

## Portfolio Risk Management: A Case Study of BPCL and ONGC

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**Abstract:** Fund managers' dreams to make a portfolio that will give good returns with minimize un-systematic risk. To minimize risk they use correlation & hedge portfolio by the future & option. And also avoid the weak fundamental stocks & add good fundamental stock. Use Technical analysis for the Trend when to hedge. Here we have discussed how to hedge to get good returns and thus reducing un-systematic risk.

### 1. Introduction

Risk is the important parameter before invest but in general most of the Investor enter into the market without knowing the risk. Investor's always will to raise money quickly in stock market without knowing the risk hence after buying if price fall they feared & booked loss some are buy more & exit at bottom & booked loss. So it's important before entering into the capital market you should know the risk. In portfolio making you have to consider the risk of each stock in your portfolio & also what the risk of portfolio is. You have to calculate systematic risk in the portfolio as beta & unsystematic risk as standard deviation. This study shows you how to calculate beta & standard deviation of the portfolio & individual stock.

Making Portfolio is not simple or hedging portfolio is too difficult if the portfolio maker is not taking concern on future & option lot size. To hedge the portfolio you will use the future & option for short or long one lot or multiple. It's impracticable to hedge complete. This study show you how after making the portfolio & calculating then also you will not able to hedge your portfolio complete.

**1.1 Correlations:** Correlations will find the linear relationships between the two variables how they move together. It has no unit of measurements & will vary from -1 to +1. -1 value means the two variables will move in opposite direction & +1 means they move together in same directions. It will calculate as below

$$\text{Correlation}(x, y) = \frac{\text{Cov}(x, y)}{\sigma_x * \sigma_y}$$

Where  $\sigma_x, \sigma_y$  are the standard deviation of x & y stocks respectively

To measure volatility of returns standard deviation is used. Standard deviation measure the deviation from means. Denoted by symbol  $\sigma$  sigma & calculated as below

$$\sigma_x = \sqrt{\sum_{i=1}^n \frac{(x_i - \bar{x})^2}{(n - 1)}}$$

Where  $\bar{x}$  is the mean of the stock return &  $x_i$  the return of the  $i$ th observation,  $n$  is the total number of observation

1.2 **Beta of the portfolio:** Beta measures the systematic Risks of the portfolio or stock with comparison on the markets. It will calculate as below

$$\beta = \frac{\text{Cov}(x, y)}{\text{Var}(x)}$$

where  $x$  is the market return,  $y$  is the stock or portfolio return

## 2. Objectives of the study

Use Correlation & Standard deviation concept to decide the weight of the stock in the portfolio and minimize unsystematic risk of the portfolio. To reduce systematic risk we have to hedge the portfolio using beta of portfolio & stock.

## 3. Data, Data Sources and Methodology:

In this study the experimental portfolio consists of two stock BPCL & ONGC. Sample data are from 22<sup>nd</sup> may 2008 to 13<sup>th</sup> June 2008. For analysis how the hedging & correlation will reduce the portfolio loss hence in this study 11th July 2008 date is consider. All the data are downloaded from [www.nseindia.com](http://www.nseindia.com). Assume that BPCL & ONGC are fundamental good stocks.

### *Steps to Make Portfolio*

- i. Chose good fundamental stock by fundamental analysis
- ii. Find the -ve correlation between them

- iii. Find the standard deviation
- iv. Calculate the beta of portfolio
- v. Make the portfolio for weight of the stocks in portfolio with concern on F&O lot size, correlation & standard deviation of the stock to get maximum returns.
- vi. Calculate market expectation or trend by technical analysis
- vii. Decide which strategy to hedge
- viii. Calculate index lot size to hedge

$$\text{lot size to hedge} = \frac{\text{Portfolio value}}{\text{price of index} * \text{lot size of index}} * \text{portfolio beta}$$

Calculate stock lot size to hedge

$$\text{lot size to hedge} = \frac{\text{stock value in portfolio}}{\text{price of stock} * \text{lot size of stock}} * \text{stock beta}$$

If we will add the stock having perfect –ve correlation then our portfolio un-systematic risk will zero because as we know that Unsystematic risks are unique to a firm or industry & the correlation will give the relationship. When one firm will in +ve it will go up but at the same time if the other firm will in –ve it will go down and vice versa so that portfolio will balance & will reduce the un systematic risk.

