Idea of Portfolio

A **portfolio** is a collection of [investments](http://en.wikipedia.org/wiki/Investment#In_finance) held by an investment company, [hedge fund](http://en.wikipedia.org/wiki/Hedge_fund), financial institution or individual. The idea of portfolio is diversification. Diversification strives to smooth out unsystematic risk events in a portfolio so that the positive performance of some investments will neutralize the negative performance of others. The benefits of diversification will hold only if the securities in the portfolio are not perfectly correlated.

How are risk and returns determined/influenced in case of a portfolio?

Risk is highly influenced in case of portfolios due to diversification the unsystematic part of risk is reduced. Since the Assets are not perfectly correlated ie the covariance varies from -1 to 1 thus reducing risk getting more return for the same risk. In presence of short selling one can get max return with much less risk. In analysis of monthly return of past 4 years the following results were obtained

\*These results do not include short selling

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Max Return | Min Risk | Max Return Constrained | Min Risk Constrained |
| Return | 13.76 | -3.9196 | 4.1484 | 13.6 |
| Risk | 12.59 | 2.5799 | 5.106 | 12.3 |

How do you optimize a portfolio of '*n*' stocks (using MS Excel-Solver)?

->Monthly/Daily returns of stocks for 2-5 years

->Using return find variance and covariance of stocks. This can be done using “var” and “covar” function in excel.

->Covariance and Variance are used to determine the standard deviation of our portfolio.

->Generate a portfolio giving equal weightage to every equity.

->Using solver function with target cell set as return of our previously generated portfolio and set standard deviation as min standard deviation of all equity by setting variable cells as our equally distributed portfolio weights and clicking solve will give our optimum portfolio.

->The above can be done through minimization of Standard deviation by setting target cell as standard deviation of portfolio and choosing constrain as maximum return among all of the equity and again setting variable cells as our equally distributed portfolio weights and clicking solve will give our optimum portfolio.

\*Note the result of above cases may vary most of the time there is large difference between the results. This can be justified by the fact that is case 1 the maximization of return is done while in case 2 minimization of Standard deviation which causes us to put different boundary conditions which result in different outputs.

In both of the cases sum constrain should be put down that is the portfolio weight should be 100%.

New parameters obtained using optimization: Portfolio return, portfolio risk, new weights, short-selling and its impact on investor wealth, etc.

The following results were obtained :--

|  |  |  |
| --- | --- | --- |
| Security Symbol | Optimal Portfolio (maximising return) | Minimising SD Constrain |
| ASIANPAINT | 0.0000 | 0.0000 |
| ACC | 0.0000 | 0.0000 |
| BAJAJ-AUTO | 0.0000 | 0.0000 |
| BHEL | 0.0000 | 0.0000 |
| BPCL | 0.0000 | 0.0000 |
| CIPLA | 0.0000 | 0.0000 |
| DRREDDY | 0.0000 | 0.0000 |
| GRASIM | 0.0000 | 0.0000 |
| AMBUJACEM | 0.0000 | 0.0000 |
| HDFCBANK | 0.0000 | 0.0000 |
| HEROMOTOCO | 0.0000 | 0.0000 |
| HINDALCO | 0.0000 | 0.0000 |
| HINDUNILVR | 10.7024 | 0.0000 |
| HDFC | 0.0000 | 0.0000 |
| INFY | 0.0000 | 0.0000 |
| ITC | 21.0367 | 0.0000 |
| KOTAKBANK | 0.0000 | 0.0000 |
| M&M | 0.0000 | 0.0000 |
| ONGC | 0.0000 | 0.0000 |
| RELIANCE | 9.2411 | 0.0000 |
| SSLT | 5.1030 | 0.0000 |
| SBIN | 0.0000 | 0.0000 |
| SUNPHARMA | 0.0000 | 0.0000 |
| TATAMOTORS | 0.0000 | 0.0000 |
| TATASTEEL | 20.2599 | 94.8882 |
| TATAPOWER | 0.0000 | 0.0000 |
| WIPRO | 0.0000 | 0.0000 |
| ZEEL | 0.0000 | 0.0000 |
| ICICIBANK | 0.0000 | 0.0000 |
| INDUSINDBK | 0.0000 | 0.0000 |
| BANKBARODA | 0.0000 | 0.0000 |
| GAIL | 0.0000 | 0.0000 |
| AXISBANK | 0.0000 | 0.0000 |
| HCLTECH | 0.0000 | 0.0000 |
| LUPIN | 0.0000 | 0.0000 |
| BHARTIARTL | 0.0000 | 0.0000 |
| PNB | 14.8575 | 5.1118 |
| MARUTI | 0.0000 | 0.0000 |
| LT | 0.0000 | 0.0000 |
| ULTRACEMCO | 0.0000 | 0.0000 |
| TCS | 18.7994 | 0.0000 |
| NTPC | 0.0000 | 0.0000 |
| YESBANK | 0.0000 | 0.0000 |
| IDFC | 0.0000 | 0.0000 |
| TECHM | 0.0000 | 0.0000 |
| CAIRN | 0.0000 | 0.0000 |
| IDEA | 0.0000 | 0.0000 |
| POWERGRID | 0.0000 | 0.0000 |
| NMDC | 0.0000 | 0.0000 |
| COALINDIA | 0.0000 | 0.0000 |
| Return % | 4.1484 | 13.6000 |
| Standard Deviation in % | 5.1060 | 12.3103 |

