INDRAPRASTHA
JOURNAL OF MANAGEMENT

Comparative Analysis of Hedging Performance of Index Options and Index Futures

Navdeep Aggarwal*

Abstract

The motivation behind this paper comes from the significant rise in the volatility in financial markets during the past several years, resultant need for protection hedging against price risk and the use of futures and options contracts for the same. While futures and options contracts can both be reliably used for hedging against price risk, relative effectiveness of the two types of contracts for protection purpose has remained unexplored. Using a completely diversified portfolio of 20 stocks carved out of Nifty 50 index along with futures and options contracts available against Nifty 50 index, the futures contracts were found to be more effective than options contracts in hedging against price volatility.

Keywords: portfolio hedging, index options, index futures

* Associate Professor, School of Business Studies, Punjab Agricultural University, Ludhiana, Punjab, India: navdeepaggarwal@pau.edu

1. INTRODUCTION

Financial markets have always been in flux and the trends shows that greater uncertainties in the global environment will fuel the volatility further in coming times. This can well be gauged from the infamous stock market crashes like the Black Monday of 1987, the dot-com bubble of 2000, the stock market downturn of 2002 across the USA, Canada, Asia, and Europe, the global financial crisis of 2008, European crisis of 2011 or the dramatic fall in oil prices in 2015. Similarly, the bullish trends in September 2007 when the Sensex jumped to 17,000-mark from the 16,000 mark in just five trading sessions or the exponential rise in stock markets in 2014-15, after NDA Government took over, clearly underline the volatility on the upper side. The constant threats of US interest rate increase or British exit from the European Union have long rattled the markets.

Lodha (2008) observed that the lethal mock tale of price volatility, integration of financial markets, volatile risk environment, availability of cheaper and faster information, and the increased ability to analyse this information have lead to a greater need for protection against price risk, counter-party risk and operating risk. This need for enhanced protection rises further in case of concentrated portfolios (Modern Portfolio Theory emphasises diversification; Goetzman & Kumar, 2005 offer a discussion of the reasons why some investors may still hold concentrated portfolios).

While the need for protection against unforeseen risk has increased over time, markets have kept pace with availability of instruments and strategies for hedging against this risk. Today, a number of specialised instruments are available that allow participants to hedge against unexpected price movements (Kumar, Singh & Pandey, 2010). Broadly, we can classify these into three types, namely hedging through short-selling, hedging through options, and hedging through futures. Among these, short-selling involves very high costs because of the associated collateral and margin requirements (for details of collaterals and margin requirements and other conditions for short-selling, visit the security lending and borrowing (SLB) section of www.nseindia.com), loan interest, and potential risk of a short squeeze or even non-availability of short-selling (for example, National Stock Exchange allows short-selling only on those stocks which are available under F&O section). Not only that; small investors face a significant downside risk on short selling of uncovered positions in the portfolio (Foltice & Langer, 2015). These factors make short selling not only very costly but also very risky – contrary to the original objective of hedging.

The second alternative that is, futures contracts offer a clean tool for protection against adverse movements as there are no premiums; transaction costs are low and full transparency is on the block. While using futures contracts as a protection, the change in the price of an asset and the corresponding futures contract should ideally offset each other. Investors therefore, go short on futures contracts if they hold a long position of the underlying asset and vice-versa. Hedging with futures takes various forms viz., hedging

through index futures, hedging through single asset futures, or cross-hedging (using futures contracts of a closely related asset). Benefits of hedging with index futures/ single asset futures have been widely studied and reported (for instance, see Kenourgios, Samitas & Drosos, 2008; Kumar, Singh & Pandey, 2010; Moon, Yu & Hong, 2010; Serrano & Martin, 2011; Aggarwal & Gupta, 2013), and cross hedging with futures has been implemented successfully in various financial markets including commodities (for example, see Foster & Whiteman, 2002; Franken & Parcell, 2003), foreign exchange (for example, see Serrano & Martin, 2011).

