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Nifty Bank Option Price & Option Greeks

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ABSTRACT

An option buyer should always consider the strike price of the option as well as the underlying price of the security/Index as they help in understanding the exact profitability as well as the intrinsic value of his/her underlying asset. The prices of options are majorly affected by factors like dividend and interest rates, volatility, Intrinsic and underlying prices as well. Thus, an option buyer should conduct various studies and analyse each factor before entering into an Option contract. Option Greeks such as Delta, Gamma, Theta, Vega and Rho can help an option buyer to understand and analyse the above-mentioned factors and thus can have a greater impact on his/her decision-making regarding option Contracts. Our research mainly concentrates on understanding and application of Option Greeks on the Option contracts of NIFTY BANK INDEX and its benefits for such option buyers.

1. Introduction

A derivative is a contract between two or more parties based upon the asset or assets. Price of a derivative is derived from the underlying price. The most common underlying assets include stocks, bonds, commodities, currencies, interest rates, and market indexes.

Options are financial derivatives which give the holder a right to buy (but not an obligation to buy) or sell (but not an obligation to sell) an underlying asset at an agreed-upon price known as the strike price on the contract expiration date. Option contracts are purchased by those investors who use it to reduce the risk of adverse price movements in an underlying asset (Hedgers), who hope to make a profit from a change in the premium of the option (Speculators) and who attempts to profit from price inefficiencies in the market by making simultaneous trades that offset each other to capture risk-free profits (Arbitrageurs).

Options are affected by several internal and external factors such as the price of an asset, volatility of market and time value of options. The influence of these factors on option pricing is summarised with the help of Greeks, which are a collection of statistical values that helps in converting risk and the reward into quantifiable terms of a given option or optionsstrategy. Anoptions trader can make better decisions about which options to trade and when to trade those using Option Greeks. This study focuses on the five Greeks, which are Delta, Gamma, Theta, Vega and Rho.

With the help of these five Greeks, an options trader will be able to assess options risk and manage option portfolio.

An option contract in both index, as well as stocks, can be bought and sold through trading members of the National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) in India. The trading members of the NSE and BSE also provide the internet facility to trade in the futures and options market and for that, an account should be opened with one of the trading members.

National Stock Exchange 50 (Nifty 50) is the flagship index that represents the weighted average of fifty Indian company stocks in twelve sectors and is one of the two main stock indices used in India. Bank National Stock Exchange Bank (Bank Nifty) is a sectored index, which shows the top twelve stocks of different banks in terms of its liquidity and market capitalization. Bank Nifty provides a benchmark to the investors and other market intermediaries that capture the capital market performance of Indian banking sector.

With the help of this research study, we are going to identify the options traded in the Bank Nifty Sectored Index in India, analyze, compare and rank them to understand their price sensitivity using Option Greeks.

2. Review of Literature:

a. (Michael, 2012)**:** In this magazine named Futures, Michael J. McFarlin discussed the five Greeks namely Delta, Gamma, Theta, Vega and Rho and how will it help in calculating the theoretical value of an option when the market condition changes for novice option traders.
b. (Dicle, 2017)**:**In this research paper, Mehmet F. Dicle discussed the methods to collect real and current options data, calculate intrinsic values, premiums, implied volatilities and Greeks to compare the effects of each associated option variable on option outcomes.
c. (Yu & Xie, 2013)**:**In this research journal, Xicheng Yu and Xiaoke Xie present a simple way to derive five Greek letters of both European call and put options under the Black-Scholes model framework and they also show the relation between Delta, Gamma, and Theta with the help of few examples.
d. (Rajanikanth & Reddy, 2015)**:** In this research journal, C. Rajanikanth and Dr. E. Lokanadha Reddy calculated the Greek letters under the Black-Scholes framework for five companies from different industry in India to help the investors to eliminate risk.

e. (Paunović, 2014)**:** In this research journal, Jelena Paunović described market risk management from the perspective of an options trader. She highlighted the risk characteristics of Plain Vanilla European Stock Options contracts through Option Greeks and she proved how Greeks help in more accurate pricing and trading.

