

# Manage Complex Option Portfolios: Simplifying Option Greeks – Part II

Monday, 11<sup>th</sup> September

7:30 PM IST | 2:00 PM GMT | 10:00 AM EST



A Pioneer Algo Trading Training Institute



Streamlined Investment Management

## About the Speaker



### **Rajib Ranjan Borah**

*Co-Founder & Director - QuantInsti™*

Rajib manages the course segment on option derivatives and also works with exchanges, financial & educational institutions to design educational programs. He has conducted workshops and conferences in America, Europe and Asia.

Rajib worked with leading HFT firm Optiver in Amsterdam on options derivatives market making & high frequency equity arbitrage strategies across all major European & US exchanges. Before Optiver, Rajib was a management strategy consultant with PricewaterhouseCoopers where he assisted a consortium in setting up a national commodity derivatives exchange.

A national Olympiad finalist, Rajib has twice represented India at the World Puzzle Championships. He has a post-graduate management degree from the Indian Institute of Management Calcutta, a bachelor's degree in Computer Engineering from the National Institute of Technology Surathkal; and has internship experiences with Bloomberg in New York (equity option derivatives research) & with Solutia's EMEA strategy HQ in Belgium.

- Price of option from Black Scholes formula

$$C_t = SN(d_1) - Xe^{-rt}N(d_2)$$

- Delta =  $\partial C / \partial S$  or  $\frac{1}{2}(\partial C / \partial S^- + \partial C / \partial S^+)$  to be more precise  
=  $N(d_1)$

$$d_1 = \frac{\ln\left(\frac{S_t}{X}\right) + \left(r + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$N(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^x e^{-\frac{z^2}{2}} dz$$

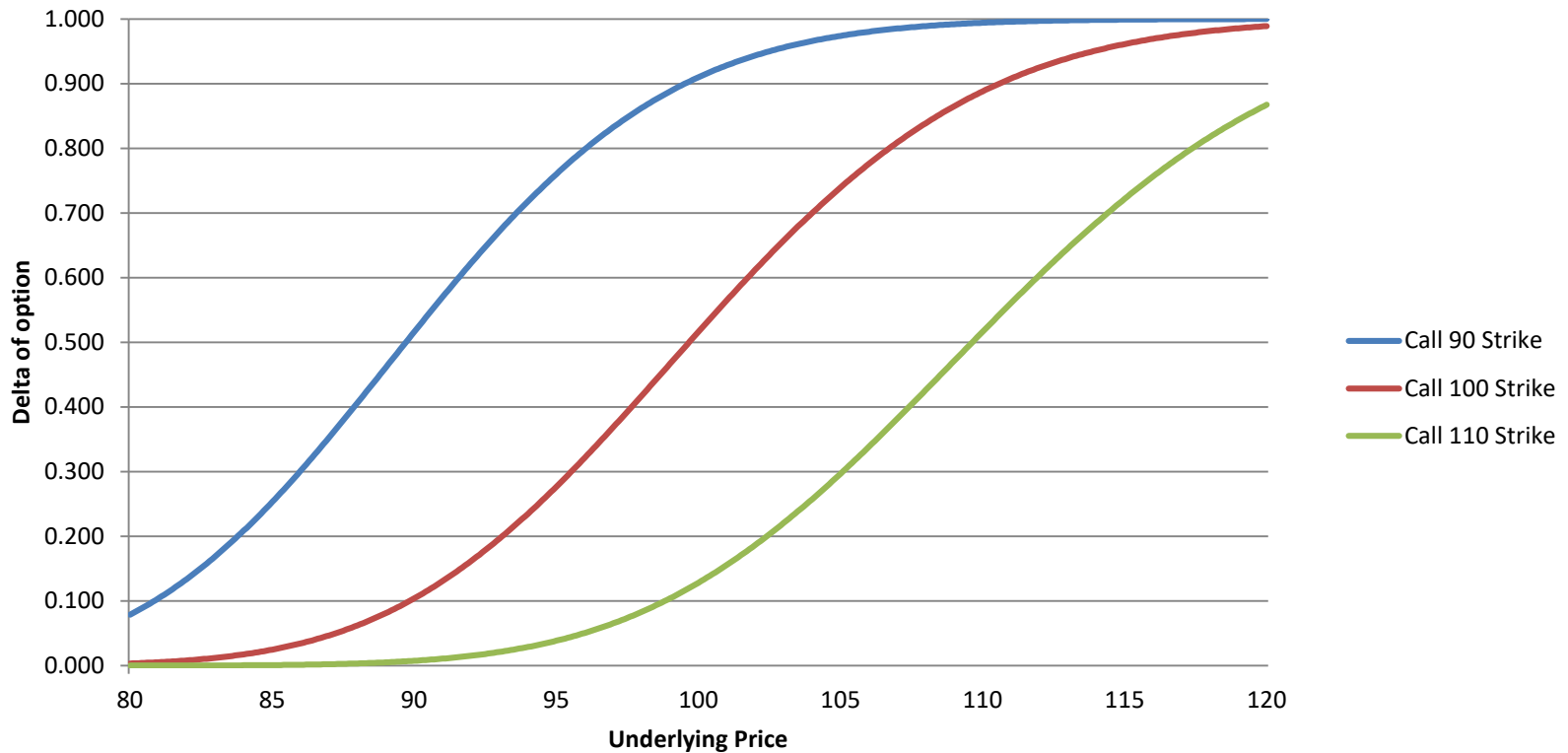
# Delta

i.e. Delta is dependent on:

