

# A Comparative Study on Beta Hedging of High PE and Low PE Stocks Using Index Futures with Reference to NSE

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## Abstract

This paper analyses the hedging effectiveness of both high and low PE stocks, which are the constituents in Nifty. This study explores the difference in hedging effectiveness between high PE and low PE stocks. A hedge is highly effective if the cash flow of the hedged item and the hedging derivative offset each other to a significant extent. The portfolio was analyzed by using fortnightly data. The beta values of the stocks were determined by using the preceding six-month data, and the hedge ratio was also determined. The performance of the portfolio - both hedged and unhedged - was studied for the period from September 2010 to March 2012. Statistical parametric tests conclude that high PE stocks hedging is highly effective, and in contrast, low PE stocks hedging is not effective.

**Keywords:** high PE, low PE, hedging effectiveness, hedging, index future, Nifty

**JEL Classification :** G10, G11, G13

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Portfolio managers often find that the performance of the portfolio heavily depends upon such factors which are beyond their control. Important among these are external influences like market risk, political, and economic risk, etc. Futures markets can provide the managers certain tools to reduce and control the systematic risk during unfavorable market conditions. The derivatives market has got a tremendous potential by giving options of hedging speculations and arbitration (Verma & Chauhan, 2008). The major attraction of the derivative market for the traders is that it allows them to assume highly innovative payoffs by combining different derivatives products (Joshipura, 2010). Dynamic futures hedging strategies have been shown to be effective in a number of markets, but the gain in risk reduction over simple, constant hedges varies (Lypny & Powalla, 1998). A perfect hedge is one that completely eliminates risk. Stein (1961) introduced the concept of portfolio theory through hedging the cash position with futures. Hedging effectiveness of futures markets is one of the important determinants of success of futures contracts (Pennings & Meulenbergh, 1997). Ederington (1979) in his research determined risk - minimizing hedge ratio, and derived a measure of hedge effectiveness. Kumar (2011) in his study has proved that there persist long-run relationship between the spot and futures prices and thus returns.

Hedging stock is an important tool for diversifying risk by pairing the stock owned (the long position) with an appropriate short position. Since the index contract is tied to the behavior of an underlying stock market index, non market risk cannot be hedged. This is the essential problem of cross hedge. However, basis risk can be present even when the hedge involves a position in the index portfolio itself, and there is no market risk (Figlewski, 1984). Price risk management, using hedging tools like futures and options and their effectiveness, is an active area of research. Hedging decisions based on futures contracts have to deal with finding optimal hedge ratio and hedging effectiveness (Kumar, Singh, & Pandey, 2008). Bose (2007) in his research found that the Indian stock markets are more volatile as compared to the other markets. Hedging in the broadest sense is the act of protecting oneself against future loss. More specifically, in the context of futures trading, hedging is regarded as the use of futures transactions to avoid or reduce price risk in the spot market. Hedging through trading futures is a process to control or reduce the risk of adverse price

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changes.

The introduction of a stock index futures contract offers an opportunity to manage market risk of a portfolio without changing the portfolio composition (Ghosh, 1993). Many researchers feel that there are very few empirical investigations on the stock futures markets and hedge ratios in the emerging market context (Bhaduri & Durai, 2008 ; Floros & Vougas, 2006). Researchers have suggested that although there are sophisticated approaches and models designed to determine the hedge ratio, a hedge ratio can be directly estimated (Bell & Krasker, 1986; Kolb & Chiang, 1981). The OLS Model is relatively simple to determine the hedge ratio (BETA) due to the only consideration for the ability of risk minimization of the hedging strategy, which has excluded the existence of expected return (Ong, Tan, & Teh, 2012). During times of financial crisis, when the correlations of most asset categories with each other increase dramatically, the traditional equity market beta can have an adverse effect on a fund and the fund's performance (Kaiser & Hartmann, 2011).

This present study shows that the hedge ratio determined using Beta is perfect, as the results prove the hedge to be highly effective.

## Objectives

- ❖ To compare the hedging effectiveness of high PE and low PE portfolios using Nifty index futures.
- ❖ To determine the performance of the portfolio during the study period.
- ❖ To compare the variances of hedged and unhedged portfolio returns.

