Options as a Tool for Portfolio Management: A Study

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Abstract: In this paper we investigated the performance of different option strategies with help of mean variance criterion, capital asset pricing model and stochastic dominance models. The strategies we have used were necked strategy (pure stock strategy), writing out of the money covered call and buying in the money protective put. For this purpose we have chosen the 4 companies which were listed on the nifty (index of national stock exchange) during the data period. The data period starts from 1st April 2010 to 31st March 2014. Our results from MV criterion shows that due to presence of leverage effect and excessive gain the mean return was increased after the introduction of ITM protective put and OTM covered call and concluded that these strategies dominate one another by MV criterion. Further we have applied the systematic risk coefficient, Sharpe ratio, and Treynor and Jensen indices for the measurement of results through the CAPM and concluded that, ITM protective put was superior to OTM covered call and necked strategy. While both hedge strategy were superior to pure stock strategy. In the end we analysed the dominancy performance of the strategies over the other and found that ITM protective put and covered call dominates the pure stock strategy in the first stochastic dominance at 1% level of significance. Also our results confirms that by adding options especially in the money protective put improve the wealth of investor, as efficiency can be improved by the adding put to portfolio.

Keys Words: Covered call option, protective put option, , mean-variance approach, Capital asset pricing model, stochastic dominance test.

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Introduction:

The valour of economy depends upon various factors. The performance of stock market/secondary market is the best indicator of a sound economy. In recent years, the volatility in Indian stock market is creeping with dangerous signals. Volatility in stock market is desirable to some extent, to attract the new investors' community to invest in the market. But, many research studies exhibit that there is excess volatility in Indian stock market. Unless, market regulators take appropriate steps to curb the excess volatility, the investor will be the scapegoat. In India, derivatives trading were introduced with such an intention to curb the excess volatility. Derivatives are financial instruments which hedge the risk of a particular financial asset so that an investor can minimize his risk associating with his/her investment. There is a perception that derivatives are the best panacea to curb the excess volatility in the stock market. In this junction an earnest attempt is made to analyse the development of derivatives market in Indian context. The rapid growth of the use of options in portfolio management has been accompanied by a variety of claims regarding option performance strategies. Many investors believe that they can enhance the performance of their pure-stock portfolios by incorporating different options strategies. Among them, the most popular strategies are covered-call writing and protective-put buying.

Review of literature:

Treynor, J.L., (1965), described a simple graphical method, through which he captured the distinctive features about the performance of a fund, including the effects of fund management. He also introduced fund performance concept and the fund-management performance measurement through the grading or rating system.

Frankfurter and Phillips (1975) studied and compared the stochastic dominance (SD) and efficiency relative to Markowitz (EV) efficiency criteria on empirical grounds. For improving computational efficiency they ascertain the several algorithms.

Ross, S., (1976), contended that option writing on an asset can improve the efficiency in the market. This efficiency permits the contingency expansion in the market. Result shows, first, that there is existence of single portfolio in the market on which there is no loss in the efficiency. Second if there is

any efficient fund in the market then there is no loss in efficiency and third complex contract can be "built up" as portfolios of simple options.

Vijay S. B., Eric B. L. and Lawrence C. R., (1979), contended that under uncertainty the stochastic dominance (SD) rules are playing prominent role in the choice of theory. The application part of stochastic dominance included the stock selection, capital budgeting etc. The theory of stochastic dominance is important because it is used as decision making rules. These rules are applicable to problem of the two parameters. Also the mean-variance is employed in financial decision making. They contended that implementation of stochastic dominance required the comparisons of probability distributions over their entire ranges.

Trennepohl and Dukes (1981) used both in-the-money (ITM) and out-of-the-money (OTM) options especially writing of calls (covered short call) or the buying of puts (put hedge). They also investigated the performance of option by using the writing and buying strategies of the option. They concluded that, these covered option reduces the risk (portfolio standard deviation) and mean return in comparison to the unprotected stock position.

Levy (1985) applied the stochastic dominance rules along with borrowing and lending at the risk-free interest rate. Author derived the upper and lower values for an option price for all unconstrained utility functions and alternatively for the concave utility functions. The derivation of these bounds is quite general and fits any kind of stock price distribution as long as it is characterized by a "nonnegative beta." Author contended that transaction costs and taxes can be easily incorporated in the model and investors are not required to revise their portfolios continuously.