- underlying price,
- time to expiry
- volatility

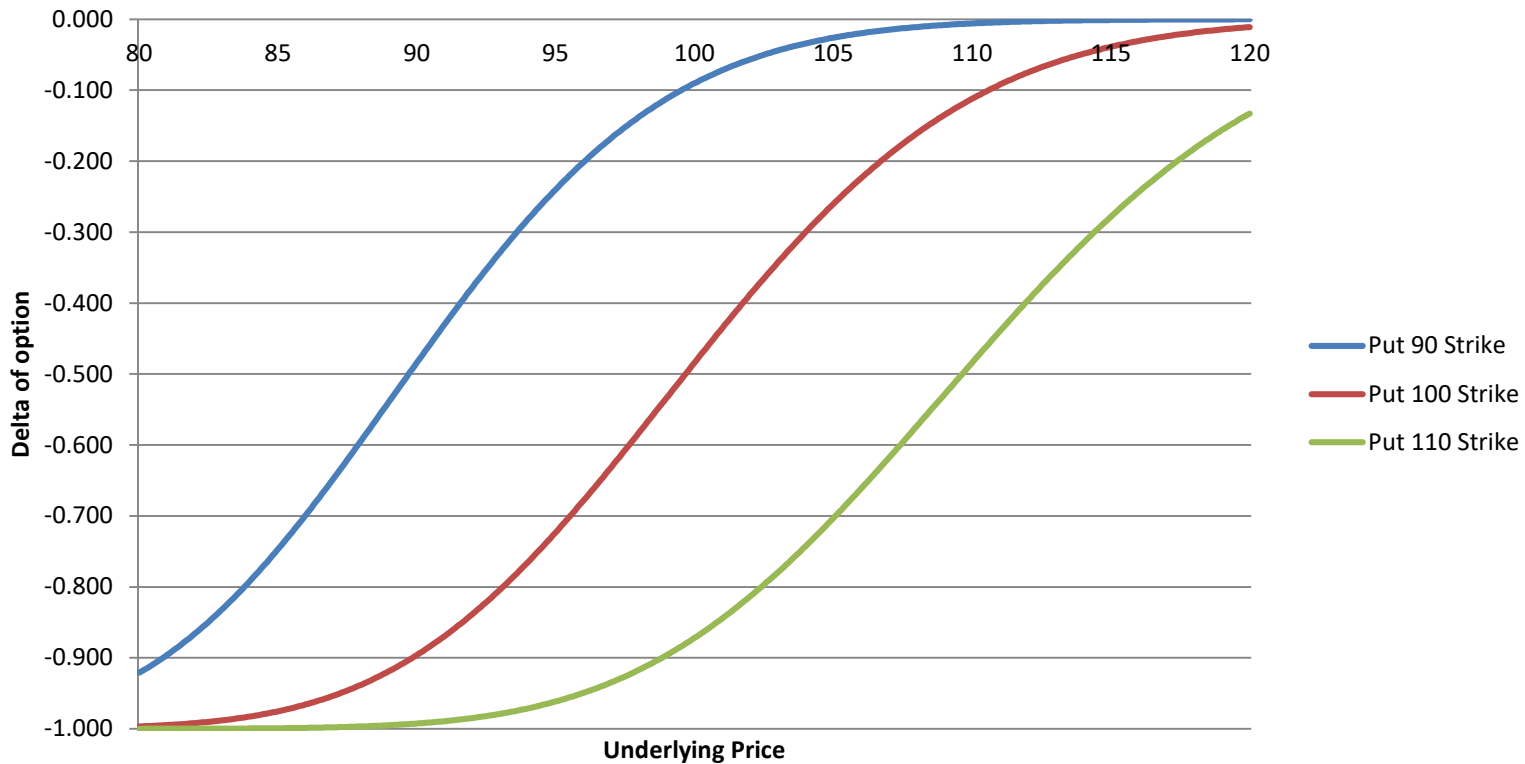
# Gamma: Delta vs Underlying Price

- Call Delta vs Underlying Price



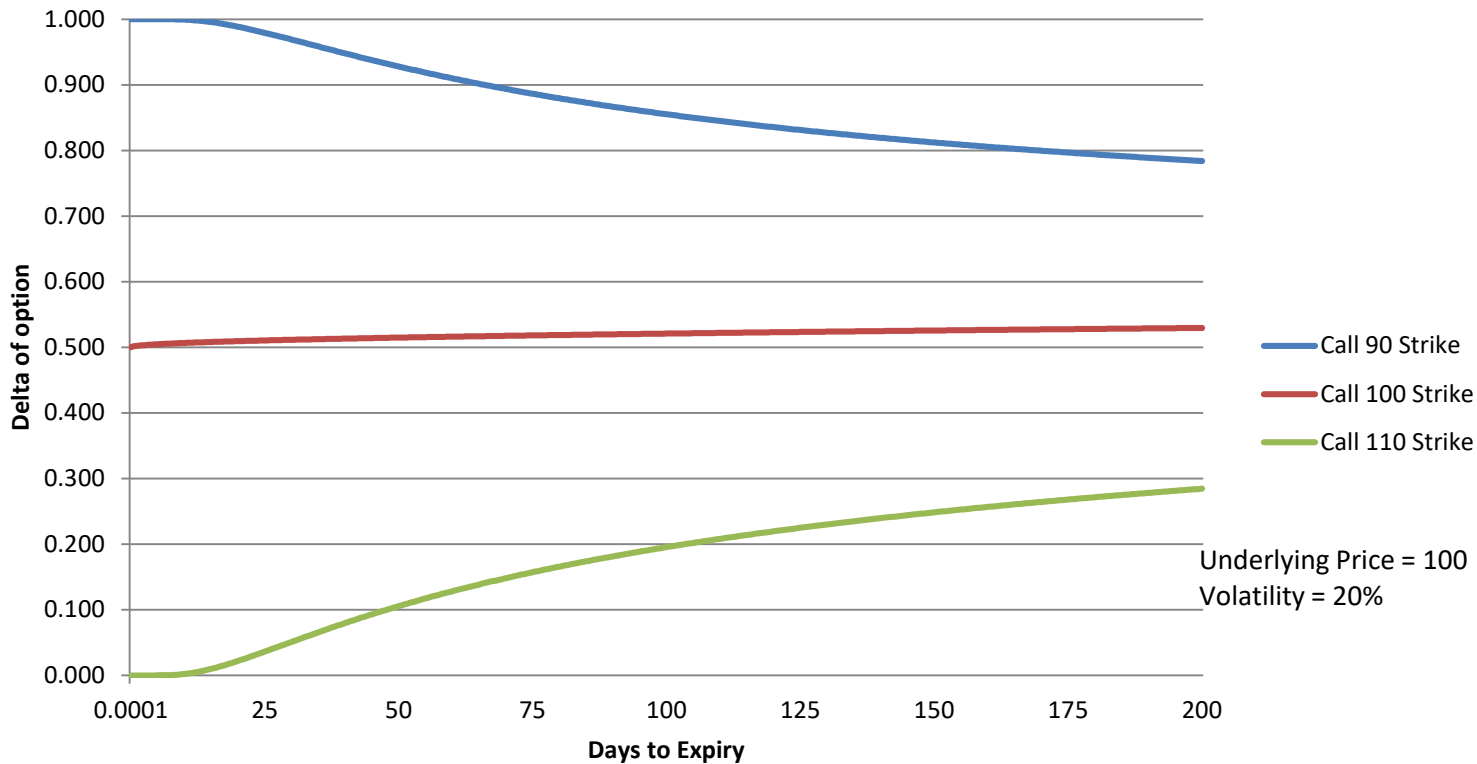
# Gamma: Delta vs Underlying Price

- Put Delta vs Underlying Price



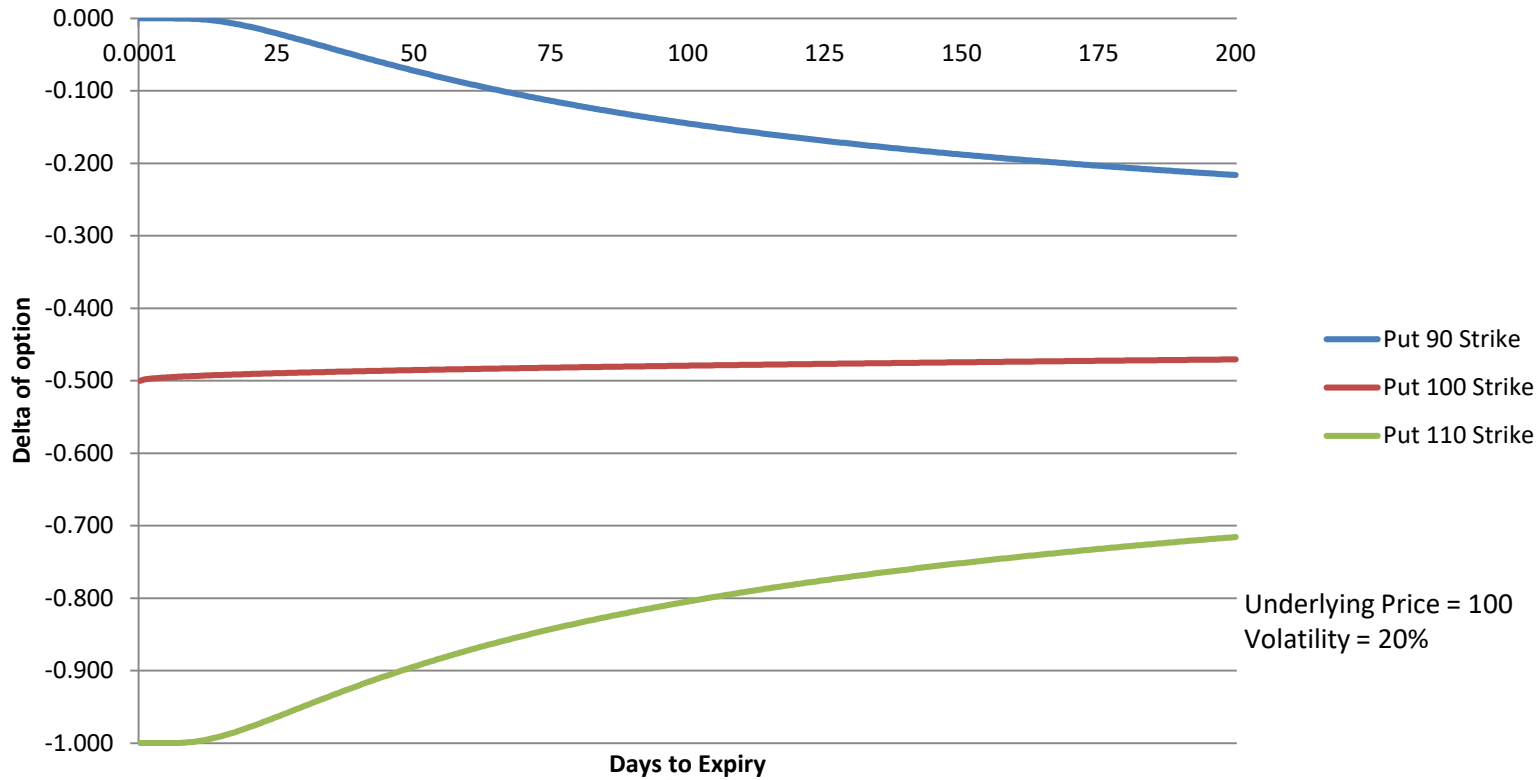
