

Study of Relevance of Black-Scholes Model in Indian Stock Option Market

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ABSTRACT

Derivatives trading is a core part of the Indian Stock Market in the current era. Trading volumes in stock options have grown up tremendously during recent years. This has also led to high volatility in the option prices. Trading in the right option on the right price is becoming more and more important for the traders for effective and profitable trades. In this scenario, the Black Scholes Pricing Model is used for fair value pricing of option contracts. In this paper, we have tried to find out the relevance of Black Scholes Model values with the market values for stock options. For this, we have selected ten stock's option contracts. We have found that in most of the cases, the Black Scholes Model values are not relevant to the market values; therefore the model is partially relevant. The findings show the need to explore the impact of other factors on pricing on option than Black Scholes Models.

Keywords: Stock Option, fair value, Volatility, Black Scholes Model.

Introduction:

Derivatives are the instruments/securities, the value of which depends upon the underlying asset on which it is created. This underlying asset may be a commodity, a security, a currency or any index. The most common derivatives are: Option Contracts, Future contracts, Forward Contracts, Swaps.

Basically, Option Contract is an agreement between two parties: a buyer and a seller, where the buyer of the option gets the right to buy or sell the underlying of that option contract; on the other hand the seller of the option has obligation to offset his position. For this, the buyer has to pay a certain amount- option premium to the seller of the option contract.

There are two categories of options: Call Option and Put Option. Call option is something in which the buyer has the right to buy the underlying asset on the exercise date whereas in put option the buyer has the right to sell the underlying asset on the exercise date. The premium value of call option increases as the underlying increases and vice versa. On the other hand, the put option premium value is just reverse to the movement in the underlying prices.

Trading in derivatives in India was commenced in June 2000, since that time there has been an enormous growth in this segment. Trading volumes in derivatives are much more than the cash market. Increasing awareness, higher volatility and risk management are the major reason for the growth of derivatives in India. Due to increasing trade volumes in options, price calculation has become more important for the traders in this market.

The price of an option contract is the premium that is acceptable to the seller of the option. There are several models which have been developed for the fair value pricing of option contracts. The Black and Scholes Model for option pricing is highly accepted model for pricing. The model of option pricing is based on the fundamental that in the future, the price of the underlying asset either increase or decrease as compare to the spot price of the underlying asset.

Black Scholes Model for option pricing:

The Black-Scholes model is used to calculate the theoretical price of European put and call options, ignoring any dividends paid during the option's lifetime. While the original Black-Scholes model did not take into consideration the effects of dividends paid during the life of the option, the model can be adapted to account for dividends by determining the ex-dividend date value of the underlying stock. The model makes certain assumptions, including:

- The options are European and can only be exercised at expiration
- Efficient markets (i.e., market movements cannot be predicted)
- No commissions
- The risk-free rate and volatility of the underlying are known and constant
- Follows a lognormal distribution; that is, returns on the underlying are normally distributed.

The Black- Scholes formula takes the following variables into consideration:

- Current underlying price
- Options strike price
- Time until expiration, expressed as a percent of a year
- Implied volatility
- Risk-free interest rates

$$C = SN(d_1) - N(d_2)Ke^{-rt}$$

$$d_1 = \frac{\ln(S/K) + (r + s^2/2)t}{s\sqrt{t}}$$

$$d_2 = d_1 - s\sqrt{t}$$

C = Call premium
 S = Current stock price
 t = Time until option exercise
 K = Option striking price
 r = Risk-free interest rate
 N = Cumulative standard normal distribution
 e = Exponential term

 s = St. Deviation
 ln = Natural Log

The model is essentially divided into two parts: the first part, $SN(d_1)$, multiplies the price by the change in the call premium in relation to a change in the underlying price. This part of the formula shows the expected benefit of purchasing the underlying outright. The second part, $N(d_2)Ke^{-rt}$, provides the current value of paying the exercise price upon expiration (remember, the Black-Scholes model applies to European options that are exercisable only on expiration day). The value of the option is calculated by taking the difference between the two parts, as shown in the equation. The put option can be calculated by using the following formula:

$$P = -S N(-d_1) + N(-d_2) K e^{-rt}$$

The following steps are applied for the determining the fair option prices and implies volatility of stock options:

Step I: First, we calculate the historical volatility using the daily log returns by using moving average method.

Daily Return= $\text{Ln}(\text{today's closing price/yesterday's closing price})$

Daily standard deviation (SD) = $(\text{Variance of daily returns})^{0.5}$

Historical Volatility = $\text{Daily SD} \times (250)^{0.5}$

(Here we consider 250 trading days in a year)

Step II: We get all required value in the Black formula from the NSE website and use them in the Black Scholes model and we get the fair value of call and put options of various strike prices.

In the next step, we will find the differences between Model value and the actual market values.

Step III: Now, we can compare the fair option premium with the actual value of option premium.

I. Literature Review:

Kim et al. (1997) tested the robustness of implied volatility estimates across option pricing models for at the money put options. They concluded that the implied volatility estimates recovered from the Black Scholes European Option Pricing Model was nearly indistinguishable from the implied volatility estimate obtained from Macmillan/Barone-Adesi and Whaley's American put option pricing model. They also investigated whether the use Black Scholes implied volatility estimates in American put pricing model significantly affected the prediction of American put option prices.

Frino et al. (1999) carried out cross sectional tests of the model using the historical data. Their conclusion was that the Black Scholes Model cannot be rejected. They carried out a time series analysis of mispricing in order to determine whether that could be attributed to a market learning effect over time. They controlled the effect of dividend and possibility of early exercise and used to limit the possibility of incompatible risk free interest rate proxies having a confounding effect on results.

Gencay and Salih (2003) put light on the fact that the Black Scholes Pricing errors are larger in the deeper out of the money options, and mispricing worsens with increased volatility. Their result indicated that the Black Scholes model is not proper pricing tool in high volatility with considerably lower errors for out-of-the-money call and put options. They also mentioned that this could be invaluable information for practitioners as option pricing is a major challenge during high volatility periods.

Vasile et al. (2009) estimated the implied volatility and then analysed the relationship between implicit volatility moneyness and due term of options (volatility smile). Further, they analysed the errors provided by Black Scholes model with respect to moneyness and due-term of options.

Angeli & Bonz (2010) examined the performance of Black Scholes model to price stock index options. They calculated the theoretical values of options under the Black-Scholes assumptions and compared these values with the real market prices in order to put the degree of deviation in two different time windows. They found clear evidence to state that BS Model performed different in the period before and after financial crisis.

