Hedging Effectiveness Analysis of High Market Cap Indian Stocks Using OLS and GARCH Hedge Ratios

By Dr. P. A. Mary Auxilia & Dr. G. Y. Vishwanath

Abstract- Managing portfolios is a daunting task in the current environment of complex integrated financial markets. Fund managers are always facing the question of whether to Hedge or not. Though hedging is done for minimizing the value erosion of the portfolio, there have been times where hedging has proved to be a wrong decision. In this context, this research is done to find out the impact of dynamic hedging of a portfolio comprising of high market cap stocks using Nifty index futures during the period from Jan 2007 to Dec 2012. As the study focused on the practical aspects of trading, hedge ratio required to hedge the portfolio was determined with two important econometric methods OLS (Ordinary least squares) and GARC (Generalized autoregressive conditional heteroscedasticity) using Eviews software. The research proves that the equity risk of a portfolio can be offset by hedging the portfolio with nifty index futures. The study concludes that during periods of uncertainty an investor holding a portfolio containing high market cap stocks can do hedging. The traditional simple OLS model is preferred to complex GARCH model in calculating hedge ratio.

Keywords: hedging, high market capitalization, index futures, OLS, GARC.

GJMBR-C Classification: JEL Code: E22

HEDGINGEFFECTIVENESSANALYSISOFHIGHMARKETCAPINDIANSTOCKSUSINGOLSANDGARCHHEDGERATIOS

Strictly as per the compliance and regulations of:

Hedging Effectiveness Analysis of High Market Cap Indian Stocks using OLS and GARCH Hedge Ratios

Dr. P. A. Mary Auxilia [α] & Dr. G. Y. Vishwanath [σ]

Abstract- Managing portfolios is a daunting task in the current environment of complex integrated financial markets. Fund managers are always facing the question of whether to Hedge or not. Though hedging is done for minimizing the value erosion of the portfolio, there have been times where hedging has proved to be a wrong decision. In this context, this research is done to find out the impact of dynamic hedging of a portfolio comprising of high market cap stocks using Nifty index futures during the period from Jan 2007 to Dec 2012. As the study focused on the practical aspects of trading, hedge ratio required to hedge the portfolio was determined with two important econometric methods OLS (Ordinary least squares) and GARCH (Generalized autoregressive conditional heteroscedasticity) using Eviews software. The research proves that the equity risk of a portfolio can be offset by hedging the portfolio with nifty index futures. The study concludes that during periods of uncertainty an investor holding a portfolio containing high market cap stocks can do hedging. The traditional simple OLS model is preferred to complex GARCH model in calculating hedge ratio.

Keywords: hedging, high market capitalization, index futures,OLS, GARC.

I. Introduction

Economic development of a country to a large extent is dependent on the smooth functioning of its financial markets. A financial market that is robust is expected to foster economic growth and social welfare (Singh, 1991). Financial markets pose a great risk to the investor's in spite of its high returns. The market risk can be reduced by portfolio insurance (Wikipedia). Derivative markets help in increasing the trading volume in financial markets because the objective of trading is not only for investment purposes but also for risk management objectives of market participants (Madhumathi & Ranganatham, 2012). Adams and Montesi, (1995) found that corporate managers prefer futures to options by virtue of the large transaction costs in option trading. Investors recognize that there is a close relationship between changes in the index and changes in the values of their portfolios. This makes index futures contract is used as a tool to show how movements in the market affects the value of a portfolio (Grant, 1982). Forecasting hedge ratio is important for hedgers in derivative market, as forecasting is an important tool in decision making. (Koenker & Bassett, 1978). Hedge ratio can be determined with different models derived by econometrics - OLS, ARCH, GARCH and VECH models to name a few. Ederington (1979) and Johnson (1960) employed portfolio theory to derive the minimum variance hedge ratio (HR) as the "average relationship between the changes in the cash price and the changes in the futures price". Engle (1982) suggested ARCH model. If an autoregressive moving average model (ARMA model) is assumed for the error variance, then the model is known as generalized autoregressive conditional heteroskedasticity GARCH model (Bollerslev 1986).