Anderson, Gordon, (1996), tested the stochastic dominance which was based on the goodness of fit extension. They compared the income distribution on the basis of non parametric test. Researcher compared and implemented it with the indirect test of the second order stochastic dominance.

Post, T., and Vliet, P. V., (2004), contended that there is no need to be growth portfolio to be efficient for the efficiency of market portfolio. They contended that stochastic dominance results are very much market sensitive and prone to sampling error.

Linton, Maasoumi, and Whang (2005), extended the Kolmogorov-Smirnov tests of Stochastic Dominance. They explain the procedure for estimating the critical values which are used in arbitrary order of stochastic dominance. This arbitrary order remains for the Kth term. By allowing the serially dependent observation they accommodate the general and prospects dependency and it was ranked. Also they contended that prospects may be residual. This residual may be of certain conditional models, so that conditional ranking can be proposed. They offered the test of Prospect Stochastic Dominance. They result was very consistent and powerful against some alternatives. They proposed some heuristic method. This method was used for the selection of the sub sample size. Also they demonstrate reasonable performance in the simulation. Also they described the other method for obtaining critical values. They compared these two methods in theory and in practice.

Best, Hodges and Yoder (2006) applied the stochastic dominance tests to check, whether value portfolio performance increases from unknown risk factor or from errors arise in forecasted earnings growth rates. They concluded that Value portfolios outperformed due to systematic errors in forecasting earnings growth rates.

Hodder, Jackwerth and Kolokolova (2014) examined the performance of second-order stochastic dominance in both ways. Through this they also construct the portfolio. By using the 21 years of daily data of pension fund benchmark, they applied the second-order stochastic dominance over a period. They suggested that portfolio choice technique significantly outperforms the benchmark portfolio out-of-sample.

Data: selection of sample size:

We have chosen the 4 companies of the nifty (index of national stock exchange). The data period starts from 1st April 2010 to 31st March 2014. The data used in this category is based on Secondary data, collected from official website of national stock exchange. We choose 8 options (call and put) and their underlying stocks for the abovementioned period. Options are selected according to its types and its Moneyness degrees and are only restrained to OTM call option and ITM put options due to the superiority of these types of options in performance enhancing. The Daily return for the unhedge

individual stock has been calculated as follows by taking the natural logarithm of the daily closing price relatives.

$$r = \ln (Pt/Pt\text{-}1)$$

Research Methodology

We investigate the performance by examining the risk and return of three different strategies for the selected period. These strategies are pure stock strategy (Naked stock strategy), Covered call (hedge strategy) and protective put (hedge strategy). In covered call strategy we have determine the risk and return by incorporating the "out of the money call" of concerning stock, along with the stock. In protective put strategy we have determine the risk and return by incorporating the "In the money put" of corresponding stock, along with the naked stock.

Objectives of the study

1. To study the performance of pure stock strategy covered call and protective put by examining their risk and return.
2. To study the dominance of hedge strategies over the naked stock strategy.
3. To study the dominance of one hedge strategy over the other.

Hypothesis

After complete study of the hypothesis of previous research and scope of the research, hypotheses were set as follows.

S_0: The returns of the Covered call strategy do not outperform the returns of the unhedged pure-stock strategy.

B_0: The returns of the Protective put strategy do not outperform the returns of the unhedged pure-stock strategy.

SB_0: There is no difference in the returns between the performance of Covered call strategy and protective put strategy.

S_1: the returns of the Covered call strategy outperformed the returns of the unhedged pure-stock strategy.

B_1: The returns of the Protective put strategy outperform the returns of the unhedged pure-stock strategy.

SB_1: There is the difference in the returns between the performance of Covered call strategy and protective put strategy.

As per the MV rule a portfolio is preferred rule: the portfolio X is preferred over Y only when

$ER_1 > ER_2$ and $SD_1 < SD_2$

To apply the MV criterion, we have computed the descriptive statistics including mean (μ) and standard deviation (σ). For the testing of hypothesis, S0, S1, B0, B1, SB0 and SB1 we have computed the coefficient of variance (σ/μ), the skewness and kurtosis coefficients and the Jarque-Bera (JB) statistic for the returns of all unhedged and hedged positions.