Choi et al. (2011) estimated implied volatility using the inverse function of Black Scholes Model and Least Square Support Vector Machine (LSSVM) model and found that LSSVM is more accurate than Black Scholes model since LSSVM's MSE value is lesser than Black Scholes model's MSE value. They used Hang Seng index option to verify the performances of these models.

Ray (2012) studied the Black Scholes Model of option pricing and made a more detailed analysis of the assumptions of the model and the mathematical derivation process of the model and also analysed the inherent loopholes in the theory.

Khan et al. (2013) incorporated modification in Black-Scholes option pricing model formula by adding some new variables on the basis of given assumption related to risk-free interest rate, and also showed the calculation process of new risk-free interest rate on the basis of modified variable. This paper also identified the various situations in empirical testing of modified and original Black-Scholes formula with respect to the market value on the basis of assumed and calculated risk-free interest rate.

Arora K. & Sharma M. (2013) determined the volatility and studied that how the implied volatility levels of an option contract of a stock is related to the pricing of that option and also determined whether a stock option is underpriced or overpriced. For this the sample data was collected from the stock options traded on the NSE. They used the basic statistical approach to determine the volatility of a stock and used this historical volatility in the Black-Scholes model in order to determine the implied volatility and then compared the historical volatility with the implied volatility to find whether an option is fairly priced.

Panduranga V. (2013) studied the relevance of Black-Scholes model in Indian Derivative market with specific reference to select cement stock options. Results of their study comprising of paired sample T-test revealed that there was no significant difference between the expected option prices calculated thorough Black-Scholes Model and market price of options. The study inferred that model was relevant for the cement stocks.

II. Research Methodology:

A. Objectives:

1. To determine the theoretical prices of stock options using Black Scholes Option Pricing Model (BSOPM).
2. To find out whether there is significant difference between BSOPM prices and the actual market prices.

B. Sampling: For this study, the ten companies are selected from NIFTY. The one year historical closing price data of these ten companies and the index NIFTY is taken from Nov. 2012 to July 2013 for the period of one year for volatility computation and 780 samples of stock options are taken from 8th July 2013 to 24th July 2013. From these samples we have made 60 sets for study.

C. Data source: The data of closing prices of shares and the actual option premiums are collected from the website www.nseindia.com.

D. Methodology:

We studied 30-30 samples of both call and put options, where each sample is consisting option values for 13 different days.

For pricing of option we have used Black Scholes Option Pricing Model.

For finding whether there is significant difference between model values and actual values, we have used paired sample t test.

Null Hypothesis (H₀): There is no significant difference between BS model values and Actual Market Values.

Alternate Hypothesis (H_a): There is significant difference between BS model values and Actual Market Value.

At 95% level of confidence:

If P-value > 0.005 then Null Hypothesis is accepted.

If $P\text{-value} < 0.005$ then Null Hypothesis is rejected.

III. Data Analysis: We have computed fair values by using Black Scholes Option Pricing Model. The Model values are mentioned in Table 1, 2, 3 & 4. Further, in table 5 and 6 we have shown the paired sample t test results of 60 sets where each set has the historical price data of 13 days. The paired sample t test is used between the Black Scholes Pricing Model value and the actual market prices of option contracts.

From paired sample t test we have come to know that out of 30 call option sets, the Null hypothesis is accepted in seven pairs which show that there is no significant difference between model price and actual price. In remaining 23 call option pairs, the null hypothesis is rejected; it shows that there is significant difference between model price and market price. In case of put option, only 3 pairs show that the difference is insignificant and in other 27 sets the difference is significant.

IV. Conclusion: The data analysis shows that most of the model prices are not near to the actual market prices which show the ineffectiveness of the model. In the given time duration, the Black Scholes model is not very much relevant. Infosys is the only share, in which the differences are not significant between model values and actual values in both call and put options. The black Scholes model is partially relevant and it can be made effective by taking into consideration all other constraints of the model to make the option pricing more effective.