Individual and institutional investors are exposed to equity risk. Predicting the movement of market is not an easy task as rightly proved by the Nobel laureate (Eugene Fama, 2013 & 1966). Stock prices are extremely difficult to predict in the short run, and that new information is very quickly incorporated into prices. In order to minimize the risk due to the adverse movement in the market there is a need for the investors to protect their portfolio value. For investors in India it is even more challenging as the volatility in Indian market is not constant and it varies over time (Securities and Exchange Board of India, 1998). Mary & Vishwanath, (2013) proved that in high PE stock portfolios, capital can be protected by hedging. With this bckground, this research examines whether hedging the portfolio with Index futures gives economic benefit to the investors.

II. Research Methodology

a) Data collection

The research is done with only secondary data obtained from periodicals, journals, website and magazines. Period of study is from January 2008 – December 2012 and daily stock and nifty index futures closing prices were taken. 2007 data is used for determining the hedge ratio.

b) Population

Population taken for the study is Nifty 50. Nifty consists of 50 companies chosen on the basis of certain parameters set by the National Stock Exchange and it broadly describes the performance of the Indian market.

Author α: Assistant Professor – Finance Rajalakshmi Engineering college Chennai – 602105. e-mail: auxilive@gmail.com
Author σ: Professor – Finance, Alvas Institute of Engineering and Technology, Mangalore – 574227. e-mail: gyvishwanath@gmail.com

13

c) *Sampling Framework*

Based on prefixed parameter ten High Market cap stocks are drawn from the population using a non probability sampling technique, judgement sampling method. The sample consists of 10 stocks constituting a portfolio worth 1 crore (10 million) rupees. Each stock is given an equal weightage of rupees 10 lakhs (1 million) worth.

Table 1 : List of sample – High Market cap Portfolio

1	Reliance
2	Infosys
3	HUL –Hindustan Unilever Ltd
4	HDFC
5	HDFC Bank
6	ONGC- Oil and Natural Gas Corporation
7	NTPC
8	Tata Consultancy Services
9	ITC
10	SBI – State Bank of India

Source: www.nse.com

d) *Financial Analysis*

i. *Calculation of Unhedged Portfolio return*

Table 2: Equal weightage portfolio representing 10 stocks (10 lakhs each)

Reliance 351 shares	Infosys 572 shares	Airtel 1033 shares	SBI 420 shares	BHEL 387 shares	ICICI 814 shares	ONGC 800 shares	NTPC 3884 shares	TCS 948 shares	RCOM 1352 shares

Source: Authors compilation.

Table 3: Representative table showing calculation of Unhedged Portfolio Return on 1/2/2008

Companies	No. of shares	Value of shares on 1/2/2008 in Rs.
Infosys	572	912111
Airtel	1033	939462
SBI	420	917532
BHEL	387	799155
ICICI	814	975294
ONGC	800	836720
NTPC	3884	798745
TCS	948	881166
RCOM	1352	826275
Reliance	351	892505
Unhedged Portfolio return	8778965	

As on 1/1/2008 the portfolio was constructed for 1 crore rupees by giving equal weightage of 10 lakhs (1 million) rupees to each stock. Number of shares bought for a value of 10 lakhs for each stock is as follows:

In similar way unhedged portfolio return is calculated every month for 5 years

ii. *Hedged Portfolio return*

The number of nifty futures contract required to hedge the portfolio worth Rupees 1 crore is determined by calculating the hedge ratio. In this study hedge ratio is obtained using two different econometric methods i) Ordinary Least squares -OLS ii) GARCH , and the results are compared to find out the method which gives better returns. The hedge ratio for 2/1/2008 is calculated using previous one year data i.e daily closing price of stock and closing price of nifty index futures from 1/1/2007 to 31/12/2007. Hedge ratio is calculated for every 3 months. So, for each stock every year hedge ratio is determined 4 times and for the total period of study it was determined 20 times for rebalancing of the portfolio. Likewise, hedge ratios were calculated for all the stocks in each sample set based on two methods OLS and GARCH with the help of Eviews software.

