Stochastic Dominance Efficiency due to Options in the Portfolio

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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 10 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.

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

JEL Code: G11

Introduction

The main aim of portfolio is to maximise the return and minimise the risk. Mean variance criterion is the most attractive method to calculate the risk and return. Genreally stock prices is controlled by the options. The options give the flexibility to the portfolio and reduce the risk of the portfolio. The expected rate of return and risk are associated with the characteristic line. A steep slope indicates the actual rate of return for the fund is relatively sensitive to fluctuations in the general stock market (Treynor, J.L., 1965). Further, Frankfurter and Phillips (1975) compared the stochastic dominance (SD) and Markowitz (EV) efficiency criteria by using several algorithms. The basic framework of options in the portfolio were developed by the Ross, S., (1976), Cox (1976) and Hakanson (1978).

Review Of Litreture:

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.

Trennephol, G. and Dukes, W., (1982) gave attention on the behaviour of option risk on the different portfolio having different size and features. Many rational investor view that un hedge long position are too risky. However if we combine long option with the less risky asset then it resulted favourable risk return characteristics.

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.

Jean and Helms (1986) discussed that, the stochastic dominance is a model through which one can take the investment decision. They developed the method of sufficient conditions for all degree of stochastic dominance. They illustrated the computational problem associated with implementing the stochastic dominance through the example.

Pardalos, P. M., Sandstrom , M., and Zopounidis, C., (1994), contended that how to allocate the money among different alternatives is the main aim of portfolio. They emphasized on the optimization problem related to the portfolio model. Researches applied the dual algorithm for the optimization problem. In their result they presented the computational results for classical Markowitz mean-variance.

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.

Isakov and Morard (2001) concluded that when option introduced in any portfolio, return increases and simultaneously volatility decreases. Also they showed that the covered portfolio is better than uncovered portfolio. They found no stochastic dominance relationships among option strategies. They also defined the hedged returns of both protective-put and covered-call strategies to take into consideration the are not exercised when the options are out of the money.

Kais and Georges (2001) analyzed the effect of generalized first and second order stochastic dominance changes in a returns distribution on optimal financial portfolios. They showed the risk aversion plays an important role in composition of portfolio. They concluded the results on the separate basis of fund.

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.

Post, T., and Versijp. P., (2007), applied their test on CRSP all-share index of U.S. market. Researchers developed the tests of stochastic dominance. This efficiency test of stochastic dominance is for all the possible portfolios for given set of the entire asset. Multivariate statistics was used in their test. They compared the superior statistical power properties against the existing stochastic dominance efficiency tests and contended that it is helpful in increase the comparability with existing mean-variance efficiency tests. Through this test researchers demonstrate the mean-variance inefficiency of beta portfolios present in the sample. They reported the superior statistical power properties in the result. In the end they concluded that tail risk not captured by variance.

Kopa and Post (2009), contended that the efficiency testing of the portfolio through the existing approach gives the leniency for making the assumption about investor preferences and return distributions. Stochastic dominance is completely based on the parametric alternative procedures and assures to give the alternative of nonparametric test. But binary choices were not considered in these procedures. Researchers considered the all portfolio which was diversified so that new concept of first-order stochastic dominance (FSD) was introduced. Though FSD they have found the optimality of all possible portfolios. Their result shows that if we applied FSD then US markets are non optimal relative to other benchmark portfolios. The whole analysis was made on the book to equity and the market capitalization. They concluded that no non satisfied investor can hold the market portfolio for the requirement of the attractive premium of small caps and value stocks.

Scaillet and Topaloglou (2010), considered the consistency test for the confirmation of stochastic dominance of the given portfolio with respect to all possible portfolios. This stochastic dominance efficiency tests was applied on the all order of the given portfolio. They discussed and justified the approaches which are based on the simulation also they blocked the bootstrap to get the valid interference. Linear and mixed integer programming methods was used to compute the estimators. Their results shows market is mean variance inefficient but Fama and French market portfolio is FSD and the SSD efficient.