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TABLE I

Black Scholes Model Values (Fair) and Actual Values of Call Options

| S.No. | Date | HDFC | | HDFC BANK | | ICICI BANK | | INFOSYS | | ITC | |
|-------|-----------|-------|--------|-----------|--------|------------|--------|---------|--------|-------|--------|
| | | Fair | Actual | Fair | Actual | Fair | Actual | Fair | Actual | Fair | Actual |
| 1 | 08-Jul-13 | 34.81 | 39.85 | 26.84 | 31.25 | 56.96 | ## | 43.34 | 104.55 | 5.54 | 7.00 |
| 2 | 09-Jul-13 | 38.75 | 43.00 | 34.66 | 31.25 | 61.74 | ## | 50.82 | 115.45 | 5.67 | 6.65 |
| 3 | 10-Jul-13 | 36.35 | 38.00 | 25.25 | 31.25 | 64.82 | ## | 49.04 | 110.25 | 4.59 | 5.35 |
| 4 | 11-Jul-13 | 58.91 | 48.00 | 45.98 | 47.00 | 82.04 | ## | 56.35 | 145.50 | 8.49 | 9.20 |
| 5 | 12-Jul-13 | 55.32 | 46.15 | 57.82 | 47.00 | 83.96 | ## | 232.64 | 217.30 | 6.46 | 6.55 |
| 6 | 15-Jul-13 | 51.58 | 50.00 | 56.97 | 50.50 | 83.47 | ## | 173.78 | 159.40 | 6.81 | 7.10 |
| 7 | 16-Jul-13 | 24.11 | 28.25 | 40.40 | 50.50 | 32.49 | 40.00 | 159.45 | 142.35 | 11.93 | 13.10 |
| 8 | 17-Jul-13 | 24.06 | 24.00 | 25.57 | 24.75 | 16.87 | 24.70 | 173.54 | 155.75 | 19.17 | 18.70 |
| 9 | 18-Jul-13 | 32.81 | 36.75 | 45.22 | 37.00 | 18.04 | 25.30 | 213.41 | 207.15 | 19.32 | 19.50 |
| 10 | 19-Jul-13 | 13.48 | 16.20 | 40.98 | 37.00 | 6.15 | 11.05 | 254.32 | 247.00 | 19.58 | 19.70 |
| 11 | 22-Jul-13 | 31.37 | 33.00 | 42.48 | 48.85 | 7.55 | 12.45 | 278.66 | 273.00 | 19.02 | 20.35 |
| 12 | 23-Jul-13 | 27.54 | 30.10 | 43.89 | 51.55 | 14.10 | 16.90 | 303.09 | 309.35 | 25.89 | 26.00 |
| 13 | 24-Jul-13 | 6.55 | 8.90 | 20.11 | 21.00 | 0.13 | 2.00 | 309.17 | 313.50 | 25.87 | 27.05 |
| 14 | 08-Jul-13 | 22.26 | 27.90 | 13.84 | 18.50 | 41.98 | 52.50 | 21.65 | 65.75 | 2.27 | 3.40 |
| 15 | 09-Jul-13 | 25.17 | 29.60 | 19.45 | 23.50 | 45.96 | 55.35 | 25.66 | 76.20 | 2.28 | 3.15 |
| 16 | 10-Jul-13 | 23.12 | 25.25 | 12.43 | 16.90 | 48.50 | 53.75 | 24.13 | 76.20 | 1.69 | 2.35 |
| 17 | 11-Jul-13 | 41.89 | 41.55 | 28.48 | 31.95 | 64.07 | 70.55 | 27.91 | 106.85 | 3.73 | 4.20 |
| 18 | 12-Jul-13 | 38.50 | 40.00 | 38.95 | 39.10 | 65.68 | 68.00 | 158.22 | 126.35 | 2.48 | 2.70 |
| 19 | 15-Jul-13 | 34.55 | 34.00 | 37.73 | 39.10 | 64.65 | 69.00 | 106.34 | 70.70 | 2.40 | 3.05 |
| 20 | 16-Jul-13 | 12.58 | 16.05 | 22.67 | 29.00 | 19.94 | 27.50 | 93.70 | 56.70 | 5.23 | 6.45 |
| 21 | 17-Jul-13 | 12.20 | 14.35 | 11.09 | 12.55 | 8.65 | 16.75 | 102.62 | 65.75 | 10.45 | 11.65 |
| 22 | 18-Jul-13 | 18.14 | 20.30 | 26.41 | 25.85 | 9.08 | 16.75 | 132.50 | 110.35 | 10.40 | 11.90 |
| 23 | 19-Jul-13 | 5.21 | 7.75 | 22.37 | 21.00 | 2.24 | 6.10 | 165.33 | 147.65 | 10.44 | 11.45 |
| 24 | 22-Jul-13 | 14.72 | 16.45 | 22.81 | 20.40 | 2.07 | 5.60 | 181.22 | 172.15 | 9.38 | 11.55 |
| 25 | 23-Jul-13 | 10.94 | 12.75 | 23.97 | 24.25 | 4.17 | 7.10 | 203.58 | 208.35 | 15.91 | 16.70 |
| 26 | 24-Jul-13 | 0.43 | 2.25 | 3.28 | 5.60 | 0.00 | 0.75 | 209.20 | 211.95 | 15.87 | 17.25 |
| 27 | 08-Jul-13 | 13.03 | 18.00 | 5.80 | 10.15 | 29.41 | 41.05 | 9.87 | 41.30 | 0.75 | 1.75 |
| 28 | 09-Jul-13 | 14.94 | 18.90 | 8.97 | 12.95 | 32.51 | 42.55 | 11.77 | 49.15 | 0.74 | 1.25 |
| 29 | 10-Jul-13 | 13.35 | 15.90 | 4.84 | 8.45 | 34.43 | 42.85 | 10.70 | 50.55 | 0.49 | 0.90 |
| 30 | 11-Jul-13 | 27.48 | 28.25 | 14.79 | 16.05 | 47.75 | 53.75 | 12.39 | 76.40 | 1.30 | 1.70 |
| 31 | 12-Jul-13 | 24.51 | 25.30 | 22.59 | 23.40 | 48.96 | 53.15 | 99.52 | 59.95 | 0.72 | 1.05 |
| 32 | 15-Jul-13 | 20.66 | 21.65 | 20.86 | 22.85 | 47.25 | 52.30 | 58.13 | 23.20 | 0.59 | 1.05 |

| | | | | | | | | | | | |
|----|-----------|------|-------|-------|-------|-------|-------|--------|--------|------|------|
| 33 | 16-Jul-13 | 5.51 | 8.95 | 9.65 | 14.35 | 11.00 | 17.95 | 48.40 | 15.80 | 1.63 | 2.40 |
| 34 | 17-Jul-13 | 5.08 | 7.45 | 3.23 | 5.05 | 3.86 | 10.25 | 52.75 | 17.25 | 4.24 | 5.75 |
| 35 | 18-Jul-13 | 8.24 | 10.20 | 11.51 | 11.50 | 3.91 | 9.65 | 71.27 | 37.15 | 4.03 | 6.20 |
| 36 | 19-Jul-13 | 1.51 | 3.20 | 8.48 | 9.60 | 0.66 | 3.30 | 93.00 | 56.60 | 3.85 | 5.90 |
| 37 | 22-Jul-13 | 4.51 | 6.35 | 7.01 | 9.10 | 0.37 | 2.10 | 95.34 | 74.30 | 2.44 | 5.40 |
| 38 | 23-Jul-13 | 2.25 | 3.70 | 6.85 | 8.35 | 0.69 | 2.35 | 109.64 | 108.20 | 6.42 | 8.70 |
| 39 | 24-Jul-13 | 0.00 | 0.45 | 0.02 | 0.60 | 0.00 | 0.35 | 110.61 | 111.05 | 6.04 | 8.20 |