Hedge ratio calculation:

$$\beta = \rho (\sigma S / \sigma F)$$

where

σS is the standard deviation of ΔS, the change in the spot price during the hedging period, σF is the standard deviation of ΔF, the change in the futures price during the hedging period, ρ is the coefficient of correlation between ΔS and ΔF.

Rebalancing is done every three months to adjust the number of contracts to be hedged and the trading profit is calculated.
Number of contracts to be hedged: Vp x h* / Vi
Vp – Value of the portfolio.
h* - Hedge ratio.
Vi – Value of one index future.

The portfolio value without hedging and the hedged portfolio value is compared to prove the hedging effectiveness. For proving this statistical tests are done with the help of SPSS software.

Table 4: Representative table showing calculation of Market Cap portfolio returns using OLS Hedge ratio.

Date	1- Jan-08	1-Feb-08	3-Mar-08
Portfolio Value in Rs.	9998896.1	8778964.8	7977702.3
Hedge ratio	0.7015	0.7015	0.7015
Nifty	6144.35	5317.25	4953
Value of nifties to be hedged in Rs.	7014226	6069806	5736569
Profit/ Loss in Rs.	0	429521	421874.68
Value of extra nifties hedged in Rs.	0	88637.4	-140211
tot hedge in Rs.		6158444	5596358
Un hedged value in Rs.	9998896.1	8778964.8	7977702.3
Trading profit in Rs.		944178.89	1366053.6
Hedged value in Rs.	9998896.05	9723143.69	9343755.82

Source: Authors research output using data from www.nse.com

Table 5: Representative table showing calculation of Market Cap portfolio returns using GARCH Hedge ratio

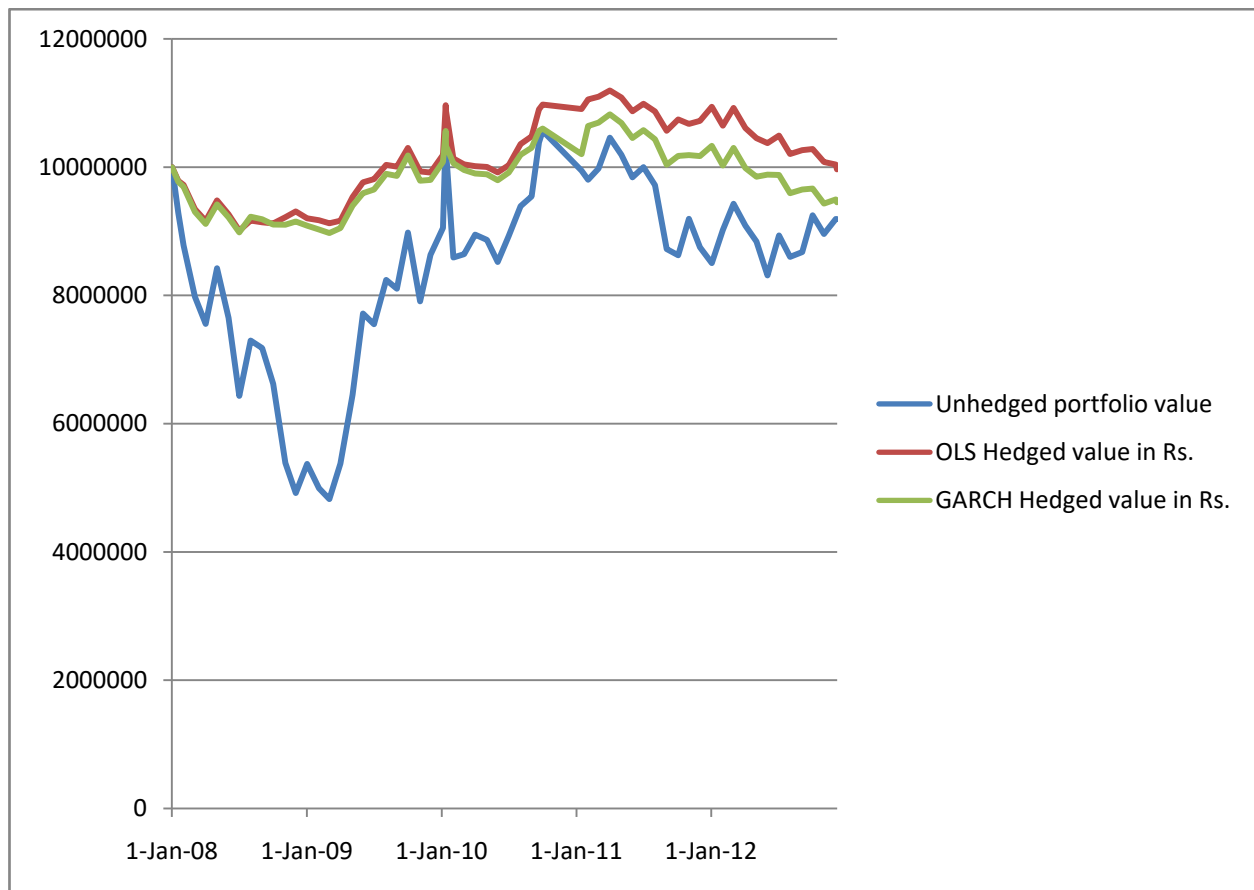| Date	1-Jan-08	1-Feb-08	3-Mar-08
Portfolio Value in Rs.	9998896.1	8778964.8	7977702.3
Hedge ratio	0.6802	0.6802	0.6802
Nifty	6144.35	5317.25	4953
Value of nifties to be hedged in Rs.	6801249	5885506	5562387
Profit/ Loss in Rs.	0	429521	409065.1
Value of extra nifties hedged in Rs.	0	85946.06	-135954
tot hedge in Rs.		5971452	5426433
Unhedged value in Rs.	9998896.1	8778964.8	7977702.3
Trading profit in Rs.	0	915510.3	1324575
Hedged value in Rs.	9998896.05	9694475	9302278

