A STUDY OF OPTIMAL STOCK & OPTIONS STRATEGIES

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ABSTRACT

Derivatives, which were originally introduced as financial instruments to hedge financial risk, are now increasingly used for speculative purposes as well. The diverse uses of derivatives arise from the skewing effect that options strategies have on the returns distribution of portfolios. In particular, it is widely believed that the performance of pure-stock portfolios can be enhanced by incorporating different options strategies, the most popular strategies being covered-call writing and protective-put buying.

The present study considers a class of stock and options strategies, involving a long or short position in a stock, combined with a long or short position in an option. The study applies these strategies to a sample of one hundred and twenty-seven stocks listed in National Stock Exchange F&O segment, using corresponding stock options and tries to find out which of these strategies yields maximum returns. It also tries to relate the optimal strategies and the returns from the optimal strategies to the characteristics of the distribution of returns of the underlying stock.

The findings of the study indicate the strategies that were optimal in two senses: one type of strategy that was optimal at the lowest strike price and whose payoff decreased

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with increase in strike price, and the other type of strategy that was optimal at the highest strike price and whose payoff increased with increase in strike price. It was found that only the standard deviation, skewness, and kurtosis of the returns distribution of the underlying stock affected the optimal strategy.

KEYWORDS: derivatives, options strategy, returns distribution, standard deviation, skewness, kurtosis.

INTRODUCTION

Derivatives, which were originally introduced as financial instruments to hedge financial risk, are now increasingly used for speculative purposes as well. The diverse uses of derivatives arise from the skewing effect that options strategies have on the returns distribution of portfolios. In particular, it is widely believed that the performance of pure-stock portfolios can be enhanced by incorporating different options strategies, the most popular strategies being covered-call writing and protective-put buying. Theoretically and empirically, however, there is no clear evidence on whether this is really the case. The general framework suggested by Hakanson (1978), Cox (1976) and Ross (1976) indicates that incorporating option strategies enhances the general efficiency of financial markets by increasing the number of investment opportunities available to investors in terms of insurance and hedging. On the other hand, options can themselves be used as short-term investment instruments, and can improve portfolio performance when used speculatively (Dash et al, 2007).

The present study investigates the effect of option buying and writing strategies on the returns of an (unhedged) stock position. The objective of the study was to find out the optimal strategies (i.e. that yield maximum returns), and to relate these optimal strategies with the characteristics of the returns distribution of the underlying stock.

LITERATURE REVIEW

Several studies compare the performance of pure-stock positions with that of stock positions combined with options, and the performance of different option strategies. Trennepohl and Dukes (1981) investigated the performance of option writing and buying strategies using in-the-money (ITM) and out-of-the-money (OTM) options, and found that covered option writing lowers portfolio standard deviation and improves portfolio mean returns. Bookstaber and Clarke (1984) compared the performance of protective-put, covered-call, and pure-stock strategies, and found that call writing is better than put buying in terms of expected return and volatility, but that the former truncates the right-hand side of a distribution causing undesirable negative skewness, while put-buying truncates the left-hand side of a distribution causing desirable positive skewness. Castellano and Giacometti (2001) compared the performance of protective-put and covered-call strategies to the performance of holding an unhedged currency portfolio and found that the option strategies perform better than the optimal naked portfolios and the protective-put strategy performs well for different VaR models. Isakov and Morard (2001) investigated the performance of a global investment strategy that combines diversification and option strategies, in particular the covered call strategy, and found that the use of option strategies consistently improves the performance of stock portfolios, even in the presence of transaction costs. Abid et al (2006) investigated the performance of option strategies, including writing OTM covered-call and buying ITM protective put, with that of the pure-stock investment, and found that, in general, the buying ITM protective-put strategy has the best performance, followed by the writing OTM covered-call strategy, both out-performing the naked stock.

Some studies show that the performance of option strategies with stock portfolios could depend on other factors or on market conditions. Benninga and Blume (1985) analyzed the optimality of portfolio insurance in complete and incomplete markets, and found that buying put option may be optimal only in an incomplete market, not in a complete market. Brooks and Hand (1988) examined the return characteristics of index futures contracts, and found that both the return distribution and performance evaluation depend on the risk-free rate, the dividend rate, the basis and the margins.

Overall, from the literature it can be concluded that option introduction improves the performance of portfolios significantly, especially buying ITM protective puts.

DATA & METHODOLOGY

The present study was undertaken to analyse the effect of options strategies on a pure-stock position. To this end, the following possibilities were considered: a long or a short position on the stock combined with buying or writing of a call or put option, giving eight option-stock combinations. The sample stocks used for the study were those stock listed on the National Stock Exchange (NSE), Mumbai, India, for which the corresponding derivatives were actively traded on the National Stock Exchange Futures & Options segment, thus constituting a judgmental sample. The sample size was one hundred and twenty-seven such stocks. The time period considered for the study was 2nd April 2007 to 29th June 2007.

