Opportunities and Perils of Using Option Sensitivities

Abstract

Espen Gaarder Haug

Option Sensitivities

Opportunities and Perils of Using

Table 1

<table>
<thead>
<tr>
<th>Option Sensitive of an Option Portfolio</th>
<th>Table of</th>
</tr>
</thead>
</table>
| Different outcomes that occur in the portfolio to an option strike price change. The data in Table 1 shows the relationship between the number of options and the portfolio value. The formula for calculating the portfolio value is:

\[ V = \sum v_i 

Where: \( V \) is the number of options in the portfolio, \( v_i \) is the value of each option.

1. RISK MANAGEMENT OF AN OPTION PORTFOLIO
Opportunities and Perils of Using Option Sensitivities

Figure 1a

Gamma Graph

Section above, these gamma-contraction graphs can serve as an essential tool in the kind
of analysis described above. The graphs are useful for visualizing the impact of changes in the
underlying asset price on the option's gamma. As the asset price moves, the gamma of the
option changes, and these changes are reflected in the graphs. The graphs can help
investors understand how sensitive their option positions are to changes in the price of the
underlying asset.

The graphs also show the relationship between the price of the underlying asset and the
gamma of the option. As the asset price increases, the gamma of a call option increases,
while the gamma of a put option decreases. This relationship is important to understand
when making investment decisions, as it can affect the profitability of option strategies.

Figure 1b

Delta Graph

The delta graph is another useful tool in option analysis. It shows the change in the option's
delta for a small change in the underlying asset price. The delta of a call option is positive,
and it increases as the asset price increases. The delta of a put option is negative, and it
decreases as the asset price increases.

Unlike gamma, which measures the change in delta, delta measures the change in the
option's value for a small change in the underlying asset price. Delta is a critical
measure for traders, as it can help them understand the risk associated with their option
positions. A high delta position can be more volatile, while a low delta position is
less sensitive to changes in the underlying asset price.

In summary, gamma and delta are essential tools in option analysis. They provide
valuable insights into the sensitivity of option positions to changes in the underlying asset
price, helping traders make informed decisions and manage risk effectively.
II. ADDING VOLATILITY RISK—AN EXCEPTION

Figure 1b shows the gamma exposure of our portfolio when options can simultaneously be hedged in Figures 1b and 1c. Figure 1b and Figure 1c show the gamma exposure of a portfolio of call options on the S&P 500 Index. The delta of the option is the change in the option price per change in the underlying asset price. As the underlying asset moves, the gamma changes accordingly. The graph in Figure 1b shows the gamma exposure of our portfolio when the stock price increases. The graph in Figure 1c shows the gamma exposure of our portfolio when the stock price decreases.
However, the portfolio's sensitivity to changes in volatility was not added for the options with different maturities. Simple adding of vega for options with different maturities is often incorrect as volatilities with different time horizons are not necessarily comparable. The relevant volatility for an option with 30 days to maturity is the future volatility for the next 30 days. For an option with 180 days to maturity, the future 180-day volatility is relevant. Implied volatility, the market's estimate of future volatility, has historically been a reasonably good measure of future volatility (Beckers, 1981; Latane and Rundleman, 1976). A simple adding of vega for options with different maturities will be an accurate measure of volatility risk only if the following assumptions are met:

1. The correlation coefficients between volatilities across the term structure of volatility (volatilities for different maturities) are positive and close to one.

2. The term structure of volatility shifts in a parallel fashion, i.e., when the 30-day volatility increases by 4 percentage points, the 60-day volatility has to change by the same amount.
Table 2 shows an example of the correlation between volatility and option returns (Computes from Daily Close Prices from 1/88-1/97 — 78 Observations).

<table>
<thead>
<tr>
<th>Volatility Estimation</th>
<th>General Priors</th>
<th>Value of Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>1.12</td>
<td>0.77</td>
</tr>
<tr>
<td>0.01</td>
<td>1.09</td>
<td>0.77</td>
</tr>
<tr>
<td>0.02</td>
<td>0.96</td>
<td>0.77</td>
</tr>
<tr>
<td>0.03</td>
<td>0.84</td>
<td>0.77</td>
</tr>
<tr>
<td>0.04</td>
<td>0.73</td>
<td>0.77</td>
</tr>
<tr>
<td>0.05</td>
<td>0.62</td>
<td>0.77</td>
</tr>
<tr>
<td>0.06</td>
<td>0.51</td>
<td>0.77</td>
</tr>
<tr>
<td>0.07</td>
<td>0.40</td>
<td>0.77</td>
</tr>
<tr>
<td>0.08</td>
<td>0.30</td>
<td>0.77</td>
</tr>
<tr>
<td>0.09</td>
<td>0.20</td>
<td>0.77</td>
</tr>
<tr>
<td>0.10</td>
<td>0.10</td>
<td>0.77</td>
</tr>
</tbody>
</table>

(To be continued)
Opposition and Perils of Living Opined Sentences

![Graph showing the relationship between time decay in volatility and volatility of volatility over 1999-2000.](image)

**Figure 2a**

The graph above shows the time decay in volatility and volatility of volatility over the period of 1999-2000. The data is plotted to illustrate the concept that as time passes, volatility decreases, and the volatility of volatility also decreases. This is a critical aspect in understanding the dynamics of financial markets.