## Research Methodology

Nifty consists of 50 companies chosen on the basis of certain parameters set by the National Stock Exchange. The data used for the study is secondary data, which was collected from the NSE website archives. PE ratio of the stocks were calculated by using the data from company websites, NSE website, and periodicals. 10 stocks having high PE and 10 stocks having low PE were chosen from Nifty based on purposive sampling technique. The beta values of the stocks were calculated, and the beta value of the portfolio was determined and used for calculating the hedge ratio. The returns of both the hedged and unhedged portfolios of high PE and low PE portfolios were calculated for the period between September 1, 2010 to March 27, 2012. F test, hedging effectiveness, correlation, and regression analysis were used to analyze the data. High PE portfolio shows high hedging effectiveness as compared to low PE stock portfolio, which moves along with the nifty.

## Scope of the Study

Portfolio managers use several hedging techniques to manage risk. In this pursuit, the use of PE ratio for selecting stocks for effective hedge is explored throughout this study. The results are convincing enough to identify specific stocks based on PE ratio for hedging. In this study, we have used only Index futures to study the hedging impact, but the use of single stock futures, commodity futures, and currency futures can also be explored by researchers. This leaves ample scope for further study and experimentation, which might bring in new understanding of the market.

## Limitations of the Study

- ❖ The study was carried out only on the basis of secondary data. Dynamic hedging was not done because of practical constraints.
- ❖ The study covered stocks only under NIFTY. Hence, it may not represent the entire population of NSE stocks.
- ❖ PE ratios do vary overtime, and rebalancing a portfolio based on PE ratio changes has not been incorporated in this study.
- ❖ Only closing prices have been used for calculating the portfolio and net asset value. NSE calculates closing price based on the last half-an-hour weighted average of prices, and hence, there could be difference between actual closing price and settlement price.

Table 1 : Portfolio Beta of High PE Stocks				
High PE Stock	Portfolio worth	Share price	No.of Shares	Beta Value
SIEMENS	1000000	695	1440	0.8
STER	1000000	157	6370	1.2
SUNPHARMA	1000000	1750	571	0.35
TATA MOTORS	1000000	1010	990	1.68
HDFC	1000000	623	1605	1.14
DR. REDDY'S	1000000	1369	730	0.44
HUL	1000000	267	3745	0.42
ITC	1000000	163	6135	0.56
KOTAK	1000000	830	1200	1.06
RPOWER	1000000	155	6450	1.2
Source : Retrieved from <a href="http://www.nseindia.com/products/content/equities/equities/eq_security.htm">http://www.nseindia.com/products/content/equities/equities/eq_security.htm</a>				

Table 2 : Portfolio Beta of Low PE Stocks				
Low PE Stock	Portfolio worth	Share price	No.of Shares	Beta Value
SAIL	1000000	188	5319	1.55
GAIL	1000000	470	2127	0.55
TATA STEEL	1000000	538	1859	1.7
BPCL	1000000	778	1285	1.68
BHEL	1000000	2420	413	1.14
HINDALCO	1000000	174	5747	1.85
PNB	1000000	1203	831	0.63
ONGC	1000000	1339	743	0.57
CAIRN	1000000	340	2941	1.23
STERLITE	1000000	256	6410	0.63
Source : Retrieved from <a href="http://www.nseindia.com/products/content/equities/equities/eq_security.htm">http://www.nseindia.com/products/content/equities/equities/eq_security.htm</a>				

## Results and Interpretation

❖ Hedge ratio based on **portfolio beta is 0.88** ( $\rho$ )

Hence, number of **nifty to be hedged** :  $\frac{\sigma_p}{\sigma_{NIFTY}} \cdot \rho_p$

$\sigma_p$  : Value of portfolio

$\rho_p$  : Beta Value

$\sigma_{NIFTY}$  : Nifty Index

$$= \frac{1,00,00,000 \times 0.88}{5476} = 1607 \text{ nifty}$$

❖ Hedge ratio based on **portfolio beta is 0.96** ( $\rho$ )

Hence number of **nifty to be hedged**:  $\frac{\sigma_p}{\sigma_{NIFTY}} \cdot \rho_p$

