Research Paper
Impact Factor: 4.164
Refereed Journal

IJMDRR
E- ISSN –2395-1885
ISSN -2395-1877

# DERIVATION OF DUAL RELATIONSHIP OF VALUE AT RISK IN INDIAN CAPITAL MARKET

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***Abstract***
*Value at Risk (VaR) is an attempt to provide a single number summarizing the total risk in a portfolio management. It has become widely used by corporate treasurers and fund managers as well as by financial institutions. The VaR measure is estimated through model building approach of simulation.*

## Introduction

Value at Risk (VaR) is an attempt to provide a single number summarizing the total risk in a portfolio management. It has become widely used by corporate treasurers and fund managers as well as by financial institutions. The VaR measure is estimated through model building approach of simulation.

In model building approach, there are two types of model namely lineal model and quadratic model. In linear model for portfolios worth (P) consisting of 'n' assets with an amount $\alpha_i$ being invested in asset ($1 \leq i \leq n$). For the change in the return $\delta x_i$ for the $i^{th}$ return of asset, the lineal model is given by

$$P = \sum^{n} \alpha_i \, \delta x_i \quad \text{where } i = 1 \text{ --------------------1}$$

In the quadratic model the value at risk for portfolio management is

$$\delta P = \Delta \, \delta S + ½ \, \Gamma \, (\delta S)^2 \quad \text{--------------------------2}$$

This is the equation of degree 2,
This paper is intended to establish the relationship between the equations (1) and (2)

## Methodology

This paper adopts a rigorous mathematical methodology. The standard equations of conic, maxima and minima of continuous functions, Rolls theorem are used to derive the desired results. The partial differential equations with respect to x and y and t are also exploited to find an expression for hedge parameters. Besides this the statistical concepts mean, standard deviations, variance and Karl Pearson's coefficient of correlations are also used. The bounded conditions for the partial differential equations of order 1 and 2 are used to solve the equations

Consider a portfolio consisting of options on a single stock, whose current price is S. $\Delta$ be the change of value of the portfolio with S. Then the rate of change is given by,

$$\Delta = \delta P / \delta S$$

$$\delta P = \Delta \, \delta S \text{ ---------------------------------1}$$

But the percentage rate of interest

$$\delta P = \delta S / S$$

$$\delta S = S \delta x \text{---------------------------------2}$$

substituting (2) in (1) we get

$$\delta P = \Delta \, S \delta x$$

Therefore we can derive an appropriate relationship for varying $x_1$ as a linear in nature.

$$\delta P = P = \sum_{i=1}^{n} \alpha_i \, \delta x$$

It is linear basis and spans the whole spare of portfolio, Now it has been checked for linear independence and dependence. It is found that $\delta P$ will never be zero, because of many portfolio. The sum also will never vanish. It implies the linear

IJMDRR
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dependence. This dependence poses a fascinating visitor for quadratic model of value at risk. Both delta and gamma to relate to δP and $\delta x_1$ are considered.
According to Taylor's service expansion we have

$$\delta P = \delta P/\delta S\ (\delta S) + \delta P/\delta t\ (\delta S) + ½\ \delta^2 P/\delta S^2\ (\delta S^2) + ½\ \delta^2 P/\delta t^2\ (St^2) + \delta^2 \Pi/\delta S \delta t\ (\delta S \delta f + \ldots\ldots\ldots) \text{ ------------------- } (3)$$

Now consider the assumption that portfolio is neutral and no change in them.

$$\delta P/\delta S\ (\delta S) = 0$$

Therefore we have

$$\delta P = \delta P/\delta t\ (\delta S) + ½\ \delta^2 P/\delta S^2\ (\delta S^2) + ½\ \delta^2 P/\delta t^2\ (St^2) + \delta^2 p/\delta S \delta t\ (\delta S \delta t + \ldots\ldots\ldots) \text{--------------------} (4)$$

The equation (4) can be rewritten using

$$\delta P = \Delta\ \delta S + 1/2\surd\ \delta S^2$$

But we know $\delta x = \delta S/S$

$$\delta P = \Delta\ S\delta x + 1/2\surd\ S^2(\delta x)^2$$

Since the period x of stock prices is normally distributed with mean valued vanished in nature. Now applying mathematical expectation on either side

$$E\ (\delta P) = E\ (\Delta\ \delta S + 1/2\surd\ \delta S^2)$$

The additive property of mathematical expectation implies

$$E\ (\delta P) = 1/2E\surd\ \delta S^2$$
$$= 1/2S^2\surd\ \sigma^2$$

This established the linear portfolio management with quadratic stock prices and their variances.

**Conclusion**

It can be concluded that the relationship between linear and quadratic model established portfolio with no derivations consisting of positions in stocks, the portfolio is linearly dependent on the percentage changes in prices of assets comprising the different portfolios. The normal distribution of stock prices in quadratic model describes constant portfolio management for specific periods and time span t.

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