

REPORT ON MARKET RISK

Written By:

Name: - Ronak Shah

Date: - 14th March, 2021

ACKNOWLEDGEMENT

The success and final outcome of this project required a lot of guidance and assistance from many people and I am extremely privileged to have got this all along the completion of my project. All that I have done is only due to such supervision and assistance and I would not forget to thank them. To list all who have helped me is difficult because they are so numerous and the depth is so enormous.

I take this opportunity to thank VittArth the Finance Club of NIBM and NIBM for giving me the chance to do this project.

I am thankful to my college, N.L. Dalmia Institute of Management Studies and Research for introducing me to this project.

I would like to thank my college library for having provided various reference books and magazines related to my project.

I am thankful to the mentors of the Market Risk Project for their continuous guidance.

I would also like to extend my gratitude to my family, friends, colleagues and well-wishers who have helped me at various levels in completing this project successfully.

Lastly I would like to thank each and every person who directly or indirectly helped me in the completion of the project and supported me throughout my project.

EXECUTIVE SUMMARY

The correct management of the market risk has become a central point of interest for the banking institutions, taking into consideration the magnitude of the effects generated by the recent financial crisis. Due to a set of unexpected shocks on the market (increasing exchange rates, increasing interest rates, reducing financial securities listing) associated with high market volatility, managers need information in advance in order to assess the impact of these shocks upon banking performance. A statistical method used for quantifying market risk is VaR.

The Indian Capital has been increasing tremendously during the last few years. With reforms of economy, reforms of investing policy, reforms of public sector and reforms of financial sector, the economy has been opened up and many developments have been taking place in the Indian money market and Capital market. In order to help the small investors, mutual fund industry has come to occupy an important place. This study helps us to understand how the companies diversify themselves in different sectors and in different companies to maximize the returns and to minimize the risks involved in it.

The main objective of the study is to give investors a basic idea of investing into the mutual funds and encourage them to invest in those areas where they can maximize the return on their capital; to analyze and evaluate the impact of the possible losses of the trading portfolio.

TABLE OF CONTENTS

SR. NO.	TITLE	PAGE NO.
1.	<u>INTRODUCTION</u>	5
2.	<u>TYPES OF MARKET RISK</u>	5
3.	<u>NEED FOR MARKET RISK</u>	7
4.	<u>CURRENT RELEVANT PRACTICES</u>	7
5.	<u>METHODOLOGY</u>	8
6.	<u>ANALYSIS & INTERPRETATION</u>	9
7.	<u>CONCLUSION</u>	10
8.	<u>BIBLIOGRAPHY</u>	10

*Click on the desired title to view its content

INTRODUCTION

Market risk is the risk associated with losses due to unfavourable price movements that affect the market as a whole. These markets range from commodities to crypto currencies. It is a measure of all the factors affecting the performance of financial markets. Market risk can be defined as the risk related to the uncertainty of a Financial Institution's earnings on its trading portfolio caused by changes, particularly extreme changes, in market conditions such as the price of an asset, interest rates, market volatility, and market liquidity.

From an investor's perspective, it refers to the possibility of an investor experiencing losses due to factors that affect the overall performance of the financial markets in which such investor has made investments. An investor tries to maximize the revenue based on the risk taken. Therefore, he/she focuses on accessing all information that might affect the prices of investment instruments on the market.

Market risk is characterised by "systematic risk". The same cannot be eliminated through portfolio diversification because market risk affects the entire market, and not specific assets, though it can be hedged against in many ways. Price volatility often arises due to unanticipated fluctuations in factors that commonly affect the entire financial market.

The objective behind this report is to explain the use of value at risk (VaR) in measuring portfolio risk; estimate and interpret the VaR under Historical, Gaussian and Modified simulation methods.