Source: Authors research output using data from www.nse.com

Table 6: Comparison table of unhedged portfolio value with OLS/GARCH hedged portfolio values

Date	Unhedged portfolio value	OLS Hedged value in Rs.	GARCH Hedged value in Rs.
1-Jan-08	9998896	9998896	9998896
1-Feb-08	8778965	9723144	9694475
3-Mar-08	7977702	9343756	9302278
1-Apr-08	7555383	9162612	9113811
2-May-08	8424073	9480263	9419544
2-Jun-08	7651525	9264630	9215956
1-Jul-08	6433563	9009214	8981359
1-Aug-08	7296548	9167081	9227024
1-Sep-08	7178987	9138187	9187090
1-Oct-08	6620391	9122432	9103742
3-Nov-08	5387486	9218522	9101810
1-Dec-08	4918888	9308613	9150694
1-Jan-09	5374288	9201967	9085503
2-Feb-09	4993423	9170367	9027243
2-Mar-09	4824524	9124227	8971733
1-Apr-09	5377937	9163493	9050244
4-May-09	6449779	9534188	9398719
1-Jun-09	7717239	9762530	9594129
1-Jul-09	7550233	9811931	9650388
3-Aug-09	8241071	10034082	9895867
1-Sep-09	8105053	10007535	9863872
1-Oct-09	8979411	10298128	10183521
3-Nov-09	7907787	9932823	9787841
1-Dec-09	8633103	9913832	9800858
4-Jan-10	9051016	10188779	10081953
1-Feb-10	8590524	10134538	10060727
2-Mar-10	8642354	10041111	9955496
1-Apr-10	8948289	10014283	9901625
3-May-10	8866261	10002144	9887423
1-Jun-10	8520929	9918298	9795859
1-Jul-10	8926718	10030060	9916299
2-Aug-10	9392359	10358432	10193533
1-Sep-10	9543286	10478217	10301716
1-Oct-10	10563767	10974948	10603327
1/11/2010	10524647	10964823	10564207
1/12/2010	10258371	10874342	10329223
14-Jan-11	9945800	10905671	10202263
1-Feb-11	9802455	11055185	10642861