The flexibility inherent in the options contracts and the predetermined cash outflows have made options one of the most favoured instrument for protection. Among different option based protective strategies presented in the literature, protective put, which was introduced way back by Leland and Rubinstein in the year 1976, has been quite popular. It consists of a portfolio invested in a risky asset (such as stocks or a basket of stocks or any other asset class) and a long position in an exchange traded put option. At the maturity, whatever be the value of the risky asset, portfolio value will always be greater than the strike price of the put option (Bertrand and Prigent, 2005). Investment performance of optioned portfolios vis-a-vis those without option positions have been widely studied (for example, see Morard & Naciri, 1990; Whaley, 2002; Feldman & Roy, 2004; Hill, Balasubramanian, Gregory & Tierens, 2006; Abid, Mroua & Wong, 2007; Kapadia & Szado, 2007; Constantinides, Jackwerth, Czerwonko & Perrakis, 2008; Aggarwal, 2011; Pezier & Scheller, 2011; Aggarwal & Gupta, 2013). In fact, a conclusion seems to have emerged that an optioned portfolio is capable of outperforming a portfolio without options on a risk adjusted basis.

While the importance of portfolio protection is increasing day by day, it is also becoming more and more difficult for investors to decide about which instrument to use for protection against adverse price movements. Although futures offer a clean instrument, marked-to-market adjustments and inability to participate in upward market movement make them less palatable to many. Similarly, the initial cash outflow in case of options renders them unattractive to others. In this article we therefore, evaluate the effectiveness of both futures and options based portfolio protection strategies.

2. METHODOLOGY

Modern portfolio theory emphasises that nobody gets any premium for bearing unsystematic risk; therefore, diversification is must. Going by this, we first of all created a diversified equity portfolio. To do so we selected stocks from those constituting Nifty 50 index, a well diversified value weighted index of 50 stocks accounting for 22 sectors of Indian economy. In order to create the portfolio, 20 most traded stocks were selected and an equally-weighted portfolio, with investment of Rs 10,000 in each stock, was created. In case two or more stocks from same industry got selected, only one with the highest trading volume was retained, so that all the 20 stocks came from different sectors, thus offering maximum diversification. This diversified portfolio was then hedged using futures and options contracts available on Nifty 50. Relevant data for Nifty 50 futures and options contracts and the selected stocks for the period of January 1, 2011 to December 31, 2015 were then extracted

from the NSE website. This period consisted of both bullish and bearish phases in the market; and is therefore deemed to be representative of general market conditions. Although longer duration F & O contracts were available during the period under study, owing to volume considerations only one month contracts were employed in this study.

In case of options, literature shows that ATM (at-the-money) and ITM (in-the-money) put options have been most popular for protection purposes. In line with the same, ATM and 2% ITM put options were utilised in the study. In case, strike prices as required were not available, nearest available strike prices were utilized (see Aggarwal, 2011). In order to execute the protective put strategy, on the F&O expiry day of Jan, 2011, the equity portfolio was purchased at the closing price, and the two put options were also purchased at their closing prices. Appropriate number of option contracts were purchased to have the value of option contracts as close as possible to the value of equity portfolio. On the next month's F&O expiry day, all the positions were squared–off at the closing prices; and a new cycle was started, which was squared-off on the next month's F&O expiry day and so on . Returns from long position in the equity portfolio were combined with those from option positions to arrive at the total returns.

For the calculation of returns, the following are defined:

R_t : Return for the month t

S_t : Closing price of the equity portfolio on F&O expiration day of month t

S_{t-1} : Closing price of equity portfolio on F&O expiration day of month t-1

P_{t-1} : Premium paid for buying put option on F&O expiry day of month t-1

P_t : Premium received on selling the put option on F&O expiry day of month t

D : Dividends from the long position in the equity portfolio

TC : Transaction costs

For any month t, the return from a portfolio with protective put is calculated as:

$$R_t = \{[(S_t + D - S_{t-1}) + (P_t - P_{t-1}) - TC] / (S_{t-1} + P_{t-1})\} \times 100$$

For protection of the portfolio through futures, traditional techniques of one-to-one and beta hedging were utilised. Under one-to-one hedging, futures contracts amounting to as close as possible to Rs 2,00,000 were short using closing price of the day on which a long position in the buy & hold portfolio was created. On the next month's F & O expiry day, the futures contracts were bought back at closing price. The cycle was repeated till the month of December, 2015. Returns on monthly basis were recorded and combined with those from the equity portfolio to arrive at returns from the hedged portfolio. For beta hedging, the beta of the 20 stock portfolio was calculated by regressing excess monthly returns from the equity portfolio on the excess monthly returns from Nifty 50 for the past 24 months on rolling basis . Each month, Nifty 50 futures contracts amounting as close as possible to beta times the value of equity portfolio were short. The cycle was repeated every month under study and the returns were calculated the same way as one-to-one hedging.