Let us take an example of two stock x & y which are perfectly –ve correlation ie -1 value then the risk of the portfolio will be calculated as below

$$\text{Portfolio risk} = \sqrt{[(w_x^2 * \sigma_x^2) + (w_y^2 * \sigma_y^2) + 2 * w_x * w_y * \sigma_x * \sigma_y * R_{xy}]}$$

Assume that they have same weight & same standard deviation  $w_x = w_y, \sigma_x = \sigma_y$  then the above formula will reduce as below

$$\sqrt{[2(w_x^2 * \sigma_x^2) + 2 * w_x^2 * \sigma_x^2 * R_{xy}]}$$

$R_{xy}$  Is the correlation between the two firm and assume  $R_{xy} = -1$  then the above formula will give zero hence the portfolio will zero unsystematic risk. By the correlation we will reduce

only the unsystematic risk of the portfolio but if we have to reduce the systematic risk beta then we have to hedge the portfolio by future & option. As example if your portfolio beta is 1.5 its means that when market fall of 1 rupee your portfolio will fall 1.5 rupee and vice versa .If you are expecting that market will fall & want to hedge then you have to short index future & lot size will calculate as below.

$$\text{hedge lot size} = \frac{\text{portfolio value} * \beta}{\text{index value} * \text{lotsize}}$$

If you will get in fraction like .9 or 1.25 or 1.75 then is difficult to hedge complete because you can short index future either one lot or two lot not 1.5 lots. So before making portfolio you have to check the portfolio should be near multiple of the index future one lot value. After shorting future also then you have to check that the stock which is more negative due to financial result or in any rumors. Hence you want to hedge then you have to check the value of the stock in portfolio & lot size as in above. So check the each stock value in your portfolio also be multiple of lot size value of that stock in future.

For deciding the weight we have to study the above factor and also standard deviation. If one stock is more risky than other in your portfolio then you have invest less in this as compare to less risky stock you can calculate your weight as below.

$$\text{weight for stock } x = \frac{\sigma_x}{\sigma_x + \sigma_y}, \quad \text{weight for stock } y = \frac{\sigma_y}{\sigma_x + \sigma_y}$$

#### 4. Data Analysis and Interpretations:

**Table 1 Real Data of the stocks & index & calculation**

Date	BPCL Close Price	ONGC Close Price	Nifty Index Close price	BPCL Daily Return	ONGC Daily Return	Nifty Index Daily Return
22-May-08	346.85	926.1	5025.45			
23-May-08	359.4	900.15	4946.55	3.62%	-2.80%	-1.57%
26-May-08	347.75	894.9	4875.05	-3.24%	-0.58%	-1.45%
27-May-08	349.9	884.45	4859.8	0.62%	-1.17%	-0.31%
28-May-08	358.45	873.85	4918.35	2.44%	-1.20%	1.20%
29-May-08	357.25	853.25	4835.3	-0.33%	-2.36%	-1.69%

30-May-08	356.9	865.2	4870.1	-0.10%	1.40%	0.72%
2-Jun-08	348.6	833.1	4739.6	-2.33%	-3.71%	-2.68%
3-Jun-08	351.8	839.3	4715.9	0.92%	0.74%	-0.50%
4-Jun-08	322.3	886.2	4585.6	-8.39%	5.59%	-2.76%
5-Jun-08	301.85	957.1	4676.95	-6.35%	8.00%	1.99%
6-Jun-08	300.95	938.95	4627.8	-0.30%	-1.90%	-1.05%
9-Jun-08	278.85	879.95	4500.95	-7.34%	-6.28%	-2.74%
10-Jun-08	284.6	829.55	4449.8	2.06%	-5.73%	-1.14%
11-Jun-08	273.25	831.4	4523.6	-3.99%	0.22%	1.66%
12-Jun-08	269.35	832.4	4539.35	-1.43%	0.12%	0.35%
13-Jun-08	266.9	841.95	4517.1	-0.91%	1.15%	-0.49%
<b>CALCULATION</b>						
Correlation between BPCL&ONGC	<b>-0.42</b>					
Standard Deviation	BPCL	<b>3.51%</b>		ONGC	<b>3.66%</b>	
Beta	BPCL	<b>0.39</b>		ONGC	<b>1.13</b>	

### Portfolio Making:

Let us make the portfolio having these two stocks as taking concerns with the future lot size value as in below table. As per the above said formula we will get the weight of BPCL & ONGC as in the below table. Let us assume that decide to invest as below in the table then the required share to invest is in fraction. Use standard deviation & lot size calculate weight of stock in portfolio & minimum value to invest.