1-Mar-11	9977395	11096714	10695383
1-Apr-11	10460052	11194389	10824778
2-May-11	10192184	11084961	10690578
1-Jun-11	9840062	10871062	10455069
1-Jul-11	9999376	10986559	10577416
1-Aug-11	9718616	10867920	10436079
2-Sep-11	8722504	10565943	10036920
3-Oct-11	8626524	10742418	10175251
1-Nov-11	9193299	10673808	10186926
1-Dec-11	8750042	10721520	10172601
2-Jan-12	8503163	10939784	10332090
1-Feb-12	9019488	10644507	10024511
1-Mar-12	9429049	10921624	10299620
2-Apr-12	9087347	10608430	9986859
2-May-12	8839367	10450895	9850908
1-Jun-12	8312360	10374691	9882290
2-Jul-12	8933901	10491976	9879232
1-Aug-12	8600267	10205241	9592587
3-Sep-12	8675457	10264616	9651932
1-Oct-12	9249876	10280517	9666759
1-Nov-12	8957466	10079923	9430342
3-Dec-12	9192079	10038634	9496697
6-Dec-12	9190658	9964966	9451217

Source: Authors research output using data from www.nse.com

Source: Authors research output using data from www.nse.co

Figure 1: Comparison chart of unhedged portfolio value with OLS/GARCH hedged portfolio values.

e) *Statistical Analysis*

T-Test - Mcap OLS hedged return and Mcap GARCH hedged return

H1: There is a significant difference between the Mcap OLS hedged portfolio returns and GARCH hedged portfolio returns.

Ho : There is no significant difference between the Mcap OLS hedged portfolio returns and GARCH hedged portfolio returns.

Table 7: Mean and standard deviation of Mcap OLS hedged return and Mcap GARCH hedged return

	Mean	N	Std. Deviation
MCAPOLS	1.01E7	63	642885.676
MCAPGARCH	9.847235E6	63	5.0545330E5

Source: Authors research output using data from www.nse.com

Table 8: T-Test: MCAP OLS hedged return and MCAP GARCH hedged return

Differences		t	df	Sig (2-tailed)
Mean	Std. Deviation			
2.8910411E5	2.2931995E5	10.007	62	.000

Source: Authors research output using data from www.nse.com

Result: Table 7 & 8 show that the Market Cap hedged portfolio calculated using OLS Beta is Rs.1,01,00,000 while that of Market Cap hedged portfolio calculated using GARCH Beta is Rs.98,47,200. Significant value is 000 which indicates that Market Cap OLS hedged portfolio and Market Cap GARCH hedged portfolio are significant (i.e) Ho is rejected and H_1 is accepted.

Inference: The T-Test confirms that there is a significant difference between Market Cap OLS hedged portfolio return and Market Cap GARCH hedged portfolio return.

As Market Cap OLS hedged portfolio value is Rs.1,01,00,000 and it performs better than Market Cap GARCH hedged portfolio which is Rs.98,47,200. So, Market Cap OLS hedged portfolio is taken for further analysis. *Mcap unhedged portfolio value and Mcap hedged portfolio value*

Ho: There is no significant difference between the Mcap unhedged portfolio value and hedged portfolio value.

H_1: There is a significant difference between the Mcap un hedged portfolio value and hedged portfolio value.

Table 8: Mean and standard deviation of Mcap OLS unhedged return and hedged return

	Mean	N	Std. Deviation
Unhedged Portfolio	8.4935E6	63	1.44986E6
Hedged Portfolio	1.0136E7	63	6.42886E5

Source: Authors research output using data from www.nse.com

Table 9: T-Test : Mcap OLS unhedged return and hedged return

Differences		t	df	Sig (2-tailed)
Mean	Std. Deviation			
-1.64282E6	9.76155E5	-13.358	62	.000

Result: The table 8 & 9 shows that Market Cap un hedged portfolio value is Rs.84,93,523 while that of Market Cap hedged portfolio(OLS) value is Rs.1,01,00,000. The null hypothesis H_0 is rejected and alternate hypothesis H_1 is accepted as sigma value is 0. Inference: The objective of hedging the portfolio and effectiveness is achieved as the Market Cap hedged portfolio (OLS) return is around the expected value which is proved by the rejection of null hypothesis. There is 16% gain over the unhedged value which is contributed by the hedge.