The option-stock combinations considered for the study were static strategies: it was assumed that, for a particular option-stock combination, the position was entered on the first day of the study period and maintained until expiration on the last day of the study period - the returns from a option-stock combination was computed as the present value of the final (expiration) value of the position less the initial value of the position. The risk-free rate was taken as 8% p.a. The data used for the study consisted of the opening prices of the stocks and option premia of the stock options at different strike prices on the first day of the study period and the closing prices of the stocks on the last day of the study period obtained from the NSE archives.

For each stock option, five strike prices were available initially: at par with the initial stock price, 2% below the initial stock price, 5% below the initial stock price, 2% above the initial stock price, and 5% above the initial stock price. In this context, for each stock, two types of optimal options strategies were identified: one which yielded highest returns at the lowest strike price (5% below the initial stock price) and for which the returns decreased with increase in strike price; and one which yielded highest returns at the highest strike price (5% above the initial stock price) and for which the returns decreased with decrease in strike price. These two optimal strategies are referred to in the study as "optimal in the first sense" and "optimal in the second sense," respectively. For each stock, the two optimal strategies were identified, and related to the characteristics of the returns distribution of the underlying stock.

ANALYSIS AND INTERPRETATION

In terms of optimality in the first sense, it was found that the "hold stock, buy call" strategy had the highest occurrence (60.6% of the time), followed by the "sell stock, sell call" strategy (18.1% of the time), the "hold stock, sell put" strategy (16.5% of the time), and the "hold stock, sell call" strategy (4.7% of the time). It was also found that, on average, the returns from the optimal strategy (in the first sense) tend to be three times more sensitive to increases in strike price than decreases in strike price.

In terms of optimality in the second sense, it was found that the "hold stock, sell put" strategy had the highest occurrence (63.8% of the time), followed by the "hold stock, sell call" strategy (11.8% of the time), the "hold stock, buy call" strategy (9.4% of the time), the "sell stock, sell put" strategy (7.9% of the time), the "sell stock, buy put" strategy (5.5% of the time), the "hold stock, buy put" strategy (0.8% of the time) and the "sell stock, sell call" strategy (0.8% of the time). It was also found that, on average, the returns from the optimal strategy (in the second sense) tend to be one and a half times more sensitive to decreases in strike price than the increases in strike price.

The association between the optimal strategies in the first sense and the second sense were found by cross-tabulation, as shown in Table 1.

Table 1: Association between optimal strategy l and optimal strategy ll

Crosstab

			optimal strategy II							
			hold stock, buy call	hold stock, buy put	hold stock, sell call	hold stock, sell put	sell stock, buy put	sell stock, sell call	sell stock, sell put	Total
optimal strategy I	hold stock, buy cal	Count	0	1	0	76	0	0	0	77
		% within optimal strategy	.0%	1.3%	.0%	98.7%	.0%	.0%	.0%	100.0%
		% within optimal strategy II	.0%	100.0%	.0%	93.8%	.0%	.0%	.0%	60.6%
	hold stock, sell call	Count	0	0	0	5	0	1	0	6
		% within optimal strategy	.0%	.0%	.0%	83.3%	.0%	16.7%	.0%	100.0%
		% within optimal strategy II	.0%	.0%	.0%	6.2%	.0%	100.0%	.0%	4.7%
	hold stock, sell put	Count	12	0	8	0	0	0	1	21
		% within optimal strategy	57.1%	.0%	38.1%	.0%	.0%	.0%	4.8%	100.0%
		% within optimal strategy II	100.0%	.0%	53.3%	.0%	.0%	.0%	10.0%	16.5%
	sell stock, sell call	Count	0	0	7	0	7	0	9	23
		% within optimal strategy	.0%	.0%	30.4%	.0%	30.4%	.0%	39.1%	100.0%
		% within optimal strategy II	.0%	.0%	46.7%	.0%	100.0%	.0%	90.0%	18.1%
Total		Count	12	1	15	81	7	1	10	127
		% within optimal strategy	9.4%	.8%	11.8%	63.8%	5.5%	.8%	7.9%	100.0%
		% within optimal strategy II	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

It was found from the cross-tabulation that the association between the optimal strategies in the two senses was highly statistically significant ($\chi^2 = 220.357$, p = 0.000). The following associations were found:

- The "hold stock, buy call" strategy [optimal in the first sense] is closely associated with the "hold stock, sell put" strategy [optimal in the second sense].
- The "hold stock, sell call" strategy [optimal in the first sense] is associated with the"hold stock, sell put" strategy (83.3%) and the "sell stock, sell call" strategy (16.7%) [optimal in the second sense].
- The "hold stock, sell put" strategy [optimal in the first sense] is associated with the "hold stock, buy call" strategy (57.1%) and the "hold stock, sell call" strategy (38.1%) [optimal in the second sense].
- The "sell stock, sell call" strategy [optimal in the first sense] is associated with the "hold stock, sell call" strategy (30.4%), followed by "sell stock, sell put" strategy (30.4%) and the "sell stock, sell put" strategy (39.1%) [optimal in the second sense].