Schweizer, M., (2010), discussed the problem of mean variance hedging with minimal mean squared error, and this hedging strategy is self financed trading strategy. Researcher discussed the findings of mean variance criteria that the returns should be maximised and variance should be minimised. In both the cases it leads to the projecting a random variable. In the end author ended with the open question related to the open questions of wide range of application.

Zagst and Kraus (2011) analysed the two portfolio insurance method. These methods were Option-based Portfolio Insurance (OBPI) and Constant Proportion Portfolio Insurance (CPPI). Also they compared the above methods with each other by using the stochastic dominance of criteria third. Also they verify the spread of empirical and implied volatility. For the verification they used the second order and third order stochastic dominance for the Constant Proportion Portfolio Insurance theory. Researchers concluded that the Constant Proportion Portfolio Insurance strategy is more likely to stochastically dominate in comparison to Option-based Portfolio Insurance strategy especially in the third-order and found the higher implied volatility.

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 10 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 20 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 restricted 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.

S0: The returns of the Covered call strategy do not outperform the returns of the unhedged pure-stock strategy.

B0: The returns of the Protective put strategy do not outperform the returns of the unhedged pure-stock strategy.

SB0:There is no difference in the returns between the performance of Covered call strategy and protective put strategy.

S1: The returns of the Covered call strategy outperformed the returns of the unhedged pure-stock strategy.

B1: The returns of the Protective put strategy outperform the returns of the unhedged pure-stock strategy.

SB1: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

$ER1 > ER2$ and $SD1 < SD2$

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

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

Where j= 1,2,3….

i= x,y

For any integer , then we can say that x is dominating y at order j (x $_j$ 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
AXISBANK	0.00047822	0.022846893	47.7748986	0.333148736	2.778594237	156.1583251
BPCL	0.000311325	0.026351511	84.64309833	-6.902000641	138.1714378	5964.401408
HDFC	-0.000212916	0.030445451	-142.9925782	-17.64033824	45.98415328	345.2882706
M&M	0.000777418	0.018500294	23.79708803	0.023119906	0.778667094	183.1883664
REC	0.000219047	0.025829645	117.9180436	0.101997977	0.431269679	174.4272882
RELINFRA	-0.000464136	0.027636629	-59.54419695	-0.182459839	3.71621803	212.0651513
TATASTEEL	-0.000258393	0.022158064	-85.75328717	0.319204413	0.977209161	156.9474367
TECHM	0.000938297	0.020214761	21.54409071	0.522159296	2.441610372	149.4261148
TITAN	0.002724842	0.048107332	17.65508924	-15.19458803	29.89627441	259.2726448
WIPRO	-0.000267228	0.021265411	-79.57777425	-6.615245284	118.7303055	552.8309

Table I (ii) :

Hedged Position: writing OTM covered call strategy						
	Mean (μ)	Std Dev (σ)	σ/μ	Skewness	Kurtosis	JB
AXISBANK	0.155646171	1.679036895	10.78752458	15.69243	285.6964005	23686.2158
BPCL	0.018757153	3.518205582	187.5660745	2.299327974	5.604025281	519.6622769
HDFC	0.000140422	0.006963969	49.59303631	0.917154297	9.17154297	159.1939743
M&M	0.024313407	0.278817584	11.46764771	0.9804627216	12.88059793	89.03733426
REC	0.046163	0.816651	17.69075	2.578312	7.426327	656.8173
RELINFRA	0.0451684	1.308643	28.9725	31.54501	997.275	99100.16
TATASTEEL	0.083462	1.231324	14.75319	17.75661	34.44881	305.649
TECHM	0.042902	0.487255	11.35751	13.56862	22.27671	175.2793
TITAN	0.003395	0.026708	7.867708	0.837975	4.897556	154.652
WIPRO	0.032114	0.496656	15.46517	21.91513	57.656	470.9671

Table I (iii):