TYPES OF MARKET RISK

Market risk depends on the type of security being traded, as well as the geographical boundaries of the trade. The types of Market risks are as follows: -



1. Interest rate risk

If interest rates increase or decrease suddenly, market volatility is likely to increase. Interest rate changes affect asset prices because the level of spending and investment across an economy will increase or decrease, depending on the direction of the rate change. If the interest rate goes up, consumers generally spend less and save more, whereas if the interest rate goes down, they tend

to spend a little more and save less. Interest rate risk can affect any market, including shares, commodities and bonds.

2. Equity price risk

Stock prices can be very volatile, more so than some other asset classes. The price of a security can change very quickly, often causing it to dip in value. This is known as equity price risk. While there are several factors that affect share prices, there are only two types of equity risk, namely systematic and unsystematic risk. The first is the risk related to the general industry, while unsystematic risk pertains to a certain company.

For example, we buy 500 shares of ABC for ₹10 per share with the aim of selling the shares at a higher price. But then, the unexpected resignation of the CEO causes the share price to drop to ₹7. If we sell the shares then, we will make a ₹1500 loss. That is the equity price risk you must carry.

3. Exchange rate risk

Exchange rate risk, also known as currency risk or foreign exchange risk, is the risk associated with the fluctuation of currency prices. When currency prices change, it becomes less or more expensive to buy foreign assets, depending on the direction of the change. Exchange rate risk increases if the trader is exposed to international forex markets, though a trader can be exposed indirectly by owning shares in a company that does a lot of foreign trade, or by trading commodities priced in foreign currency. Further, a country with higher debt will have a high currency risk.

4. Commodity price risk

Commodities, such as crude oil, gold and wheat can experience sudden price fluctuations if there are any sort of political, regulatory or seasonal changes. This risk is known as commodity price risk. Commodity price changes can affect traders, investors, consumers and producers.

For example, a drought can affect wheat production and could therefore cause a price increase. If an individual has a position on wheat, the individual is exposed to this commodity price risk.

However, commodity price risk extends beyond the risk of price changes to the commodities themselves. They are the building blocks of most goods, which is why changes to their prices can have far-reaching consequences for companies and consumers. Price changes put strain on the entire supply chain, which ultimately affects economic performance.

NEED FOR MARKET RISK

Market Risk defines what should or should not be purchased by an investor at any given time and in any given situation. Every investor is unique and likewise every investor's perception of risk is unique. The key to long-term investing success is being able to stay invested in the proper asset class investments when things get ugly, and they always do. A successful investor will conservatively consider his market risk threshold when building out a portfolio of investments to match his/her risk tolerance. Wealth can be acquired over time by staying invested in the correct risk tolerance and asset allocation model, even when the market is down. Understanding market risk is the key! To analyze portfolio performance, one should be able to measure the expected return and risks of a portfolio. For this analysis, one needs to find the expected numbers, standard deviations, and correlations of a portfolio composed of randomly selected financial instruments in a random period of time. The framework of the study is consecutively conducted with risk types and the key concepts related to the measuring risk, VaR method.

CURRENT RELEVANT PRACTICES

Risk management is a crucial process used to make investment decisions. The process involves identifying and analysing the amount of risk involved in an investment, and either accepting that risk or mitigating it. Some common measures of risk include Standard Deviation (S.D.), Sharpe Ratio, R-Squared, Beta (β) and Value at risk (VaR).

1. Standard Deviation (S.D.)

Standard deviation measures the dispersion of data from its expected value. It is useful for making an investment decision to measure the amount of historical volatility associated with an investment relative to its annual rate of return. It indicates how much the current return is deviating from its expected historical normal returns. For example, a stock that has high standard deviation experiences higher volatility, and therefore, a higher level of risk is associated with the stock.

2. Sharpe Ratio

The Sharpe ratio measures performance as adjusted by the associated risks. This is done by removing the rate of return on a risk-free investment, such as a U.S. Treasury Bond, from the experienced rate of return.

This is then divided by the associated investment's standard deviation and serves as an indicator of whether an investment's return is due to wise investing or due to the assumption of excess risk.

