</td>
</tr>
<tr>
<td>Equity</td>
<td>9.89%</td>
<td>1.28%</td>
<td>-14.46%</td>
<td>11.44%</td>
<td>13.71%</td>
<td>-0.46</td>
<td>3.86</td>
<td>7.81%</td>
<td>6.07%</td>
<td>0.39</td>
<td>64%</td>
</tr>
<tr>
<td>LV</td>
<td>7.24%</td>
<td>0.18%</td>
<td>-10.41%</td>
<td>26.52%</td>
<td>18.18%</td>
<td>1</td>
<td>5.34</td>
<td>8.07%</td>
<td>6.00%</td>
<td>0.15</td>
<td>53%</td>
</tr>
<tr>
<td>VRP</td>
<td>52.75%</td>
<td>4.20%</td>
<td>-26.31%</td>
<td>15.28%</td>
<td>17.27%</td>
<td>-1.81</td>
<td>10.37</td>
<td>9.74%</td>
<td>6.00%</td>
<td>2.79</td>
<td>85%</td>
</tr>
</tbody>
</table>

Data: S&P500, Merrill Lynch 7-10Y US government bonds, volatility strategies based on VIX index

Source: Datastream, Bloomberg, authors’ calculations
Volatility exposure in a portfolio: Performance

- Long volatility
  - Returns 7.2%, comparable to bonds
  - Smaller success rate (53% vs 68%) and SR (0.15)
  - But a definitive advantage: strong positive skewness

- Volatility risk premium
  - Exceptionally high returns (52.7%)
  - High success rate (85%) and SR (2.79)
  - But high extreme risks: strong negative skewness and positive kurtosis
Volatility exposure in a portfolio: Co-dependance

Correlation matrix (Feb 1990 – Aug 2008)

<table>
<thead>
<tr>
<th></th>
<th>Bonds</th>
<th>Equity</th>
<th>LV</th>
<th>VRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equity</td>
<td>-0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV</td>
<td>0.08</td>
<td></td>
<td>-0.61</td>
<td></td>
</tr>
<tr>
<td>VRP</td>
<td>-0.17</td>
<td>0.46</td>
<td>-0.61</td>
<td></td>
</tr>
</tbody>
</table>

Source: Datastream, Bloomberg, authors’ calculations
Volatility exposure in a portfolio: Co-dependance

- **Long volatility**
  - Strong diversification power with equities (correl -61%)
  - Strong diversification power with VRP (correl -61%)

- **Volatility risk premium**
  - Small diversification power with equities (correl 46%)
  - Better diversification with bonds (correl -17%)

- Co-skewness and co-kurtosis matrices give similar picture for extreme co-movements
Volatility exposure in a portfolio: Co-dependances

- Very few months of negative LV and equity returns

- Only 4 months of negative returns of both LV and VRP

Source: Datastream, Bloomberg, authors’ calculations
We compare 4 basic portfolios
(1) Bonds Equities (BE)
(2) Bonds Equities + Long Volatility (BE+LV)
(3) Bonds Equities + Volatility Risk Premium (BE+VRP)
(4) Bond Equities + 2 Volatility Strategies (BE+LV+VRP)
Volatility exposure in a portfolio: Efficient frontiers

Adding volatility strategies allows to improve efficient frontiers (mean-modified VaR framework)

Source: Datastream, Bloomberg, authors’ calculations
# Volatility exposure in a portfolio: Min VaR portfolios