3. Research Design:

a. Statement of Problem:

The underlying price of an index is highly volatile in nature and so does the option price for an option contract to lock in the price at which the contract can be executed in future. An option's price is the summation of intrinsic value and extrinsic value (also known as volatility premium/time value). An intrinsic value is a value by which the strike price for an option is in the money while the extrinsic value is the value by which the option's price exceeds the intrinsic value. There are many factors that affect an option's price namely dividend rate, interest rate, transaction quantity (quantity traded), the underlying price of the asset and time value. Anoptions trader should consider the above factors affecting the option's price when he/she enters into an option contract to reduce the risks associated. This can be done with the help of Option Greeks. Thereby, the options trader will be able to identify and differentiate how each variable affects the option's price.

b. Objective:

To compute Delta, Gamma, Theta, Vega,and Rho for NIFTY BANK option contracts to determine its price sensitivity.

c. Sources of Data:

Our source of collection of data is secondary data. The data required for this study is collected from the following sources:

- National Stock Exchange India (NSE India) Website
- Nifty Indices Website
- Option Price Calculator(Black and Scholes Options Pricing Model) Website
- Varsity by Zerodha Website(To know about Option Greeks)
- Investopedia Website (To know about Option Greeks)

d. Data Analysis Tool:

The data analysis tool used for this study is MS Excel.

e. Expected Outcome:

After getting to know the purpose of each Option Greek, the option trader who wants to buy an option contract of NIFTY BANK expiring on future will be able to determine which contract can be in-the-money, at-the-money and out-the-money as well as he/she will also be able to determine what factors affects the option's price the most and can reduce the risks associated.

f. Limitations:

- Among all the indexes in National Stock Exchange, only NIFTY Bank Index is considered for applying Option Greeks.
- No primary data is collected for the conduct of this study.

4. Data Analysis:

The data required for computing option Greeks for the Nifty Bank option contracts expiring on September 27th, 2018 is as follows:

Sl.No.	Underlying Price/S_0 (in Rs.)	Strike Price/X (in Rs.)	Implied Volatility/ "Sigma" (In %)	Interest Rate/'r' (in %)	Dividend Yield/'q' (in %)	Number of days to expiry/'n'	Time to expiration/'t' (as % to the year)
1	25596.9	26500	19.14%	7.0612%	0.50%	6.00	1.6438%
2	25596.9	26000	15.68%	7.0612%	0.50%	6.00	1.6438%
3	25596.9	27000	21.71%	7.0612%	0.50%	6.00	1.6438%
4	25596.9	26800	18.14%	7.0612%	0.50%	6.00	1.6438%
5	25596.9	26700	19.73%	7.0612%	0.50%	6.00	1.6438%
6	25596.9	26600	19.60%	7.0612%	0.50%	6.00	1.6438%
7	25596.9	26400	18.62%	7.0612%	0.50%	6.00	1.6438%
8	25596.9	25500	18.53%	7.0612%	0.50%	6.00	1.6438%
9	25596.9	26200	18.47%	7.0612%	0.50%	6.00	1.6438%
10	25596.9	26300	10.29%	7.0612%	0.50%	6.00	1.6438%
11	25596.9	26300	18.45%	7.0612%	0.50%	6.00	1.6438%
12	25596.9	25000	21.13%	7.0612%	0.50%	6.00	1.6438%
13	25596.9	26100	16.38%	7.0612%	0.50%	6.00	1.6438%
14	25596.9	26900	20.98%	7.0612%	0.50%	6.00	1.6438%

15	25596.9	25800	16.38%	7.0612%	0.50%	6.00	1.6438%
16	25596.9	26000	18.36%	7.0612%	0.50%	6.00	1.6438%
17	25596.9	26400	10.17%	7.0612%	0.50%	6.00	1.6438%
18	25596.9	25900	15.49%	7.0612%	0.50%	6.00	1.6438%
19	25596.9	26200	18.89%	7.0612%	0.50%	6.00	1.6438%
20	25596.9	26500	NIL	7.0612%	0.50%	6.00	1.6438%

Figure 1

The above data is collected on September 21st,2018 from NSE India.

