JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Hedging in Options Market

[1]Dr. Sonal Sharma
[1]Associate Professor
[1]Hansraj College, University of Delhi, Delhi, India

Abstract : Introduction of option contracts in India, in 2001, has positioned Indian options market at the top of the globe. The volume in the Indian options market has phenomenally grown in the last two decades. With such boom in the market it becomes crucial to understand how well an investor can hedge through these option contracts. Present study tries to identify undervalued and overvalued options so as to create strategies in order to test whether these can lead to substantial hedged profits in these markets or not.

***IndexTerms* – Volatility, Stock Market, Options, Derivatives**

I. INTRODUCTION

A derivative contract can be defined as "a financial instrument whose value depends on (or derives from) the values of other, more basic underlying variables. A call option gives the holder the right to buy the underlying asset by a certain date for a certain price. The price in the contract is known as the exercise or strike price the date in the contract is known as the expiration date or maturity" Hull (2005). This feature of an option contract of passing on the right with no obligation to definitely perform the contract has attracted many investors, especially hedgers towards these markets. Hedging mainly involves buying one asset with successively selling another with the purpose of transferring risk to the other party. Hedgers sometime utilize an option pricing models in order to create a hedging strategy. The most basic and simple model is the Black and Scholes (BS) option pricing model that can be used for knowing the price of an option contract for a given underlying asset. Since its year of introduction, that is 1973, the BS model is still widely used, understood and compared with the model's alternatives. Literature has shown that the BS model can be used to identify hedging strategies in the markets in order to make profits (eg. Black (1972), Galai (1977), Geske and Roll (1984), Macbeth and Merville (1979, 1980), Rubeinstein (1985), Whaley (1982), Fleming and Whaley (1994), Bakshi, Cao and Chen (1997), Dupire (1993), Harvey and Whaley (1992a,b), Dumas, Fleming and Whaley (1995), etc). Present study tries to test the hedging effectiveness of the BS model by using the model to price the option contracts so as to identify hedging strategies on Nifty index.

The study is divided into following sections: first section deals with data and methodology, second section is presents the results and last section concludes the study.

III RESEARCH METHODOLOGY

The methodology section outline the plan and method that how the study is conducted. The details are as follows;

3.1 Data and Sources of Data

This study uses secondary data which was collected from the website of the National Stock Exchange of India. The daily closing index prices and the Nifty call option prices for the sample are obtained from 1 July 2002 to 30 June 2011. And from the website of RBI the data for the interest rate variables are collected for the period involved.

3.2 Statistical tools and econometric models

An investor needs six variable inputs, out of which volatility of the underlying asset is the only unobservable variable, in order to apply the BS model. Present study uses two volatility forecasts models, that is the random walk and the Long Term Mean model to have two different volatility forecast as input into the BS model to forecast option contract prices. The BS model can be applied through the following equation:

$$C = S\,N(d_1) - Xe^{-rt}\,N(d_2) \qquad \text{-------------- [1]}$$

Where

$$d_1 = \frac{\ln[S/X] + [r + \sigma^2/2]t}{\sigma\sqrt{t}}$$

$d_2 = d_1 - \sigma\sqrt{t}$, C is value of the call option, S is price of underlying security, X is exercise price, t is time to expiration, σ^2 is variance rate of return for the underlying security, r is short term interest rate which is continuous and constant through time and N (d_i) is cumulative normal density function evaluated at d_i .

According to the random walk model the best forecast for tomorrow's volatility is today's volatility;

$$\hat{\sigma}_{t+1} = \sigma_t \qquad \text{--------------------[2]}$$

Where σ_t alone is used as a forecast for σ_{t+1}. Letting $R_t = \ln(P_t/P_{t-1})$ represent daily returns on the index, the MA model defines the volatility for today as the equally weighted average of realized volatilities in the past "n" days, where n is the moving average period or "rolling window":

$$\sigma_t^2(MA) = \frac{1}{n}\sum_{i=1}^{n} \sigma_{t-i}^2 \qquad \text{-----------------[3]}$$

We take n as fifteen days. Some option contracts were excluded from the pricing data. Like, options less than six days to maturity, options with absolute money ness more than 10 percent are excluded. These selected observations are divided into six categories according to their money ness. A call option is said to be deep out-of-the-money options (M<0.93), not so deep out-of-the-money options ($0.94 \le M < 0.97$), near-the-money options ($0.97 \le M < 1$ and $1 \le M < 1.03$), not so deep out-of-the-money options ($1.03 \le M < 1.06$) and deep out-of-the-money options ($M \ge 1.06$).

