

**Czech University of Life Sciences Prague**

**Faculty of Economics and Management**

**Department of Management**



**Diploma Thesis**

**Security Analysis using CAPM Model**

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# CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

## DIPLOMA THESIS ASSIGNMENT

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**Security Analysis using CAPM Model**

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### Objectives of thesis

The main aim of the thesis is to pursue the practical application of the CAPM Model by comparing the actual risk and return with the estimated risk and return. It also analyses the performance of companies of selected index and aid the investors in making the investment decision.

The following research questions are raised in this study:

1. What is the most profitable NIFTY50 based on CAPM model?
2. What is the actual and estimated risk and return of the investment of the top 50 Indian Companies?
3. What are the undervalued and overvalued securities?

### Methodology

Methodology for the literature overview is based on data collection from the relevant legal framework, specialized publications and other written or online sources. The practical part of the thesis will be based on the information gained from the published annual reports of the chosen company. CAPM Model will be used to assess the performance of the companies and to prepare the practical part of the thesis. The methods of analysis, synthesis, comparison, and deduction will be used to formulate the conclusions of the thesis. The stock prices of selected companies will be analysed for assessment of performance of securities. The selected company for analysis includes all the companies of Nifty. The analysis covers a period of 10 years, i.e., starting from 1st April 2012 to 31st March 2022. The data of stock prices will be obtained from the website of NSE. The definition of the stock market and stock exchange, the information about stock market industry as well as the information about various portfolio theories are included in the literary review of this thesis.

The formula used to calculate the CAPM model is as follows :

$$ER_i = R_f + \beta_i (R_m - R_f)$$

Where :  $E(r_i)$  – Expected return of investment

$R_f$  – Risk Free rate

$\beta_i$  – Beta of the investment (Systematic Risk)

$(R_m - R_f)$  – Market Risk premium

The market risk premium has been defined and explained to negate the Average return of the stock and the Safe long term government treasury bills.

The  $\beta$  of the investment is the measure of market risk. When  $\beta$  is equal to 1, then the market is up by +1% and the stock is up by +1%. This determines the relationship between market and investment. It is seen that the stock fluctuates more when in comparison with the market. The stocks are always relatively moving faster. To answer the question whether or not  $\beta$  can be negative? it's yes, there are some assets that are negatively correlated with the market so when the assets go up  $\beta$  goes up and similarly, when assets go down the  $\beta$  goes down.

Some of the application of the CAPM model are :

1. Cost of equity for stock valuation
2. Inclusion of stock for a diversified portfolio can be made using the CAPM model

To analyse the securities, and to verify whether they are undervalued or overvalued the stock prices of the top 50 Indian companies were selected. They are called the NIFTY 50 index. This is an index used to evaluate the corrective value of a stock in the Indian market. The three day moving average method was used to calculate the closing price of stock. Adjacent closing price was selected, since the closing price doesn't calculate the dividends while that with adjacent stocks calculates the dividends. The formula to calculate the three day moving average was as follows :

$$R_i = \frac{(\text{Opening Price} - \text{Closing Price})}{(\text{Closing Price})} \times 100$$

The theoretical rate of return of an investment with zero risk is termed as risk free rate. Although it is well known that practically it is impossible to have a risk free return from a security. When there is an investment on a security there is bound to be some sort of risk. Although, the National stock exchange of India (NSE) defines the risk free rate with respect to the local market as 6.23% taken from the state treasury bonds.

To find out the the undervalued and overvalued stock, we use the Security market line method as well as the  $\alpha$  method. The  $\alpha$  method shows whether to invest or disinvest from securities whereas the SML graphs shows the undervalued and overvalued stocks.

Based on the above calculations, the investors are recommended on what type of stocks to invest upon which gives the max profit with lesser risk free rate.

**The proposed extent of the thesis**

60-70 p.

**Keywords**

• CAPM – Capital Asset Pricing model • BSE – Bombay stock Exchange • Nifty 50 • Investment portfolio • Risk • Return • SEBI – Securities & Exchange Board of India • NSE -National Stock Exchange

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## **Declaration**

I declare that I have worked on my diploma thesis titled "**Security Analysis using CAPM Model**" by myself, and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that it does not break the copyrights of any person.

In Prague on date of submission

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# Security Analysis using CAPM Model

## Abstract

The analysis of securities is important for obtaining maximum return at minimum risk. Most of the investors face difficulties in making effective investment decision. They suffer from a lot of problems not only in selection of security but also in deciding about which security to hold. Thus, it becomes essential to analyse securities before making investment decision. The thesis's primary goal is to analyse securities using Capital Asset Pricing Model. The thesis consists analysis of fifty scrips of Nifty 50. The data of daily historical stock prices of securities are taken into consideration for preceding 10 years i.e., from 2012 to 2022. The return, risk and beta are calculated for each security. In addition to this, the expected return is also calculated for each security using CAPM Model. After the calculation of expected return, alpha value is determined which in turn recommended investors regarding whether to invest or disinvest from particular security. Moreover, the security market line is formed based on beta and return of securities which helped investors in identifying undervalued and overvalued securities. The investors are suggested to invest in undervalued securities as compared to overvalued securities because the undervalued securities have potential to provide more return in future. The insights of analysis are covered under the result and discussion chapter. The synthesis of whole thesis is provided in the form of conclusion.