3. R-Squared

R-Squared is a statistical measure that represents the percentage of a fund portfolio or a security's movements that can be explained by movements in a benchmark index. For fixed-income securities and bond funds, the benchmark is the U.S. Treasury Bill. The S&P 500 Index is the benchmark for equities and equity funds. R-squared values range from 0 to 100. According to Morningstar, a mutual fund with an R-squared value between 85 and 100 has a performance record that is closely correlated to the index. A fund rated 70 or less typically does not perform like the index.

4. Beta

Beta is another common measure of risk. Beta measures the amount of systematic risk an individual security or an industrial sector has relative to the whole stock market. The market has a beta of 1, and it can be used to gauge the risk of a security. If a security's beta is equal to 1, the security's price moves in time step with the market. A security with a beta greater than 1 indicates that it is more volatile than the market and a beta less than 1 indicates that the security is less volatile than the market.

5. Value at Risk (VaR)

Value at Risk (VaR) is a statistical measure used to assess the level of risk associated with a portfolio or company. The VaR measures the maximum potential loss with a degree of confidence for a specified period.

Risks arising from complex trading books can best be quantified and monitored using Value-at-Risk (VaR) methods. The advantages of VaR are manifold, including among others comparability among risk types, portfolios, or any other reporting dimensions. Value-at-Risk metrics allow capturing complex risk structures in a single figure which is easy to interpret and communicate.

a) Historical VaR method derives a portfolio's loss distribution based on historical market data movements. The scenarios are generated by applying historical shifts of risk factors (interest rates, exchange rates, equity prices etc.) to current market data. For each of these scenarios the portfolio is revalued and the P&L computed. VaR as well as other risk measures can be computed on the basis of the resulting P&L distribution.

b) Monte-Carlo VaR method derives the portfolio loss distribution, based on the simulation of multiple correlated random market scenarios. The portfolio is revalued under each of these market scenarios. The resulting P&L distribution is further used to calculate VaR and other risk. The solution's high-performance Monte-Carlo simulation engine allows to configure the complete scenario generation

METHODOLOGY

Sources of Data and Information

Data can be pulled out from many sources such as Money Control, Yahoo finance, NSE and BSE website, Bloomberg, Investing.com, and many such websites.

For calculation of VaR in Excel data was taken from Investing.com and for the purpose of RStudio data was extracted from Yahoo Finance.

Approach-Tools and Techniques of analysis

VaR measures only quantile losses and, in this way, it does not take into consideration any other loss situated above the VaR level. In this way, a risk manager that uses only VaR as a measure for evaluating the risk may be tempted to neglect losses that are situated within the confidence level while these losses increase above the VaR level.

VaR is not a coherent measure because it does not comply with the sub-additivity property. If an authority uses a non-sub-additivity measure of risk for establishing the necessary capital of a financial institution, this will be stimulated to divide in several subsidiaries for reducing the capital requirements. Also, the sub-additivity property is responsible for the decentralization of the management risk systems.

The three methods of estimating VaR are the parametric method, the historical simulation method, and the Monte Carlo simulation method.

The **Parametric method** of VaR estimation typically provides a VaR estimate from the left tail of a normal distribution, incorporating the expected returns, variance, and covariance of the components of the portfolio.

The **Historical simulation method** of VaR estimation uses historical return data on the portfolio's current holdings and allocation. The historical simulation method has the advantage of incorporating events that actually occurred and is only useful to the extent that the future resembles the past.

The **Monte Carlo simulation method** of VaR estimation requires the specification of a statistical distribution of returns and the generation of random outcomes from that distribution. It is an extremely flexible but complex and time consuming method to use.

For quantifying losses, in the case of unexpected events on the market, managers use stress tests. Stress tests are considered to be management tools use to evaluate the potential impact upon the portfolio values in the case of unexpected events within a set of financial variables. Stress tests are built based upon some historical scenarios and hypothetical events or a combination of those two. Once a probability is associated to a scenario a proper measure for quantifying risk may be obtained.