##: Values not available

TABLE II

Black Scholes Model Values (Fair) and Actual Values of Call Options

| S.No. | Date | L&T | | ONGC | | RELIANCE | | TATAMOTORS | | TCS | |
|-------|-----------|--------|--------|-------|--------|----------|--------|------------|--------|--------|--------|
| | | Fair | Actual | Fair | Actual | Fair | Actual | Fair | Actual | Fair | Actual |
| 1 | 08-Jul-13 | 46.69 | ## | 17.35 | 24.65 | 14.97 | 19.25 | 13.29 | 15.35 | 34.90 | 62.20 |
| 2 | 09-Jul-13 | 59.68 | ## | 15.81 | 17.15 | 17.94 | 22.10 | 13.93 | 15.90 | 32.64 | 60.75 |
| 3 | 10-Jul-13 | 51.04 | ## | 11.28 | 12.15 | 9.63 | 13.35 | 10.32 | 11.95 | 35.64 | 63.40 |
| 4 | 11-Jul-13 | 83.74 | 68.10 | 17.46 | 18.50 | 14.42 | 16.75 | 10.57 | 12.00 | 74.11 | 92.10 |
| 5 | 12-Jul-13 | 107.15 | 99.20 | 11.09 | 12.10 | 24.39 | 27.10 | 15.66 | 16.70 | 115.05 | 117.00 |
| 6 | 15-Jul-13 | 113.31 | 99.20 | 9.91 | 11.35 | 26.56 | 31.25 | 11.75 | 13.65 | 145.02 | 140.10 |
| 7 | 16-Jul-13 | 81.99 | 99.20 | 12.26 | 13.45 | 28.43 | 35.15 | 13.83 | 14.95 | 152.22 | 154.00 |
| 8 | 17-Jul-13 | 78.01 | 99.20 | 12.80 | 13.20 | 39.16 | 42.25 | 8.86 | 10.45 | 181.02 | 168.60 |
| 9 | 18-Jul-13 | 91.21 | 99.20 | 25.20 | 24.70 | 40.51 | 45.60 | 9.62 | 11.25 | 162.61 | 165.85 |
| 10 | 19-Jul-13 | 79.98 | 99.20 | 27.36 | 27.80 | 45.80 | 48.95 | 15.66 | 16.95 | 244.69 | 232.00 |
| 11 | 22-Jul-13 | 20.12 | 19.00 | 17.59 | 27.80 | 30.43 | 32.25 | 18.10 | 18.25 | 247.44 | 244.50 |
| 12 | 23-Jul-13 | 16.33 | 13.10 | 22.27 | 27.80 | 30.24 | 32.35 | 18.93 | 19.15 | 250.43 | 247.70 |
| 13 | 24-Jul-13 | 1.54 | 1.15 | 18.46 | 27.80 | 29.58 | 31.15 | 17.36 | 17.70 | 283.12 | 279.90 |
| 14 | 08-Jul-13 | 22.31 | ## | 10.59 | 12.40 | 8.31 | 12.25 | 7.70 | 9.80 | 4.25 | 25.30 |
| 15 | 09-Jul-13 | 31.01 | ## | 9.31 | 10.95 | 10.16 | 13.80 | 8.07 | 10.10 | 3.48 | 24.05 |
| 16 | 10-Jul-13 | 24.55 | ## | 5.98 | 7.70 | 4.78 | 7.80 | 5.46 | 7.15 | 3.76 | 23.10 |
| 17 | 11-Jul-13 | 57.79 | | 10.39 | 11.05 | 7.59 | 9.65 | 5.54 | 7.05 | 14.73 | 41.95 |
| 18 | 12-Jul-13 | 77.06 | 42.95 | 5.68 | 6.60 | 14.17 | 17.80 | 9.02 | 10.05 | 34.82 | 53.05 |
| 19 | 15-Jul-13 | 80.69 | 42.95 | 4.57 | 5.95 | 14.98 | 20.50 | 5.85 | 7.60 | 53.07 | 64.20 |
| 20 | 16-Jul-13 | 53.48 | 42.95 | 5.96 | 6.90 | 16.01 | 23.30 | 7.13 | 8.50 | 57.74 | 73.65 |
| 21 | 17-Jul-13 | 49.49 | 42.95 | 6.15 | 6.95 | 23.88 | 28.55 | 3.75 | 5.20 | 82.75 | 85.90 |
| 22 | 18-Jul-13 | 59.47 | 42.95 | 15.93 | 15.90 | 24.55 | 30.50 | 4.01 | 5.50 | 65.27 | 76.55 |
| 23 | 19-Jul-13 | 49.24 | 42.95 | 17.77 | 17.95 | 28.52 | 33.70 | 7.85 | 8.90 | 144.86 | 133.50 |
| 24 | 22-Jul-13 | 6.14 | 4.70 | 8.45 | 8.90 | 14.28 | 16.25 | 8.90 | 10.25 | 147.52 | 140.00 |
| 25 | 23-Jul-13 | 3.56 | 1.85 | 12.39 | 12.15 | 13.09 | 14.65 | 9.29 | 10.25 | 150.48 | 146.00 |
| 26 | 24-Jul-13 | 0.04 | 0.25 | 8.55 | 9.75 | 11.13 | 13.85 | 7.53 | 8.35 | 183.14 | 179.90 |
| 27 | 08-Jul-13 | 8.43 | ## | 5.75 | 7.55 | 4.21 | 7.40 | 3.98 | 5.80 | 0.17 | 8.05 |
| 28 | 09-Jul-13 | 12.85 | ## | 4.83 | 6.50 | 5.23 | 8.20 | 4.15 | 5.95 | 0.11 | 6.60 |
| 29 | 10-Jul-13 | 9.14 | ## | 2.73 | 4.35 | 2.13 | 4.20 | 2.52 | 4.00 | 0.11 | 5.95 |
| 30 | 11-Jul-13 | 37.65 | ## | 5.38 | 6.10 | 3.58 | 5.10 | 2.51 | 3.95 | 0.91 | 15.60 |
| 31 | 12-Jul-13 | 52.40 | 34.20 | 2.46 | 3.35 | 7.40 | 10.60 | 4.50 | 5.60 | 3.77 | 17.60 |
| 32 | 15-Jul-13 | 53.61 | 37.35 | 1.68 | 2.85 | 7.38 | 12.65 | 2.38 | 3.85 | 6.49 | 19.80 |
| 33 | 16-Jul-13 | 31.91 | 22.25 | 2.28 | 3.20 | 7.78 | 14.55 | 2.97 | 4.15 | 6.77 | 24.40 |
| 34 | 17-Jul-13 | 28.34 | 20.45 | 2.27 | 3.05 | 12.60 | 17.35 | 1.21 | 2.30 | 14.05 | 31.75 |
| 35 | 18-Jul-13 | 34.81 | 26.20 | 8.31 | 8.35 | 12.68 | 18.80 | 1.22 | 2.25 | 7.12 | 22.75 |
| 36 | 19-Jul-13 | 26.53 | 19.50 | 9.50 | 9.75 | 15.01 | 21.45 | 2.92 | 3.55 | 50.14 | 41.20 |
| 37 | 22-Jul-13 | 1.28 | 1.00 | 2.41 | 3.00 | 4.49 | 6.35 | 2.67 | 3.95 | 49.12 | 45.90 |
| 38 | 23-Jul-13 | 0.42 | 0.35 | 4.16 | 5.15 | 3.19 | 4.10 | 2.39 | 3.40 | 51.03 | 48.40 |
| 39 | 24-Jul-13 | 0.00 | 0.20 | 1.35 | 2.25 | 1.43 | 3.50 | 0.99 | 2.30 | 83.16 | 80.45 |