We have also employed the CAPM model for the construction of portfolio and evaluation of performance of above mentioned portfolios. In the CAPM analysis we have used the β effect, Sharpe's ratio trenor's ratio and Jensen's analysis to measure the degree of performance of each strategy. After the estimation of all the linear regression for CAPM equation, we have used the following equation for both the hedge as well as un-hedge portfolio of the particular stock.

$$R_i\text{-}R_f = \alpha_i + \beta_i (R_{m,t} - R_{f,i}) + \varepsilon_{i,t}$$

Where,

α = Intercept

β = Slop of i^{th} stock and systematic risk

R_m = Return of market index

R_f =Risk free rate of return

ε = Residual of individual and identical distributed residuals

Beta is the slop of characteristic regression line. Beta describes the relationship between stock return and market return. Beta also measures the sensitivity of stock return to the measurement of market portfolio return. After that we have computed the Sharpe's ratio trenor's ratio and Jensen's ratio.

We have applied the Davidson and Duclos (DD, 2000) nonparametric SD DD test. This test is based on the empirical distribution of the data. DD is used to test any dominance from any of the two random samples of the returns series, with the number of observations. DD also check the corresponding cumulative distribution functions (CDFs), and the corresponding probability density functions (PDFs).

D_i^0 = fi

fi = Probability density for the i= return series

$$D_i^j(x) = \int_i^x D_i^{j-1}(y)\,dy$$

Where j= 1,2,3....

i= x,y

For any integer j $\geq$ 1, then we can say that x is dominating y at order j ($x \succ_j y$)

If $D_x^j(a_i) \geq D_y^j(a_i)$,

Then for all a, there is inequality with a.

The null hypothesis of the DD for the equality $D_x^j(a_i) = D_y^j(a_i)$, is as follows,

$$T^j = \frac{D_x^j(a) - D_y^j(a)}{\sqrt{Vj}(a)}$$

$$V^j(a) = V_x^j(a) + V_y^j(a) - 2V_{x,y}^j(a)$$

$$D_x^j(a) = \frac{1}{N(j-1)} \sum_{i=1}^{N} (a - xi)^{j-1}$$

$$D_y^j(a) = \frac{1}{N(j-1)} \sum_{i=1}^{N} (a - yi)^{j-1}$$

$$V_x^j(a) = \frac{1}{N}\left[\frac{1}{N(j-1)} \sum_{i=1}^{N} (a - xi)^{j-1} - D_x^j(a)^2\right]$$

$$V_y^j(a) = \frac{1}{N}\left[\frac{1}{N(j-1)} \sum_{i=1}^{N} (a - yi)^{j-1} - D_y^j(a)^2\right]$$

$$V_{xy}^j(a) = \frac{1}{N}\left[\frac{1}{N(j-1)}\right] \sum_{i=1}^{N} (a - xi)^{2j-1} - D_x^j(a)^2\, D_y^j(a)^2$$

Data analysis:

Descriptive statistics for the returns of both unhedged and hedged positions are as Follows:

Table I (i) : Descriptive statistics of returns on unhedged and hedged stock.

Unhedged Position pure -stock strategy						
Company	**Mean (μ)**	**Std Dev (σ)**	**σ/μ**	**Skewness**	**Kurtosis**	**JB**
ITC	0.000597681	0.021766833	36.41880801	-1.260060259	29.32228627	181.5524391
LT	0.000215427	0.022297574	103.5039739	-2.75687216	40.59786849	131.3221039
PNB	-0.009045741	0.021006024	-2.322200519	0.116304015	1.849016791	172.9760533
TATAMOTORS	0.00047086	0.035249547	74.86206162	-12.03273245	27.64224716	166.39346

Table I (ii):

Hedged Position: writing OTM covered call strategy						
Company	**Mean (μ)**	**Std Dev (σ)**	**σ/μ**	**Skewness**	**Kurtosis**	**JB**
ITC	0.043676903	0.435698063	9.975479734	1.066037304	14.2921731	106.0728093
LT	0.054857014	0.854325531	15.57367903	1.990015952	46.48745561	386.400696
PNB	0.013628	0.288276	21.15382	1.580756	3.681507	240.4668
TATAMOTORS	0.001159	0.049825	42.98103	0.966312	21.22934	162.6657

Table I (iii):

Hedged Position: buying ITM protective put strategy						
Company	**Mean (μ)**	**Std Dev (σ)**	**σ/μ**	**Skewness**	**Kurtosis**	**JB**
ITC	0.088708453	0.237460009	2.676858871	1.693186893	3.558996864	277.1089409
LT	0.201921664	0.287523207	1.423934417	1.164578879	18.88135995	1275.644318
PNB	0.619125	0.962281	1.554259	1.981324	4.215315	382.9414
TATAMOTORS	-0.00646	0.018103	-2.80129	0.046987	6.591782	180.4017

Interpretation of Mean Variance analysis:

Presence of leverage effect and excessive gain was found in all companies and this leverage effect and excessive gain results that mean return was increased after the introduction of ITM protective put and OTM covered call. On comparison of all three strategies, it was found that ITM protective put has highest mean return and standard deviation followed by the OTM covered call, while the necked strategy has least mean return and standard deviation. Hence it can be concluded that these strategies dominate one another by MV criterion.

