Option Greeks

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Purpose

Review how pricing changes based on intrinsic and extrinsic factors

Discuss how the Option Greeks act as financial measures of the sensitivity of an option's price to its underlying determining parameters

Learn how balancing these measures can keep your portfolio away from certain risks

Option Pricing Review

For those wanting to trade options, it's important to understand how the option price changes based on factors related to Intrinsic and Extrinsic Values.

- We know Options are sensitive to the asset’s price, time, and volatility, but by how much?

Certain Option Strategies want to take advantage of certain market conditions, but how can we determine how much ‘edge’ we have by using the contracts and do we know how much risk we’re taking on?

In order to make these determinations, we will be using the Option Greeks to understand how the option’s price is sensitive to these measures.

The Greeks

Delta (Δ)

Represents the rate of change of the Option Price and a $1 increase in the underlying asset's price. Known as Price Sensitivity.

Gamma (Γ)

Represents rate of change of Delta for every $1 increase in the underlying asset' price. Known as Delta Sensitivity, Acceleration of Delta, or Delta of Delta.

Theta (Θ**)**

Represents rate of change of the Option Price for every day that passes until expiration. Known as Time Sensitivity.

Vega (V)

Represents the rate of change of the Option Price due to a 1% increase in Implied Volatility (IV). Known as Volatility Sensitivity.

Rho (ρ)

Represents the rate of change of the Option Price due to 1% increase in Risk-Free Interest Rates. Known as Rate Sensitivity.

Delta

Represents the rate of change of the Option Premium due to a $1 increase in the underlying asset's price. Known as Price Sensitivity.

- Delta of .75 => Option Premium increases .75 for a $1 increase in Asset Price.

For Calls, Delta is positive to indicate an increase in the Option Premium if the asset price increases.

For Puts, Delta is negative to indicate a decrease in the Option Premium if the asset price increases.

Delta also represents a rough probability of the option being ITM at expiration.

- ITM Call is .5 to 1 Delta / ITM Put is -.5 to -1 Delta
- ATM Call is .5 Delta / ATM Put is -.5 Delta
- OTM Call is 0 to .5 Delta / OTM Put is -.5 to 0 Delta

Delta Curve

General Curve of how Delta is applied to each Strike Price on the Option Chain is as follows:

Example: Stock Price = $100/share

Higher Delta

ATM = .50 Delta

Lower Delta

Call Delta	Strike Price	Put Delta
.62	97	-.37
.59	98	-.40
.55	99	-.44
.50	100	-.50
.45	101	-.56
.41	102	-.61
.37	103	-.65

Lower Delta

ATM = -.50 Delta

Higher Delta

Gamma

Represents rate of change of Delta for every $1 increase in the underlying asset’s price. Known as Delta Sensitivity, Acceleration of Delta, or Delta of Delta.

- Example: If Gamma is .10 and Delta is .50, if the asset price increases by $1, the new Delta will be .60 and the new Gamma will be adjusted.

Calls and Puts both have positive Gamma to indicate an increase in the Delta if the asset price increases.

Gamma is highest in the respective Series when the contract is ATM and the Gamma Curve increases closer to expiration.

- Options close to expiration have a high sensitivity to Gamma

Gamma Curve

General Curve of how Gamma is applied to each Strike Price on the Option Chain is as follows:

Example: Stock Price = $100/share

Call Gamma	Call Delta	Strike Price	Put Delta	Put Gamma
.03	.62	97	-.37	.02
.04	.59	98	-.40	.03
.05	.55	99	-.44	.04
.05	.50	100	-.50	.06
.04	.45	101	-.56	.05
.03	.41	102	-.61	.04
.03	.37	103	-.65	.03

Gamma Increases

Gamma Highest ATM

Gamma Increases

Gamma Increases

Gamma Highest ATM

Gamma Increases

Theta

Represents rate of change of the Option Price for every day that passes until expiration. Known as Time Sensitivity.