The second assumption is that even in the presence of evidence and a period without correlation between volatility and expiration, the correlation between volatility and expiration will be consistent with the option with the longer time frame. This is because the option with the longer expiration is more likely to reflect the underlying asset's price movement, thus leading to an increase in volatility. The opposite is true for options with a shorter expiration, as their volatility is more likely to be driven by short-term factors such as market news or company-specific events.

Expected volatility may not affect short-term options as they may have
Figure 2c

Figure 2d

International Business Machines
Oppotunities and Parts of Using Opinion Semantics

The opportunities and parts of using opinion semantics are as follows:

1. **Incorporating Opinions into Text Analysis**
   - Incorporating opinions into text analysis can provide a more nuanced understanding of the data.
   - Opinion segmentation and opinion mining can help identify the presence of opinions in text.
   - Sentiment analysis can help categorize opinions as positive, negative, or neutral.

2. **Enhancing User Experience**
   - Opinion-based recommendations can improve user satisfaction by providing personalized suggestions.
   - Social media monitoring can help brands understand public sentiment and react accordingly.

3. **Business Decision-Making**
   - Opinion analytics can inform business decisions by providing insights into consumer preferences.
   - Competitive analysis can help businesses understand their competitors' strengths and weaknesses.

4. **Legal and Regulatory Compliance**
   - Sentiment analysis can assist in compliance with regulations related to disclosure of opinions.
   - Monitoring public sentiment can help detect potential legal issues before they escalate.

5. **Customer Feedback and Satisfaction**
   - Opinion analytics can provide insights into customer satisfaction and help identify areas for improvement.
   - Sentiment analysis can be used to gauge customer satisfaction with products or services.

6. **Marketing and Advertising**
   - Opinion monitoring can help advertisers understand the effectiveness of their campaigns.
   - Opinion analytics can be used to track the performance of marketing campaigns and adjust strategies accordingly.

7. **Product Development and Innovation**
   - Opinion analysis can inform product development by identifying customer needs and preferences.
   - Sentiment analysis can help companies understand the emotional response to new products or innovations.

8. **Risk Management**
   - Opinion analytics can help identify potential risks associated with products or services.
   - Sentiment analysis can be used to monitor public sentiment and detect potential risks early.

9. **Evaluating Internal Communications**
   - Opinion analysis can help evaluate the effectiveness of internal communications and identify areas for improvement.
   - Sentiment analysis can be used to gauge the effectiveness of internal communications and identify areas for improvement.

10. **Public Relations**
    - Opinion analysis can help monitor public sentiment and manage crises effectively.
    - Sentiment analysis can be used to track the public's reaction to events and manage media relations.

In conclusion, opinion semantics play a crucial role in various domains, offering valuable insights that can inform decision-making and enhance customer experience.
The net weighted Vega exposure (NWV) can be calculated using the following formula:

\[ \text{NWV} = \sum_{i=1}^{n} \left( \frac{\text{Vega}_{i}}{\text{Volume}_{i}} \right) \times \text{Volume}_{i} \]

where:
- \( \text{Vega}_{i} \) is the Vega of the ith option
- \( \text{Volume}_{i} \) is the volume of the ith option
- \( n \) is the number of options in the portfolio

This formula takes into account the weighted Vega of each option in the portfolio, giving higher weight to options with higher volume. The result is the net weighted Vega exposure (NWV) of the portfolio.
Table 3
Option Portfolio

<table>
<thead>
<tr>
<th>Days to maturity</th>
<th>120.00</th>
<th>60.00</th>
<th>60.00</th>
<th>30.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strike</td>
<td>$105.00</td>
<td>$85.00</td>
<td>$100.00</td>
<td>−$100.00</td>
</tr>
<tr>
<td>Call price</td>
<td>$4.99</td>
<td>$16.53</td>
<td>$4.88</td>
<td>$3.27</td>
</tr>
<tr>
<td>Vega</td>
<td>22.86</td>
<td>3.11</td>
<td>15.81</td>
<td>11.31</td>
</tr>
<tr>
<td>No. of contracts</td>
<td>450.00</td>
<td>100.00</td>
<td>−400.00</td>
<td>−300.00</td>
</tr>
<tr>
<td>Volatility of volatility</td>
<td>4.00%</td>
<td>5.50%</td>
<td>5.50%</td>
<td>6.50%</td>
</tr>
<tr>
<td>Correlation coefficients</td>
<td>1.00</td>
<td>0.85</td>
<td>0.85</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Stock price $100, risk–free interest rate 10%, volatility 25%,
One contract represents rights to 100 shares of the underlying stock.