**Keywords:** CAPM Model, Portfolio Theory, Security Analysis, Risk, Return, Nifty 50

# Analýza cenných papírů pomocí modelu CAPM

## Abstrakt

Analýza cenných papírů je důležitá pro dosažení maximálního výnosu při minimálním riziku. Většina investorů se potýká s obtížemi při přijímání efektivních investičních rozhodnutí. Trpí mnoha problémy nejen při výběru cenných papírů, ale také při rozhodování o tom, který cenný papír držet. Proto se stává nezbytnou analýza cenných papírů před přijetím investičního rozhodnutí. Hlavním cílem této práce je analyzovat cenné papíry pomocí modelu oceňování kapitálových aktiv. Diplomová práce se skládá z analýzy padesáti skriptů Nifty 50. V úvahu jsou brány údaje o denních historických cenách cenných papírů za předchozích deset let, tj. od roku 2012 do roku 2022. Pro každý cenný papír je vypočítán výnos, riziko a beta. Kromě toho je pro každý cenný papír vypočítán také očekávaný výnos pomocí modelu CAPM. Po výpočtu očekávaného výnosu se určí hodnota alfa, která následně investorům doporučí, zda investovat, nebo neinvestovat do určitého cenného papíru. Kromě toho je na základě beta a výnosu cenných papírů vytvořena linie trhu cenných papírů, která investorům pomohla identifikovat podhodnocené a nadhodnocené cenné papíry. Investorům se doporučuje investovat do podhodnocených cenných papírů ve srovnání s nadhodnocenými cennými papíry, protože podhodnocené cenné papíry mají potenciál zajistit v budoucnu vyšší výnos. Poznatky z analýzy jsou uvedeny v kapitole Výsledky a diskuse. Syntéza celé práce je uvedena v podobě závěru.

**Klíčová slova:** Model CAPM, teorie portfolia, analýza cenných papírů, riziko, výnos, Nifty 50



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## **1. Introduction**

Markets for financial instruments supply a place where they can be bought and sold, and therefore they are an important aspect of the financial system. The way securities are priced in the capital market has long been a source of worry for both companies and investors. A financial opportunity's risk and reward have a direct impact on the price of any assets. Until the mid-20th century, there were few attempts to construct a consistent asset pricing method. (Fisher and Lorie, 1964) developed Capital Asset Pricing Model (CAPM) when he noticed that the old investment models were unable to evaluate the risk-return relationship of a security coupled with its pricing behaviour. CAPM can be used to evaluate any security, because to the model's flexibility. In this method, the price of a security is set by comparing its predicted return to its risk (Ratra, 2017). CAPM demonstrates how a stock market's expected return on an asset is calculated (Mukherjee and Metia, 2001). Share returns can be explained by variables other than beta risk. Investors should exercise caution when using the model to assess the performance of their investment (Laubscher, 2002). In government-backed instruments, such as Treasury bills and bonds, the default risk is zero. To computing total return, the risk-free return and the risk premium included in the CAPM are used. The degree to which a risk is accepted decides the risk premium. Systematic risk is the difference between the risk-free rate of return and the risk-adjusted rate of return.

## **2. Objectives and Methodology**

### **1.1 Objectives**

The main aim of the thesis is to pursue the practical application of the CAPM Model by comparing the actual risk and return with the estimated risk and return. It also analyses the performance of companies of selected index and aid the investors in making the investment decision.

### **1.2 Methodology**

Methodology for the literature overview is based on data collection from the relevant legal framework, specialized publications and other written or online sources. The practical part of the thesis will be based on the information gained from the published annual reports of the chosen company. CAPM Model will be used to assess the performance of the companies and to prepare the practical part of the thesis. The methods of analysis, synthesis, comparison, and deduction will be used to formulate the conclusions of the thesis. The stock prices of selected companies will be analysed for assessment of performance of securities. The selected company for analysis includes all the companies of Nifty. The analysis covers a period of 10 years, i.e., starting from 1st April 2012 to 31st March 2022. The data of stock prices will be obtained from the website of NSE. The adjusted closing prices will be taken into consideration for the purpose of analysis because it considers the other factors like dividends, stock splits etc. while the closing price doesn't consider the effect of other factors. Therefore, the adjusted closing prices are more accurate measure of stock value as compared to closing prices. The definition of the stock market and stock exchange, the information about stock market industry as well as the information about various portfolio theories are included in the literary review of this thesis.

### **1.3 Research Tools**

The various measures used for analysis are as follows:

#### **Return**

Return indicates the reward for understanding investment(Chandra, 2017) It is defined as the total gain or loss over a stipulated period of time. The adjusted closing prices of 50 securities

for past 10 years have been considered for calculation of return. It is calculated by using the following formula:

**Formula 1 : Calculation of Return**

$$Ri = \frac{(Pe - Pb)}{Pb} \times 100 \quad (1)$$

where,

Pe= Price of ending year

Pb= Price of begining year

**Standard deviation**

Risk means the dispersion of variable. The widely used measure of risk in finance is standard deviation. Standard deviation is a measure of the dispersion of a set of data from its mean. It can also be calculated as the square root of variance. The standard deviation can be calculated by using formula 2 which is mentioned below (Chandra, 2017).