(Note: 1.The interest rate for all the option contract is taken as 7.0612%, which is the 91-day Treasury bill rate as on 21st September 2018.

2. The last option contract with the strike price of Rs. 26500 is having Implied Volatility as NIL. Hence, option Greeks cannot be computed for the last option contract.)

The Option Greeks are computed for the above data as follows:

Figure 2(a): Option Greeks of Call Options (Below):

Sl. No.	Call Price (in Rs.)	Call Delta	Call Gamma	Call Theta	Call Vega	Call Rho
1	25.0644	0.08742	0.000252992	-8.71586	5.21521	0.36373
2	71.1380	0.23774	0.000600976	-14.3419	10.1491	0.98861
3	8.54615	0.03112	0	-4.3057	2.30166	0.12953
4	6.24682	0.02762	0.000106717	-3.27772	2.08495	0.11521
5	14.4662	0.0534	0.000167844	-6.10718	3.56662	0.22233
6	19.7906	0.07021	0.000209212	-7.53278	4.41637	0.29215
7	31.4460	0.10805	0.000303769	-9.94373	6.09181	0.44945
8	309.2460	0.58582	0.000640721	-22.3813	12.787	2.41406
9	57.3904	0.1772	0.000428626	-13.9282	8.52647	0.73614
10	3.12807	0.02467	0.000171147	-1.73939	1.89674	0.10329
11	42.0915	0.13826	0.00036447	-11.7635	7.2424	0.57482
12	691.2290	0.82227	0.000375263	-18.6877	8.54003	3.34619
13	56.9736	0.19351	0.00051049	-13.1727	9.00586	0.80487
14	9.92034	0.03653	0.00011622	-4.75753	2.62609	0.15206
15	138.792	0.37655	0.000706276	-18.7138	12.4598	1.56157
16	99.4027	0.27217	0.000550925	-17.9013	10.894	1.12884
17	1.2901	0.0113	0	-0.87646	0.97309	0.04734
18	95.1505	0.29855	0.000682431	-16.0518	11.385	1.24055
19	61.0068	0.18274	0.000427279	-14.5135	8.69295	0.75886
20	NIL	NIL	NIL	NIL	NIL	NIL

Figure2 (b): Option Greeks of Put Options (Below):

Sl. No.	Put Price (in Rs.)	Put Delta	Put Gamma	Put Theta	Put Vega	Put Rho
1	899.527	-0.91249	0.000252992	-3.94579	5.21521	-3.98729
2	446.181	-0.76218	0.000600976	-9.66844	10.1491	-3.28032
3	1382.43	-0.9688	0	0.56098	2.30166	-4.30358
4	1180.36	-0.97229	0.000106717	1.55031	2.08495	-4.28507
5	1088.7	-0.94651	0.000167844	-1.29847	3.56662	-4.16153
6	994.137	-0.92971	0.000209212	-2.7434	4.41637	-4.07528
7	806.025	-0.89187	0.000303769	-5.19299	6.09181	-3.88515
8	184.869	-0.4141	0.000640721	-17.8045	12.787	-1.77276
9	632.201	-0.82272	0.000428626	-9.21608	8.52647	-3.56562
10	677.823	-0.97525	0.000171147	2.99202	1.89674	-4.21489
11	716.786	-0.86166	0.00036447	-7.03203	7.2424	-3.74335
12	67.4313	-0.17764	0.000375263	-14.2075	8.54003	-0.75854
13	531.9	-0.8064	0.00051049	-8.47988	9.00586	-3.48047
14	1283.92	-0.96339	0.00011622	0.08982	2.62609	-4.26463
15	314.067	-0.62337	0.000706276	-14.079	12.4598	-2.67452
16	474.445	-0.72775	0.000550925	-13.2279	10.894	-3.14008
17	775.869	-0.98862	0	3.87428	0.97309	-4.28725
18	370.309	-0.70137	0.000682431	-11.3977	11.385	-3.01196
19	635.817	-0.81718	0.000427279	-9.80138	8.69295	-3.5429
20	NIL	NIL	NIL	NIL	NIL	NIL

The option contracts with the highest strike price are Rs.27000 and the option contracts with the lowest strike price are Rs.25000. In Figures 2(a)and 2(b) above, the numbers highlighted with the yellow color represents the highest value while the numbers highlighted with the greycolor represents the lowest value.