On comparison of coefficient of variance, it was found that mean return has been increased and variance was decreased in hedge positions which indicates that volatility or movement has been decreased after the introduction of option strategies.

The result also suggested that after the introduction of option strategies the distribution remains away from normality. Further skewness coefficient that the time series for un-hedge stock was normally distributed and hedge strategies was non-normally distributed.

Returns shows the evidence of fat tail in the time series since kurtosis exceed three, which was the normal value. Jarque bera test also following the non-normality distribution in all strategies.

INTERPRETATION:

Table II: Summary of index performance measure of individual stock/index position

Table II (i):

Unhedged Position pure -stock strategy					
Company	**Beta**	**Sharpe**	**Treynor**	**Jensen**	**T*(β)**
ITC	0.279675996	-3.18844359	-0.248152576	-0.018979639	0.000509481
LT	0.704563599	-3.139258355	-0.099349222	-0.049317298	-0.000220042
PNB	0.684350389	-3.336683732	-0.102418963	-0.047994985	-0.000306279
TATAMOTORS	0.888703102	-1.972483196	-0.078236635	-0.061738357	0.000190592

Table II (ii):

Headged Position: writing OTM covered call strategy					
Company	**Beta**	**Sharpe**	**Treynor**	**Jensen**	**T*(β)**
ITC	-0.348745	0.4320007	0.0929526	0.0402016	0.0000061
LT	0.5973218	0.4325102	0.0180576	0.5296543	0.00000948
PNB	0.6041085	0.684376	0.0863438	0.292543	0.00000188
TATAMOTORS	0.6973485	0.3529808	0.0405082	0.06298293	0.00000106

Table II (iii):

Hedged Position: buying ITM protective put strategy					
Company	**Beta**	**Sharpe**	**Treynor**	**Jensen**	**T*(β)**
ITC	-0.348745	0.4320007	0.0929526	0.0402016	0.0000061
LT	0.5973218	0.4325102	0.0180576	0.5296543	0.00000948
PNB	0.6041085	0.684376	0.0863438	0.292543	0.00000188
TATAMOTORS	0.6973485	0.3529808	0.0405082	0.06298293	0.00000106

Systematic Risk (Beta) effect:

Systematic risk was decreased in the strategies having call and put. Beta coefficient was found highest in necked strategy among all strategies.

Sharpes and Trenor Ratio:

ITM protective put having the largest sharpes and trenor ratio which suggests that larger change in mean return then the systematic risk by incorporating put in the necked strategy.

Jensens Ratio:

Jensens ratio was found highest in the option strategies. This suggest that on incorporating call put in the pure stock strategy, beats the market return. The overall result concludes that ITM protective put was superior to OTM covered call and necked strategy. While both hedge strategy were superior to pure stock strategy.

Table III: DD stochastic dominance tests between unhedged and hedged positions for individual stock's portfolios

- Pure Stock Strategy **Vs** Writing OTM covered-call strategy and Buying ITM protective-put strategy
- Writing OTM covered-call strategy **Vs** Pure Stock Strategy
- Buying ITM protective-put strategy **Vs** Pure Stock Strategy

Pure Stock Strategy	**Writing OTM covered-call strategy**	**Buying ITM protective-put strategy**	**Writing OTM covered-call strategy**	**Pure Stock Strategy**	**Buying ITM protective-put strategy**	**Pure Stock Strategy**
ITC	ND	ND	ITC	FSD	ITC	FSD
LT	ND	ND	LT	FSD	LT	FSD
PNB	ND	ND	PNB	FSD	PNB	FSD
TATAMOTORS	ND	ND	TATAMOTORS	FSD	TATAMOTORS	FSD

Table IVA: DD stochastic dominance tests between unhedged and hedged positions for individual stock/index in the first Sub-period:

April 2010 to March 2012

- Pure Stock Strategy **Vs** Writing OTM covered-call strategy and Buying ITM protective-put strategy
- Writing OTM covered-call strategy **Vs** Pure Stock Strategy
- Buying ITM protective-put strategy **Vs** Pure Stock Strategy

Pure Stock Strategy	**Writing OTM covered-call strategy**	**Buying ITM protective-put strategy**	**Writing OTM covered-call strategy**	**Pure Stock Strategy**	**Buying ITM protective-put strategy**	**Pure Stock Strategy**
ITC	ND	ND	ITC	FSD	ITC	FSD
LT	ND	ND	LT	FSD	LT	FSD
PNB	ND	ND	PNB	FSD	PNB	FSD
TATAMOTORS	ND	ND	TATAMOTORS	FSD	TATAMOTORS	FSD

IV B: DD stochastic dominance tests between unhedged and hedged positions for individual stock/index in the second sub-period: April 2012 to March 2014

- Pure Stock Strategy **Vs** Writing OTM covered-call strategy and Buying ITM protective-put strategy
- Writing OTM covered-call strategy **Vs** Pure Stock Strategy
- Buying ITM protective-put strategy **Vs** Pure Stock Strategy

Pure Stock Strategy	**Writing OTM covered-call strategy**	**Buying ITM protective-put strategy**	**Writing OTM covered-call strategy**	**Pure Stock Strategy**	**Buying ITM protective-put strategy**	**Pure Stock Strategy**
ITC	ND	ND	ITC	FSD	ITC	FSD
LT	ND	ND	LT	FSD	LT	FSD
PNB	ND	ND	PNB	FSD	PNB	FSD
TATAMOTORS	ND	ND	TATAMOTORS	FSD	TATAMOTORS	FSD

Table V: DD stochastic dominance relationships between hedged positions for individual stock positions for the entire period and the two sub-periods.

	Writing OTM covered call	**Buying ITM protective put**	**Writing OTM covered call**	**Buying ITM protective put**	**Writing OTM covered call**	**Buying ITM protective put**
ITC Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
ITC Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--
LT Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
LT Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--
PNB Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
PNB Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--
TATAMOTORS Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
TATAMOTORS Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--

Interpretation for Individual Scrip

Dominancy Analysis:

ITM protective put and covered call dominates the pure stock strategy in the first stochastic dominance at 1% level of significance. Hence null hypothesis of S0 and B0 was rejected and concluded that both hedge strategies were superior to pure stock strategy. Further, all company has the arbitrage

opportunity in option trading and investor can increase the wealth of investor by switching to pure stock to hedge strategy. Further we analysed the sub-periods and found that in the first sub-period the hedge position has dominancy over pure stock strategy.

Conclusion & discussion:

Our result shows that both mean and standard deviation of the daily returns was increased for each stock from the necked strategy to the two-hedged positions (writing OTM covered call and buying ITM protective put). The gain in ITM put and OTM covered call compensate the negative change in price of the underlying. On comparing all the three strategy necked strategy, ITM protective put and OTM covered call strategy the statistics shows that ITM protective put have highest return and highest standard deviation. Along with this we measured the optimal risk and return performance by the coefficient of variation and found that by introducing the option in trading strategy volatility also increased on increasing mean return. To be very specific the results shows that ITM protective put having lowest coefficient of variation which is followed by OTM covered call and necked strategy. Kurtosis results support the evidence of non-normality in all the stock. The result of the JB statistic shows that normality is rejected for time series of stock. Further we have checked the performance of different strategy by using beta coefficient, Sharpe ratio, Treynor and Jensen indices for each strategy on each stock or index. After the introduction of the options it has been found that beta (systematic risk) is reduced in all of the companies. In addition, the Beta coefficients are less than one or even become negative due to systematic risk minimisation. It has been found that both Sharpes and Treynor ratio becomes positive and higher in all hedge strategy than necked strategy. It was also found that ITM protective put strategy was having largest Sharpe and Treynor ratio which is followed by the OTM covered call strategy. These results indicates larger change in mean return then the change in the systematic risk by adopting call or put in trading stock was the reason for largest change in Sharpe and Treynor ratio. Results of Jensen ratio coincide with the sharpes and Treynors ratio. Further we have applied the stochastic dominance test on all the time series of all the unhedge and hedge position and result shows that in unhedge position all stock of necked strategy do not shows any stochastic dominance.

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