The above numbers indicated the risk which one has to bear in order to get optimum return.

Considering the market assumptions as rational etc. Under normal trading of shares ie no short selling the investor has to bear a large risk in order to get more return. This can be explained by the fact that the portfolio we obtained was generated by returns of NIFTY stocks and the return of NIFTY stocks was less and there was greater risk which resulted our portfolio to be moderate return with moderate risk. Upon comparing with individual assets the portfolio return can be considered a better. If there is free shorting of assets then investor can get more than 30% return and risk to 5% which is excellent option for investors and it will have a huge impact on investor’s wealth.

What do all these numbers (results) mean for: an investor/client (outside party) and a portfolio manager (inside party)?

To investor who is only interested in return and risk these numbers give a better opportunity. The portfolio helps and investor to earn more with less risk rather than investing in single stocks/equity.

To a portfolio manager who does all the calculations this is only statistics with optimization. A portfolio manager understands that only optimization of risk or return cannot guarantee the best portfolio. There are other factors such as higher moments that is skewness and kurtosis which highly influence the weights in portfolio and in turn can help and investor from extreme returns (negative favourable/positive unfavourable) for investor or unidirectional movements.

This graph of portfolio return and there risk indicates that higher risk doesn’t mean higher return.

Higher Moments –An Introduction

The variance is considered as second moment upon considering higher moments there can be huge difference in weights of portfolio and can result in low returns.

Skewness definition

Describe asymmetry from the normal distribution in a set of statistical data. Skewness can come in the form of "negative skewness" or "positive skewness", depending on whether data points are skewed to the left (negative skew) or to the right (positive skew) of the data average.

Kurtosis definition

A statistical measure used to describe the distribution of observed data around the mean. It is sometimes referred to as the "volatility of volatility."

Importance of Skewness & Kurtosis

Most sets of data, including stock prices and asset returns, have either positive or negative skew rather than following the balanced normal distribution (which has a skewness of zero). By knowing which way data is skewed, one can better estimate whether a given (or future) data point will be more or less than the mean.

A high kurtosis portrays a chart with fat tails and a low, even distribution, whereas a low kurtosis portrays a chart with skinny tails and a distribution concentrated toward the mean.

MVS and MVKS

On optimizing the portfolio considering higher moments we got some interesting results. Using the method of minimizing deviation the optimal solution should be obtained but results were different since method of deviations minimize the deviations if one deviations can be minimized and another cannot then there may be a case where variance is low and return is also low thus total deviation is minimized but what we are getting is not a feasible solution. This can be considered as one of the drawback of above method. In order to overcome one may give unequal weightage to each and every deviation.

On applying the method of deviations both return in MVS and MVKS model were negative which supports the above statement. When shorting is allowed all the above deviations were satisfied and there was high return with low kurtosis ,high positive skewness and high returns.

Considering different cases where return was fixed

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On performing the calculations for given return constrain it is observed that return and risk in both MVS and MVKS model were approximated as linear near return of 8-9%.

Skewness for higher return in MVS and MVKS model are approximately same this can be

fact that as for higher return in above models the effect of skewness decreases as return

increases and effect of kurtosis increases. Since kurtosis depicts unpredicted high or low

returns.

There were large differences in return and risk when shorting was introduced this can be

due to

->Return data since return of most of the equity was negative with high risk in order to

convert negative return to positive one has to short sell.

->The period of our data was 2011-2015.If the individual return of that assets was not

calculated from year 2011-2015 there can be discrepancies in the results. Since shorting

can overcome negative returns it gave us favourable returns in case of shortselling

Lets take a look over shorting of equity and compare



When we shorted the equity is was easier to achieve the desired to return, deviation, skewness and kurtosis.

Importance of Kurtosis

Since MVS model does not consider the kurtosis even if use short sell the equity there is high Kurtosis to be observed which proves us that each of the four moments have there own importance and neglecting any of them can result in poor calculations.