# Charm: Delta vs Time

- Call Delta vs Time left to expiry



# Charm: Delta vs Time

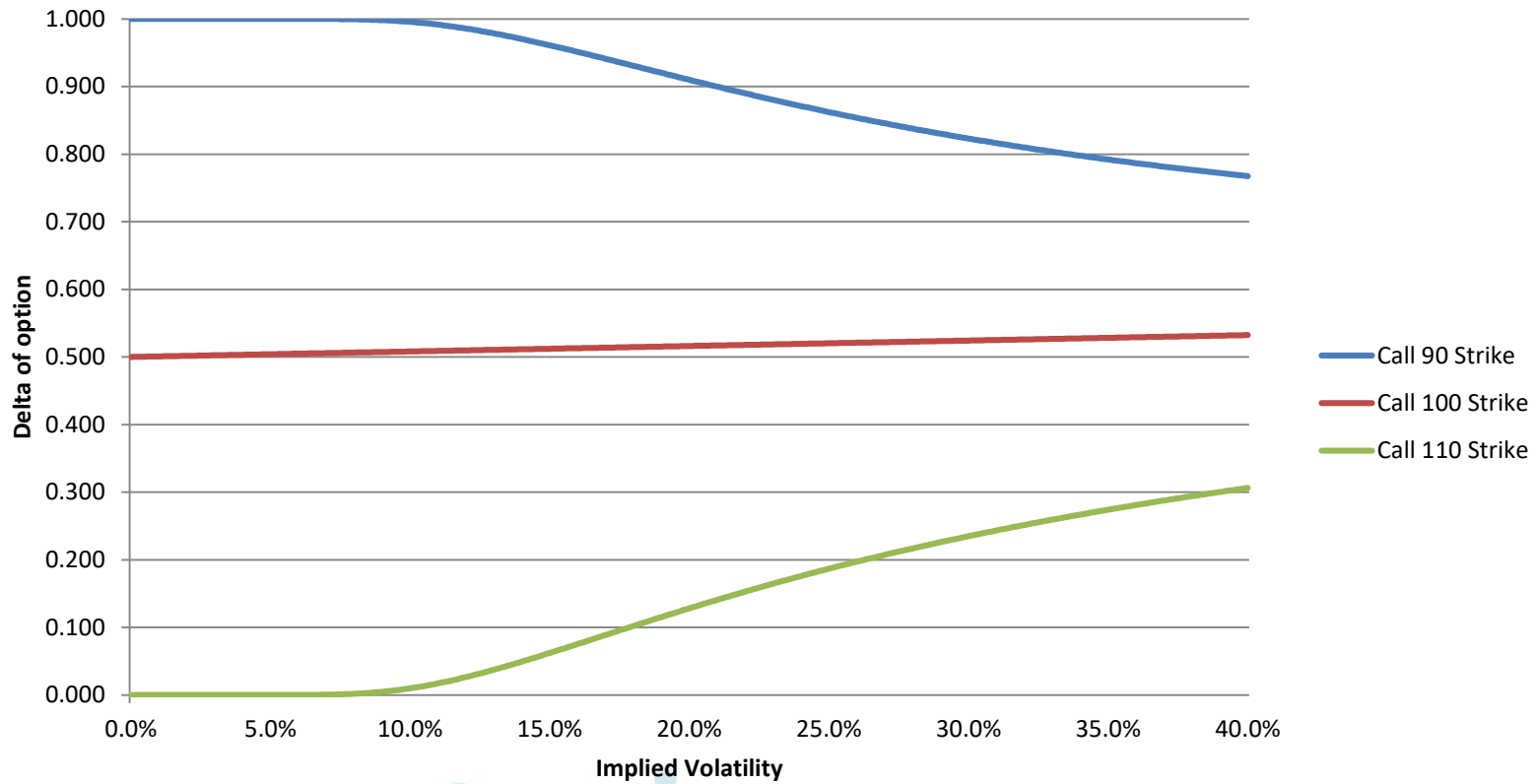
- Put Delta vs Time left to expiry





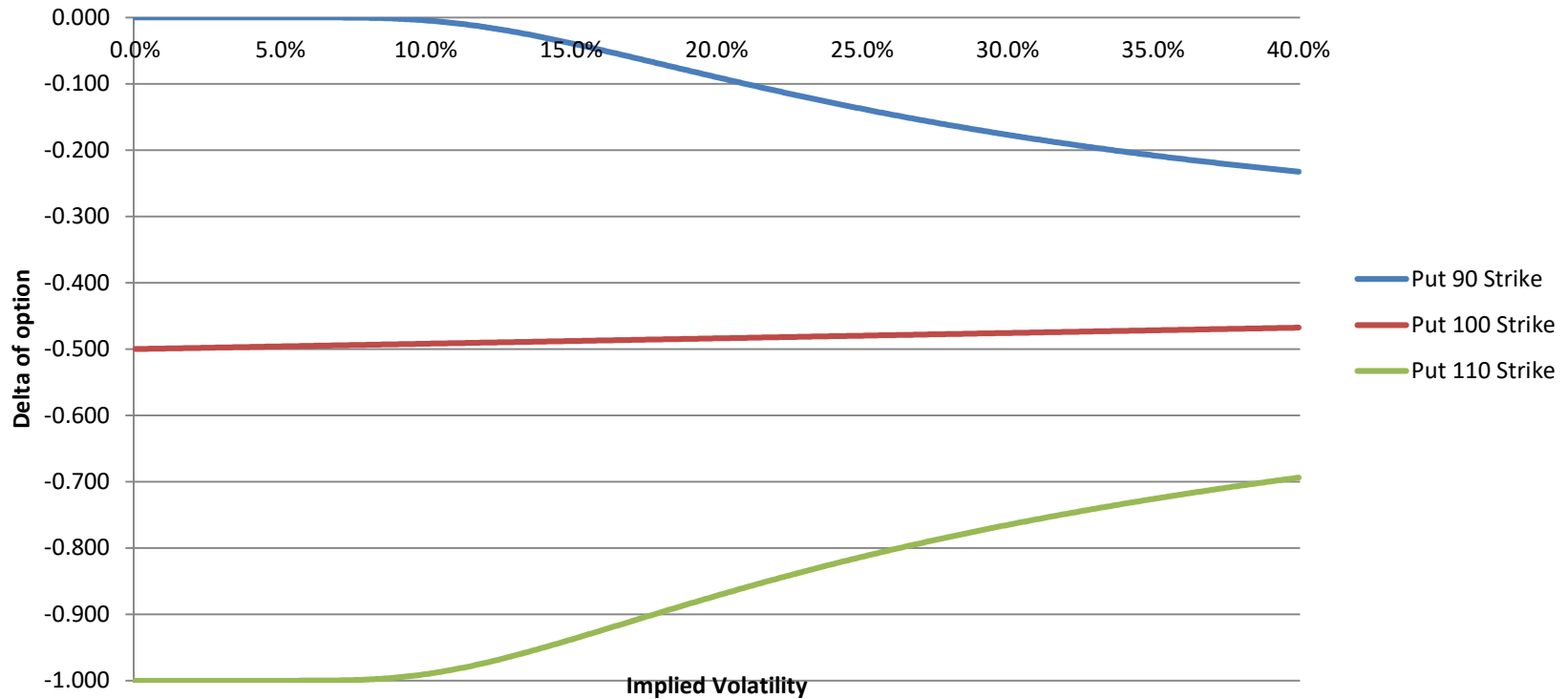
# Vanna: Delta vs Volatility

- Call Delta vs Volatility



# Vanna: Delta vs Volatility

- Put Delta vs Volatility