##: Values not available

TABLE III

Black Scholes Model Values (Fair) and Actual Values of Put Options

| S.No. | Date | HDFC | | HDFC BANK | | ICICI BANK | | INFOSYS | | ITC | |
|-------|-----------|-------|--------|-----------|--------|------------|--------|---------|--------|-------|--------|
| | | Fair | Actual | Fair | Actual | Fair | Actual | Fair | Actual | Fair | Actual |
| 1 | 08-Jul-13 | 8.00 | 11.40 | 3.97 | 8.35 | 5.85 | 13.00 | 165.57 | 217.40 | 7.62 | 8.85 |
| 2 | 09-Jul-13 | 6.09 | 9.25 | 2.08 | 5.80 | 4.41 | 10.05 | 143.56 | 214.10 | 7.07 | 8.10 |
| 3 | 10-Jul-13 | 6.41 | 9.40 | 3.81 | 7.60 | 3.48 | 9.20 | 139.40 | 194.15 | 7.96 | 8.80 |
| 4 | 11-Jul-13 | 1.84 | 3.20 | 0.73 | 2.85 | 1.48 | 4.75 | 120.07 | 206.05 | 4.08 | 4.85 |
| 5 | 12-Jul-13 | 1.91 | 3.40 | 0.22 | 1.70 | 1.13 | 4.05 | 21.08 | 7.60 | 4.92 | 5.65 |
| 6 | 15-Jul-13 | 1.45 | 2.90 | 0.09 | 1.25 | 0.56 | 2.90 | 25.41 | 7.15 | 3.50 | 4.55 |
| 7 | 16-Jul-13 | 6.60 | 8.80 | 0.42 | 2.15 | 7.36 | 12.70 | 25.55 | 6.15 | 1.23 | 2.10 |
| 8 | 17-Jul-13 | 5.65 | 7.90 | 1.53 | 3.85 | 15.13 | 22.30 | 18.16 | 3.15 | 0.25 | 1.20 |
| 9 | 18-Jul-13 | 2.62 | 3.35 | 0.12 | 0.70 | 12.28 | 17.35 | 8.70 | 1.20 | 0.16 | 0.90 |
| 10 | 19-Jul-13 | 9.31 | 11.45 | 0.13 | 0.75 | 25.73 | 28.70 | 3.47 | 0.70 | 0.10 | 0.70 |
| 11 | 22-Jul-13 | 0.58 | 1.55 | 0.00 | 0.35 | 12.54 | 16.50 | 0.21 | 0.30 | 0.01 | 0.50 |
| 12 | 23-Jul-13 | 0.37 | 0.95 | 0.00 | 0.45 | 4.08 | 6.20 | 0.01 | 0.25 | 0.00 | 0.30 |
| 13 | 24-Jul-13 | 3.14 | 4.50 | 0.02 | 0.50 | 28.15 | 26.70 | 0.00 | 0.10 | 0.00 | 0.25 |
| 14 | 08-Jul-13 | 15.36 | 19.10 | 10.89 | 15.40 | 10.77 | 18.65 | 243.46 | 272.00 | 14.31 | 15.90 |
| 15 | 09-Jul-13 | 12.44 | 15.65 | 6.79 | 11.00 | 8.55 | 15.05 | 218.01 | 281.05 | 13.65 | 14.00 |
| 16 | 10-Jul-13 | 13.10 | 16.80 | 10.92 | 15.20 | 7.08 | 14.15 | 214.12 | 259.00 | 15.03 | 14.50 |
| 17 | 11-Jul-13 | 4.74 | 6.30 | 3.17 | 6.25 | 3.44 | 7.90 | 191.30 | 268.30 | 9.29 | 10.00 |
| 18 | 12-Jul-13 | 5.02 | 5.90 | 1.28 | 3.45 | 2.79 | 6.00 | 46.34 | 19.10 | 10.91 | 11.75 |
| 19 | 15-Jul-13 | 4.37 | 5.40 | 0.80 | 2.90 | 1.68 | 4.55 | 57.73 | 22.65 | 9.06 | 11.00 |
| 20 | 16-Jul-13 | 15.02 | 16.65 | 2.64 | 5.75 | 14.77 | 20.15 | 59.58 | 23.45 | 4.52 | 5.35 |
| 21 | 17-Jul-13 | 13.76 | 15.60 | 7.01 | 10.10 | 26.87 | 31.50 | 47.04 | 14.55 | 1.51 | 3.30 |
| 22 | 18-Jul-13 | 7.92 | 7.65 | 1.28 | 2.25 | 23.29 | 27.40 | 27.61 | 5.25 | 1.23 | 2.70 |
| 23 | 19-Jul-13 | 21.01 | 22.95 | 1.49 | 2.15 | 41.80 | 41.90 | 14.33 | 2.00 | 0.95 | 2.20 |
| 24 | 22-Jul-13 | 3.91 | 5.30 | 0.32 | 1.40 | 27.04 | 29.30 | 2.69 | 0.80 | 0.35 | 1.85 |
| 25 | 23-Jul-13 | 3.76 | 4.60 | 0.08 | 0.90 | 14.14 | 15.50 | 0.45 | 0.70 | 0.01 | 0.80 |
| 26 | 24-Jul-13 | 17.01 | 16.90 | 3.19 | 4.10 | 48.01 | 46.00 | 0.01 | 0.30 | 0.00 | 0.65 |
| 27 | 08-Jul-13 | 26.05 | 29.50 | 22.77 | 30.75 | 18.12 | 26.65 | 331.27 | 414.00 | 22.75 | 46.40 |
| 28 | 09-Jul-13 | 22.13 | 24.65 | 16.24 | 20.65 | 15.02 | 22.35 | 303.73 | 336.00 | 22.06 | 21.00 |
| 29 | 10-Jul-13 | 23.27 | 27.45 | 23.25 | 27.30 | 12.93 | 20.35 | 300.32 | 335.00 | 23.79 | 21.00 |
| 30 | 11-Jul-13 | 10.27 | 11.50 | 9.40 | 13.40 | 7.05 | 12.55 | 275.42 | 332.40 | 16.82 | 16.00 |
| 31 | 12-Jul-13 | 10.97 | 11.15 | 4.86 | 8.05 | 6.01 | 9.90 | 87.32 | 47.75 | 19.12 | 16.00 |
| 32 | 15-Jul-13 | 10.44 | 12.55 | 3.89 | 7.50 | 4.24 | 8.20 | 109.28 | 68.00 | 17.22 | 16.00 |
| 33 | 16-Jul-13 | 27.90 | 28.75 | 9.58 | 13.50 | 25.79 | 30.05 | 114.06 | 72.00 | 10.88 | 11.00 |
| 34 | 17-Jul-13 | 26.59 | 29.15 | 19.11 | 23.25 | 42.04 | 45.65 | 96.97 | 68.00 | 5.28 | 7.20 |
| 35 | 18-Jul-13 | 17.98 | 16.70 | 6.35 | 7.25 | 38.08 | 39.00 | 66.21 | 30.40 | 4.85 | 6.50 |
| 36 | 19-Jul-13 | 37.27 | 37.50 | 7.57 | 7.60 | 60.19 | 58.80 | 41.86 | 11.65 | 4.34 | 6.05 |
| 37 | 22-Jul-13 | 13.70 | 14.50 | 4.51 | 6.25 | 45.33 | 44.20 | 16.74 | 3.90 | 3.40 | 5.50 |
| 38 | 23-Jul-13 | 15.06 | 15.75 | 2.94 | 4.10 | 30.65 | 27.50 | 6.46 | 1.25 | 0.52 | 2.55 |
| 39 | 24-Jul-13 | 36.58 | 35.00 | 19.92 | 19.80 | 68.00 | 66.00 | 1.40 | 0.45 | 0.16 | 2.15 |