The relation between the returns from the optimal strategy in the first sense and the characteristics of the distribution of daily returns of the underlying stock were investigated using regression analysis. The results of the regression analysis are shown in Table 2.

Table 2: Regression of returns of optimal strategy I on the characteristics of the distribution of daily returns of the underlying stock

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	121.655	38.992		3.120	.002
	Kurtosis	18.294	4.717	.328	3.878	.000

a. Dependent Variable: returns I

It was found that the returns of optimal strategy in the first sense were significantly influenced only by the kurtosis, and not by any other characteristic, of the distribution of daily returns of the stock, explaining 10.7% of the variation in returns. The sensitivity of returns of optimal strategy in the first sense was not influenced significantly by any of the characteristics of the distribution of daily returns of the stocks.

The relation between the returns from the optimal strategy in the second sense and the characteristics of the distribution of daily returns of the underlying stock were investigated using regression analysis. The results of the regression analysis are shown in Table 3.

Table 3: Regression of returns of optimal strategy II on the characteristics of the distribution of daily returns of the underlying stock

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	52.072	14.018		3.715	.000
	Kurtosis	12.009	1.696	.535	7.081	.000

a. Dependent Variable: returns II

It was found that the returns of optimal strategy in the second sense were significantly influenced only by the kurtosis, and not by any other characteristic, of the distribution of daily returns of the stock, explaining 28.6% of the variation in returns. The sensitivity of returns of optimal strategy in the first sense was not influenced significantly by any of the characteristics of the distribution of daily returns of the stocks.

The relation between the strategy that was optimal in the first sense and the characteristics of the distribution of daily returns of the underlying stock were investigated using discriminant analysis. The descriptive statistics of the daily returns of the underlying stock for each optimal strategy in the first sense are shown in Table 4, and the results of the discriminant analysis are shown in Tables 5-7.

Table 4: Optimal Strategy I related to the Mean, Standard Deviation, Skewness, and Kurtosis of the underlying stock

Optimal Strategy I	mean daily returns of underlying stock	std. dev. of daily returns of underlying stock	skewness of daily returns of underlying stock	kurtosis of daily returns of underlying stock
hold stock, buy call	6.9347%	2.6281%	0.4607	2.8483
hold stock, sell call	16.7321%	2.1635%	0.1470	1.7773
hold stock, sell put	14.4849%	2.3007%	0.0142	2.4626
sell stock, sell call	4.2513%	2.2623%	-0.6844	5.6436
(p-value)	0.4460	0.4910	0.0000	0.0910

It was found that there was no significant difference in the mean and standard deviation of the daily returns of the underlying stock between different optimal strategies in the first sense, while the difference in the skewness of the daily returns of the underlying stock between different optimal strategies in the first sense was highly statistically significant, and the difference in kurtosis of the daily returns of the underlying stock between different optimal strategies in the first sense was significant at 10%.

Table 5:

Standardized Canonical Discriminant Function Coefficients

	Function	
	1	2
Standard Deviation of Daily Returns of underlying stock	1.122	.830
Skewness of Daily Returns of underlying stock	1.377	-.225

Table 6:

Canonical Discriminant Function Coefficients

	Function	
	1	2
Standard Deviation of Daily Returns of underlying stock	.651	.482
Skewness of Daily Returns of underlying stock	1.095	-.179
(Constant)	-1.799	-1.168

Unstandardized coefficients

Table 7:

Functions at Group Centroids

	Function	
Optimal Strategy I	1	2
hold stock, buy call	.417	.016
hold stock, sell call	-.228	-.151
hold stock, sell put	-.285	-.062
sell stock, sell call	-1.076	.044

Unstandardized canonical discriminant functions evaluated at group means

It was found that the only characteristics of the distribution of the daily returns of the underlying stock that discriminate between different optimal strategies in the first sense were the standard deviation and the skewness of the daily returns of the underlying stock. The discriminant functions in Tables 5-7 were found to correctly classify 52.8% of the cases.