**Table 2: Portfolio as per Theory**

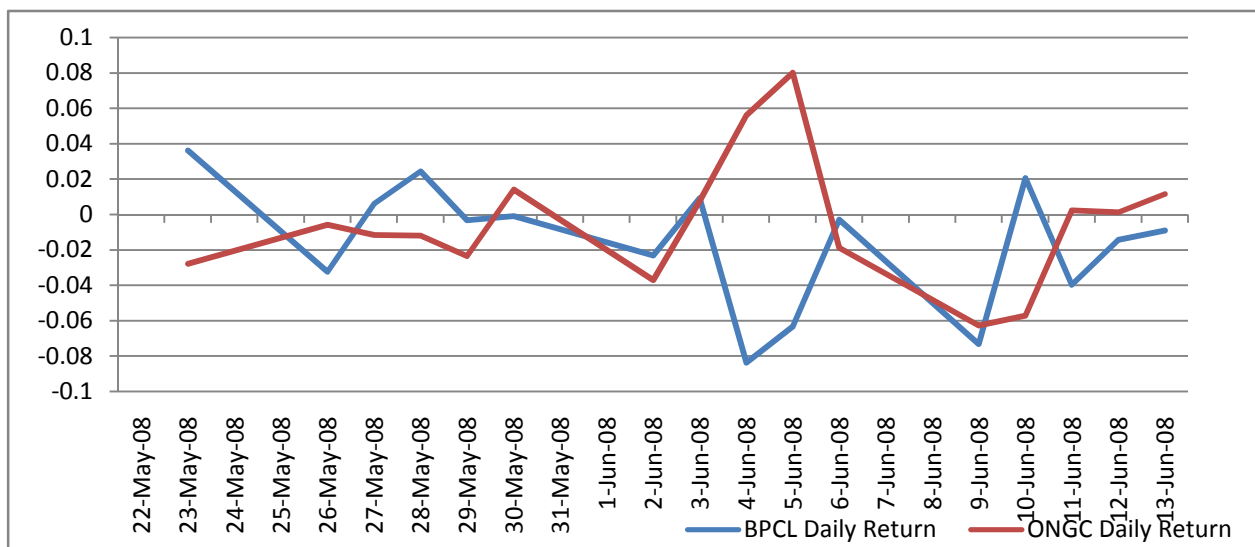
	Weight	Value To Invest	Share To Invest	Share To Invest lot size
Decide to invest	900000			
BPCL	48.96%	440629.41	1650.92	1.18
ONGC	51.04%	459370.59	545.60	2.74
Nifty Lot for hedge	3.07			

After rounding up make the portfolio by buying 1651 share of BPCL & 546 share of ONGC so for hedging it's easy to short 3 lot of nifty & if want to hedge stock ONGC 3lot & for BPCL 1 lot. Let us make the final portfolio as below.

**Table 3: Portfolio as per Investor**

Stock	No Of share	Invested Price	Invested Value	Weight	Portfolio Beta	Portfolio Risk
BPCL	1651.00	266.9	440651.9	48.94%	0.770	1.94%
ONGC	546.00	841.95	459704.7	51.06%		
Portfolio Value			900356.6			

If we assume that the correlation between this two stock BPCL and ONGC is -1 & adjust the weight then total risk will zero. As per the above data if this study observed that daily returns chart of BPCL & ONGC as below easily found that maximum time the direction of the returns are in opposite to each other.



Let us assume market will going downwards up to 11<sup>th</sup> July 2008 hence for hedging your portfolio short nifty index short of 3lots on 13<sup>th</sup> June 2008 @ 7517.1 let us check on 11<sup>th</sup> July 2008 the portfolio value as in below table-5.

**Table 4: July 11, 2008 based on closing prices**

BPCL	255.75
ONGC	849.5
NIFTY	4049

**Table 5: July 11, 2008 based on portfolio values**

Stock	No Of share	Invested Price	Value 11-07-08	Weight 11-07-08	Portfolio Beta 11-07-08	Portfolio Risk 11-07-08
BPCL	1651.00	266.9	422243.25	47.65%	0.779	1.95%
ONGC	546.00	841.95	463827	52.35%		
Portfolio Value on 11-07-08			886070.25			
Return Of Portfolio on 11-07-08			-1.59%			
Hedging profit of Nifty 3 lot short			70215			
Return Of Portfolio on 11-07-08 adding this hedging profit			6.21%			

As per the above decision of hedging instead of loss on portfolio it gave us profit. After one month of investment the portfolio return is lower than the portfolio risk indication. If the fund manager will feel from these two stocks one will fall more, than for hedging one can buy the put option of that stock.

## 5. Conclusion

To manage portfolio risk correlation will minimize the unsystematic risk whereas beta minimize systematic risk of the portfolio. One can hedge by shorting index and also by buying put option of the stock of which stock trend is more negative in the portfolio. Also as per the standard deviation, correlation one can decide the weight so that the risk will minimize. And also invest as the portfolio value& each stock value in the portfolio are equal or multiple of market lot size or stock lot size value respectively.

## 6. References

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