##: Values not available

TABLE IV

Black Scholes Model Values (Fair) and Actual Values of Put Options

| S.No. | Date | L&T | | ONGC | | RELIANCE | | TATAMOTORS | | TCS | |
|-------|-----------|--------|--------|-------|--------|----------|--------|------------|--------|--------|--------|
| | | Fair | Actual | Fair | Actual | Fair | Actual | Fair | Actual | Fair | Actual |
| 1 | 08-Jul-13 | 8.42 | ## | 2.50 | 3.45 | 24.76 | 27.30 | 4.41 | 7.00 | 22.91 | 56.95 |
| 2 | 09-Jul-13 | 4.74 | ## | 2.71 | 3.70 | 20.07 | 24.50 | 3.81 | 6.75 | 22.71 | 57.40 |
| 3 | 10-Jul-13 | 6.01 | ## | 4.25 | 5.20 | 30.75 | 36.90 | 5.32 | 8.65 | 18.97 | 49.60 |
| 4 | 11-Jul-13 | 16.50 | 8.00 | 1.88 | 2.40 | 21.68 | 25.95 | 4.78 | 6.90 | 5.15 | 36.25 |
| 5 | 12-Jul-13 | 9.42 | 3.95 | 3.77 | 4.70 | 11.95 | 16.85 | 2.33 | 4.30 | 1.11 | 16.40 |
| 6 | 15-Jul-13 | 5.20 | 2.50 | 3.21 | 4.10 | 7.79 | 14.60 | 2.67 | 4.85 | 0.12 | 6.95 |
| 7 | 16-Jul-13 | 9.20 | 4.40 | 1.98 | 2.30 | 6.10 | 11.70 | 1.71 | 3.70 | 0.04 | 5.90 |
| 8 | 17-Jul-13 | 8.44 | 4.80 | 1.53 | 2.00 | 2.68 | 8.20 | 3.10 | 4.70 | 0.00 | 4.35 |
| 9 | 18-Jul-13 | 4.71 | 2.85 | 0.14 | 0.40 | 1.91 | 6.15 | 2.27 | 3.60 | 0.00 | 3.20 |
| 10 | 19-Jul-13 | 4.95 | 3.15 | 0.05 | 0.25 | 0.94 | 5.10 | 0.63 | 1.65 | 0.00 | 0.55 |
| 11 | 22-Jul-13 | 18.11 | 16.50 | 0.06 | 0.40 | 0.80 | 2.20 | 0.06 | 0.90 | 0.00 | 0.40 |
| 12 | 23-Jul-13 | 14.88 | 9.75 | 0.00 | 0.30 | 0.31 | 1.20 | 0.01 | 0.40 | 0.00 | 0.35 |
| 13 | 24-Jul-13 | 34.01 | 31.20 | 0.00 | 0.05 | 0.03 | 1.20 | 0.00 | 0.25 | 0.00 | 0.20 |
| 14 | 08-Jul-13 | 23.87 | ## | 5.69 | 6.90 | 38.01 | 39.60 | 8.78 | 11.15 | 91.84 | 100.00 |
| 15 | 09-Jul-13 | 15.92 | ## | 6.18 | 7.20 | 32.21 | 36.80 | 7.92 | 10.95 | 93.16 | 100.00 |
| 16 | 10-Jul-13 | 19.37 | ## | 8.90 | 9.95 | 45.82 | 49.90 | 10.43 | 13.80 | 86.73 | 100.00 |
| 17 | 11-Jul-13 | 30.41 | ## | 4.77 | 5.15 | 34.78 | 37.90 | 9.72 | 11.45 | 45.43 | 80.05 |
| 18 | 12-Jul-13 | 19.21 | 8.50 | 8.33 | 9.05 | 21.66 | 25.80 | 5.66 | 7.75 | 20.56 | 50.60 |
| 19 | 15-Jul-13 | 12.48 | 6.00 | 7.86 | 8.75 | 16.16 | 22.90 | 6.74 | 8.90 | 7.92 | 29.50 |
| 20 | 16-Jul-13 | 20.61 | 13.00 | 5.65 | 5.90 | 13.64 | 19.05 | 4.99 | 7.05 | 5.34 | 25.50 |
| 21 | 17-Jul-13 | 19.84 | 14.00 | 4.86 | 5.25 | 7.35 | 13.70 | 7.97 | 9.35 | 1.54 | 21.15 |
| 22 | 18-Jul-13 | 12.90 | 7.90 | 0.84 | 1.20 | 5.92 | 11.05 | 6.65 | 7.60 | 2.49 | 17.70 |
| 23 | 19-Jul-13 | 14.15 | 8.45 | 0.45 | 0.65 | 3.64 | 9.30 | 2.81 | 3.70 | 0.02 | 0.95 |
| 24 | 22-Jul-13 | 44.10 | 41.15 | 0.91 | 1.40 | 4.63 | 5.15 | 0.85 | 2.10 | 0.00 | 0.50 |
| 25 | 23-Jul-13 | 42.10 | 37.25 | 0.12 | 0.45 | 3.15 | 3.55 | 0.36 | 1.25 | 0.00 | 0.35 |
| 26 | 24-Jul-13 | 72.51 | 70.20 | 0.09 | 0.50 | 1.59 | 3.20 | 0.16 | 0.70 | 0.00 | 0.20 |
| 27 | 08-Jul-13 | 49.82 | ## | 10.81 | 11.95 | 53.83 | 56.25 | 15.02 | 16.95 | 187.34 | 270.50 |
| 28 | 09-Jul-13 | 37.60 | ## | 11.66 | 12.85 | 47.21 | 50.00 | 13.96 | 16.50 | 189.39 | 270.50 |
| 29 | 10-Jul-13 | 43.81 | ## | 15.62 | 16.00 | 63.10 | 78.50 | 17.45 | 20.55 | 182.70 | 270.50 |
| 30 | 11-Jul-13 | 50.13 | ## | 9.74 | 10.10 | 50.70 | 78.50 | 16.65 | 18.55 | 131.27 | 270.50 |
| 31 | 12-Jul-13 | 34.43 | 20.90 | 15.08 | 16.20 | 34.83 | 39.15 | 11.11 | 12.55 | 89.19 | 110.25 |
| 32 | 15-Jul-13 | 25.31 | 13.65 | 14.94 | 15.35 | 28.51 | 36.65 | 13.24 | 14.70 | 61.10 | 83.75 |
| 33 | 16-Jul-13 | 38.94 | 28.30 | 11.96 | 11.95 | 25.36 | 29.85 | 10.80 | 12.70 | 54.15 | 74.00 |
| 34 | 17-Jul-13 | 38.61 | 28.25 | 10.96 | 11.05 | 16.04 | 22.55 | 15.41 | 16.15 | 32.63 | 65.30 |
| 35 | 18-Jul-13 | 28.18 | 16.95 | 3.21 | 3.40 | 14.02 | 18.85 | 13.84 | 14.35 | 44.17 | 63.70 |
| 36 | 19-Jul-13 | 31.39 | 21.35 | 2.16 | 2.30 | 10.10 | 16.50 | 7.86 | 8.25 | 5.16 | 8.35 |
| 37 | 22-Jul-13 | 79.20 | 76.40 | 4.87 | 5.20 | 14.84 | 14.25 | 4.61 | 5.60 | 1.52 | 3.50 |
| 38 | 23-Jul-13 | 78.94 | 74.00 | 1.88 | 2.35 | 13.23 | 11.60 | 3.46 | 4.25 | 0.50 | 1.95 |
| 39 | 24-Jul-13 | 112.46 | 104.35 | 2.89 | 3.00 | 11.88 | 11.60 | 3.62 | 4.25 | 0.00 | 0.45 |