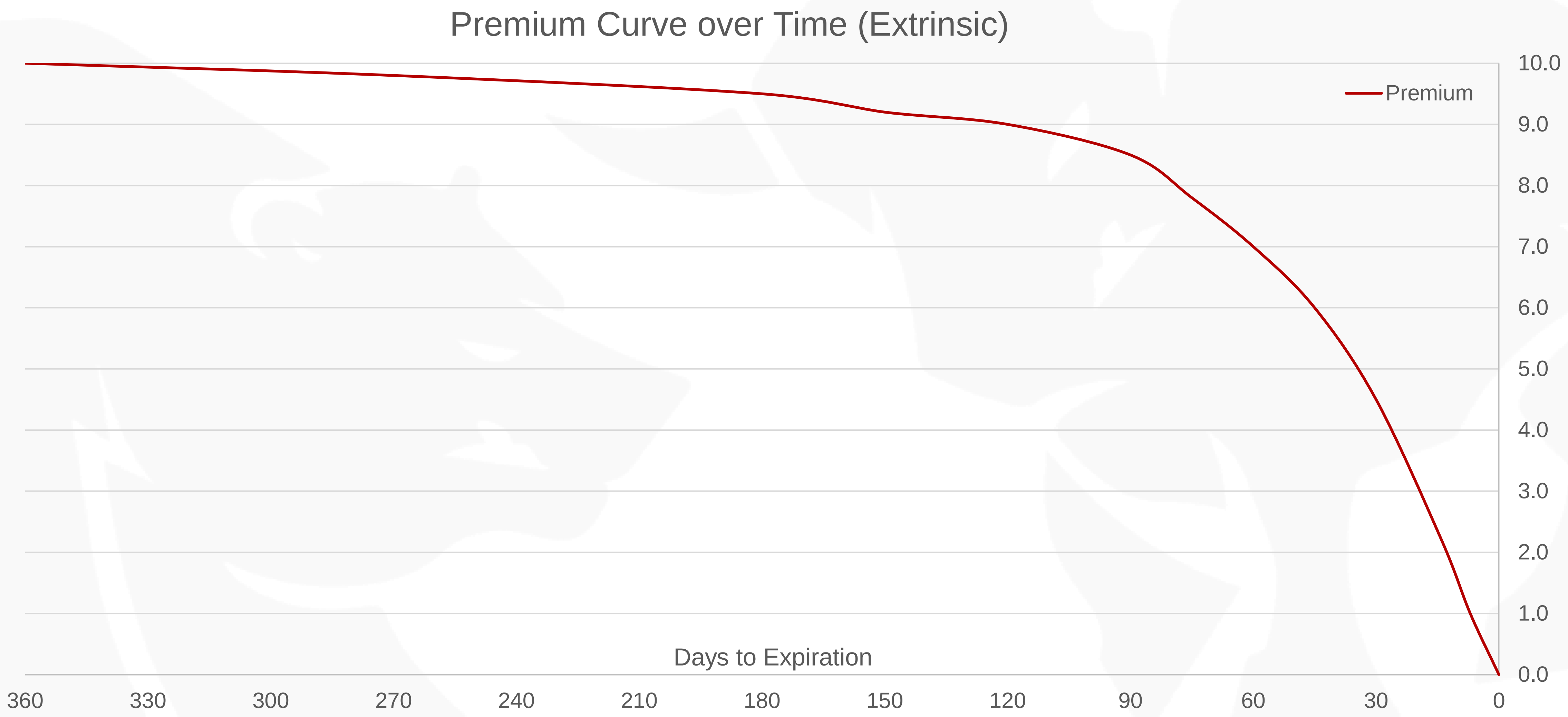
- Example: Theta = -.08 means the time value of the option decreases -.08 per day, including weekends.

Calls and Puts both have negative Theta to represent time decaying the option premium.

Time value decreases exponentially as time passes, so the further the Expiration Date, the more time value is built into the Option Price. Theta Decay will increase - as in Theta will become more negative - as time passes.

Time value decays the fastest during the last 30 - 60 days.

Theta Curve


Premium Curve over Time (Extrinsic)
Premium
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Days to Expiration
360
330
300
270
240
210
180
150
120
90
60
30
0

Vega

Represents the rate of change of the Option Price due to a 1% increase in Implied Volatility (IV). Known as Volatility Sensitivity.