**Formula 2 : Calculation of Standard deviation**

$$\sigma = \sqrt{\frac{\sum(Ri - \bar{Ri})^2}{n-1}} \quad (2)$$

Where,

Ri = Actual rate of return

$\bar{Ri}$  = Average rate of return (mean)

n = Number of time period

**Beta**

The Systematic risk of the stock has been measured using the beta. Beta is a numeric value that measures the fluctuations of a stock to changes in the overall stock market. Beta measures the responsiveness of a stock's price to changes in the overall stock market (Economicstimes.com, 2020). The beta is calculated by using formula 3 which is as follows:

**Formula 3 : Calculation of Beta**

$$\beta = \sqrt{\frac{\sum(Ri - \bar{Ri})(Rm - \bar{Rm})}{\sum(Rm - \bar{Rm})^2}} \quad (3)$$

Where,

$R_i$  = Actual rate of return

$\overline{R_i}$  = Average rate of return (mean)

$R_m$  = Actual rate of market return

$\overline{R_m}$  = Average rate of market return (mean)

### **Alpha**

Alpha is a measurement used to determine how well an asset or portfolio performed relative to its expected return on investment with a given amount of risk (Wall, 2017) The alpha is calculated by using formula 4 which is mentioned below:

#### **Formula 4 : Calculation of Alpha**

$$\text{Alpha} = \text{Actual return} - \text{Required return} \quad (4)$$

### **Capital Asset Pricing Model**

Capital Asset Pricing Model is developed on the basis of Markowitz Portfolio Theory. It describes the relationship between the risk and return of security. The formula of Capital Asset Pricing Model is as Same as formula of Security Market Line which is described below (Sekreter, 2017):

#### **Formula 5 : Calculation of CAPM**

$$R_i = R_f + \beta(R_m - R_f) \quad (5)$$

Where,

$R_i$  = Rate of a stock return

$R_f$  = Risk-free rate of return

$\beta$  =  $\text{Cov}(R_i, R_m) / \text{var}(R_m)$

$R_m$  = Rate of market return

## **3. Literature Review**

### **3.1 Indian Stock Market**

A company's ownership right is represented by a share or stock. When a company is registered with the authorities, it must begin operations with a specified amount of capital from its owners. This shows who owns the business. A company's ownership structure is mirrored in its shareholding pattern. As a result, everybody who buys a share of a firm is a partly owner of the company until the shares are transferred to them. They no longer own it after they sell it. Stocks or shares are bought and sold in the market, and ownership patterns change over time. It is a product with a market, and the dynamics of supply and demand decide its price. Although shares signify ownership, a major part of share trading occurs every day for the purpose of profiting from price appreciation.

A person who owns a stock is entitled to the dividends declared on the shares. The individual must, however, hold the shares on that date to receive the dividend (Chaudhuri, 2018). Markets for the issuance, buying, and selling of publicly traded stocks are known as the "stock market" (CFI, 2018). The Indian Stock Market is one of the most established Stock Markets in Asia. Before the eighteenth century, the East India Company used to execute Loan Securities (Raju and Paldon, 2019). Exchanging on business stocks and offers in Bank and Cotton presses took place in Mumbai throughout the 1830s. According to Mark Twain, the world is divided into two types of people: those who have seen a notable Indian site, such as the Taj Mahal, and those who have not.

He said the same thing about budgeting directors. There are two types of agents: those who consider project opportunities in India and those who have no knowledge (Raju and Paldon, 2019). The East India Company started trading in loan securities in the 18th century, and this is when security trading began in India. With the stock of Bank and Cotton presses, corporate shares were first exchanged in Mumbai (now Mumbai) in the 1830s. The modest and informal beginnings of stock exchanges in India may be traced back to the 1850s, when twenty-two stockbrokers started trading under a banyan tree in front of Bombay's Town Hall. The tree can still be found in the Horniman Circle neighbourhood (India, 2018). A decade later, the location was changed to banyan trees at the Meadows Street intersection, which is now called as Mahatma Gandhi Road.

As the number of brokers grew, the shift continued, eventually settling in 1874 on what is now known as Dalal Street. The Bombay Stock Exchange (BSE) was founded in



1875 by an informal group named as the Native Share and Stockbrokers Association. The BSE is Asia's oldest stock exchange and was the first to be awarded permanent status under the Securities Contract Regulation Act, 1956. (India, 2018). The Ahmedabad Stock Exchange, which concentrated on trading in shares of textile mills, followed the BSE in 1894. The Calcutta Stock Exchange first opened its doors in 1908, dealing plantation and jute mill shares.

The Madras Stock Exchange was set up in 1920. (India, 2018). There are currently twenty-four stock exchanges in the country, twenty-one of which are regional markets with designated territories. The National Stock Exchange (NSE) and the Over-the-Counter Exchange of India (OICEI), both set up during the reform era, have the mandate to have nation-wide trading (Chand, 2020). They have offices in Ahmedabad, Vadodara, Bengaluru, Bhubaneswar, Mumbai, Kolkata, Kochi, Coimbatore, Delhi, Guwahati, Hyderabad, Indore, Jaipur, Kanpur, Ludhiana, Chennai, Mangalore, Meerut, Patna, Pune, Rajkot, and Vadodara (Chand, 2020). The governing boards and executive chiefs of the stock exchanges oversee running them.