Hedged Position: buying ITM protective put strategy						
	Mean (μ)	**Std Dev (σ)**	**σ/μ**	**Skewness**	**Kurtosis**	**JB**
AXISBANK	0.691782	0.877301	1.268176	1.753898	36.53801	297.9813
BPCL	0.111446957	3.230134998	28.98360882	0.3137668424	9.899403783	980.2657694
HDFC	0.002156542	0.091334288	42.35219938	4.478323962	79.444702	1703.077665
M&M	0.51077747	13.76976654	26.95844543	3.101855252	9.732776326	957.619282
REC	0.132067	1.400511	10.60458	1.391802	2.196539	184.7699
RELINFRA	0.101542	1.879348	18.50815	2.452913	6.434837	59.31783
TATASTEEL	0.540017	0.653327	1.209826	14.68786	25.89581	206.5713
TECHM	0.185431	0.290268	1.565366	10.11195	13.45902	94.98118
TITAN	0.000667	0.003454	5.175281	0.654155	7.415102	149.1031
WIPRO	0.144559	1.852881	12.81749	18.69232	409.0377	33973.12

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.

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

Unhedged Position pure -stock strategy					
	Beta	**Sharpe**	**Treynor**	**Jensen**	**T*(β)**
AXISBANK	0.884636009	-3.042942388	-0.078588006	-0.061446301	0.000199235
BPCL	0.396790315	-2.644579813	-0.175630988	-0.027463997	0.00018619
HDFC	0.660290863	-2.306187451	-0.106336344	-0.046433277	-0.00042115
M&M	0.516091033	-3.741701741	-0.134128627	-0.035348954	0.00061466
REC	0.796279565	-2.701583878	-0.087633735	-0.058695725	-0.00003207275
RELINFRA	0.858702348	-2.549664634	-0.082058861	-0.060573301	-0.000734943
TATASTEEL	0.730556762	-3.170782065	-0.096171026	-0.051397366	-0.000488787
TECHM	0.468240482	-3.416399706	-0.147491952	-0.031838537	0.00079063
TITAN	0.579383091	-1.84930653	-0.120326748	-0.040272099	0.000101999
WIPRO	0.271643351	-3.304296655	-0.258674574	-0.019282263	-0.000352895

Table II (ii):

Headged Position: writing OTM covered call strategy					
	Beta	Sharpe	Treynor	Jensen	T*(β)
AXISBANK	0.61345082	0.1829425	0.0829846	0.265384	0.0000022
BPCL	-0.814315	0.729236	0.0883762	0.318294	0.0000012
HDFC	0.38912401	0.268583	0.0920830	0.536295	0.00000496
M&M	0.4378817	0.6834295	0.04936829	0.439458	0.00000126
REC	0.5134748	0.2863108	0.0934158	0.0534532	0.00000677
RELINFRA	0.8164318	0.8289573	0.0831844	0.0346310	0.00000941
TATASTEEL	0.6816758	0.4893406	0.0126534	0.6240136	0.0000089
TECHM	0.3489264	0.6352083	0.0456212	0.056243	0.00000084
TITAN	0.5039621	0.63903115	0.0006429	0.285885	0.00000527
WIPRO	0.1256453	0.9537424	0.0842534	0.1926313	0.00000281

Table II (iii):

Hedged Position: buying ITM protective put strategy					
	Beta	Sharpe	Treynor	Jensen	T*(β)
AXISBANK	0.1652189	0.2650001	0.0846213	0.4215934	0.000000413
BPCL	-0.9635487	0.7593678	0.0901329	0.3639621	0.000000128
HDFC	0.28538137	0.278593	0.09451402	0.643456	0.000000462
M&M	0.3659322	0.7289634	0.0524563	0.626452	0.000000186
REC	0.4386531	0.297893	0.0982984	0.232567	0.000000511
RELINFRA	0.713458	0.886257	0.0865984	0.0842167	0.000000871
TATASTEEL	0.5321641	0.644332	0.0463892	0.700488	0.000000126
TECHM	0.2145298	0.8050137	0.0678958	0.20568205	0.000000237
TITAN	0.4890528	0.7146706	0.0026293	0.464298	0.000000416
WIPRO	-0.138216	0.9725345	0.0984539	0.247645	0.000000005

