Weekly Strategy Note
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On Bloomberg:

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**Introduction to Correlation**

The Chicago Board Options Exchange (CBOE) this week announced the launch of their new S&P 500 implied correlation indices for January 2010 (ticker symbol ICJ) and January 2011 (ticker symbol JCJ) option maturities. In this Weekly Strategy Note we explain the basics of correlation and how investors can use the measure to effectively hedge portfolio risk.

Trading index volatility involves analyzing two factors: component stock volatilities and implied correlation of components’ price returns. The single stock volatility component can be determined by simply calculating the weighted average volatilities that comprise the index or ETF. Using both the index volatility and the component volatility, one can then back out the level of correlation. Below is the mathematical calculation of correlation. For a quick estimate, one can simply take index volatility divided by component volatility, squared. Realized correlation is calculated using realized volatility inputs, while implied correlation is calculated using implied volatility inputs.

$$Correlation = \left( \frac{\text{Index Volatility}}{\text{Single Stock Volatility}} \right)^2 \times \frac{1}{\text{# of Stocks}} \times \frac{\text{# of Stocks} - 1}{\text{# of Stocks} - 1}$$

*Source: MRA*

The single stock component of index volatility is the “micro”, while correlation represents the “macro” portion. As a result, correlation tends to rise during periods of economic uncertainty when macro themes dictate market direction. Higher levels of realized correlation, all else being equal, will result in higher levels of realized index volatility. The table below exhibits the effect correlation (horizontal variable) has on index volatility based on various levels of component single stock volatility (vertical variable). For example, a single stock volatility of 30% combined with 20% correlation results in an index volatility of 13.5%. If realized correlation were instead 60% on the same basket of underlying stocks, index volatility would jump almost 10 points to 23.3%.

<table>
<thead>
<tr>
<th>Realized Correlation</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
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<td>20%</td>
<td>9.0%</td>
<td>12.7%</td>
<td>15.5%</td>
<td>16.7%</td>
<td>17.9%</td>
<td>19.0%</td>
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<td>30%</td>
<td>13.5%</td>
<td>19.0%</td>
<td>23.3%</td>
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<td>28.5%</td>
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<tr>
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<td>25.3%</td>
<td>31.0%</td>
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<td>31.7%</td>
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<tr>
<td>60%</td>
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<td>38.0%</td>
<td>46.5%</td>
<td>50.2%</td>
<td>53.7%</td>
<td>56.9%</td>
</tr>
</tbody>
</table>

*Source: MRA*

**The Interaction Between Single Stock Volatility and Realized Correlation**

In our piece “Thoughts on Equity Correlation” from May 12th, 2008 we noted:

“It is often the case that macroeconomic uncertainty can make stocks both more volatile and more highly correlated at the same time. Common sources of macro risk include the Fed, energy prices, terrorism, inflation shocks, unemployment, elections and fiscal policy. In the graph below we provide a scatter plot of 30 day realized single stock volatility in the SPX and 30 day realized correlation. In general, during periods like the recent one, when stocks have been more volatile, they have been more highly correlated as well. Low correlation and low stock volatility also tends to coincide with the very economic environment that breeds low stock volatility also lacks any impactful macro risk factor. This was generally the case from 2004 to mid 2007.

Our experience is that the realization of economic and corporate profit uncertainty are the factors most capable of lifting correlation. For example, during the tremendous market volatility during 2002, three month realized correlation reached nearly 60% as consumer sentiment fell, payroll data was exceptionally weak and the overall economy grew slowly. The potential for a similar scenario to unfold, and the historical impact on correlation of this scenario, causes us to favor index option protection.”

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Realized correlation has remained at elevated levels since the credit crisis began in the summer of 2007. The scatter plot below shows individual data points of realized volatility and realized correlation. In 2006 equity markets were in a low volatility/low correlation regime (bottom left of the chart). In late 2008, volatility and correlation reached unprecedented levels. Note, as per the graph below, there is never an instance of high single stock volatility but low realized correlation (the upper left of the graph). When stock volatility is high, correlation tends to be high as well (the upper right of the graph).

The graph below looks at rolling realized correlation in the SPX (top 50 names). Correlation in 2009, while still historically high, has declined from late 2008 levels as we have begun to see sector correlations break down. For example, technology is up 34%, while financials are flat year to date. The ongoing deleveraging, economic uncertainty, and continuous government intervention all point to continued high levels of correlation for the foreseeable future. When correlation is expected to remain elevated, investors should use ETF and index options to express market views. When correlation is low, investors should instead implement strategies using single stock option as index volatility will be muted.

The table below calculates realized correlation across different maturities in the broad market indices. Note, these realized levels include all component members.