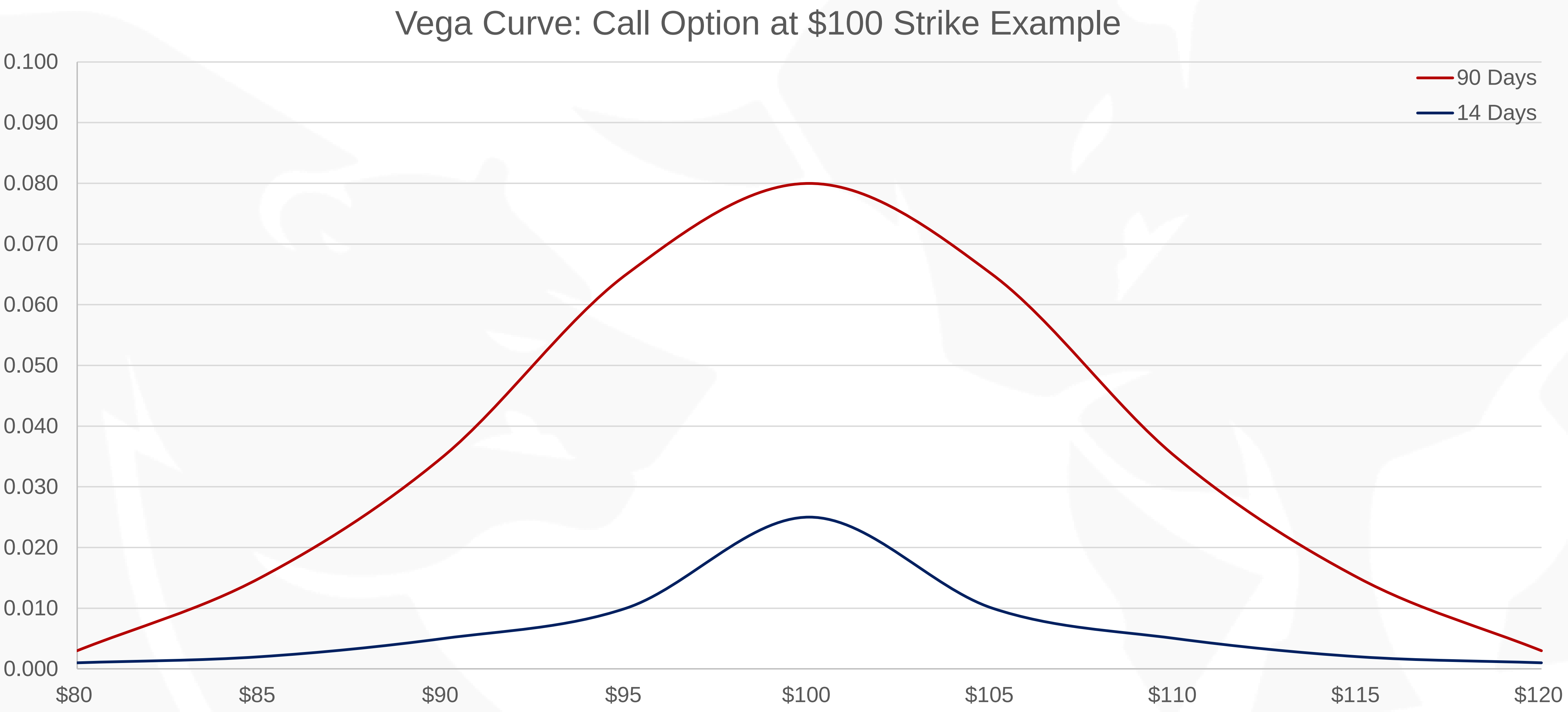
- Example: If Vega is .02 and the Option Premium is 2.00, if IV increases from 30% to 31%, it will change the Option Premium to 2.02.

Volatility makes up Extrinsic Value and increases around events that are likely to make the asset move with a higher range than usual.

Typically, you want to be an option buyer when the IV relative to the asset is low (< 50% the Average) and an option seller when the IV relative to the asset is high (> 50% the Average). This is known as the IV Percentile.

Vega is higher further from expiration, as there is more volatility 'risk' in a longer time frame.

Vega Curve


Vega Curve: Call Option at $100 Strike Example
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
$80
$85
$90
$95
$100
$105
$110
$115
$120
90 Days
14 Days

Putting it All Together

Knowing our Greek exposures, no matter the strategy and position, allows us to know what sensitivities we have in a portfolio of trades

Each strategy is trying to take advantage of one or more of these factors, which gives them edge over several executions.

Strategies with multiple option contracts, or spreads, will be merging multiple Greek values into one aggregate value, along with having new sensitivity to how the values change.