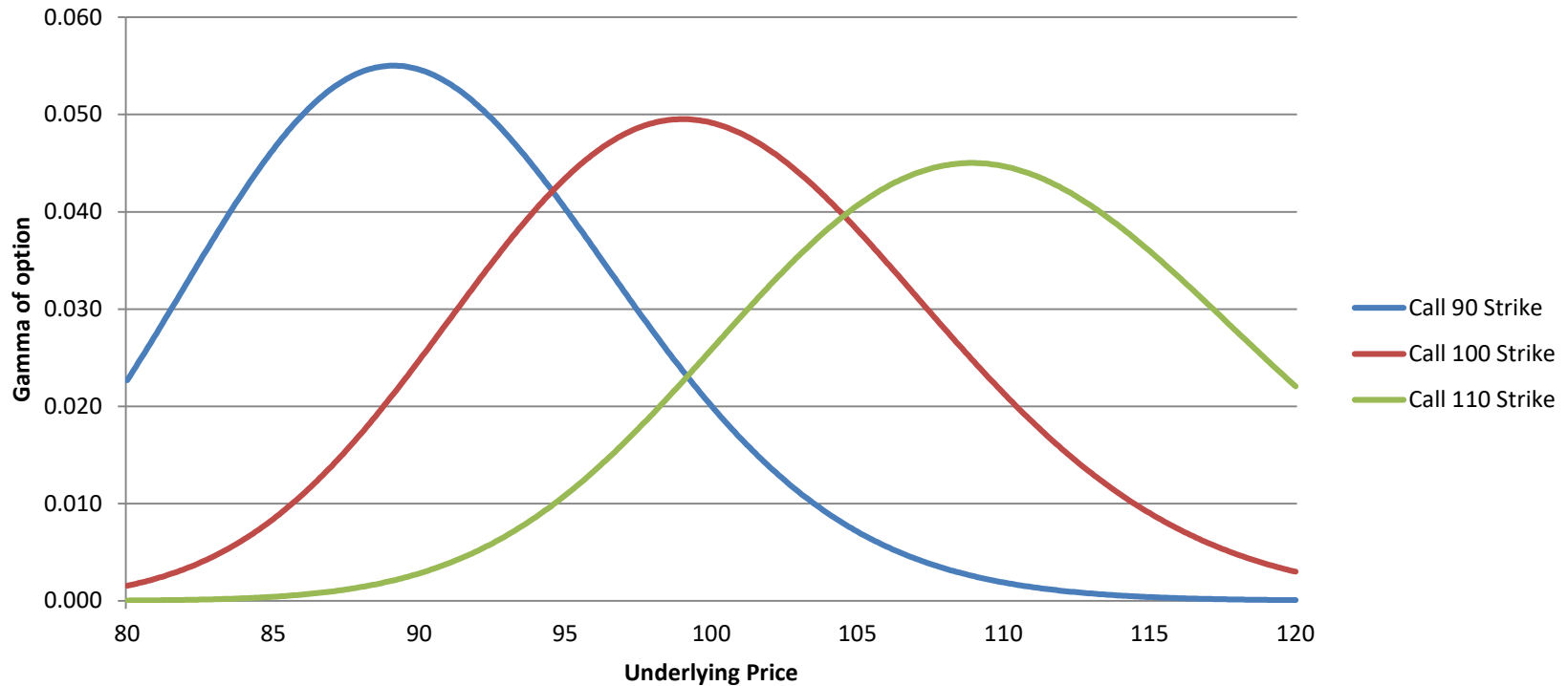
# Gamma

- As we have seen, deltas change with underlying price (more so towards expiry)
- Gamma is the second derivative of the change of option price with respect to change in underlying price

$$= \partial^2 C / \partial S^2 = \partial \Delta / \partial S = N'(h) / (S \sigma \sqrt{t})$$

