

Analysis of Nifty Option Price Using Black Scholes and Greeks



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Index Options are extremely risky and gainful derivatives which are influenced by the specific market variables like index value, strike price, the time to expiration, underlying indices value, interest rate, market sentiment etc. We calculate Call option price, Put option price and Greeks of Nifty option using Black Scholes Model for the month of Oct 2018. Greeks –Delta, Gamma Theta, Vega and Rho are analyzed with respect to their individual impact on option positions of each strike prices which able to understand and measure different dimensions of risk in each index option positions.

Keywords: Index Call and Put Option, Option Price, Option Greeks, Black Scholes Model, Option Moneyness

1. Introduction

Derivatives have a great compact of use in risk Management. Futures and Options are most commonly traded derivatives on Indian capital market and NSE enjoys almost complete monopoly in derivatives trading. Option's value derived from the underlying assets value like indices, stocks etc. NSE introduced trading in Nifty 50 index option on 4-June-2001. At present NSE provides index option contracts on 9 major indices, among them Nifty 50, Bank Nifty, Nifty Midcap 50 and Nifty IT are more frequently traded index options. Options became extensively popular after Fisher Black, Myron Scholes and Robert Merton developed a theoretical option pricing model in 1973 known as the Black – Scholes model. This model is widely accepted by all investors throughout the world even though this model could make certain pricing bias in realistic market since it provides an analytical solution for option price along with its sensitivities to risk known as Option Greeks. The most commonly calculated option Greeks are Delta, Gamma Theta, Vega and Rho which are sensitive to a particular market variables like strike price, the time to expiration, underlying value, interest rate, market sentiment etc. When we open option position intensity of these Greeks have magnificent impact on option position simultaneously. No doubt the success of option trade mainly depend upon in which direction market moves but also these Greeks dictates the movement of the option price. Hence many research work have been carried in valuation of Black –Scholes pricing model and analysis of option Greeks to manage the risk associated with options. The research studies by **Black and Scholes (1973)** observed that option buyers pays more than that is predicted as there is larger transaction costs in option market. **Lazibat and Bakovic (2007)** found that the price risk is one of the most important risk that foreign trade companies face. Hence they mainly concentrate how options, which are normally considered a main tool for speculation, can successfully be used as a tool for price risk elimination. **Yuh-Dauh and Teng (2011)** found that risk hedging through Option Greeks is to be less variant from the actual result this help for predicting by using various formulas numerically which are unbiased. **Xishen and Xiaoke (2013)** found that Greek letter measures the sensitivity of an option price with respect to the change in the value of a given underlying asset's price, value, time etc. **Jelena (2014)** explains the market risk management from the perspective of options trader, and shows how to describe the risk characteristics of plain vanilla European stock option contracts by going through the Greeks. **Kakati (2006)** found that the pricing option contracts for ten Indian stocks using Black-Scholes (BS) model, which are mispriced considerably and underpriced the options in many cases. However one cannot draw generalized conclusions from his studies since his research is limited to only ten Indian stock option contracts. **Saravanan and Pradeep (2012)** explains the accuracy of the Black-Scholes option pricing model with relate to market prices and helps in finding whether the stock options are properly priced. **Khan et.al (2013)** found that the credit rate in India was assessed using Black- Scholes-Merton model which supports the argument that liquidity premium and transaction costs account for the unexplained component of market spreads. **Sanjana (2013)** observed that trading options and option strategies are based on risk factors and it can be predicted using Greeks. **Panduranga (2013)** found the paired sample T-test revealed that there is no significant difference between the expected option prices calculated thorough Black-Scholes Model and market price of options. It can be inferred that model is relevant for cement stocks. **Nagendra and Venkateswar (2014)** explained the robustness of the Black-Scholes model in pricing stock options in India and that pricing is further improved by incorporating implied volatility into the model. **Nilakantan and Shalini (2014)** observed that Black-Scholes model is imperfect despite its prevalent use in hedging as it assumes continuous hedging and zero transaction cost. **Rajanikanth and Lokanadha (2015)** found the price of a European option in the future and its sensitivity through Greek letters and risk measure by using Delta, Vega, Theta, Rho, and Gamma. **Muthusamy and Vevek (2015)** found that in most of the contracts the calculated options price differs from the market value of the options contract. Though many studies suggest that BSM model is best for estimating European options price, it provides arbitrage opportunity for the market participants in Indian market. **Bhardwaj (2017)** found that the financial market of India is likely to grow rapidly in the long run, owing to the developments brought in by the Indian government. Even though derivatives contains some risk if the investors use carefully, they can do wonders for the investors and the companies.