The Ministry of Finance sets up policies for their regulation and management. In April 1988, the government set up the Securities and Exchange Board of India (SEBI) to oversee the development and regulation of the securities industry and stock exchanges (Chand, 2020). The BSE dominated the amount of trading in the post-independence era. However, due to a lack of transparency and unreliable clearing and settlement systems, as well as other macro reasons, a financial market regulator was needed, and the SEBI was set up as a non-statutory entity in 1988. In 1992, it became a statutory entity (Investeek India, 2018). Following the Harshad Mehta stock market fraud in 1992, there was a pressing need for a new stock exchange huge enough to compete with the BSE while also bringing greater transparency to the stock market.

The National Stock Exchange was born because of this (NSE). It was founded in 1992, was appointed as a stock exchange in 1993, and began trading in 1994. It has been the first stock exchange to allow for electronic trading. In response to this rivalry, the BSE launched BSE On-line Trading (BOLT) in 1995, an electronic trading system (India, 2018). In 1986, the BSE created the Sensex, which is currently known as the S&P BSE Sensex, with 1978–79 as the base year. This is a benchmark stock index made up of thirty businesses that measures the exchange's overall performance. In July 1990, the index reached 1,000, then

2,000 in January 1992, then 4,000 in March 1992, 5,000 in October 1999, and 6,000 in February 2000.

In the year 2000, the exchange began offering equity derivatives. In June 2001, index options, stock options, and stock futures were introduced, followed by index options in July 2001 and stock futures in November 2001. BSE Teck, India's first free-float index, was created in July 2001. (India, 2018). In 1996, its competitor, the NSE, launched the CNX Nifty, now called as the Nifty 50, as its benchmark exchange. It consists of fifty stocks and serves as the exchange's performance indicator. It outperformed the BSE in terms of electronic screen-based trading and derivatives, launching first-of-their-kind products and services (India, 2018).

The Indian stock exchange is divided into two stock exchanges: BSE stands for Bombay Stock Exchange, and NSE stands for National Stock Exchange. The BSE was set up in 1875. The NSE was set up in 1992 and began trading in 1994. The two exchanges are looking for a close match in terms of trading hours, structure, and settlement process, among other things. The BSE has 4,700 registered entities at the time of our latest review, while the NSE had only 1,200. The BSE's top five hundred companies account for more than 90% of the market's value; the rest is made up of extremely illiquid stocks (Raju and Paldon, 2019). Extra segments of the movement system were started in 1991, when capital markets development was considered a major part of the re-trying structure.

Indian marketplaces have now reached general norms in terms of degree structure and working ability (Raju and Paldon, 2019). The Securities and Exchange Board of India (SEBI), which has been merged in 1992 as a free specialised, manages the overall development, supervision, and regulation of the stock market. Since then, the SEBI has worked tirelessly to set up market arrangements based on the best market practises. It has broad powers of imposing orders on market participants if a breach of norms (Raju and Paldon, 2019). A capital market is a financial market that buys and sells long-term debt (over a year) and equity-backed securities, as opposed to a money market, which buys and sells short-term debt.

The money of savers is channelled through capital markets to those who can putting it to long-term productive use, such as businesses or governments undertaking long-term investments (O'Sullivan and Sheffrin, 2005). Financial regulators such as the Securities and Exchange Board of India (SEBI), the Bank of England (BoE), and the Securities and Exchange Commission of the United States (SEC) regulate capital markets, among other

things, to protect investors against fraud. A capital market is a place where buyers and sellers trade financial securities such as bonds, stocks, and other derivatives. Individuals and institutions take part in the trade (Jamapunji.pk, 2019). Most securities traded on the capital market are long-term.

The scale of a country's capital markets is directly proportional to its economy, which implies that small ripples in one corner can generate big waves in another (Jamapunji.pk, 2019). Types of Capital Market - There are two sorts of capital markets: primary and secondary. Primary Market - The primary market is where fresh shares or securities are sold. A primary market is when a corporation sells new securities to investors in exchange for cash (buyer) (Jamapunji.pk, 2019). It deals with the trading of contemporary issues of stocks and other securities sold to investors. Secondary Market - The secondary market is where investors can trade existing or previously issued securities. Once new securities have already been sold in the primary market, they must be resold in an efficient way.

Investors can use secondary markets to resell or exchange their existing securities. The nature of the security sold or bought, i.e., stock market and bond market, is another key divide in the capital market (Jamapunji.pk, 2019). The phrases 'Stock' and 'Exchange' are combined to form the term "Stock Exchange." Stock refers to a part or fraction of a company's capital, and Exchange refers to the act of transferring ownership; it also refers to a market for buying and selling. As a result, the stock exchange can be described as a market or a location where various sorts of securities are bought and traded. Shares issued by corporations, unit trusts, derivatives, pooled investment products, and bonds are all examples of securities traded on a stock exchange.

The stock exchange is sometimes called as the 'assets market' or 'securities exchange' because it deals in a variety of securities. Because trading takes place only for securities which have already been issued to the public and are now eligible to be exchanged on the floor of a stock exchange after being listed with the stock exchange, a stock exchange is a secondary market for securities. The primary market is where stocks and bonds are first offered to investors, and the secondary market is where they are traded after that (Technofunc.com, 2013).