For the calculation of returns, the following are defined:

R_t : Returns for the month t

S_t : Closing price of the equity portfolio on F&O expiration day of month t

S_{t-1} : Closing price of equity portfolio on F&O expiration day of month t-1

F_{t-1} : Price at which futures contracts were short on F&O expiration day of month t-1

F_t : Price at which futures contracts were long on F&O expiration day of month t

D : Dividends from the long position in the equity portfolio

TC : Transaction costs

For any month t, the return from a portfolio with futures contracts was calculated as:

$$R_t = \{[(S_t + D_t - S_{t-1}) + (F_{t-1} - F_t) - TC] / S_{t-1}\} \times 100$$

Transaction costs included the bid-ask spread, securities transaction tax, brokerage, service tax on brokerage, and stamp duty. For calculation of these costs methodology used by Aggarwal (2010) was utilised.

3. FINDINGS

In the following text we provide summary statistics for five portfolios, that is simple buy & hold; portfolios with one-to-one and beta hedging using futures contracts; options based portfolios using ATM put and 2% ITM put. We present both average returns and standard deviation of returns for each strategy implementation. As the literature reports non-normality in the returns from portfolio consisting of derivative securities, results of normality check are also presented. In the light of the same, risk measured through standard deviation may not be an effective measure, alternative measures such as the maximum and minimum along with range are also presented. Hedging effectiveness of different strategies has been measured as variance of the unhedged position minus variance of hedged position divided by variance of unhedged position (see Aggarwal and Gupta, 2013). Although the purpose of hedging is to contain the risk of a portfolio, reference to returns is as important. Anderson and Danthine (1981), suggest that it is always better to talk about risk reduction when reference to returns is made and vice-versa. In other words, risk and returns cannot be optimized in isolation but one should talk about risk adjusted returns. In this light, we therefore report risk adjusted performance measure of CV and Sharpe ratio.

Table 1 presents the returns statistics for the five strategies taken up in the study. The mean returns were highest for the beta hedging 0.09% and the lowest for 2% ITM put based portfolio at -0.11%. However, the range of returns was largest in case of portfolio with ATM put option at 18.64% and lowest in case of buy & hold at 0.37%. The standard deviation of returns was however, highest for buy & hold portfolio at1.98% and the lowest for beta-hedged portfolio at 1.38%. This indicates that protection through derivatives in the portfolio helps in risk reduction, irrespective of the instrument used. Results of Anderson-Darling test for normality show that returns from all strategies were normally distributed. Application of conventional measures like CV or Sharpe Ratio was thus right in place.

Table 1: Statistics for returns from different portfolio protection strategies

Measures	Futures		Protective Put		Buy & Hold
	One-to-One	Beta-Hedging	ATM	2% ITM	
Mean	0.04	0.09	-0.07%	-0.11%	0.06%
Minimum	-5.48%	-4.98%	-8.41%	-9.77%	-0.28%
Maximum	4.33%	2.22%	10.23%	6.72%	0.09%
Range	9.813%	7.216%	18.64%	16.49%	0.37%
Standard Deviation	1.60%	1.38%	1.76%	1.71%	1.98%
Protection Effectiveness	34.69%	51.41%	20.97%	15.54%	--
Anderson-Darling A^2	0.32*	0.33*	0.82*	0.88*	0.34*
CV	40.00	15.33	-25.14	-15.54	33.00
Sharpe Ratio	0.02	0.06	-0.04	-0.06	0.02
* Non-significant					

As the essence of protection is to reduce the risk of the portfolio; the same was captured through protection effectiveness. As shown, the protection effectiveness was the highest in case of beta hedging at 51.41% and lowest for 2% ITM put option at 15.547%.

To check the performance in mean-variance framework, coefficient of variation (CV) offers the most basic tool. The CV was the lowest in case of beta hedging at 15.33. The same was highest at 40.00 for one-to-one, -25.14 for ATM put option, -15.54 for 2% ITM put option, and 33.00 for buy & hold, again reflecting the usefulness of derivative securities. Risk adjusted performance measures also presented similar picture as Sharpe ratio was the highest for beta hedged portfolio at 0.06 and the lowest for buy & hold portfolio at 0.02. The same stood at -0.04 for portfolio with ATM option and -0.06 for portfolio with 2% ITM put option.