Kumar (2018) found that the effectiveness of commonly used Greeks such as Delta, Gamma, Theta, Vega, and Rho and their significance in managing various types of risks associated with an option contract. Hence investors use the Greeks under Black- Scholes model framework as a benchmark for properly adjusting option position so that they can manage their risk. In this empirical paper we focused on Nifty index option and analyze the impact of each Greeks on Option buyer's point of view. We have estimated daily Nifty option value (both call and put) and option Greeks which are expired on 25-Oct-18 within the framework of Black- Scholes option pricing model. For our analysis we have selected four strike prices 10000, 10800, 11000 and 11200. Finally estimated Greeks value helps in understanding the different dimension to the risk in a Nifty option position so that we can successfully manage their risk.

2. Objectives and Methodology

2.1 Objectives

The following objectives are set based on the literature reviews by Nagendra and Venkateswar (2014), Rajanikanth and Lokanadha (2015) and Kumar (2018):

- To estimate Nifty option price and Greeks using Black- Scholes model for each selected strike prices.
- To analyze different dimension to risk in a Nifty option position using option Greeks.

2.2 Data Sample and Methodology

The sample of the study covers the daily European call and put Nifty option price for strike prices 10000, 10800, 11000 and 11200 which are expired on 25- Oct-2018. This secondary data is collected from 1- Oct- 2018 to 25-Oct-2018 from NSE website. In this paper Nifty option Greeks are estimated within Black-Scholes model (1973) framework for selected strike prices using computer Programmed online Black- Scholes option pricing model and option Greeks calculator. Daily implied volatility is also estimated using online calculator. As per original Black Scholes option pricing model assumptions implied volatility and risk free interest rate are constant. But in this empirical paper we considered change in the implied volatility for each day from 1- Oct-2018 to 25-Oct-2018. So fluctuating input variables are implied volatility rate (%), underlying Nifty spot value and days until expiration and constant input variable is risk free interest rate $r = 10\%$ as per NSE website. Dividend yield is taken as Zero since Nifty option is an index option (no dividends are received on Index options).

Formulas or Models Used

1. Black - Scholes option pricing model :(Merton's extension that accounts for dividends but in this paper dividend yield is zero)

- **Call Option Price (C)** 1

$$C = S_0 e^{-qt} * N(d_1) - X e^{-rt} * N(d_2)$$

- **Put Option Price (P)** 2

$$P = X e^{-rt} * N(-d_2) - S_0 e^{-qt} * N(-d_1)$$

The formulas for d_1 and d_2 are³

$$d_1 = \frac{\ln\left(\frac{S_0}{X}\right) + t\left(r - q + \frac{\sigma^2}{2}\right)}{\sigma\sqrt{t}} \quad \& \quad d_2 = d_1 - \sigma\sqrt{t}$$

Where, S_0 = underlying spot value, X = strike price, σ = volatility or standard deviation, r = continuously compounded risk-free interest rate, q = continuously compounded dividend yield (dividend yield is zero), t = time to expiration, $N(d)$ = standard normal cumulative distribution function, $e = 2.71828$ (Base of natural log function), \ln = Natural Logarithm function.