In order to determine whether or not excess returns can be earned by employing the arbitrage trading strategies that underlie the BS model, we would be judging the hedging efficiency of the BS model in the Indian options market. In conducting empirical tests of the Black and Scholes model, researchers need to consider whether the market is truly efficient or not. Given the assumption that the markets are efficient, above normal profits for an ex-post test is an indication that the model is not correct.

For testing the BS model, an ex-post test is performed. The test will indicate the ability of the BS model to establish position that, on the average, produce above normal profits. In other words, the null hypothesis tested through the ex-post test is that no profits can be earned through the hedging strategy, in which a position in an option is matched with a position in the underlying stock, over and above the risk free rate of interest. For conducting the ex-post test, firstly, on every day t, the model call prices are calculated by putting all the required information. Secondly, on same day, we identify the undervalued and overvalued calls by relating the actual call prices with the market prices. Next, a hedge is created on day t, in which overpriced/underpriced call options are sold/bought at the market price and nd_{1t} number of index contracts are bought (sold) in the market. Then the investment required for creating the hedge is calculated. If the call option is undervalued, the investment required is

$$V_{H1} = C_t^A - nd_{1t}S_t < 0 \qquad \text{..............................[4]}$$

and if it is overvalued, the investment required is

$$V_{H2} = nd_{1t}S_t - C_t^A > 0 \qquad \text{..............................[5]}$$

where nd_{1t} is the hedge ratio and V_{Hi} is the investment required in the creation of the hedge. This hedged position is maintained till the next day $t+1$ at which time it is closed out or liquidated at the $t+1$ prices and the excess returns from the hedged position is calculated. The hedged position is then reestablished on day $t+1$ through creation of a new hedge. This procedure is continued for all call option contracts on each day and the returns are then averaged.

IV. RESULTS AND DISCUSSION

After identifying under/overvalued options and creating hedges, maintaining them for each day, the returns are averaged and shown in table 1 below. The table shows the hedging returns for one-month Nifty Index option contracts.

Moneyness (M) is defined as S_A/X where S_A is the Index level adjusted for dividends and X is the exercise price. There are six moneyness categories defined: deep out-of-the-money options (M<0.93), not so deep out-of-the-money options ($0.94 \le M < 0.97$), near-the-money options ($0.97 \le M < 1$ and $1 \le M < 1.03$), not so deep out-of-the-money options ($1.03 \le M < 1.06$) and deep out-of-the-money options ($M \ge 1.06$). Positive figure shows over and above normal average profits and negative figure shows average losses.

Table 1: Hedging results for one-month Nifty index options

Model	Moneyness					
	<.94	.94-.97	.97-1	1-1.03	1.03-1.06	>1.06
RW	13.88	9.26	2.38	-15.18	-22.09	-24.69
MA	5.3	3.55	-4.89	-17.97	-28.89	-31.78

The above test results in excess returns are shown in the table above, according to their money ness. A positive figure in the table indicates an average return whereas a negative figure indicates an average loss. Analysis of the table shows that we were able to locate the overvalued and undervalued near-the-money options. These options lie in the money ness range of 0.94 to 1.03. The hedge returns are maximum for options with money ness between 0.94 to 0.97. For deep in-the-money and at-the-money options, the averages indicate an average loss. For these options, we could not identify the overvalued and undervalued contracts.