A stock exchange is described as an "association, organisation, or body of individuals, whether incorporated or not, created for the purpose of helping, regulating, and controlling the business of buying, selling, and dealing in Securities" under the Securities Contracts (Regulation) Act of 1956 (Technofunc.com, 2013). "Securities exchanges are market venues

where securities that have been listed there may be bought and sold for either investment or speculation," according to Pyle (Technofunc.com, 2013). "An association of persons involved in the buying and selling of stocks, bonds, and shares for the public on commission and regulated by particular norms and regulations," writes K.L. Garg (Technofunc.com, 2013). The most essential functions of stock exchanges are as follows:

Deciding a reasonable price - The stock markets make it easier to find reasonable pricing for publicly traded stocks. Trading securities incessantly aids in deciding the price of listed securities (ClearTax.in, 2022). Advancing industrial development - The availability of capital is critical to a country's industrialization. This is ensured by stock exchanges, which allow the general people to invest directly in firms (ClearTax.in, 2022). Defending the interests of investors - The stock markets set rules for how listed companies should run. Companies must adhere to these guidelines to preserve investors' interests, as they are the ones who funded the activities. Any key decision made by the company must be brought to the attention of the stock exchange (ClearTax.in, 2022).

Assume secondary market roles - Investors in certain bonds, such as sovereign gold bonds (SGBs), will be able to sell their holdings before the lock-in period or maturity date if they use stock exchanges (ClearTax.in, 2022). Corporates' reliance on loans should be reduced - The existence of stock exchanges has aided listed companies in avoiding the need for a loan by allowing them to raise cash through the issuance of securities. This has allowed them to save a large amount in interest payments (ClearTax.in, 2022).

List of Indian stock exchanges. The following is a list of Indian stock exchanges that run Bombay Stock Exchange (BSE) - The Bombay Stock Exchange (BSE) began as little more than a social meeting of stockbrokers in 1875 and was renamed the Bombay Stock Exchange in 1876. (BSE). The Government of India recognised the Bombay Stock Exchange as the real Stock Exchange in the country in 1956, as showed by the Securities Contracts Regulation Act (Raju and Paldon, 2019). In any event, there was no meaningful system for evaluating the exchange's overall execution. In 1986, the Bombay Stock Exchange (Sensx = Sensitive Index) created BSE Sensx, an outline of the top 30 affiliations, which supplied an approach to deal with monitor straight measure the Exchange's overall performance (Raju and Paldon, 2019). The Bombay Stock Market, or BSE, was founded in 1875 and is not just India's but also Asia's oldest stock exchange. It is India's largest stock exchange, with headquarters in Mumbai, Maharashtra. BSE's market capitalization was \$2.8 trillion in February 2021. (ClearTax.in, 2022).

National stock exchange (NSE) - The Bombay Stock Exchange was beaten in April 1992 because of the Harshad Mehta Scam. Dr. Manmohan Singh, who has served in the past, has advocated that other stock exchanges collaborate with the BSE. He pushed the Industrial Development Bank (IDB) out of the task for causing a squabble in the BSE (Raju and Paldon, 2019). The National Stock Market (NSE) was set up in November 1992 as the first electronic stock exchange in India. In terms of business operations, the NSE has become India's best stock exchange (Raju and Paldon, 2019)). The National Stock Exchange of India pushed the S&P CNX Nifty index in 1996. CNX (Nifty = National Fifty) is a redesigned index that includes 50 equities from 25 different economies. The webpage was launched by the National Stock Exchange of India in 1998. It was the veritable exchange in India that began exchanging stock on the Internet in the year 2000. Currently, NSE has a 100 percent gigantic worth accomplice turnover rate and a 66 percent focal worth spot turnover rate. The NSE and BSE are two of India's official stock exchanges, with the NSE and BSE being the finest (Raju and Paldon, 2019). The National Stock Exchange (NSE) was founded in 1992. It is India's first stock exchange to supply investors a decentralised electronic trading platform. According to the most recent figures, the NSE's market capitalization was \$2.27 trillion. NSE, like BSE, is headquartered in Mumbai, Maharashtra (ClearTax.in, 2022).

Calcutta Stock Exchange (CSE) - In 1908, the Calcutta Stock Exchange (CSE) was set up. Kolkata, West Bengal, is where the company's headquarters are found. The Securities and Exchange Board of India has urged the CSE to leave (SEBI). However, the case is currently being heard by Kolkata High Court (ClearTax.in, 2022). India International Exchange (India INX) - In 2017, the India International Exchange, or India INX, was set up. It was the first international stock exchange in India. It is a subsidiary of BSE and is based in Gujarat International Finance Tec-City (Clear tax, n.d.). Metropolitan Stock Exchange (MSE) - In 2008, the Metropolitan Stock Exchange (MSE) was set up. The MSE is a modern clearing house that was set up to manage the clearing and settlement of contracts forming diverse asset types. Mumbai, Maharashtra, is where it is based (ClearTax.in, 2022). NSE IFSC Ltd (NSE International Exchange) - In 2016, the NSE IFSC Limited (NSE International Exchange) rose to prominence. It is a division of the New York Stock Exchange. Gujarat International Finance Tec-City is where it is based (ClearTax.in, 2022).