2. Option Greeks

- **Delta (Δ)**⁴

Delta is the measure of rate of change of the option price with respect to the change in the underlying Value. It is positive value for call option varies from 0 to 1 and negative value for Put option varies from -1 to 0.

$$\text{Call delta} = e^{-qt} * N(d_1)$$

$$\text{Put delta} = e^{-qt} * (N(d_1) - 1)$$

- **Gamma (γ)**

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Gamma is the measure of rate of change of delta with respect to the change in the underlying value. It is positive value for both call and put options.

$$Gamma = \frac{e^{-qt}}{S_0 \sigma \sqrt{t}} * \frac{1}{\sqrt{2\pi}} * e^{-\frac{d_1^2}{2}}$$

- **Theta (θ)**

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Theta is the measure of rate of change of option price with respect to the passage of time i.e. it considers the time of expiry. It is mentioned as negative value for both call and put option which indicates the how many points the option price will erode for each day that passes to the time of expiry.

Call theta =

$$= \frac{1}{T} \left(- \left(\frac{S_0 \sigma e^{-qt}}{2\sqrt{t}} * \frac{1}{\sqrt{2\pi}} * e^{-\frac{d_1^2}{2}} \right) - r X e^{-rt} N(d_2) + q S_0 e^{-qt} N(d_1) \right)$$

Put theta =

$$= \frac{1}{T} \left(- \left(\frac{S_0 \sigma e^{-qt}}{2\sqrt{t}} * \frac{1}{\sqrt{2\pi}} * e^{-\frac{d_1^2}{2}} \right) + r X e^{-rt} N(-d_2) - q S_0 e^{-qt} N(-d_1) \right)$$

- **Vega (v)**

7

Vega is the measure of rate of change of the option price with respect to the volatility of the underlying value. Both Call and put Options have positive Vega.

$$Vega = \frac{1}{100} S_0 e^{-qt} \sqrt{t} * \frac{1}{\sqrt{2\pi}} * e^{-\frac{d_1^2}{2}}$$

- **Rho (ρ)**

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Rho is the measure of rate of change of option price with respect to the interest rate. Call options have positive Rho and put Options have negative Rho.

$$Call rho = \frac{1}{100} X t e^{-rt} * N(d_2)$$

$$Put rho = - \frac{1}{100} X t e^{-rt} * N(-d_2)$$

Where,

$$\frac{1}{\sqrt{2\pi}} * e^{-\frac{d_1^2}{2}}$$

Is the standard normal probability density function.

3. Moneyness of options

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Moneyness of option	Call option	Put option
In the money(ITM)	Exercise price < Market Price	Exercise Price > Market Price
At the money(ATM)	Exercise Price = Market Price	Exercise Price = Market Price
Out of the money (OTM)	Exercise Price > Market Price	Exercise Price < Market Price

3. Results and Analysis

We have calculated daily Nifty call and put option prices and Greeks from 1-Oct-2018 to 25-Oct-2018. For our analysis purpose we have selected Nifty call and put option Prices and Greeks on 1- Oct-2018, 10-Oct-2018, 16-Oct-2018 and 24-Oct-2018 which have time to expiry left 24days, 15days, 9days and 1day respectively. The data are tabulated in Table 1,

Table 2, Table 3 and Table 4 for each selected strike prices 10800, 11000, 11200 and 10000. Finally Greeks are analyzed for each Nifty option poisons. Which are discussed as per below.

Table 1 Nifty CE and PE Option price and Greeks for Strike Price - 10800

Option Type	Nifty CE option				Nifty PE option			
Expiry Date	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18
Date	01-Oct-18	10-Oct-18	16-Oct-18	24-Oct-18	01-Oct-18	10-Oct-18	16-Oct-18	24-Oct-18
Strike Price	10800	10800	10800	10800	10800	10800	10800	10800
Days to expiry	24	15	9	1	24	15	9	1
Spot Value	11008.3	10460.1	10584.75	10224.75	11008.3	10460.1	10584.75	10224.75
Interest Rate (%)	10	10	10	10	10	10	10	10
Implied Volatility (%)	16.16	14.12	14.36	40.98	18.99	19.86	18.38	54.84
Nifty option price (Rs)	352.6	26.6	29.8	0.4	100.25	357.4	239.6	575.65
Delta	0.73905	0.16671	0.22001	0.00571	-0.29058	-0.74923	-0.72497	-0.97021
Gamma	0.00071	0.00084	0.00124	0	0.00064	0.00076	0.00109	0.00023
Theta	-5.22073	-2.98943	-4.55604	-1.80046	-2.92248	-2.22302	-3.49533	-7.05141
Vega	9.17345	5.33973	4.92142	0.08709	9.67162	6.74936	5.54625	0.36203
Rho	5.1176	0.71429	0.56685	0.00159	-2.16926	-3.36759	-1.95121	-0.28756

Note: For 1-Oct-2018 to 25-Oct-2018 data are available with author.

