Managing a Portfolio by Greeks

Adil Dastur

January 20, 2010

Introduction

- This presentation starts by defining the Greeks. It assumes that the reader already has a working knowledge of complex option positions.

- Then it presents the idea that basic option positions have no edge and that you need a diversified and complex option position to provide an edge.

- Finally, this presentation shows how to use Greeks to create a hedge in order to manage risk for the overall portfolio.

Definition of Greeks

- Delta – The rate of profit over price, expressed as profit per $1 move in the underlying (profit/price).
- Gamma – The rate of delta over price, expressed as change in delta per $1 move in the underlying squared (profit/price^2).
- Theta – The rate of profit over time, expressed as profit per day (profit/day).
- Vega – The rate of profit over volatility expressed as profit per 1 percent move in volatility (profit/%).
- Beta – The ratio of a symbols price movement over S&P500 price movement, expressed as percentage (%/%).

Which is better
Long or Short Options?

- There is a school of thought that says that options are a zero sum gain. In other words, over time, you will just break even.
- This may be oversimplified, but it raises some good points that must be respected.
  - Both long and short option positions may make money ***in timeframe X***
  - Both long and short option positions may loose money ***in timeframe Y***
  - The problem is that we can never know in advance the values of X or Y yet we are required to select them.
  - The result is a matter of chance.
  - Statistically, matters of chance tend to result in 50/50 outcomes over a large enough sample size
  - In which case, ***there is no statistical basis to determine one being better than the other***.

- This school of thought, which I tend to believe, implies that ***basic option positions have no edge and are speculative.***
- Your exposure to such positions should be limited according to however much risk you are willing to assign to speculative positions.
- To be able to trade with larger amounts of money and over longer timeframes, the option trader needs something beyond speculation. ***The option trader needs an edge***.

If Basic Options Have No Edge, What does?

- It is commonly stated that ***option traders who are consistently profitable over longer timeframes trade spreads***. Whether this is true in general, who can say for sure? But it makes sense and it is consistent with my experiences.
- Its not an individual spread that matters as much as the overall portfolio (complex position).

- Theoretically, you may want the overall portfolio Greeks to be zero delta, gamma, and vega, and positive theta, resulting in a fixed profit each and every day. Essentially, this would be like a saving account but with a much higher rate of return.
- In reality, you can create a complex option position with low enough directional risk and high enough positive theta such that you have a very good probability of holding the position long enough for theta gains to exceed directional losses. ***Your edge is your ability to remain in the trade until it is profitable. The most reliable way I know how to do this is to create a diversified and complex option position and then hedge it with S&Ps.***

- The steps for correlating Greeks on the next page assume that you already have a diversified and complex option position with positive theta and you want to reduce directional risk by hedging it with SPX/SPY options. All positions in a portfolio of stocks and options can be theoretically correlated to each other in order to determine a portfolios overall risk with respect to changes in price. Beta-weighting is the name given to correlating delta and/or gamma between two symbols. Theta does not require correlation. Vega correlation is theoretically possible but it is something that you must do on your own. Brokers don't provide a volatility correlation factor. Otherwise Vega correlation may be loosely approximated as the sum of individual vegas.

Correlating Greeks

1. Determine the underlying symbol's beta value. Be certain not to blindly trust just any beta value you may find and make sure that it accurately represents recent price movements. Check several sources. Otherwise, using stale data may cost you. You can manually calculate an underlying symbol's beta for a given period of time as:

$$\text{Beta}_{\text{underlying}} = \frac{1}{\text{n}} \frac{\text{SPX}}{\text{Underlying}} \frac{\sum_{\text{i}=1}^{\text{n}} \Delta\text{underlying}_{\text{i}}}{\sum_{\text{i}=1}^{\text{n}} \Delta\text{SPX}_{\text{i}}}$$

   where *n* is the number of samples.

2. Once you have an accurate beta for a given underlying, you may use that value to correlate the underlying delta and gamma to SPX delta and gamma as follows:

$$\text{Delta}_{\text{SPX}} = \text{Beta}_{\text{underlying}} \times \text{Delta}_{\text{underlying}} \left[\frac{\text{Price}_{\text{underlying}}}{\text{Price}_{\text{SPX}}} \right]$$

$$\text{Gamma}_{\text{SPX}} = \text{Beta}_{\text{underlying}} \times \text{Gamma}_{\text{underlying}} \left[\frac{\text{Price}_{\text{underlying}}}{\text{Price}_{\text{SPX}}} \right]^2$$

3. Repeat steps 1, 2 for each underlying.
4. Add up all the individual SPX correlated deltas to determine the portfolio's overall beta-weighted SPX delta.
5. Add up all the individual SPX correlated gammas to determine the portfolio's overall beta-weighted SPX gamma.
6. Add up all the individual position thetas to determine the portfolio's overall theta.
7. Add up all the individual position vegas to determine a ***ballpark*** value of the portfolio's overall vega.

Selecting an SPX/SPY Hedge

- Once we have determined the portfolio's overall Greeks, we can use those values to select a SPX/SPY position as a hedge. The table below shows some choices for hedging.
- For example, if your portfolio's overall Greeks are positive delta, negative gamma, and negative vega, the hedge would be negative delta, positive gamma, and positive vega. Looking at the table below shows that you could create such a hedge by buying a put or put vertical.
- Theta is considered on the next page.

Vega \ Delta, Gamma	+, +	+, -	-, -	-, +
+	Buy a Call or Call Vertical	Buy an OTM Call Calendar	Buy an OTM Put Calendar	Buy a Put or Put Vertical
-	Sell an OTM Put Calendar	Sell a Put or Put Vertical	Sell a Call or Call Vertical	Sell an OTM Call Calendar

Gamma to Determine Sufficient Theta

- Even zero delta has directional risk because delta changes at the rate of gamma.
- For example, how would you calculate a loss over a 30 price move in SPX? Could you use the linear equation 30 x 0 = 0? Of course not because delta does not stay zero.
- A better approximation would be gamma to determine the average delta over this 30 price move.
- For example, if delta is zero and gamma is -1.6, then a 30 price move results in new delta of approximately -1.6 x 30 = -48. The average delta is ½ that value, -24. The loss is approximately -24 x 30 = -$720. To protect against a 1-day 30 price move, this position requires a theta of approximately 720.
- If theta is not 720 or greater, your price risk is beyond the limits of this strategy. Consider further adjustments.

Summary

- Determine the portfolio's overall Greeks by beta-weighting delta and gamma, and summing up individual theta and vega values.
- Determine a SPX/SPY hedge that provides neutral delta, gamma, and vega.[1]
- Then verify that theta is sufficiently high to compensate for gamma risk.
- Once these conditions are met, you stand a much greater chance of remaining in the trade until it is profitable.

- 1: Summing individual vegas results in a ballpark value. Zero vega is not necessarily neutral because of volatility skews. Further correlating vegas may provide an even tighter volatility hedge.