4. CONCLUSION

Rising volatility in the financial markets has constantly forced investors to look for protective measures for their investment portfolios. Today, a number of specialized instruments including short-selling, futures, and options contracts allow market players to protect themselves against adverse market movements. While short-selling has its own limitations, futures and option contracts offer potent and effective ways to protection. Since both have their own merits and limitations, choosing between the two offers a difficult situation to many investors and traders. This research was carried out to check the relative hedging performance of the two types of instruments.

Using a diversified portfolio of twenty Nifty 50 stocks and Nifty 50 futures and options contracts while incorporating all transaction costs, it can be concluded that derivative securities definitely

help reducing risk of a portfolio. However, when it comes to choosing between futures and options contracts, futures definitely outperform options contracts. Among the techniques chosen for deciding about the number of futures contracts to go short or long, beta-hedging turned out to be the most reliable.

5. REFERENCES

Abid, F., Mroua, M., & Wong, W.K. (2007). Impact of options strategies in financial portfolio performance: Mean-variance and stochastic dominance approaches, Retrieved from http://ssrn.com/abstract=982332.

Aggarwal, N. (2011). An empirical investigation into performance of covered call strategy on S&P CNX Nifty. *Asia Pacific Business Review*, 7, 4, 80-90.

Aggarwal, N., & Gupta. M. (2013). Portfolio hedging through options; Covered call versus protective put. *Journal of Management Research*, 13, 118-26.

Anderson, R. W., & Danthine, J. P. (1981). Cross hedging. Journal *of Political Economy*, 81, 1182-1196.

Bertrand, P., & Prigent, J. (2005). Portfolio insurance strategies: OBPI versus CPPI. *Finance*, 26, 5-32.

Butterworth, D., & Holmes, P. (2001). The hedging effectiveness of stock index futures: evidence for the FTSE-100 and FTSE-Mid 250 indexes traded in the UK. *Applied Financial Economics*, 11, 57-68.

Constantinides, G.M., Jackwerth, J.C., Czerwonko, M. , & Perrakis, S. (2008). Are options on Index futures profitable for risk averse investors: Empirical evidence. Retrieved from http://cofe.uni-konstanz.de/Papers/dp08_08.pdf

Feldman, B., & Roy, D. (2004). *Passive Options-based Investment Strategies: The Case of the CBOE S&P 500 Buy Write Index*, Ibbotson Associates, Chicago.

Foltice, B., & Langer, T. (2015). Profitable momentum trading strategies for individual investors. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2420743.

Foster, F.D., & Whiteman, C.H. (2002). Bayesian cross hedging: an example from the Soybean market. *Australian Journal of Management*, 27, 2, 95–122.

Franken J.R.V., & Parcell, J.L. (2003). Cash ethanol cross-hedging opportunities. *Journal of Agricultural and Applied Economics,* 35, 3, 509–516.

Goetzmann, W.N., & Kumar, A. (2005). Why do individual investors hold under-diversified portfolios? *Working paper*, Yale University.

Hill, J.M., Balasubramanian, V., Gragory, K., & Tierens, I. (2006). Finding Alpha via covered call writing. *Financial Analyst Journal*, 62, 5, 29-46.

Kapadia, N., & Szado, E. (2007). The risk and return characteristics of the buy write strategy on Russell 2000 Index. *Journal of Alternative Investments*, 9, 4, 39-56.

Kenourgios, D., Samitas, A., & Drosos, P. (2008). Hedge ratio estimation and hedging effectiveness; the case of S & P stock index futures contract. *International Journal of Risk Assessment and Management*, 9, ½, 121-34.

Kumar, B, Singh, P, & Pandey, A. (2010). Hedging effectiveness of constant and time-varying hedge ratio in Indian stock and commodity futures market. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1206555.

Lodha, K.R. (2008). Derivatives in Indian financial market - Structure & financial concerns: An Indian perspective. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1089967

Moon, G.H., Yu, W.C., & Hong, C.H. (2010). Dynamic hedging performance evaluation of multivariate GARCH models: evidence from KOSTAR index models. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1324972

Morard, B., & Naciri, A. (1990). Options and investment strategies. *Journal of Futures Markets*, 10, 505-517.

Pezier, J., & Scheller, J. (2011). A comprehensive evaluation of portfolio insurance strategies. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1864533.

Serrano, L.G., & Martin, J.J. (2011). Currency hedging strategies using dynamic multivariate GARCH. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1952205

Whaley, R. E. (2002). Return and risk of CBOE buy write monthly index, *Journal of Derivatives*, 10, 2, 35-42.