Table 1 shows the Nifty CE option price, PE Option price and Option Greeks for strike price 10800. As per our observations and analysis, on 1- Oct-2018 Delta value and Option Price of a Nifty CE option are higher, 0.73905 and 352.6 Rs respectively since Nifty spot price value is higher 11008.3 when compared to strike price 10800 I e call option contract is ITM. Later days when Nifty CE option contract tends to expiry date the delta values decreases to 0.00573 and Nifty call option prices also decreases to 0.4 Rs. This is because the Nifty spot value moves down to 10224.75 which tends the contract to OTM. In case of Nifty PE option changes in Delta and option price values against same nifty spot value 11008.3 are exactly reverse in nature. I e Delta value of Nifty PE option and option price are lower, -0.29058 and 100.25 Rs. respectively because put option contract is OTM. Later days when Nifty PE option contracts approaches to expiry date the Delta value increases to -0.97015 and Put option price rises to 575.65 Rs. This is because contract tends to ITM since Nifty spot value moves down to 10224.75. Gamma value of both Nifty CE option and Nifty PE option decreases as option approaches near to expiry date 24-Oct – 2018 e days to expiry left is 1 day. Gamma value is zero for Nifty CE option which is OTM option and Nifty PE option's Gamma value is 0.00023 which is ITM option. Theta value is more for Nifty CE option on 1- Oct -2018, - 5.22073 and it decreases as the contract approaches to expiry and on 24-Oct-2018 value is -1.80046. In case of Nifty PE option Theta value is -2.92248 and it increases as the contract approaches to expiry on 24- Oct – 2018 value is -7.05141 since implied volatility is more 54.84%. Rho value for Nifty CE option on 1-Oct-2018 is higher 5.1176 since the contract is ITM and days to left for expiration is more I e 24 days. In the later days the contract tends to OTM and days to left for expiration is 1 day hence Rho value decreases to 0.00159. Rho values for Nifty PE option on 1-Oct -2018 is -2.16926 and on 24-Oct-2018 is -0.28756.

Table 2 Nifty CE and PE Option Price and Greeks for Strike Price 11000

Option Type	Nifty CE option				Nifty PE option			
Expiry Date	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18
Date	01-Oct-18	10-Oct-18	16-Oct-18	24-Oct-18	01-Oct-18	10-Oct-18	16-Oct-18	24-Oct-18
Strike Price	11000	11000	11000	11000	11000	11000	11000	11000
Days to expiry	24	15	9	1	24	15	9	1
Spot Value	11008.3	10460.1	10584.75	10224.75	11008.3	10460.1	10584.75	10224.75
Interest Rate (%)	10	10	10	10	10	10	10	10
Implied Volatility	14.86	14.8	15.04	51.46	17.18	21.69	21.08	0
Nifty Option Price (Rs)	210	8.6	7.05	0.3	155.2	530.35	413.2	771.9
Delta	0.58372	0.06357	0.06512	0.00358	-0.42528	-0.84829	-0.85802	-1
Gamma	0.00093	0.0004	0.00051	0	0.00081	0.00051	0.00064	0
Theta	-5.11221	-1.48357	-1.95028	-1.48545	-2.63456	-1.02535	-1.77243	-3.01287
Vega	11.01247	2.64269	2.11041	0.05735	11.06322	4.98154	3.73479	0
Rho	4.08705	0.26976	0.16822	0.00099	-3.18037	-3.86446	-2.34128	-0.30129

Note: For 1-Oct-2018 to 25-Oct-2018 data are available with author.