$\sigma_p$  : Value of portfolio

$\rho_p$  : Beta Value

<b>Table 3 : Descriptive Statistics of High PE and Low PE Portfolio</b>				
<b>DESCRIPTIVE STATISTICS</b>	<b>HIGH PE STOCK PORTFOLIO</b>		<b>LOW PE STOCK PORTFOLIO</b>	
	<b>UNHEDGED PORTFOLIO</b>	<b>HEDGED PORTFOLIO</b>	<b>UNHEDGED PORTFOLIO</b>	<b>HEDGED PORTFOLIO</b>
Sum	409896076.00	409715692.00	348268821.00	348063636.00
Count	38.00	38.00	38.00	38.00
Max	11864961.00	11300571.00	10919306.00	9996921.00
Min	9480030.00	9992081.00	6732503.00	8258609.00
Arithmetic Mean	10786738.00	10781991.00	9164968.97	9159569.37
Median	10925147.00	10801029.00	9521977.00	9278860.00
Population Variance	402714849626.00	102205384080.00	1391500675622.00	292301168430.00
Sample variance	413599034751.00	104967691757.00	1429108801990.68	300201200009.00
Population Std Dev	634598.00	319695.00	1179618.87	540664.84
Sample Std Dev	643116.00	323987.00	1195453.39	547906.20
Coefficient of Variation	6%	3%	13%	6%
Source : Retrieved from <a href="http://www.nseindia.com/products/content/equities/indices/historical_index_data.htm">http://www.nseindia.com/products/content/equities/indices/historical_index_data.htm</a> .				

$\sigma_{NIFTY}$  : Nifty Index

$$= \frac{1,00,00,000 \times 0.96}{5476} = \mathbf{1828 \text{ nifty}}$$

The Table 3 shows that the coefficient of variation of hedged high PE stock portfolio is 3% compared to 6% to that of unhedged portfolio, which shows that the portfolio volatility is considerably reduced. Hedged value of the high PE portfolio never declined below ₹ 9992081 during the period of the study. In the case of low PE stock portfolio, the movement of unhedged values are in tandem with the nifty values, which shows that the hedging is ineffective.

<b>Table 4: F - Test for Nifty and High PE Hedged Portfolio</b>	
<b>Data</b>	
Level of Significance	0.01
<b>Population 1 Sample</b>	
Sample Size	38
Sample Standard Deviation	8.2
<b>Population 2 Sample</b>	
Sample Size	38
Sample Standard Deviation	3.19
Intermediate Calculations	
F Test Statistic	6.6076
Population 1 Sample Degrees of Freedom	37
Population 2 Sample Degrees of Freedom	37
<b>Two-Tail Test</b>	
Lower Critical Value	0.4208
Upper Critical Value	2.3763
p-Value	0.0000
Reject the null hypothesis	
Source : Retrieved from <a href="http://www.nseindia.com/products/content/equities/indices/historical_index_data.htm">http://www.nseindia.com/products/content/equities/indices/historical_index_data.htm</a> .	

Table 5 : F - Test for Nifty and Low PE Hedge Portfolio	
Data	
Level of Significance	0.01
<b>Population 1 Sample</b>	
Sample Size	38
Sample Standard Deviation	8.2
<b>Population 2 Sample</b>	
Sample Size	38
Sample Standard Deviation	5.38
Intermediate Calculations	
F Test Statistic	2.3231
Population 1 Sample Degrees of Freedom	37
Population 2 Sample Degrees of Freedom	37
Two-Tail Test	
Lower Critical Value	0.4208
Upper Critical Value	2.3763
p-Value	0.0121
Do not reject the null hypothesis	
Source : Retrieved from <a href="http://www.nseindia.com/products/content/equities/indices/historical_index_data.htm">http://www.nseindia.com/products/content/equities/indices/historical_index_data.htm</a> .	