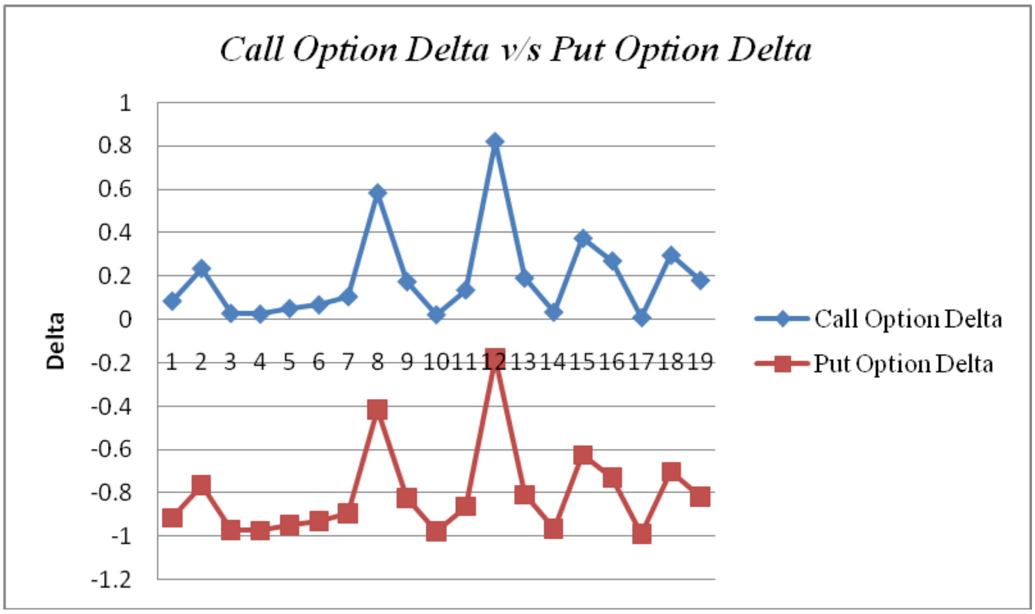
An options trader without the knowledge of Option Greeks will look to enter in a contract where the strike price of an underlying asset is lower than its market price.

In case of a call option, the contracts with the value of delta higher than 0.5 represents in-the-money, with the value of delta at 0.5 represents at-the-money and with the value of delta lesser than 0.5 represents out-the-money while in case of a put option, the contracts with the value of delta lesser than -0.5 represents in-the-money, with the value of delta at -0.5 represents at-the-money and with the value of delta greater than -0.5 represents out-the-money.

In case of the call options, we can find that the highest delta is .82227 which represents in-the-money at the strike price of Rs.25000 as it is greater than 0.5 and the lowest delta is 0.0113 which represents out-the-money as it is lesser than 0.5 at the strike price of Rs.26400.

In case of the put options, we can find that the lowest delta is -0.98862 which represents in-the-money at the strike price of Rs.26400 as it is lesser than -0.5 and the highest delta is -0.17764 which represents out-the-money as it is greater than-0.5 at the strike price of Rs.25000.

Figure 3(a): (Below)



In the above Figure 3(a), the blue line represents a call option delta which varies from 0 to 1 while the red line represents put option delta which varies from -1 to 0.

Gamma measures the rate of change in the delta which states that if the value of gamma is higher, then the risk will be higher and vice versa.

In case of a call option and put option, we can find that the option contracts with the strike price of Rs. 25800 has the highest gamma which shows that it has the highest risk among all while the contracts with the strike price of Rs. 27000 and Rs.26400 have the lowest risk since it is having a gamma value of 0 which is the least.