##: Values not available

TABLE V

| Paired Sample T-test for Black Schoes Model Premium Value and Actual Market Premium Value | | | | | | | | | |
|---|---------------|--------------|--------------------|--------------------|----------|----|-------------------|---------------------------------------|---------------------------|
| Call Pairs | Stock Options | Strike Price | Paired Differences | | t | df | P-Value | Null Hypothesis Acceptance/ Rejection | Conclusion |
| | | | Mean | Standard Deviation | | | | | |
| 1 | HDFC | 800 | 0.5 | 1.39 | 0.361631 | 12 | 0.723915 | Accepted | No significant Difference |
| 2 | HDFC | 820 | 2.19 | 0.46 | 4.72767 | 12 | 0.00049 | Rejected | Significant Difference |
| 3 | HDFC | 840 | 2.09 | 0.37 | 5.585048 | 12 | 0.000119 | Rejected | Significant Difference |
| 4 | HDFC BANK | 640 | -0.43 | 2.22 | -0.19211 | 9 | 0.851919 | Accepted | No significant Difference |
| 5 | HDFC BANK | 660 | 1.86 | 0.73 | 2.55956 | 12 | 0.025022 | Rejected | Significant Difference |
| 6 | HDFC BANK | 680 | 2.14 | 0.43 | 5.03 | 12 | 0.000295 | Rejected | Significant Difference |
| 7 | ICICI Bank | 980 | 75.77 | 22.09 | 3.43 | 12 | 0.004984 | Rejected | Significant Difference |
| 8 | ICICI Bank | 1000 | 5.59 | 0.82 | 6.85 | 12 | 1.80E-05 | Rejected | Significant Difference |
| 9 | ICICI Bank | 1020 | 5.87 | 0.9 | 6.5 | 11 | 4.40E-05 | Rejected | Significant Difference |
| 10 | Infosys | 2600 | 15.61 | 10.65 | 1.47 | 12 | 0.16827 | Accepted | No significant Difference |
| 11 | Infosys | 2700 | 3.3 | 11.1 | 0.3 | 12 | 0.771458 | Accepted | No significant Difference |
| 12 | Infosys | 2800 | -4.81 | 10.07 | -0.48 | 12 | 0.641578 | Accepted | No significant Difference |
| 13 | ITC | 350 | 0.61 | 0.17 | 3.68 | 12 | 0.003134 | Rejected | Significant Difference |
| 14 | ITC | 360 | 1.02 | 0.14 | 7.27 | 12 | 0.00001 | Rejected | Significant Difference |
| 15 | ITC | 370 | 1.31 | 0.25 | 5.15 | 12 | 0.000239 | Rejected | Significant Difference |
| 16 | LT | 900 | 2.32 | 4.27 | 0.54 | 9 | 0.600655 | Accepted | No significant Difference |
| 17 | LT | 940 | 12.74 | 4.71 | -2.7 | 8 | 0.026891 | Rejected | Significant Difference |
| 18 | LT | 980 | -7.53 | 2.25 | -3.35 | 8 | 0.010081 | Rejected | Significant Difference |
| 19 | ONGC | 290 | 3.05 | 1.02 | 2.98 | 12 | 0.011521 | Rejected | Significant Difference |
| 20 | ONGC | 300 | 0.88 | 0.18 | 4.77 | 12 | 0.00046 | Rejected | Significant Difference |
| 21 | ONGC | 310 | 0.95 | 0.14 | 6.55 | 12 | 2.7E-05 | Rejected | Significant Difference |
| 22 | Reliance | 880 | 3.5 | 0.41 | 8.54 | 12 | 0.00001 | Rejected | Significant Difference |
| 23 | Reliance | 900 | 3.94 | 0.48 | 8.26 | 12 | 0.00001 | Rejected | Significant Difference |
| 24 | Reliance | 920 | 3.63 | 0.56 | 6.5 | 12 | 2.90E-05 | Rejected | Significant Difference |
| 25 | Tata Motors | 280 | 1.26 | 0.18 | 6.89 | 12 | 1.70E-05 | Rejected | Significant Difference |
| 26 | Tata Motors | 290 | 1.43 | 0.11 | 13 | 12 | less than 0.00001 | Rejected | Significant Difference |
| 27 | Tata Motors | 300 | 1.28 | 0.09 | 14.01 | 12 | less than 0.00002 | Rejected | Significant Difference |
| 28 | TCS | 1500 | 5.32 | 4.12 | 1.29 | 12 | 0.220334 | Accepted | No significant Difference |
| 29 | TCS | 1600 | 9.33 | 3.5 | 2.66 | 12 | 0.020615 | Rejected | Significant Difference |
| 30 | TCS | 1700 | 7.35 | 2.52 | 2.91 | 12 | 0.013074 | Rejected | Significant Difference |