The relation between the strategy that was optimal in the second sense and the characteristics of the distribution of daily returns of the underlying stock were investigated using discriminant analysis. The descriptive statistics of the daily returns of the underlying stock for each optimal strategy in the first sense are shown in Table 8, and the results of the discriminant analysis are shown in Tables 9-11.

Table 8: Optimal Strategy II related to the Mean, Std. Dev., Skewness, and Kurtosis of the underlying stock

Optimal Strategy II	mean daily returns of underlying stock	std. dev. of daily returns of underlying stock	skewness of daily returns of underlying stock	kurtosis of daily returns of underlying stock
hold stock, buy call	16.9203%	2.2641%	0.2413	2.1128
hold stock, buy put	1.1801%	2.6592%	0.0130	-0.1270
hold stock, sell call	6.7350%	2.1329%	-0.1331	2.2287
hold stock, sell put	7.8188%	2.6038%	0.4535	2.8313
sell stock, buy put	14.0385%	3.0718%	-2.1372	13.3067
sell stock, sell call	-0.1361%	1.7751%	-0.3868	0.7743
sell stock, sell put	-0.0374%	1.9682%	-0.1380	2.9585
(p-value)	0.6460	0.7920	0.0000	0.0290

It was found that there was no significant difference in the mean and standard deviation of the daily returns of the underlying stock between different optimal strategies in the second sense, while the difference in the skewness of the daily returns of the underlying stock between different optimal strategies in the second sense was highly statistically significant, and the difference in kurtosis of the daily returns of the underlying stock between different optimal strategies in the second sense was significant at 5%.

Table 9:

Standardized Canonical Discriminant Function Coefficients

	Function		
	1	2	3
Standard Deviation of Daily Returns of the underlying stock	1.758	.129	-1.269
Skewness of Daily Returns of the underlying stock	1.091	.652	.598
Kurtosis of Daily Returns of the underlying stock	-1.160	1.171	1.109

Table 10:

Canonical Discriminant Function Coefficients

	Function		
	1	2	3
Standard Deviation of Daily Returns of the underlying stock	1.015	.074	-.733
Skewness of DAily Returns of the underlying stock	.911	.545	.499
Kurtosis of Daily Returns of the underlying stock	-.157	.158	.150
(Constant)	-2.165	-.787	1.253

Unstandardized coefficients

Table 11:

Functions at Group Centroids

	Function		
optimal strategy II	1	2	3
hold stock, buy call	.021	-.153	.032
hold stock, buy put	.566	-.602	-.708
hold stock, sell call	-.470	-.348	-.042
hold stock, sell put	.447	.101	-.004
sell stock, buy put	-3.082	.382	-.071
sell stock, sell call	-.832	-.743	-.128
sell stock, sell put	-.758	-.248	.187

Unstandardized canonical discriminant functions evaluated at group means

It was found that the only characteristics of the distribution of the daily returns of the underlying stock that discriminate between different optimal strategies in the second sense were the standard deviation, the skewness, and the kurtosis of the daily returns of the underlying stock. The discriminant functions in Tables 9-11 were found to correctly classify only 36.2% of the cases.

DISCUSSION

The results of the study show that there were two strategies that were optimal more than 60% of the time: “hold stock, buy call” (in the first sense), and “hold stock, sell put” (in the second sense); and that these two strategies were very strongly associated with each other. In fact, the covered-call and protective-put strategies, which were so widely investigated in the literature, were optimal only to a marginal extent (0.8% of the time). Further, the optimal strategies were found to be discriminated by the standard deviation, the skewness, and the kurtosis of the daily returns of the underlying stock; and the returns of the optimal strategies were found to be related to the kurtosis of the daily returns of the underlying stock. In particular, skewness and kurtosis in the daily returns of the underlying stock tended to favour to more aggressive options positions. This suggests that the optimal strategies are influenced by (abnormal?) tail behaviour of the daily returns of the underlying stock.

The present study has some limitations. The study considers options strategies only for NSE-listed stocks, but the results should be generalisable to other stock exchanges as well, particularly in other emerging economies. Also, the study considers only three-month contracts, for a specific period (viz. 2nd April 2007 to 29th June 2007), so that the results obtained may not be generalised to other periods. The results could be due to the overall bull run witnessed by Indian stock markets in the period in question. There is scope for further research to examine the generalisability of the results of the present study; particularly whether the results continue to hold in similar conditions.

A more serious limitation is that the study does not investigate the distributions of daily returns of the option-stock positions, from which even richer results may have been obtained. There is a vast scope for further research to investigate the distributions of daily returns of different option-stock positions and to relate these to the distributions of daily returns of the underlying stocks.

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