Table 2 shows the Nifty CE option price, PE Option price and Option Greeks for strike price 11000. As per our observations and analysis the Nifty CE option on 1-Oct-2018 Delta value is 0.58372 and Option price is 210 Rs. as the contract is ATM since Nifty spot value is 11008.3 which is almost equal to strike price 11000. Later days both delta values and option prices are decreased. On 24-Oct-2018 the delta value is 0.00358 and option price is 0.3 Rs. as the contract tends towards to expiry become OTM since Nifty spot value is 10224.75. Gamma value is more 0.00093 on 1-Oct-2018 since the contract is ATM which implies that acceleration of change in delta value is more for every point change in the Nifty spot value. Later days contracts tends to OTM as approaches to expiry date on 24-Oct-2018 and Gamma value decreases to zero. Hence option price will not change much even any significant movement of Nifty spot value due to high implied volatility I e 51.46%. Further we observed that Theta and Vega value is higher on 1-Oct-2018 -5.11221 and 11.01247 respectively since contract is ATM. Later days both the values decreases and on 24-Oct-2018 Theta value is -1.48545 and Vega value is 0.05735 as the contracts tends expiry and become OTM. Rho value is higher I e 4.08705 on 1-Oct-2018 since still 24 days are left to expiry. As contract tends to expiry date on 24-Oct-2018 the Rho value decreases to 0.00099 so it does not effect on option price. We observed Nifty PE option on 1-Oct-2018, the contracts is also ATM since Nifty spot value is 11008.3 which is almost equal to strike price 11000. Hence Delta value is near to 0.5 I e 0.452528 and have higher Gamma value I e 0.00081. Later days as contracts tend towards to expiry and becomes ITM. Hence on 24-Oct-2018 Delta value increases and becomes -1 but Gamma value decreases to zero which indicates that option price moves up by Rs.1 for every one point upward movement in Nifty spot value. We also observed that Nifty PE option price is also increases from 155.2 Rs to 771.9 Rs. On 1-Oct-2018 Theta value is -2.63456 and Vega value 11.06322. Later days on 10-Oct-2018 and 16-Oct-2018 steadily decreases. But on 24-Oct-2018 Theta value increases to -3.01287 since Vega and implied volatility is zero. We also observed that higher value Theta does not affect the option price since Nifty PE option contract is ITM which has more intrinsic value and less time value. We also observed that Rho value is higher -3.18037 on 1-Oct-2018 and lesser value -0.30129 on 24-Oct-2018.

Table 3 Nifty CE and PE Option Price and Greeks for Strike Price – 11200

Option Type	Nifty CE Option				Nifty PE Option			
Expiry Date	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18
Date	01-Oct-18	10-Oct-18	16-Oct-18	24-Oct-18	01-Oct-18	10-Oct-18	16-Oct-18	24-Oct-18
Strike Price	11200	11200	11200	11200	11200	11200	11200	11200
Days to Expiry	24	15	9	1	24	15	9	1
Spot Value	11008.3	10460.1	10584.75	10224.75	11008.3	10460.1	10584.75	10224.75
Interest Rate (%)	10	10	10	10	10	10	10	10
Implied Volatility	13.78	16.79	18	61.65	15.54	27.13	27.97	0
Nifty Option Price(Rs)	103.9	4.2	3.3	0.25	241.4	729.55	612.85	969.9
Delta	0.38789	0.03073	0.02888	0.00257	-0.59805	-0.87295	-0.88653	-1
Gamma	0.00098	0.00019	0.00022	0	0.00088	0.00036	0.00041	0
Theta	-4.2458	-0.91055	-1.1785	-1.31811	-1.66532	-1.29086	-2.22658	-3.06765
Vega	10.81366	1.47168	1.09566	0.04253	10.91943	4.41478	3.19545	0
Rho	2.73931	0.13035	0.07455	0.00071	-4.48763	-4.05235	-2.46491	-0.30677

Note: For 1-Oct-2018 to 25-Oct-2018 data are available with author.