III. Findings and Discussion

Indian equity investors can hedge their portfolio with nifty index futures as hedging reduces loss to a great extent based on this study. Even during the worst of times hedged portfolio value remains unscathed compared to the unhedged open portfolio. Use of complex heteroscedastic models are discouraged as simple OLS model is giving better results than complex heteroscedasticity GARCH models as observed. Even when there are differences in performance, they are very minimal which can be ignored. It can be noticed that when a portfolio is hedged it can withstand harsh bearish conditions like that of 2008 crash.

Though we have ignored the transaction cost it can affect the portfolio performance if more churning is done or if the transaction costs are prohibitive. However in the current low cost (brokerage) scenario the impact of transaction cost will be minimal in the Indian context. Fund managers can use either fundamental factors or technical tools to decide when to hedge the portfolio. This study is useful for Investors in selecting the right kind of stocks for the portfolio. In this study it is proved that high Mcap stocks can be hedged effectively using index hedging. Investors can invest in high Mcap stocks as they provide the best appreciation even during uncertain periods and hedging is very effective.

IV. Conclusion

The research proves that the equity risk of a portfolio can be offset by hedging the portfolio with nifty index futures. The hedged value determined based on OLS (Ordinary least squares) method is high for Market Cap stock portfolios than GARCH (Generalized autoregressive conditional heteroscedasticity) model. So, the traditional simple OLS model is preferable to complex GARCH model in calculating hedge ratio/beta. During periods of financial crisis like 2008-2009 maximum loss covered by hedging the portfolio is up to 68%. The protection of a portfolio through hedging should not encourage investors to use it indiscriminately for unwarranted situations. Only Unhedged portfolio can fulfill the objective of the portfolio by giving good returns.

Hedging should be used as an anchor in a sailing ship charting risky waters. Hence use of hedging should be restricted to special situations where there is an inherent risk of market crash and the portfolio should be unhedged under normal circumstances. This spring's another question; when to hedge or whether to hedge or not?. This situation is a tricky one as further research is needed to find out the suitability of stop loss or other models to initiate hedging. Both fundamental and technical analysis tools may be employed to arrive at the decision.

References Références Referencias

1. Adams, J. & Montesi, C. J. (1995): "Major Issues Related to Hedge Accounts." Financial Accounting Standard Board – Business & Economics.
2. Bollerslev, T. (1986). "Generalized Autoregressive Conditional Heteroskedasticity." Journal of Econometrics, 31(1), 307-327.
3. Engle, R. (1982). "Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of United Kingdom Inflation." Econometrica, 50(9), 987-1008.
4. Tarun Ramadorai (2013) : An excellent choice of Nobel laureates. Retrieved from www.voxeu.org/article/fama-hansen-and-shiller-nobelists-2013.
5. Fama, Eugene F, Lawrence Fisher, Michael C Jensen, and Richard Roll (1969). "The Adjustment of stock prices to New Information." International Economic Review,10(1), 1-21.
6. Figlewski, S. (1984). "Hedging Performance and Basis Risk in Stock Index Futures." The Journal of Finance, 39(3), 657-669.
7. Grant, D. (1982). "Market Index Futures Contract and Portfolio Selection." Journal of Economics and Business, 34(14), 387-390.
8. Madhumathi. R & Ranganatham. M (2012). "Derivatives and Risk Management." Pearson publication. pp. 4-20
9. Mary. A, Vishwanath. & Panneerselvam (2013). "A comparative study on beta hedging og high PE and Low PE stocks using Index futures with reference to NSE." Indian Journal of Finance, 7(8), 43-50.
10. Roger Koenker and Gilbert Bassett (1978), "Regression quantiles". Econometrica, 46(1) 33-50.
11. Securities and Exchange Board of India. (1998), "L. C. Gupta Committee Report", retrieved from http://www.sebiindia.com.
12. Singh, A. (1997). "Financial Liberalisation, Stockmarkets and Economic development." The Economic Journal, 107(442) 771-782.