Theta tells how much the spot price of an underlying asset will move towards the strike price over the period of expiration. Thus, higher the time period towards expiration, higher the chances of spot price moving towards expiration.

In case of a call option, the options contracts with the strike price of Rs.25500 has the lowest theta value and the option contracts with the strike price of Rs. 26400 has the highest theta value which shows that the value of the option has increased by 22.3813 and0.87646 respectively over the period of expiration.

In case of a put option, the options contracts with the strike price of Rs.25500 has the lowest theta value while the option contracts with the strike price of Rs. 26400 has the highest theta value which shows that the option value has increased by 17.8045 and decreased by 3.87428 respectively over the period of expiration.

Vega tells how much the option price (inclusive of premium) will change when there is a change in market volatility.

In case of a call option, the options contracts with the strike price of Rs.25800 has the highest Vega value and the option contracts with the strike price of Rs.26400 has the lowest Vega value. This means that the option price of Rs.138.792 is moved up by Rs.12.4598 and the option price of Rs. 1.2901 is moved up by Rs. 0.97309 respectively as a result of a change in market volatility.

In case of a put option, the options contracts with the strike price of Rs.25800 has the highest Vega value and the option a contract with the strike price of Rs.26400 has the lowest Vega value. This means that the option price of Rs. 314.067 is moved up by Rs. 12.4598 and the option price of Rs. 775.869 is moved up by Rs. 0.97309 respectively as a result of a change in market volatility.

Rho tells the rate of changes in an underlying asset with respect to changes in interest rates. Since the risks free interest rate of return (91-day Treasury bill rate is 7.0612%) for all the contracts is the same, there is no change in interest rate among the contracts. Hence, Rho values are not as significant as the other Greek variables to the options trader.

5. Findings and Suggestions:

From our study, we were able to identify and understand the significance of five option Greeks that tells about the various factors associated with an option contract.

Each option Greek gives an idea to the options trader with respect to what stand he/she must take in different situations.

To understand the different stands an options trader must take at different situations, let us take a look at the significance of the following Option Greeks:

Delta:Delta helps in identifying the contracts, which are in-the-money, at-the-money,and out-the-money. This is shown in the following tables:

Figure 4(a): Call Option (Below)

Sl.No.	Strike Price (in Rs.)	Call Option Delta	Whether it is		
			In-the-money?	At-the-money?	Out-the-money?
1	26500	0.08742	No	No	Yes
2	26000	0.23774	No	No	Yes
3	27000	0.03112	No	No	Yes
4	26800	0.02762	No	No	Yes
5	26700	0.0534	No	No	Yes
6	26600	0.07021	No	No	Yes
7	26400	0.10805	No	No	Yes
8	25500	0.58582	Yes	No	No
9	26200	0.1772	No	No	Yes
10	26300	0.02467	No	No	Yes
11	26300	0.13826	No	No	Yes
12	25000	0.82227	Yes	No	No
13	26100	0.19351	No	No	Yes
14	26900	0.03653	No	No	Yes
15	25800	0.37655	No	No	Yes
16	26000	0.27217	No	No	Yes
17	26400	0.0113	No	No	Yes
18	25900	0.29855	No	No	Yes
19	26200	0.18274	No	No	Yes
20	26500	0	No	No	Yes

Figure 4(b): Put Option (Below)

Sl. No.	Strike Price	Put Option Delta	Whether it is		
			In-the-money?	At-the-money?	Out-the-money?
1	26500	-0.91249	Yes	No	No
2	26000	-0.76218	Yes	No	No
3	27000	-0.9688	Yes	No	No
4	26800	-0.97229	Yes	No	No
5	26700	-0.94651	Yes	No	No

6	26600	-0.92971	Yes	No	No
7	26400	-0.89187	Yes	No	No
8	25500	-0.4141	No	No	Yes
9	26200	-0.82272	Yes	No	No
10	26300	-0.97525	Yes	No	No
11	26300	-0.86166	Yes	No	No
12	25000	-0.17764	No	No	Yes
13	26100	-0.8064	Yes	No	No
14	26900	-0.96339	Yes	No	No
15	25800	-0.62337	Yes	No	No
16	26000	-0.72775	Yes	No	No
17	26400	-0.98862	Yes	No	No
18	25900	-0.70137	Yes	No	No
19	26200	-0.81718	Yes	No	No
20	26500	0	No	No	Yes