Moreover, the hedge returns for OTMs were more if Random Walk model is used instead of the moving average model as an input for the forecasted volatility in the BS model. For ATMs with moneyness between 0.97 to 1, it is better to hedge by implementing the RW model instead of the MA as the latter is leading to average losses. Thus, one can say that the ex-post hedge strategy can locate deviations between model and actual prices for in-the-money options that can be translated into above normal profits through the hedge strategies. The null hypothesis that no above normal profits can be obtained from hedging positions is accepted only for deep in-the-money and at-the-money options whereas it is rejected for other categories of options.

IV CONCLUSIONS

Option contracts, since their introduction have attracted investors creating large volumes in the market. One of the active players in an option's market is the hedgers. Hedging mainly involves buying one asset with successively selling another with the purpose of transferring risk to the other party. Hedgers sometime utilize an option pricing models in order to create a hedging strategy. The most basic and simple model is the Black and Scholes (BS) option pricing model that can be used for knowing the price of an option contract for a given underlying asset. Since its year of introduction, that is 1973, the BS model is still widely used, understood and compared with the model's alternatives.

Present study utilizes the data on the Nifty index call option contracts in order to understand whether by using the simplest available model, that is the BS model, can an investor make ex-post hedge returns or not. The results show that the model can identify undervalued option contracts and the overvalued option contracts so as to enable creating hedging strategies only for deep in-the-money options and not-so-deep-in-the-money option contracts. Moreover, it is better for the investor to utilize the forecasted volatilities from the random walk model instead of a moving average model in order to maximize his hedge returns identified through the Black and Scholes option pricing model.

REFERENCES

[1] Bakshi, G., Cao, C. and Chen, Z., 1997. Empirical performance of alternative option pricing models. *The Journal of finance*, *52*(5), pp.2003-2049.

[2] Black, F. and Scholes, M., 1972. The valuation of option contracts and a test of market efficiency. *The journal of finance*, *27*(2), pp.399-417.

[3] Dumas, B., Fleming, J. and Whaley, R.E., 1998. Implied volatility functions: Empirical tests. *The Journal of Finance*, *53*(6), pp.2059-2106.

[4] Duque, J. and Paxson, D.A., 1993. Dynamic hedging of equity call options. *Estudos de Gestão*, *1*(2), pp.83-92.

[5] Dupire, B., 1994. Pricing with a smile. *Risk*, *7*(1), pp.18-20.

[6] Fleming, J. and Whaley, R.E., 1994. The value of wildcard options. *The Journal of Finance*, *49*(1), pp.215-236.

[7] Galai, D., 1977. Tests of market efficiency of the Chicago Board Options Exchange. *The Journal of Business*, *50*(2), pp.167-197.

[8] Geske, R. and Roll, R., 1984. On valuing American call options with the Black-Scholes European formula. *The Journal of Finance*, *39*(2), pp.443-455.

[9] Harvey, C.R. and Whaley, R.E., 1992a. Market volatility prediction and the efficiency of the S & P 100 index option market. *Journal of Financial Economics*, *31*(1), pp.43-73.

[10] Harvey, C.R. and Whaley, R.E., 1992b. Dividends and S&P 100 index options. *Journal of Futures Markets*, *12*, pp.123-137.

[11] Hull, J.C., 2003. *Options futures and other derivatives*. Pearson Education India.

[12] MacBeth, J.D. and Merville, L.J., 1979. An empirical examination of the Black-Scholes call option pricing model. *The journal of finance*, *34*(5), pp.1173-1186.

[13] MacBeth, J.D. and Merville, L.J., 1980. Tests of the Black-Scholes and Cox call option valuation models. *The Journal of Finance*, *35*(2), pp.285-301.

[14] Rubinstein, M., 1985. Nonparametric tests of alternative option pricing models using all reported trades and quotes on the 30 most active CBOE option classes from August 23, 1976 through August 31, 1978. *The Journal of Finance*, *40*(2), pp.455-480.

[15] Whaley, R.E., 1982. Valuation of American call options on dividend-paying stocks: Empirical tests. *Journal of Financial Economics*, *10*(1), pp.29-58.

[16] Whaley, R.E., 1993. Derivatives on market volatility: Hedging tools long overdue. *The journal of Derivatives*, *1*(1), pp.71-84.