Bombay Stock Exchange - BSE Limited, often referred as the Bombay Stock Exchange (BSE), is a stock exchange in Mumbai, India. It is found on Dalal Street. Cotton merchant Premchand Roychand, a Rajasthani Jain industrialist, founded the company in

1875. (PTI, 2018). It is Asia's oldest stock market (Rawal, 2015) as well as the tenth oldest in the world (Oldest.org, 2020). As of January 2022, the BSE is the ninth largest stock exchange in the world, with a market capitalization of more than 276.713 lakh crore (World-exchanges.org, 2019). Premchand Roychand founded the Bombay Stock Exchange in 1875. (PTI, 2017).

While Dalal Street is today linked with BSE Limited, this was not always the case. Five stock dealers gathered under a Banyan tree in front of Mumbai Town Hall in the 1850s, where Horniman Circle now stands (Malepati, 2015). After a decade, the brokers moved to a lush new location, this time under banyan trees at the intersection of Meadows Street and what was then known as Esplanade Road, now Mahatma Gandhi Road. They had to move around a lot due to the rapid increase in the number of brokers. Finally, in 1874, the brokers were able to secure a permanent address that they could call their own. In 1875, the brokers formed "The Native Share & Stockbrokers Association," an official organisation (BSEIndia, 2014).

Until 1928, the Bombay Stock Exchange was housed in a building near the Town Hall. The exchange bought the current location near Horniman Circle in 1928, and a structure was built and inhabited in 1930. Because of the location of the exchange, the street on which the property is found has been dubbed Dalal Street in Hindi (meaning "Broker Street"). The BSE was the first stock exchange registered by the Indian government under the Securities Contracts Regulation Act on August 31, 1957. The Phiroze Jeejeebhoy Towers, found on Dalal Street in the Fort district, began construction in the late 1970s and was completed and inhabited by the BSE in 1980. Following the death of Sir Phiroze Jamshedji Jeejeebhoy, chairperson of the BSE since 1966, the building's name was changed shortly after occupation to Sir Phiroze Jamshedji Jeejeebhoy Towers.

The S&P BSE SENSEX index was created in 1986, offering the BSE a way to track the exchange's overall performance. The BSE used this index to launch its derivatives market in 2000, where S&P BSE SENSEX futures contracts were traded. In 2001 and 2002, the BSE expanded its trading platform by developing S&P BSE SENSEX options and equity derivatives. During the 1993 Bombay bombings, a vehicle bomb exploded in the basement of the building on March 12, 1993. (News18.com, 2017).

The Bombay Stock Exchange, which had previously been an open outcry floor trading exchange, transitioned to an electronic trading system built by Cmc ltd. in 1995. The shift took only 50 days for the swap. BSE On-Line Trading (BOLT), an automated, screen-based

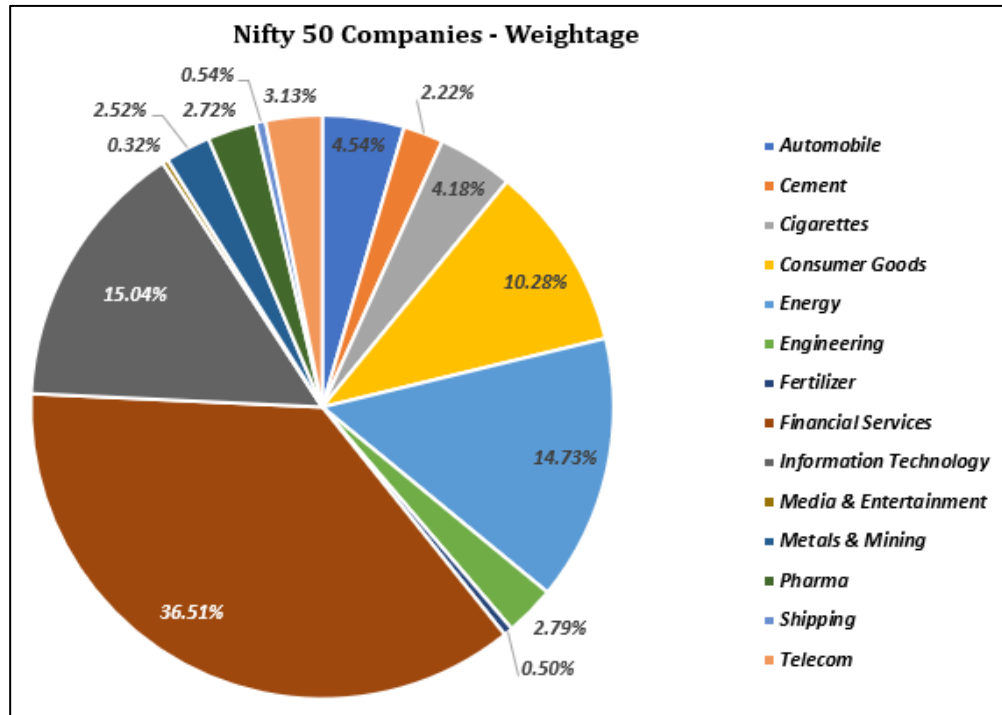
trading platform, has a daily capacity of eight million orders. BSE has now raised capital through issuing shares, and the BSE share, which is listed on the NSE, closed on 3 May 2017 with a price of 999. In September 2012, the BSE became a Partner Exchange of the United Nations Sustainable Stock Exchange project (UNCTAD, 2012). On December 30, 2016, the BSE launched India INX. India INX is the country's first international exchange (Indiainx.com, 2017). Gold and silver commodities futures contracts are now available on the BSE (PTI, 2018).