<table>
<thead>
<tr>
<th></th>
<th>Bond</th>
<th>Bond Equity + Bond Equity +</th>
<th>Bond Equity +</th>
<th>Bond Equity +</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LV</td>
<td>VRP</td>
<td>LV + VRP</td>
<td></td>
</tr>
<tr>
<td>Mean Ann. Return</td>
<td>8.19%</td>
<td>8.65%</td>
<td>14.89%</td>
<td>15.68%</td>
</tr>
<tr>
<td>Ann. Std. Dev.</td>
<td>5.41%</td>
<td>4.66%</td>
<td>5.29%</td>
<td>4.11%</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.04</td>
<td>0.47</td>
<td>-0.41</td>
<td>-0.04</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>4.15</td>
<td>3.93</td>
<td>3.44</td>
<td>4.24</td>
</tr>
<tr>
<td>Min Monthly Loss</td>
<td>-4.02%</td>
<td>-3.12%</td>
<td>-3.52%</td>
<td>-3.19%</td>
</tr>
<tr>
<td>Max Monthly Gain</td>
<td>5.98%</td>
<td>5.57%</td>
<td>4.75%</td>
<td>4.77%</td>
</tr>
<tr>
<td>Mod. VaR(95%)</td>
<td>1.87%</td>
<td>1.28%</td>
<td>1.43%</td>
<td>0.63%</td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>0.68</td>
<td>0.89</td>
<td>1.96</td>
<td>2.72</td>
</tr>
<tr>
<td>Success Rate</td>
<td>71.30%</td>
<td>70.00%</td>
<td>80.30%</td>
<td>89.20%</td>
</tr>
<tr>
<td>Bond</td>
<td>79%</td>
<td>50%</td>
<td>78%</td>
<td>40%</td>
</tr>
<tr>
<td>Equity</td>
<td>21%</td>
<td>31%</td>
<td>2%</td>
<td>16%</td>
</tr>
<tr>
<td>LV</td>
<td>-</td>
<td>19%</td>
<td>-</td>
<td>24%</td>
</tr>
<tr>
<td>VRP</td>
<td>-</td>
<td>-</td>
<td>20%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Source: Datastream, Bloomberg, authors’ calculations
Volatility exposure in a portfolio: Min VaR portfolios

- Smaller VaR levels with volatility strategies in portfolio
- Much higher returns, Sharpe ratios and success rates
- Smaller minimum monthly loss
- Extreme risks are smaller (with LV), higher (with VRP) or equivalent (LV+VRP) than for traditional portfolio
Conclusions

- Volatility opens up multiple perspectives for investors

- Long volatility mitigates extreme risks of the portfolio
  - Particularly valuable for a portfolio holding equities (hedge of downside equity risk)

- Volatility risk premium investment strongly improves performance
  - Boost returns / success rate for a given level of risk
  - But at the cost of very high extreme risks

- Combination of 2 volatility exposures
  - Allows higher absolute and risk adjusted returns
  - Extreme risks similar to traditional balanced portfolio
Conclusions

Limitations

- Historical analysis of past 20 years
- Could crises (variance swap losses) be more acute than they were?

Further developments

- LV a sufficient hedge of VRP in times of crises?
- Tactical, intra-class arbitrage strategies to improve performances
## Appendix

- **Min VaR portfolios returns (sample period + sept-dec 2008)**
  - Sharpe ratios remain attractive
  - But extreme risks increased a lot

<table>
<thead>
<tr>
<th></th>
<th>Bond Equity</th>
<th>Bond Equity + LV</th>
<th>Bond Equity + VRP</th>
<th>Bond Equity + LV + VRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Ann. Return</td>
<td>8.19%</td>
<td>8.65%</td>
<td>13.49%</td>
<td>14.19%</td>
</tr>
<tr>
<td>Ann. Std. Dev.</td>
<td>5.67%</td>
<td>4.64%</td>
<td>7.64%</td>
<td>6.03%</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.07</td>
<td>0.47</td>
<td>-3.81</td>
<td>-4.09</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>4.15</td>
<td>3.93</td>
<td>29.58</td>
<td>33.53</td>
</tr>
<tr>
<td>Max Monthly Loss</td>
<td>-4.50%</td>
<td>-3.12%</td>
<td>-16.18%</td>
<td>-12.92%</td>
</tr>
<tr>
<td>Max Monthly Gain</td>
<td>5.98%</td>
<td>5.57%</td>
<td>5.55%</td>
<td>4.77%</td>
</tr>
<tr>
<td>Mod. VaR(95%)</td>
<td>2.00%</td>
<td>1.28%</td>
<td>3.11%</td>
<td>2.08%</td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>0.66</td>
<td>0.90</td>
<td>1.18</td>
<td>1.61</td>
</tr>
<tr>
<td>Success Rate</td>
<td>70.9%</td>
<td>70.0%</td>
<td>79.7%</td>
<td>88.1%</td>
</tr>
<tr>
<td><strong>Bond</strong></td>
<td>79%</td>
<td>50%</td>
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<td>40%</td>
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<td>-</td>
<td>20%</td>
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*Source: Datastream, Bloomberg, authors’ calculations*
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