30–day, 5.5 percentage points 60–day, 4.0 percentage points 120–day, and correlation coefficients of 0.65 between 30–day volatility and the reference volatility (120–day), 0.85 for the 60–day volatility and, naturally, 1.0 between 120–day volatility and the reference volatility. If we assume that the historical estimates will not undergo significant changes in the coming period, these can be used without any adjustments. It follows that: $\Psi_1 = 6.5$, $\Psi_2 = 5.5$, $\Psi_3 = 4.0$, $\Psi_R = 4.0$, $\rho_{IR} = 0.65$, $\rho_{IR} = 0.85$, $\rho_{IR} = 1.0$.

\[
NWV = \sum_{i=1}^{m} \sum_{j=1}^{n} w_{ij} \text{vega}_i \frac{\Psi_i}{\Psi_R} \rho_{\sigma(i), \sigma(R)}
\]

\[
= -300 \times 11.31 \times \frac{6.5}{4.0} \times 0.65 - 400 \times 15.81 \times \frac{5.5}{4.0} \times 0.85
\]

\[
+ 100 \times 3.11 \times \frac{5.5}{4.0} \times 0.85 + 450 \times 22.86 \times \frac{4.0}{4.0} \times 1.0
\]

\[
= -324.55
\]

Hence, for each percentage point rise in the reference volatility (120–day), we will lose approximately $325. By simple adding vega, the net vega exposure would be:

Net Vega = $-300 \times 11.31 - 400 \times 15.81 + 100 \times 3.11 + 450 \times 22.86 = 881$

Opportunities and Perils of Using Option Sensitivities
Net Vega and Net Weighted Vega of Portfolio in Table 3

The difference between Vega and NAVA will essentially depend upon the correlation between volatility and the correlation of the volatility. Substitution of these variables and the volatility of the underlying will be as follows:

\[ \text{Net Vega} = \text{Vega} - \text{Correlation} \times \text{Volatility} \]

If the square root of the volatility and the square correlation coefficient are both larger than one, then the square root of the weighted volatility can be defined as follows:

\[ \text{Weighted Vega} = \text{Vega} \times \text{Square Root of Volatility} \]

The weighted Vega measure would be used for each percentage point free in the weighted portfolio.
Opposite of and Pelt of the Option Sensitivities

CONCLUSION AND SUMMARY

Options with a shorter time to maturity have a larger time to maturity. The risk of early exercise is higher for calls and puts with longer maturities. The volatility of the underlying asset affects the value of the option, and the option's price increases with higher volatility. The value of a call option increases with the increase in the underlying asset's price, while the value of a put option decreases with the increase in the underlying asset's price. The delta of an option measures its sensitivity to changes in the underlying asset's price.
\[
1 - (\phi)N = \frac{S_0}{e} = \nu \sqrt{V}
\]

\[
(\phi)N = \frac{S_0}{Qe} = \nu \cdot \sigma
\]

**Delta**

Delta and Gamma sensitivity to the different pricing parameters:

\[
\frac{\Delta}{\Delta} = \frac{\Delta X}{\Delta t}
\]

Hence:

\[
\frac{\Delta X}{X} = \frac{(\phi)N}{(\phi)N}
\]

**Black and Scholes Option Pricing Formula:**

**Appendix**
\[(\varphi)_{\text{Nem}} \propto X = \frac{10}{d} = \text{uneq} \]

\[(\varphi)_{\text{Nem}} \propto \text{N} = \frac{10}{C} = \text{unco} \]

\[\text{Note:} \]

\[(\varphi), N \propto \frac{\partial X}{\partial \theta} = \frac{\partial X}{\partial \bar{C}} = \text{uneq} \]

\[\text{Vega:} \]

\[(\varphi)_{\text{Nem}} \propto X^1 = \frac{1/\theta}{\text{V}(\varphi), \text{NS}} - \frac{10}{d^2} = \text{unco} \]

\[(\varphi)_{\text{Nem}} \propto X^2 = \frac{1/\theta}{\text{V}(\varphi), \text{NS}} - \frac{10}{C^2} = \text{unco} \]

\[\text{Theta:} \]

\[\frac{1/\text{VNS}}{(\varphi), N} = \frac{1/\bar{C}}{d^2} = \frac{1/\bar{C}}{C^2} = \text{uneq} \]

\[\text{Gamma:} \]
Opportunities and Perils of Using Option Sensitivities


REFERENCES

In the article, the author discusses the potential benefits and challenges of using options in financial planning. The main points discussed include:

1. The attractiveness of options as a tool for managing financial risk.
2. The role of options in portfolio diversification.
3. The impact of options on investor behavior.
4. The potential for options to improve investment returns.

To access the full text, please refer to the reference page provided in the article.