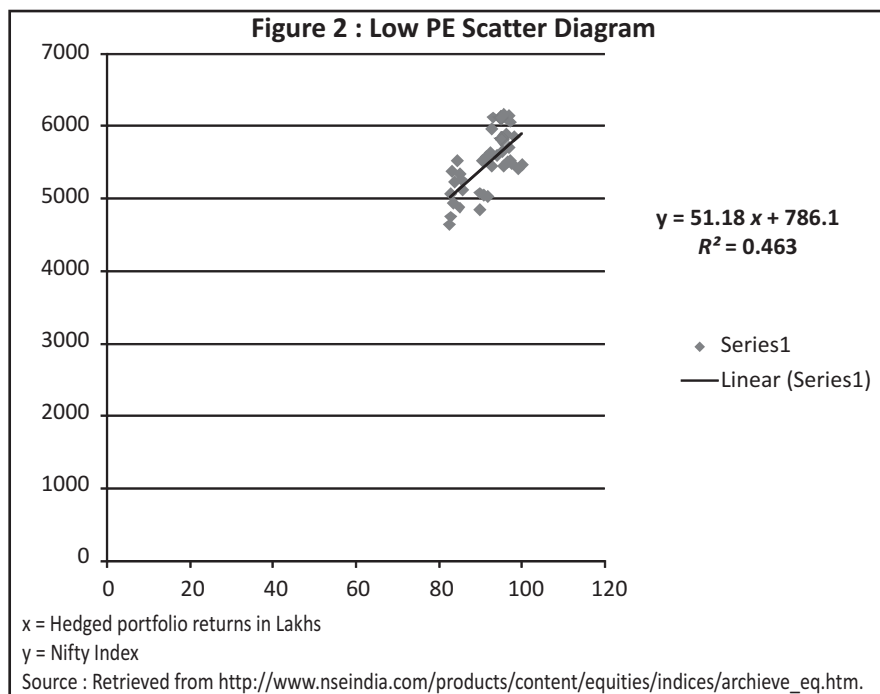
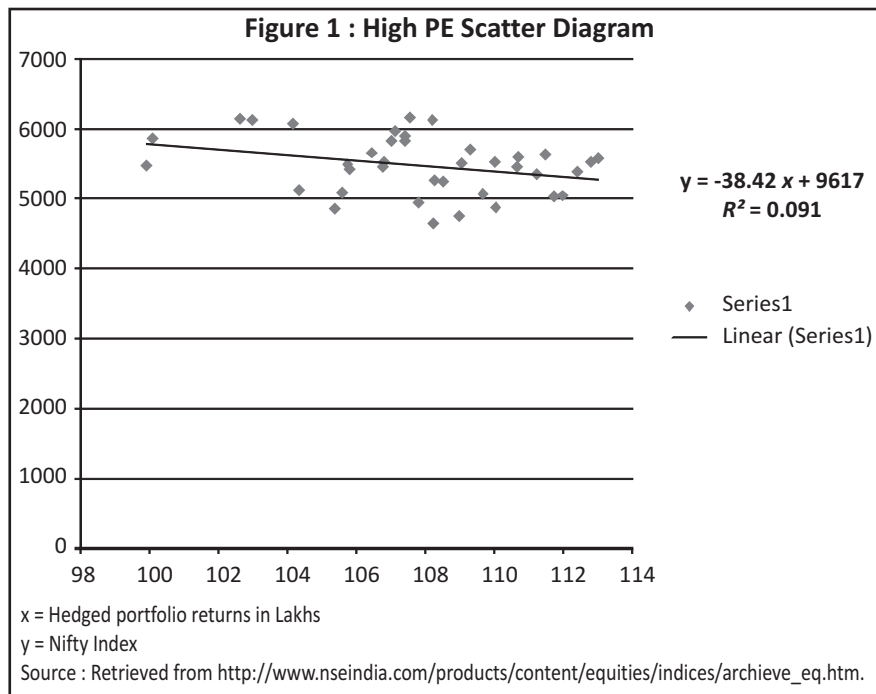
The value of the unhedged portfolio is calculated on the basis of the movement of the constituent stocks. It shows that the unhedged portfolio declined to a low of ₹ 94,80,030 during January 2012. Hedged portfolio is the addition of unhedged portfolio value and the short position on the index, when the market declined unhedged portfolio value is reduced, and it is offset by the profit in the hedge position. However, when the market raised the profit in the portfolio, the same is neutralized by the loss in the hedge position.