Table 3 shows the Nifty CE option price, PE Option price and Option Greeks for strike price 11200. As per our observations and analysis Nifty CE option on 1-Oct-2018 the contract is OTM since Nifty spot value is 11008.3. Hence have lesser delta value, 0.38789 and it decrease to 0.00257 as contracts approaches to expiry date on 24-Oct-2018 and becomes deep OTM since Nifty spot value moves down to 10224.75. Gamma value is also more, 0.00098 on 1-Oct-2018 and later days steadily decreases and becomes zero on 24-Oct-2018. We also observed that Nifty CE option price on 1-Oct-2018 is 103.9 Rs. decreases to 0.25 Rs. on 24-Oct-2018 since contracts become further deep OTM. Theta and Vega value is higher on 1-Oct-2018 I e -4.2458 and 10.81366 respectively. Further we observed that both Theta and Vega value decreases as contracts approaches to expiry date and on 24-Oct-2018 values are -1.31811 and 0.04253 respectively. Rho value is higher 2.73931 on 1-Oct-2018 since 24 days are left to expiry. Rho value decreases to 0.00071 on 24-Oct-2018 since only one day left to expiry. We also observed that on 1-Oct-2018 Nifty PE option contract is ITM since Nifty spot value is 11008.3. Hence Delta value is 0.59805 and higher Gamma value, 0.00088. As the contract tend towards to expiry date it becomes further deep ITM as Nifty spot value moves up to 10224.75. Hence on 24-Oct-2018 Delta value increases to -1, Gamma value decreases to Zero and option prices also increases from 241.4 Rs. to 969.9 Rs. We observed that on 1-Oct-2018 Theta value is -1.66532 and

higher value of Vega I e 10.91943. Later as contract tends to expiry date on 24-Oct-2018 Theta have higher value I e – 3.06765 since Vega value decreases to zero since implied volatility is zero. On 1-Oct-2018 Rho value is -4.48763 since 24 days are left to expiry. On 24-Oct-2018 Rho value decreases to -0.30677 because only one day left to expiry.

Table 4 Nifty CE and PE Option price and Greeks for Strike Price – 10000

Option Type	Nifty CE Option				Nifty PE Option			
Expiry Date	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18	25-Oct-18
Date	01-Oct-18	10-Oct-18	16-Oct-18	24-Oct-18	01-Oct-18	10-Oct-18	16-Oct-18	24-Oct-18
Strike Price	10000	10000	10000	10000	10000	10000	10000	10000
Days to Expiry	24	15	9	1	24	15	9	1
Spot Value	11008.3	10460.1	10584.75	10224.75	11008.3	10460.1	10584.75	10224.75
Interest Rate (%)	10	10	10	10	10	10	10	10
Implied Volatility	0	0	0	0	24.56	23.13	24.04	29.38
Nifty Option Price (Rs)	1068.85	490.75	592.8	224	14.25	36.4	9.65	4.95
Delta	1	1	1	1	-0.04833	-0.14221	-0.05596	-0.07067
Gamma	0	0	0	0	0.00014	0.00046	0.00028	0.00086
Theta	-2.72177	-2.72849	-2.73298	-2.73898	-1.30008	-3.26027	-2.33838	-10.43447
Vega	0	0	0	0	2.83339	4.77017	1.87435	0.72388
Rho	6.53225	4.09273	2.45968	0.2739	-0.3592	-0.6263	-0.14843	-0.01993

Note: For 1-Oct-2018 to 25-Oct-2018 data are available with author.