National Stock Exchange - The National Stock Exchange of India Limited (NSE), headquartered in Mumbai, Maharashtra, is India's largest stock exchange. According to figures kept by the Futures Industry Association (FIA), a derivatives trade association, it will be the world's largest derivatives exchange in 2021 by number of contracts traded. According to World Federation of Exchanges (WFE) figures for the calendar year 2021, the NSE is ranked fourth in the world in cash equities by number of deals. It is owned by a number of major financial institutions, banks, and insurance firms (Simpson, 2022).

The National Stock Market (NSE) was founded in 1992 as the country's first dematerialized electronic exchange. The NSE was the first exchange in the country to offer a contemporary, fully automated screen-based electronic trading system that allowed investors from all over the country to trade with ease. NSE's Managing Director and Chief Executive Officer is Vikram Limaye. As of August 2021 (World-exchanges.org, 2021), the National Stock Exchange had a total market capitalization of more over US\$3.4 trillion, making it the world's 10th largest stock exchange.

The NSE's flagship index, the NIFTY 50, is a 50-stock index that is widely recognised as a gauge of the Indian capital market by investors in India and around the world. NSE created the NIFTY 50 index in 1996. (Indiainfoline.com, 2019). However, according to Vaidyanathan, the stock exchanges in India account for only roughly 4% of the Indian economy or GDP. Unlike in the United States, where huge corporations account for approximately 70% of GDP, India's corporate sector accounts for about 12–14 percent of national GDP (as of October 2016). Barely 7,400 firms are listed, with only four thousand trading on the BSE and NSE stock markets. As a result, the BSE and NSE stocks account for only about 4% of the Indian economy, which obtains most of its income from the so-called unorganised sector and family spending.

Figure 1 – NIFTY 50 Weightage



Source: (Indiainfoline.com, 2019)

According to the Economic Times, as of April 2018, 6 crore (sixty million) retail investors in India had invested their savings in stocks, either directly or through mutual funds (Thukral, 2018). According to research by the Bimal Jalan Committee, only 1.3 percent of India's population invests in the stock market, compared to 27 percent in the US and 10 percent in China (Moneylife.in, 2011). The NSE's efficient leadership positions across asset classes in the Indian and global exchange industries attest to the exchange's stability and liquidity.

NSE was set up in 1992. In April 1993, SEBI appointed it as a stock exchange, and it began operations in 1994 with the opening of the wholesale debt market, supports the establishment of the cash market section shortly after. Sensex and Nifty are stock market indices, while BSE and NSE are stock exchanges. A stock market index is a real-time summary of the market's moves. A stock market index is built by combining stocks of similar types. The Bombay Stock Exchange's stock market index, known as the Sensex, stands for 'Stock Exchange Sensitive Index.' Nifty is the index for the National Stock Exchange and stands for 'National Stock Exchange Fifty' (Indiainfoline.com, 2019).



### **3.2 Security & Exchange Board of India**

BSE continued to run with limited forthrightness and delicate clearing and settlement mechanisms until the late 1980s. The new economic powers, money shortages, and economic movement that marked the end of the 1980s emphasised the need for modernization of the budgetary framework. In 1988, the government set up the Securities and Exchange Board of India (SEBI) (Raju and Paldon, 2019). The Securities and Exchange Board of India (SEBI) is an Indian regulator of financial markets that was founded on April 12, 1988. It began as a non-statutory body, meaning it had no authority over anything, but in 1992, it was recognised an independent body with statutory powers. This regulatory authority manages overseeing India's securities market. As a result, it is critical to understand the goal and purpose of the project (Elearnmarkets.com, 2022)

Capital markets became the new craze among Indians at the late 1970s and the beginning of the 1980s. Unauthorized self-styled merchant bankers, unauthorized private placements, price rigging, non-compliance with the Companies Act, violation of stock exchange rules and regulations, lag in transfer of shares, price rigging, and other malpractices began to appear. People began to lose faith in the stock market because of these misdeeds. The government was compelled to create an entity to control working conditions and reduce malpractices. As a result, the government set up the Securities and Exchange Commission of India (SEBI) (Elearnmarkets.com, 2022).

This regulatory authority runs as a watchdog for all capital market participants, and its principal goal is to create an atmosphere for financial industry lovers that makes the securities market more efficient and smoother. SEBI also has a significant impact on the economy (Elearnmarkets.com, 2022). To do so, it assures that the three primary actors in the financial market, namely issuers of securities, investors, and financial intermediaries, are taken care of.