With the help of the above figures 4(a) and 4(b), the following stands can be taken by the options traders:

Call/Put Option Buyer/Seller	**In-the-money**	**At-the-money**	**Out-the-money**
Call Buyer	Should enter into a contract to make a profit.	Can enter into a contract but he/she can't either make profit nor loss.	Shouldn't enter into a contract as he/she will result in a loss.
Call Seller	Shouldn't enter into a contract as he/she will result in a loss.	Can enter into a contract but he/she can't make any profit nor loss.	Should enter into a contract to make a profit.
Put Buyer	Shouldn't enter into a contract as he/she will result in a loss.	Can enter into a contract but he/she can't make any profit nor loss.	Should enter into a contract to make a profit.
Put Seller	Should enter into a contract to make a profit.	Can enter into a contract but he/she can't either make profit nor loss.	Shouldn't enter into a contract as he/she will result in a loss.

a. **Gamma:** With the help of Gamma, an options trader can take a decision with respect to entering into a contract or not.

If the value of Gamma is higher, then it is advisable to the buyers of the option contract to enter into a contract as they can avoid high risks by locking a price at which the contract can be executed in future.

If the value of Gamma is lower, then it is advisable to the sellers of the option contract to enter into a contract as they will be able to make substantial gains.

b. **Theta:** With the help of Theta, an options trader can take a decision by understanding the risk involved in entering into a contract. The type of risk can be identified as follows:

Days to Expiry	**Risk**
High	Low
Medium	Medium
Less	High

Vega: With the help of Vega, an options trader can take the following stands:

Vega	Call Buyer	Call Seller	Put Buyer	Put Seller
High	Should not enter into an option contract, an option price will be high because of increase in premium amount.	Should enter into an option contract as the option price will be high because of increase in the premium amount and him/she can make a profit.	Should enter into an option contract, an option price will be high because of increase in premium amount.	Should not enter into an option contract, an option price will be high because of increase in premium amount.
Low	Should enter into an option contract, an option price will be less because of a decrease in premium amount.	Should not enter into an option contract as the option price will be less because of a decrease in premium amount and will result in a loss.	Should not enter into an option contract as the option price will be less because of a decrease in premium amount and will result in a loss.	Should enter into an option contract, an option price will be less because of a decrease in premium amount.

c. **Rho**: With the help of Rho, an options trader can understand the rate of changes in underlying assets because of a change in interest rates. As the interest rate is the same for all the contracts in our study, we cannot identify the rate of change in underlying asset due to a change in interest rates.

6. Conclusion

An option's price is highly volatile in nature as it is affected by factors like price changes in the underlying asset, interest rates, time value etc. Our study is conducted to help Option buyers to consider the above-mentioned factors and to determine the most profitable options. Greeks i.e., Vega, Theta, Gamma, Rho,and Delta helps to determine the option prices and their fluctuations and other parameters to be considered.

- Delta helps an investor to determine the price movement of options with the change in the value of the underlying asset. It also shows the level of sensitivity of options prices. Thus, it helps to determine the relationship between change in option prices and change in the value of the underlying asset.
- Gamma helps to determine the changes in the delta which has sensitivity to the movement in prices of securities. An option contract will have a higher risk if the gamma value is high and vice versa.
- Theta helps to measure the decaying value of options. Theta value is lower when the expiry of an option is still far. An option price gets reduced as they near the expiry date and the profit of an investor is affected by this factor.
- Vega is used to measuring the price sensitivity of the options to change in Implied Volatility. Hence, a positive Vega tells that the option price is incremented by that amount and vice versa.
- Rho helps to understand the relationship between the option price and interest rates. Interest rate plays an important role in long-term option pricing while they are constant in short-term option pricing.

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