Decision Making on Stocks Investment with minimum Risk

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Abstract

Stock Market is a versatile business, people with keen observation on historical movement of stock prices and related business growth can make huge profit and failure to keep track of those events may cost players their fortune. There is an ever-ending search in finding the right pattern to do a profitable trading business. It hurts more for people who suffer heavy loss. Financial risk analysis plays an important role in determining how to invest in stock market. The study analyze Indian Oil Corporation, Tata steel and Infosys stock prices from Bombay stock exchange and make a decision on how to invest among these stocks to get minimum loss.

Keywords: Stock investment, Risk modelling, Asset Management

Wordcount: 108

# Literature Review

Value at Risk (VaR) measures the maximum potential loss of a given portfolio over a prescribed holding period at a given confidence level. However, it is not sub additive measure of risk. Expected shortfall (ES) is a risk measure that overcomes these weaknesses, and that is becoming increasingly widely used. ES is defined as the conditional expectation of the return given that it exceeds the VaR (Taylor, 2008). ES is the average of all losses which are greater or equal than VaR, which is useful to decide which stock to invest.

We can make stock market investment in multiple ways. There are different strategies like equally distributing risk on the investment or high risk with more gain etc. Most often users go for a portfolio with minimum risk i.e minimum variance in the portfolio. GMVP is the methodology of investing with minimum risk, it is used often as it is completely dependent of the expected asset returns, which have been found to the principle source of risk estimation (Gabriel Frahm, 2009).

The study is done using R language and Rstudio. R data community (kc, 2018) and (2019), provides immense source on how to perform timeseries analysis in R. explaining ARIMA, GARCH and forecasting of values, which will be very helpful in asset management. Timeseries and forecast packages in R are widely used in timeseries analysis for asset management which also contains functions to get portfolio investment percentage. We use PGMV function in this study to get the GMVP investment percentage.

# Methodology

Quandl package in R is used to fetch historical price of the stocks in timeseries. The study analyzed Autoregressive integrated moving average (ARIMA) to detect non stationarity in timeseries data and suppress them by applying one or more initial differencing steps and pass it to Generalized Autoregressive Conditional Heteroskedasticity (GARCH) which is used to predict the volatility and provide the estimated shortfall of each asset. Autoregressive nature of GARCH depend on past squared observations and past variances to model for current variance.

The study took the covariance of asset returns and passed to global minimum variance portfolio function in R which will provide the portfolio with lowest possible volatility, ensuring the resultant portfolio is of minimum risk.

# Analysis

Analyzed timeseries close price of IOC, Tata Steel and Infosys close prices from 2015-01-01 (Figure 1) and calculated the asset losses by taking difference in the log values of the previous day close price (Figure 2). Mean of the asset loss values of IOC = -0.1071702, Tata Steel=-0.02682208 and Infosys=-0.08654827.

Calculated return of the assets using return series function, which is in Figure 3, mean of return series value are IOC = 0.1775025, Tata Steel = 0.05557905 and Infosys = 0.1465191. Figure 4, shows the ACF and PCF plots of individual assets.

Auto ARIMA function gives the lags to be suppressed, which is used with GARCH to get the Estimated shortfall. Covariance of the asset returns which is represented in Table 2 is passed to PGMV function which will provide the percentage of investment on the assets to have minimum risk.

# Results

The analysis done in R and the code is stored in GitHub (Pari, 2020). The Analysis Produced Estimated shortfall for each asset with 95% Confidence Interval which is shown in Table 1. The investment portfolio result from Global Minimum Value portfolio is shown in Table 3.

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Tables

Table 1

Estimated Shortfall

|  |  |  |  |
| --- | --- | --- | --- |
|  | IOC | Tata Steel | Infosys |
| Estimated Shortfall | 6.649093 | 6.650501 | 6.582849 |

Table 2

Covariance Matrix

|  |  |  |  |
| --- | --- | --- | --- |
|  | IOC | Tata Steel | Infosys |
| IOC | 20.4918334 | 1.4630289 | 0.2859075 |
| Tata Steel | 1.4630289 | 5.7758687 | 0.9817572 |
| Infosys | 0.2859075 | 0.9817572 | 17.5182264 |

Table 3

GMVP Portfolio

|  |  |  |  |
| --- | --- | --- | --- |
|  | IOC | Tata Steel | Infosys |
| Investment | 15.39890 | 64.73697 | 19.86413 |

AssetClosePriceTS

A screenshot of a map

Description automatically generated

Figure 1. Asset Close Price in Time Series

AssetClosePriceLossesTS

A screenshot of a social media post

Description automatically generated

Figure 2. Asset Close Price Losses in Time Series

AssetClosePriceResturnsTS

A screenshot of a social media post

Description automatically generated

Figure 3. Asset Close Price Returns in Time Series

ACF\_PACF

A screenshot of a cell phone

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Figure 4. ACF and PACF on assets close price