Interpretation:

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
AXISBANK	ND	ND	AXISBANK	FSD	AXISBANK	FSD
BPCL	ND	ND	BPCL	FSD	BPCL	FSD
HDFC	ND	ND	HDFC	FSD	HDFC	FSD
M&M	ND	ND	M&M	FSD	M&M	FSD
REC	ND	ND	REC	FSD	REC	FSD
RELINFRA	ND	ND	RELINFRA	FSD	RELINFRA	FSD
TATASTEEL	ND	ND	TATASTEEL	FSD	TATASTEEL	FSD
TECHM	ND	ND	TECHM	ND	TECHM	ND
TITAN	ND	ND	TITAN	ND	TITAN	ND
WIPRO	ND	ND	WIPRO	FSD	WIPRO	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
AXISBANK	ND	ND	AXISBANK	FSD	AXISBANK	FSD
BPCL	ND	ND	BPCL	FSD	BPCL	FSD
HDFC	ND	ND	HDFC	FSD	HDFC	FSD
M&M	ND	ND	M&M	FSD	M&M	FSD
REC	ND	ND	REC	FSD	REC	FSD
RELINFRA	ND	ND	RELINFRA	FSD	RELINFRA	FSD
TATASTEEL	ND	ND	TATASTEEL	FSD	TATASTEEL	FSD
TECHM	ND	ND	TECHM	FSD	TECHM	FSD
TITAN	ND	ND	TITAN	FSD	TITAN	FSD
WIPRO	ND	ND	WIPRO	FSD	WIPRO	FSD

Table IVB: 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
AXISBANK	ND	ND	AXISBANK	FSD	AXISBANK	FSD
BPCL	ND	ND	BPCL	FSD	BPCL	FSD
HDFC	ND	ND	HDFC	FSD	HDFC	FSD
M&M	ND	ND	M&M	FSD	M&M	FSD
REC	ND	ND	REC	FSD	REC	FSD
RELINFRA	ND	ND	RELINFRA	FSD	RELINFRA	FSD
TATASTEEL	ND	ND	TATASTEEL	FSD	TATASTEEL	FSD
TECHM	ND	ND	TECHM	FSD	TECHM	FSD
TITAN	ND	ND	TITAN	SSD	TITAN	SSD
WIPRO	ND	ND	WIPRO	FSD	WIPRO	FSD

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

	Entire Period		First Sub-period		Second Sub-period	
	Writing OTM covered call	**Buying ITM protective put**	**Writing OTM covered call**	**Buying ITM protective put**	**Writing OTM covered call**	**Buying ITM protective put**
AXISBANK Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
AXISBANK Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--
BPCL Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
BPCL Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--
HDFC Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
HDFC Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--
M&M Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
M&M Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--
REC Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
REC Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--
RELINFRA Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
RELINFRA Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--
TATASTEEL Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
TATASTEEL Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--
TECHM Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
TECHM Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--
TITAN Writing OTM covered call	--	**SSD**	--	**ND**	--	**SSD**
TITAN Buying ITM protective put	**ND**	--	**FSD**	--	**ND**	--
WIPRO Writing OTM covered call	--	**ND**	--	**ND**	--	**ND**
WIPRO Buying ITM protective put	**FSD**	--	**FSD**	--	**FSD**	--

Interpretation for 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 which is followed by Covered call strategy and in the necked strategy which is small in comparison to hedge strategy. 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. After introducing ITM put option to pure-stock strategy our result shows that no company shows the negative skewness coefficients out of the 10 stocks, this finding is consistent with the findings of Bookstaber and Clarke (1981, 1984) which contend that introducing ITM put option alters stock return in 90% by giving more weight on the right-hand side of the distribution. While in the OTM covered call option none company shows the negative skewness while other were remain positive and this indicated that OTM call also shift the return distribution towards the right hand. 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. while one stock (Titan) Shows the second stochastic dominance over the unhedge strategy. Remaining nine stock dominating the unhedge position at the level of first stochastic dominance. This protective put and covered call dominance over 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.

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