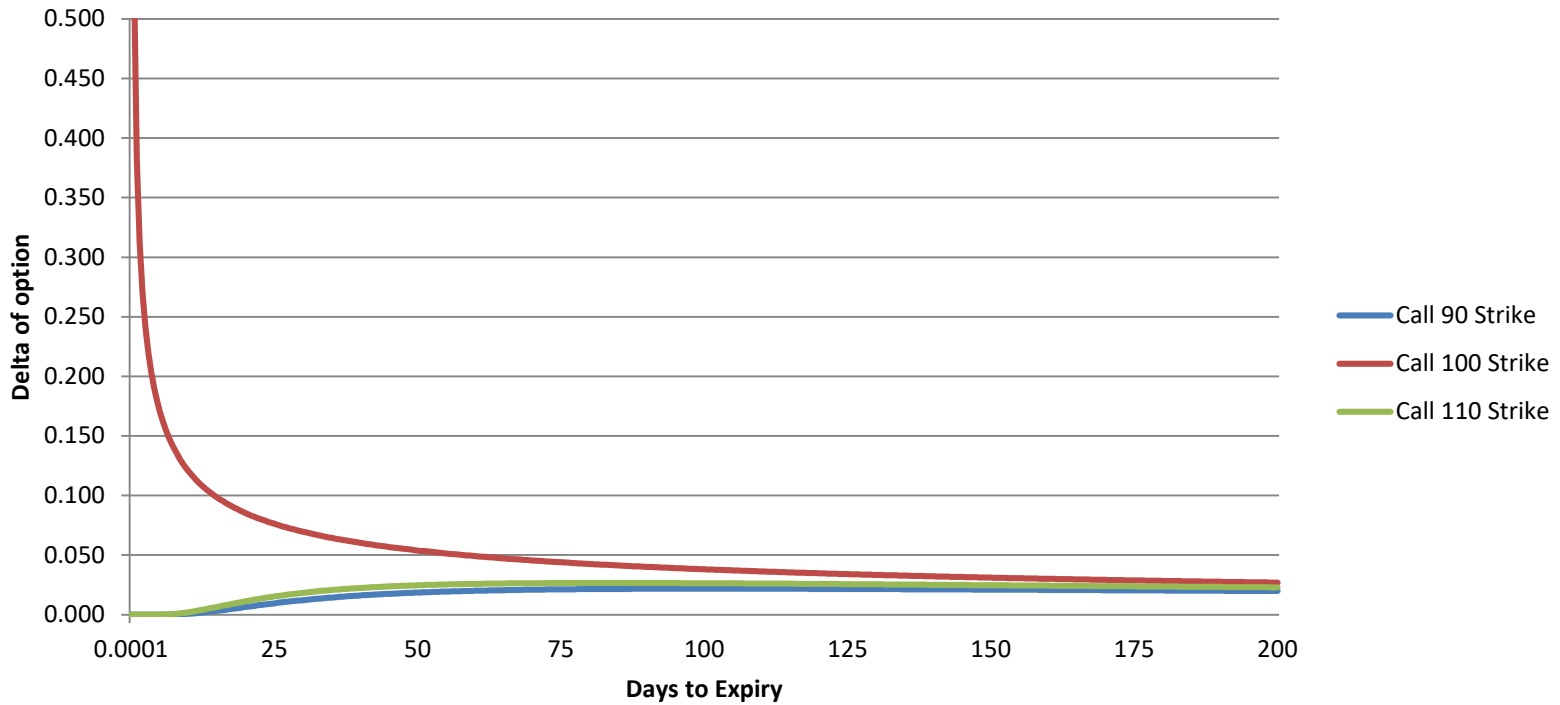
# Speed: Gamma vs Price of Underlying

- Gamma vs Price of Underlying



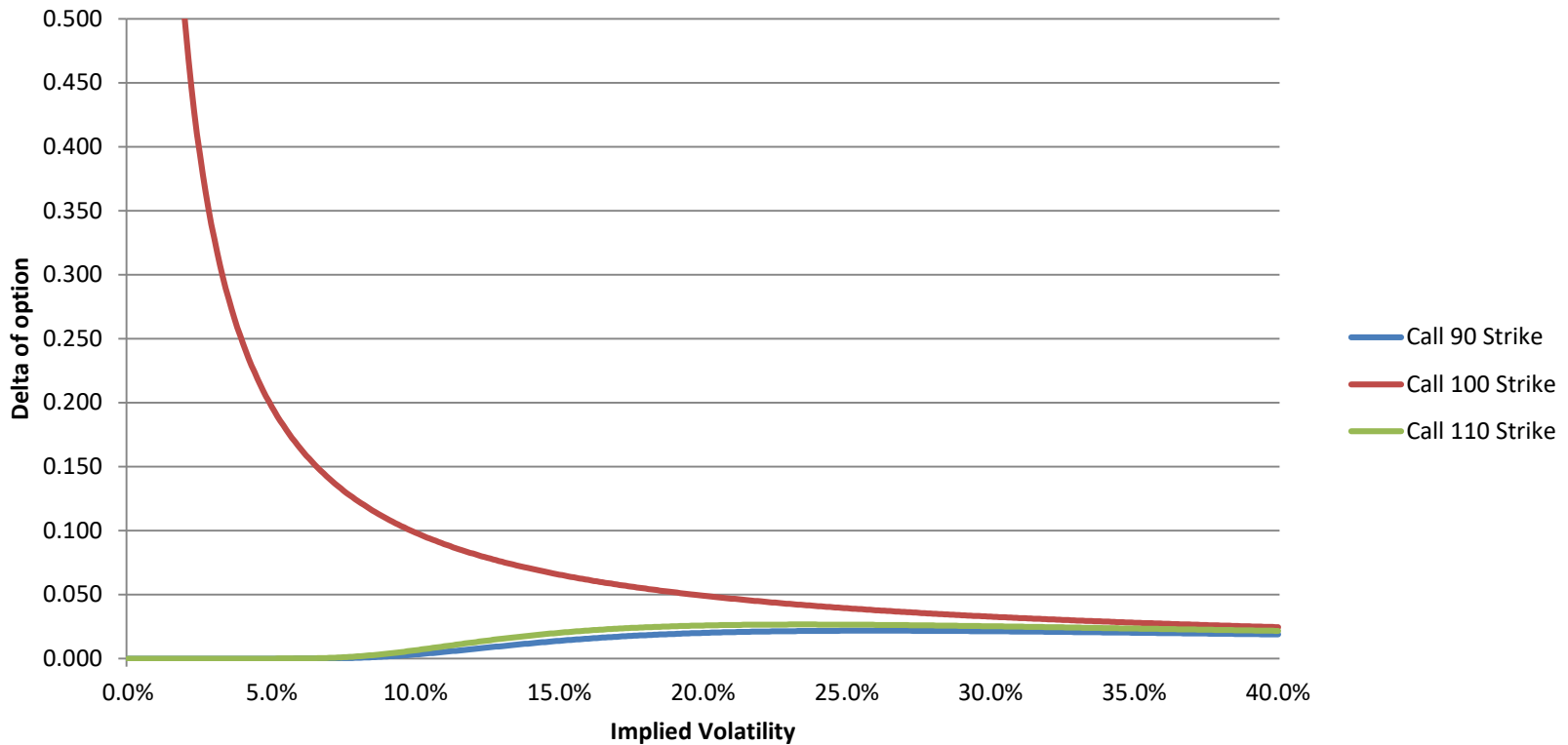
# Color: Gamma vs Time

- Gamma vs Time



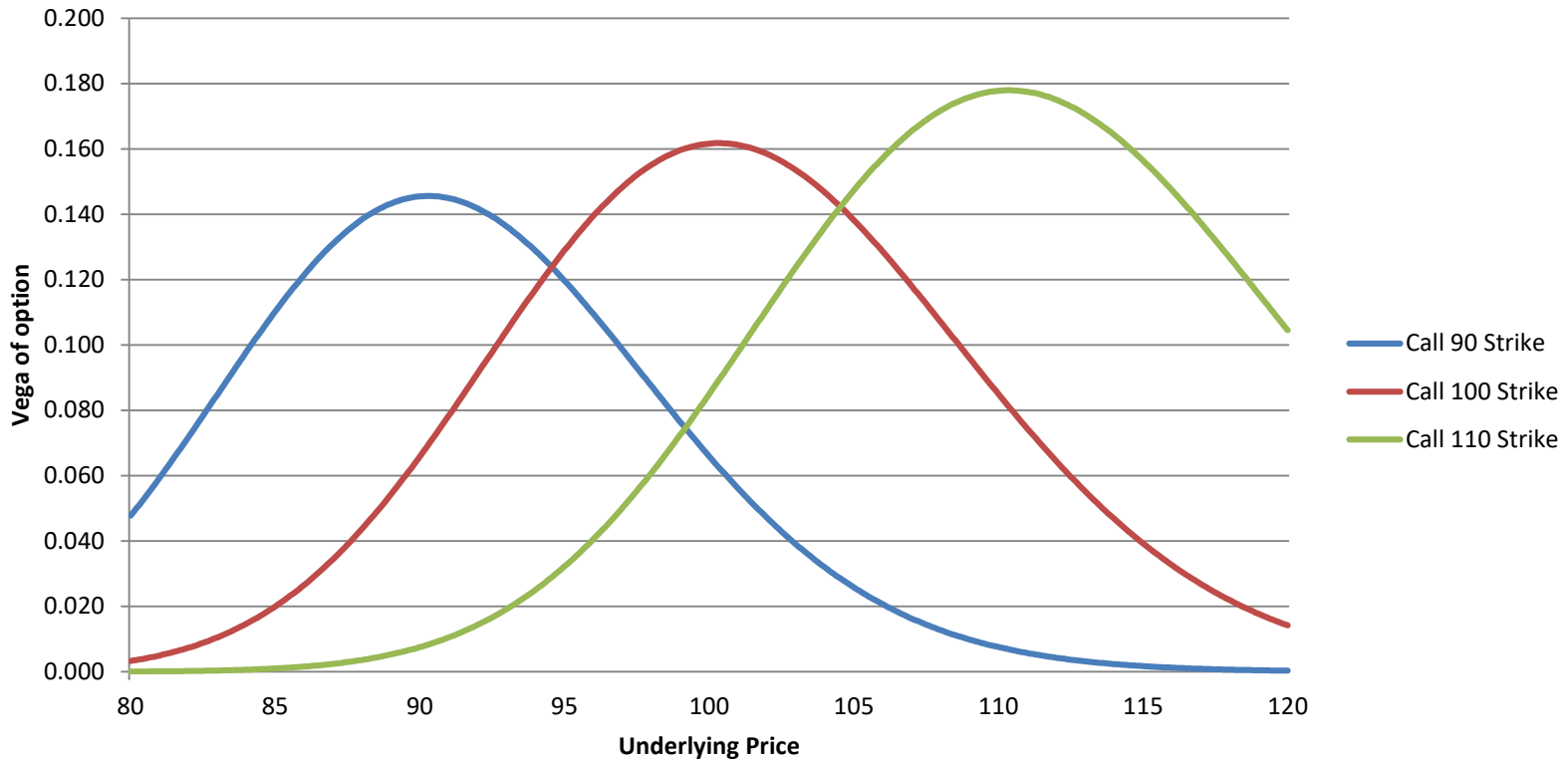
# Zomma: Gamma vs Volatility

- Gamma vs Volatility



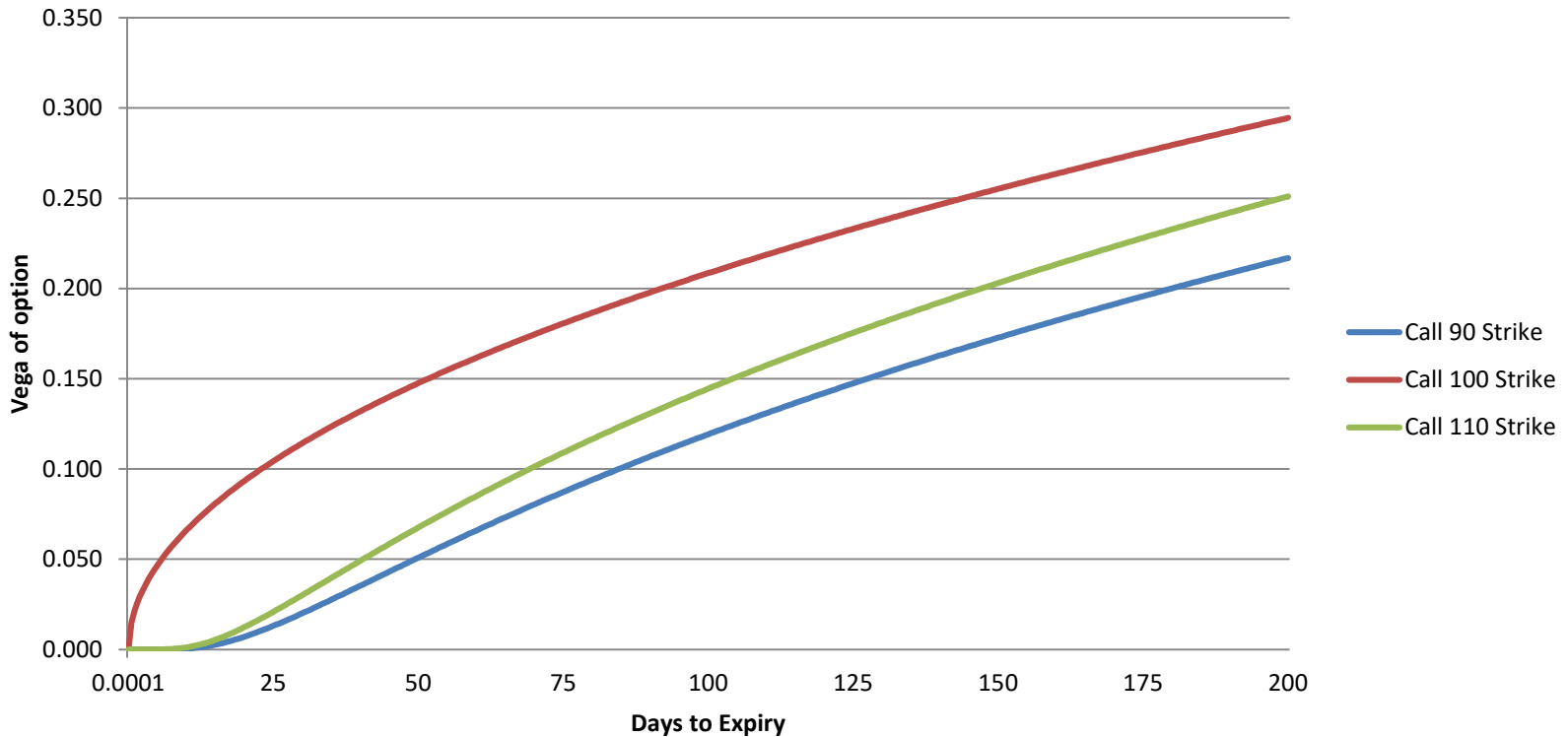
