

Delta, Gamma, Vega, Theta & Rho

* These are Greek words which are used with reference to Black & Scholes model of option valuation.

* We know that value of call option is determined by 5 factors:

- i) Spot price
- ii) Strike price
- iii) Interest Rate
- iv) Standard Deviation
- v) Time to maturity

* Once a call option has been written, strike price cannot change. Change is possible only in other 4 factors.

* So Greek words delta, Gamma, Vega, theta & Rho explain effect of change in one factor on value of call option.

* Important point to Note:

"All factors are positively correlated with value of call option."

Delta : (Change in option value with respect to change in spot price)

The delta of an option is the rate of change of the option value with respect to price of underlying asset - other factor remaining unchanged.

$$\text{Delta of an call option} = N(d_1)$$

for Example: If delta of an option is 0.40, this means if the price of underlying asset increases by 1 Re., the value of the option will increase by 0.40 and vice-versa.

Gamma :

It refers to the change in delta on one rupee change in spot price.

for example :

- If Gamma of an call option = .40
- It means 1 Re. change in spot price of underlying asset, change the value of delta by 0.40 in same direction.

Example : Let spot price : ₹ 20

value of call optⁿ : ₹ 3

delta : 0.50

Gamma : 0.04

now if spot price changes with 1 Re. means it becomes ₹ 21

then value of call option will become = $3 + 0.50 = \underline{3.50}$

& then Delta = $0.50 + 0.04 = \underline{0.54}$

Vega :

It state the change in option value for a unit change in Standard Deviation, other factors remaining unchanged.

Example : value of call option = ₹ 10

Vega = 0.60

Standard Deviatⁿ = 0.25 (or 25%)

now if Standard Deviatⁿ increased to 0.26 or (26%)

then value of call option will become 10.60 ($10 + 0.60$)

Theta :

It is the change in option value as the time passes.

Means as the time to maturity decreases, the value of option also decreases

means change in option value with respect to change to 1 day change in time.

Example :

Value of call option = ₹ 80

Time = 25 days

Theta = ₹ 5

So value of call option tomorrow will be ₹ 75

[after 1 days time will become 24 & V_{co} will be $(₹ 80 - 5) = 75$]

RHO :

It is a measure of change in option value with respect to 1% change in risk free rate.

Example :

Value of call option = ₹ 90

RHO = 0.60

Interest Rate = 10%.

Now if interest Rate changes & become 11%. (change of 1%.)

then value of call option = $90 + 0.60$
= 90.60 Ans