The Table 4 proves that the variances of the two population nifty and hedged portfolio of high PE stocks are not equal. It means there is a significant difference between the market return and the hedged portfolio returns of high PE stocks. Whereas, the Table 5 shows that there is no significant difference between the market return and hedged portfolio returns of low PE stocks. The coefficient of determination was calculated by using hedged portfolio returns and nifty index for both high PE and low PE portfolio. The Table 6 shows that the coefficient of correlation is negative in high PE hedging as compared to low PE hedging.

Table 6 : Coefficient of Determination of the Portfolio		
	High PE	Low PE
Standard Deviation ( $\sigma_x$ )	8.2	8.2
Standard Deviation ( $\sigma_y$ )	3.19	5.38
Coefficient of correlation $R$	-0.3022	0.680811
Source :Retrieved from <a href="http://www.nseindia.com/products/content/equities/indices/archieve_eq.htm">http://www.nseindia.com/products/content/equities/indices/archieve_eq.htm</a> .		

## Discussion

The Beta for the high PE stocks chosen for the study was determined as 0.88 (Table 1) and 0.96 for low PE stocks (Table 2) using 6 months data from March 2010 to August 2010 for calculating the hedge ratio. The number of index futures was determined as 1607 nifties for high PE stocks and 1828 nifties for low PE stocks using the hedge ratio. The portfolio comprising of 10 high PE stocks in equal proportions, worth ₹ 1 crore was hedged against 1607 and 1828



nifties. The performance of the portfolio, both hedged and unhedged, was studied during the period from September 2010 to March 2012, and it was found that the unhedged portfolio value during market crash touched a low of ₹ 94,80,030, whereas the hedged portfolio value was maintained around or above ₹ 1 crore (initial portfolio value) (Table 3). Hedged portfolio is the addition of unhedged portfolio value and the short position on the index, when the market declined unhedged portfolio value declined [hedge], and it was offset by the profit in the hedge position. However, when the market raised the profit in the portfolio, the same was neutralized by the loss in the hedge position. This proves that the hedge is very effective. However, in the case of low PE hedging, the hedging is not effective (Table 3) as the portfolio value ranged from a low of ₹ 82,58,609 to a high of ₹ 99,96,921 in contrast to high PE hedging, which produced excellent results.

The F test proves that the variances of the two population nifty and hedged portfolio of high PE stocks are not equal. It means there is a significant difference between the market return and hedged portfolio returns of high PE stocks (Table 4). Whereas, the test concludes that there is no significant difference between the market return and hedged portfolio returns of low PE stocks (Table 5). Coefficient of correlation is negative in high PE hedging as compared to low PE hedging (Table 6). In the case of high PE, the movement of hedged value is random in relation to nifty, which is proved by coefficient of determination ( $R^2$  value), which is only 9 % (Figure 1). In the case of low PE, the movement of hedged value is relatively in tandem with nifty, which is shown by the coefficient of determination ( $R^2$  value) to be 46% (Figure 2).

## Conclusion

This paper assesses the hedging effectiveness of both high and low PE stocks, which are constituents of nifty using a suitable Hedge Ratio. We determined the hedge ratio by using the previous six months' stock price data. We constructed two portfolios using high PE and low PE stocks and found that the high PE portfolio is effectively hedged using Index futures, which is not the case with the low PE portfolio.

The empirical properties of the hedged and unhedged portfolios have been analyzed in more detail. Though the objective is to protect the capital, the research shows that the hedged portfolio has protected the capital, and also, it has appreciated in value, bringing in profit. The F test of high PE portfolio stocks show that the variances of nifty and hedged portfolio are not equal. F test of low PE portfolio stocks reveals that the variances are similar. These results show that the high PE portfolio can be effectively hedged, whereas the low PE portfolio cannot be hedged because of the inherent volatility limitations which are seen in the stocks. However, low PE hedging proved to be quite ineffective in all parameters. The movement is erratic and the standard deviation is high. Coefficient of correlation is positive and coefficient of determination is high, which proves that the hedged portfolio moves in tandem with the nifty.

Hence, the study concludes that high PE stock hedging is effective as compared to the low PE stock hedging. Further research has to be done on this particular topic to find out the actual hedging effectiveness in the Indian context in different time periods.

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