# Vanna: Vega vs Underlying Price

- Vega at different strikes



# Veta: Vega vs Time

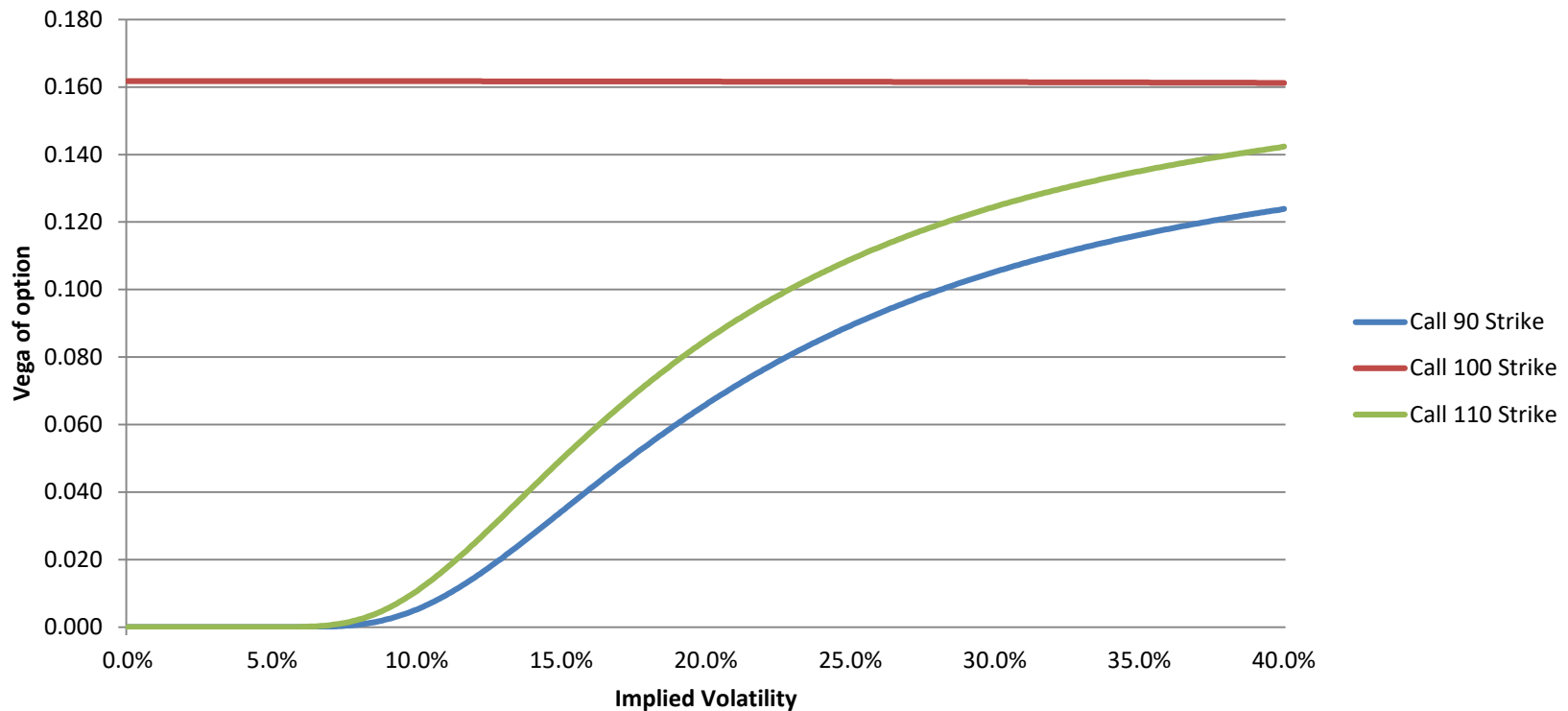
- Vega of an option with varying time left to expiry





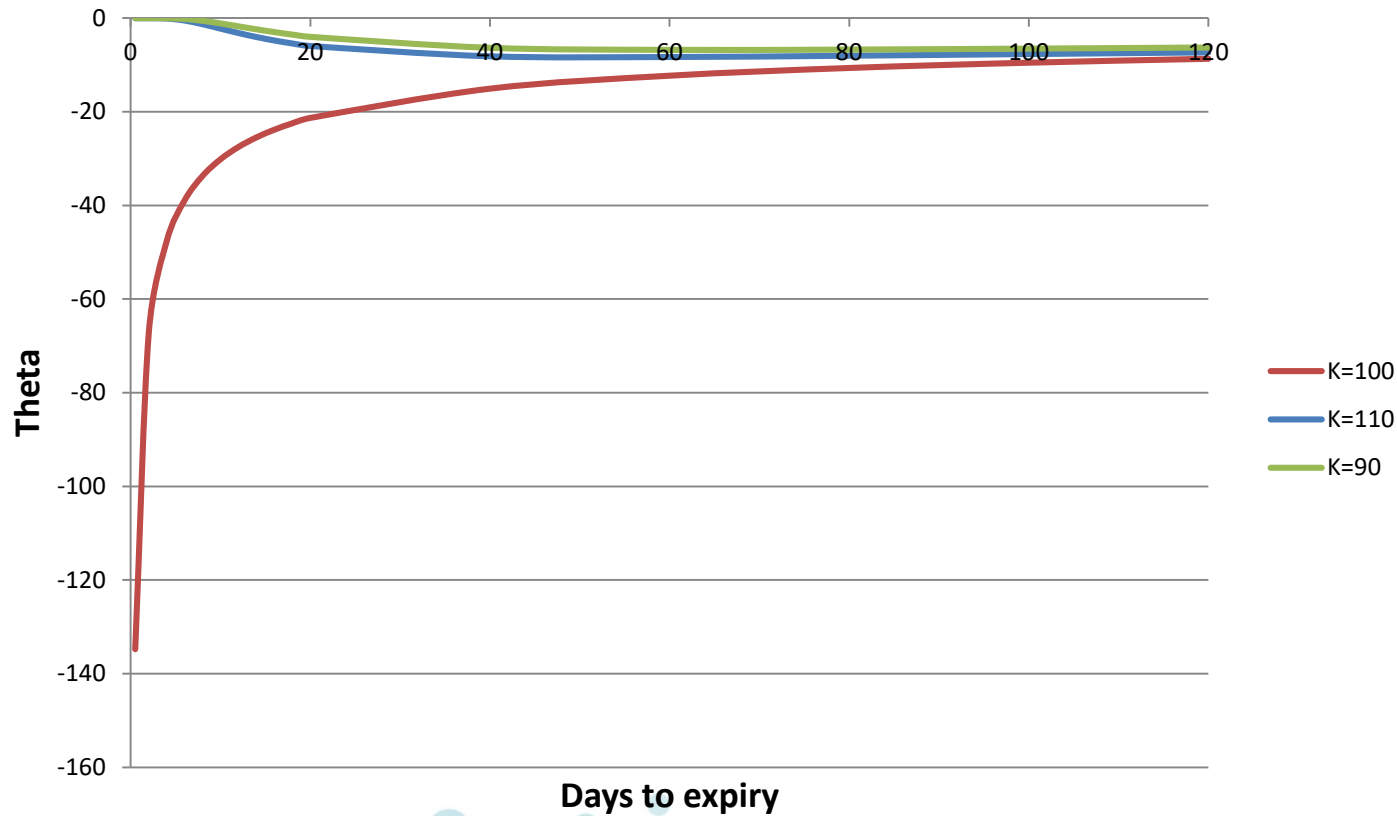
# Vomma: Vega vs Volatility

- Sensitivity to volatility is sensitive to volatility itself



# Thega: Theta v/s Time to expiration

- Theta with changing time to expiry



TAKE THE NEXT STEP WITH EPAT™



Over **10,000 professionals** from **100+ countries** have benefited from QuantInsti's educational initiatives.

If you want to be a **successful Algorithmic Trader**, then **enroll for EPAT™** now!

For more information visit us on:

<https://www.quantinsti.com/epat/>

or Call us on

**+91-22-6169-1400 / +91-9920-44-88-77**

Next Batch Starts from **October 28, 2017!**



KEEP  
CALM  
AND BE AN  
EARLYBIRD

Grab the early bird  
discount before the  
next batch starts on  
**October 21, 2017!**

Questions?