Table 4 shows the Nifty CE option price, PE Option price and Option Greeks for strike price 10000. As per our observations and analysis on 1-Oct-2018 Nifty CE option contract is deep ITM since Nifty spot value is 11008.3 and Nifty option price is also higher, 1068.85Rs. Hence throughout the life span of contract Delta value is absolute 1 and Gamma is zero since implied volatility is also zero. As contracts tends to expiry it becomes less ITM I e Nifty spot value moves downwards from 11008.3 to 10224.75 hence option price decreases and reaches to 224 Rs. on 24-Oct-2018. This is because even though Contract has absolute delta value 1 the Gamma, Vega and Implied volatility is Zero which will not affect much to Option price in relate to movement of Nifty spot value. We also observed that Theta value ranges between -2.72117 to – 2.73898 till the expiry of contract. Rho value is 6.53225 on 1-Oct-2108 since still 24 days are let to expiry. On 24- Oct-2018 Rho value decreases to 0.2739 since only one day left to expiry. Further we observed on 1-Oct-2018 Nifty PE option have lesser delta value, -0.04833 since Nifty spot value is 11008.3 I e the contract is deep OTM. Later days as contracts approaches to expiry on 24-Oct-2018 delta value increases to -0.07067 since Nifty spot value moves downwards, 10224.75 and contract become lesser OTM. On 1-Oct-2018 Option price was 14.25 Rs and on 10-Oct-2018 its value is 36.4 this is because Delta value increases to -0.14221 and higher Gamma, 0.00046. Theta value is less on 1-Oct-2018 I e -1.30008 and Vega value is 2.8339. On 24-Oct-2018 the Theta value increases to -10.43447 since implied volatility is higher I e 29.38% and Vega value decreases to 0.72388. On 1-Oct-2018 Rho value is -0.3592 since 24 days are left to expiry and on 24-Oct-2018 Rho value decreases to -0.01993 since only one day left to expiry.

4. Summary and Conclusion

After analysis of five Greeks values – Delta, Gamma, Theta, Vega and Rho from above Table 1, Table 2, Table 3 and Table 4 for strike prices 10800, 11000, 11200 and 10000 on Option Buyer's point of view we can summarize that Nifty PE options for strike prices 10800, 11000 and 11200 expired ITM on 24-Oct-2018 having highest upward movement of Option Prices, Rs.575.65, Rs.771.9 and Rs.969.9 respectively making profit to option buyer. Whereas Nifty CE Options for Strike Prices 10800, 11000, 11200 expired OTM on 24- Oct-2018 having downward movement of Option Prices, Rs. 0.4, Rs. 0.3 and Rs. 0.25 respectively creating loss to Option buyer. In case of Nifty CE option for strike price 10000 which is initially deep ITM and later expired very less deep ITM on 24- Oct-2018 having downward movement of Option price, Rs.224 creating relatively less loss to Option buyer. The Nifty PE option for strike price 10000 is initially deep OTM and later expired very lees deep OTM having downward movement of Option price, Rs.4.95 on 24-Oct-2018 making relatively less loss to Option buyer.

Thus Price of a call option or put option on non-dividend paying asset is a function of five variables namely the Spot price of the underlying value, Strike Price, Time Till Expiration, Implied Volatility and Risk-Free Interest Rate. If any changes in these variables it will affect the option price. Each Greeks of an option measures the sensitivity of an option price in relative to changes in these market variables. If Delta value is higher then there is more probability that an option contract will expire ITM. ATM option will have Delta value 0.5.and it changes rapidly. Delta value changes slowly for OTM and ITM options. If the Gamma is small Delta changes slowly. ATM option have highest Gamma value when compared to ITM and OTM

options. Theta is also known as the time decay of an option and helps the trader to identify the right strike price and at right time to trade. ATM option have a highest theta when compared to ITM and OTM options. Theta is higher when implied volatility is lower. Black-Scholes Model assumes the volatility constant but in practical it changes continuously. All option price increases when volatility increases. The effect of volatility is more when more days left for expiry. If Vega is highly positive or highly negative the option price is very sensitive to small changes in volatility. If Vega is close to zero, volatility changes have relatively little impact on the value of the option price. Rho value is larger for ITM option and decreases as option tends to OTM. Rho increases as time to expiration increases. For Shorter term options change in interest rate will not have much effect on option price. But for long term options like LEAPS if more interest rate will effect option price since greater cost of carry.

Finally we conclude that the Greeks are incredibly useful in helping investors to forecast what will happen to the price of the options in the future since they effectively measure the sensitivity of option price in relation to market variables. Thus it helps investors to identify the best option strikes considering the time to expiry.

5. References

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