ANALYSIS & INTERPRETATION

Unlike standard deviation, VaR basically takes into consideration the extreme values or happenings which may affect the portfolio for example covid-19, the subprime crises, and other such incidents. Value at risk is the maximum amount of money that may be lost on a portfolio over a given period of time, with given level of confidence. For an example, daily VaR of 100 Euros with confidence level of 95%, means that in normal market conditions- or in 95 out of 100 days loss will not exceed 100 Euros.

For the purpose of this report I have created a portfolio of 4 Large cap equities and 2 major currencies. Large cap equities consist of Tata Steel Ltd., Infosys Ltd., Wipro Ltd. and Asian Paints Ltd. and the major currencies taken for portfolio are USD(\$) and EURO(€). Data for closing prices of all equities and currencies are extracted from yahoo finance and all are NSE prices. The data taken for calculating market risk and expected shortfall (ES) is for the period of 1 year starting from 7th February 2020 to 7th February 2021.

Using Excel, daily log returns are calculated on the closing prices of equities and currencies. Different weights are assigned to large cap equities and the currencies and under these proportionate weights are given to individual equities and currency. After calculating log returns, Simulated Profit and loss on a daily log value is computed.

To assess the possible portfolio returns we used the historical approach it considers all the possibilities that have already happened in the past. All the equity stocks and forex currencies were calculated based on this. Based on the simulation returns portfolio was created and some factors were taken hypothetically like the mv of equity, currency and portfolio. So basically these are the market value of these stocks.

I have taken the confidence level of 95% for the portfolio which indicates that there is only a 5% chance that the value of the portfolio will drop below its estimated value. Based on this, according to my portfolio VaR came to 21.0124 million. This means that with all the current stocks in the portfolio total loss can be up to 21.0124 million overall.

After this Expected shortfall (ES) was calculated by taking into consideration the portfolio values. Expected shortfall is a risk measure sensitive to the shape of the tail of the distribution of returns on a portfolio, unlike the more commonly used VaR. Expected shortfall is calculated by averaging all of the returns in the distribution that are worse than the VAR of the portfolio at a given level of confidence. After calculating Expected shortfall Stress Value was generated which states that if a very rare and particular situation happens because of which all the stocks and currencies and portfolio are affected adversely then what will be the total risk value. In simple terms it is the highest loss any investor can occur in a particular stock or portfolio. Under my portfolio biggest loss overall was of 105.2675. The main results of the VaR and ES test shows that the increased losses of the portfolio may be determined by the increased volatility of the market. We also considered Gaussian and Modified model while analysing risk in R studio. Gaussian usually takes normal conditions into consideration and in modified Skewness and Kurtosis is considered while calculating VaR.

CONCLUSION

One should create a portfolio combining high-risk and risk-free investment instruments, and thus balance optimal revenue level and reasonable risk level. The most common financial instruments in portfolio investments are equity securities and bonds. While a portfolio is created, investment instruments should be diversified based on risk and expected revenues. A company's profitability and market conditions play key roles in setting the value of equity securities in capital markets. When all information regarding market expectations is bought, an investor aiming for high revenues and low risk is expected to switch from bonds and promissory notes to shares. Modern portfolio theory stresses the correlation between securities. "In this approach, portfolio diversification cannot eliminate risks as securities (or groups of securities) move under the same market trends". According to modern portfolio theory, market is efficient. All available information on the market affects the prices, investors can access to all information. Nevertheless, financial risks may remain steady or be changeable according to the economic conditions or portfolio diversification. As a result, the risks and returns on investment should consider together and quantitative methods should apply for making investment decision.

BIBLIOGRAPHY

<https://cleartax.in/g/terms/market-risk>

<https://corporatefinanceinstitute.com/resources/knowledge/trading-investing/market-risk/>

<https://www.ig.com/en/trading-strategies/market-risk-explained-190213>

<https://www.investopedia.com/ask/answers/041415/what-are-some-common-measures-risk-used-risk-management.asp>