TABLE VI

| Paired Sample T-test for Black Schoes Model Premium Value and Actual Market Premium Value | | | | | | | | | |
|---|---------------|--------------|--------------------|--------------------|-------|----|------------------|---------------------------------------|---------------------------|
| Put Pairs | Stock Options | Strike Price | Paired Differences | | t | df | P-Value | Null Hypothesis Acceptance/ Rejection | Conclusion |
| | | | Mean | Standard Deviation | | | | | |
| 1 | HDFC | 800 | 1.85 | 0.26 | 7.27 | 12 | less than .00001 | Rejected | Significant Difference |
| 2 | HDFC | 820 | 1.64 | 0.35 | 4.64 | 12 | 0.000568 | Rejected | Significant Difference |
| 3 | HDFC | 840 | 1.23 | 0.47 | 2.6 | 12 | 0.02337 | Rejected | Significant Difference |
| 4 | HDFC BANK | 640 | 1.78 | 0.39 | 4.57 | 12 | 0.000645 | Rejected | Significant Difference |
| 5 | HDFC BANK | 660 | 2.38 | 0.39 | 6.04 | 12 | 5.90E-05 | Rejected | Significant Difference |
| 6 | HDFC BANK | 680 | 3 | 0.62 | 4.86 | 12 | 0.000389 | Rejected | Significant Difference |
| 7 | ICICI Bank | 980 | 4.02 | 0.66 | 6.12 | 12 | 5.20E-05 | Rejected | Significant Difference |
| 8 | ICICI Bank | 1000 | 3.68 | 0.78 | 4.71 | 12 | 0.000503 | Rejected | Significant Difference |
| 9 | ICICI Bank | 1020 | 2.9 | 1.08 | 2.69 | 12 | 0.019759 | Rejected | Significant Difference |
| 10 | Infosys | 2600 | 15.58 | 11.12 | 1.4 | 11 | 0.188593 | Accepted | No significant Difference |
| 11 | Infosys | 2700 | 3.57 | 1061 | 0.34 | 12 | 0.741963 | Accepted | No significant Difference |
| 12 | Infosys | 2800 | -2.33 | 11.47 | -0.2 | 12 | 0.842745 | Accepted | No significant Difference |
| 13 | ITC | 350 | 0.85 | 0.06 | 13.17 | 10 | less than .00001 | Rejected | Significant Difference |
| 14 | ITC | 360 | 1.04 | 0.2 | 5.21 | 11 | 0.000292 | Rejected | Significant Difference |
| 15 | ITC | 370 | 2.01 | 1.88 | 1.07 | 12 | 0.304941 | Rejected | Significant Difference |
| 16 | LT | 900 | -3.83 | 0.69 | -5.58 | 9 | 0.000342 | Rejected | Significant Difference |
| 17 | LT | 940 | -5.72 | 0.83 | -6.88 | 9 | 0.000127 | Rejected | Significant Difference |
| 18 | LT | 980 | -9.26 | 1.14 | -8.14 | 8 | 3.90E-05 | Rejected | Significant Difference |
| 19 | ONGC | 290 | 0.55 | 0.09 | 5.83 | 12 | 8E-.5 | Rejected | Significant Difference |
| 20 | ONGC | 300 | 0.59 | 0.09 | 6.23 | 12 | 4.40E-05 | Rejected | Significant Difference |
| 21 | ONGC | 310 | 0.46 | 0.12 | 3.91 | 12 | 0.002067 | Rejected | Significant Difference |
| 22 | Reliance | 880 | 4.01 | 0.54 | 7.45 | 12 | less than .00001 | Rejected | Significant Difference |
| 23 | Reliance | 900 | 3.79 | 0.6 | 6.32 | 12 | 3.80E-05 | Rejected | Significant Difference |
| 24 | Reliance | 920 | 6.2 | 2.18 | 2.85 | 12 | 0.01464 | Rejected | Significant Difference |
| 25 | Tata Motors | 280 | 1.73 | 0.26 | 6.63 | 12 | 2.40E-05 | Rejected | Significant Difference |
| 26 | Tata Motors | 290 | 1.75 | 0.24 | 7.28 | 12 | less than .00001 | Rejected | Significant Difference |
| 27 | Tata Motors | 300 | 1.41 | 0.23 | 6.08 | 12 | 5.50E-05 | Rejected | Significant Difference |
| 28 | TCS | 1500 | 18.44 | 4.64 | 3.97 | 8 | 0.004096 | Rejected | Significant Difference |
| 29 | TCS | 1600 | 17.04 | 3.29 | 5.18 | 9 | 0.000581 | Rejected | Significant Difference |
| 30 | TCS | 1700 | 39.55 | 12.16 | 3.25 | 12 | 0.00693 | Rejected | Significant Difference |

Source: For Calculation stock prices have been taken from www.nseindia.com.