1. Securities issuers - These are corporate entities that raise capital from a variety of sources in the market. This company ensures that they have a safe and transparent environment in which to conduct their business (Elearnmarkets.com, 2022).
2. Investor - Investors are the person who keeps the financial markets afloat. This regulatory authority oversees ensuring a free-of-misconduct environment to regain the trust of the common person who invest his or her hard-earned money in the markets (Elearnmarkets.com, 2022).
3. Intermediaries in the Financial Sector - These are the individuals who function as

intermediaries between issuers and investors. They ensure that financial transactions are simple and secure (Elearnmarkets.com, 2022).

The important primary three functions are follows: Protective Function, Regulatory Function, Development Function. 1. Protective Function - SEBI performs these tasks to protect the interests of investors and other financial actors, as the name implies (Elearnmarkets.com, 2022). Checking for price manipulation is one of them. Stop insider trading, encourage ethical behaviour, increase investor awareness, Prohibit deceptive and unfair business practises.

2. Regulatory Function - These functions are mostly undertaken to keep an eye on how the financial markets are running (Elearnmarkets.com, 2022)). Designing standards and a code of conduct for the correct operation of financial intermediaries and corporations is one of these roles, Regulation of corporate takeovers, Inquiries and audits of exchanges are carried out, Brokers, sub-brokers, merchant bankers, and other financial professionals must be registered, Fees are assessed, Powers to perform and exercise, Credit rating agencies must be registered and regulated, Learn about the stock market with Market Experts' Basics of Financial Markets Course.

3. Development Function - This regulatory authority also has development responsibilities, which include but are not limited to (Elearnmarkets.com, 2022): Providing intermediary training, Fair trading is promoted, and malpractices are reduced, Work on your research, Organizations that are self-regulatory are encouraged, Through a broker, you can buy and sell mutual funds directly from AMC.

SEBI's Goals - The Stock Exchange Board of India's goals are as follows (Elearnmarkets.com, 2022): one. Investors are protected - SEBI's main goal is to safeguard investors' interests in the stock market and to create a healthy environment for them. 2. Malpractice prevention - SEBI was set up for this reason. Preventing malpractice is one of the key goals. 3. Proper and fair operation - SEBI oversees ensuring the smooth operation of capital markets and keeps a careful eye on the actions of financial intermediaries such as brokers, sub-brokers, and others.

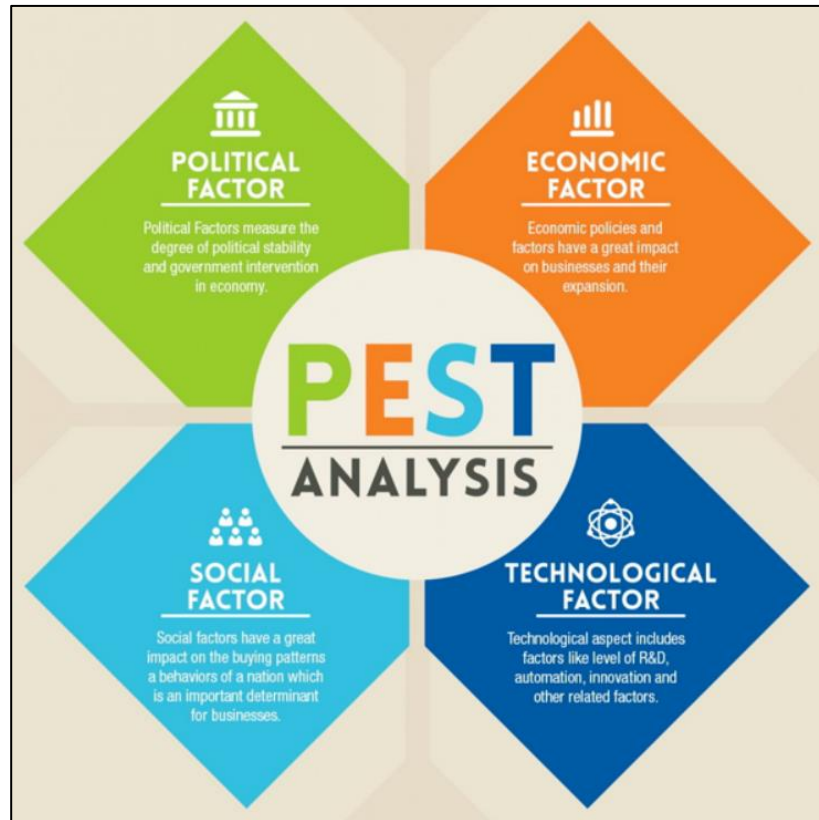
SEBI's Organizational Structure - The SEBI Board is made up of nine members, including one Chairman selected by the Indian government, two officers from the Union Finance Ministry are members, one representative from the Reserve Bank of India, The Union Government of India appoints five members (Elearnmarkets.com, 2022).

SEBI's Authority - When it relates to stock exchanges, SEBI does have the authority to regulate and implement any legislation governing their operations, It has the authority to inspect all stock exchanges' journals of records and accounts, as well as to arrange for periodic inspections and returns into the stock exchanges' operations, It can also hold hearings and issue judgements if any stock exchange irregularities are discovered, When it comes to company handling, it has the authority to list and de-list firms from any stock exchange in the country, It has the authority to regulate all areas of insider trading and to impose penalties and expulsions if a business is found to be engaging in unethical behaviour, It can also persuade corporations to list their stock on multiple stock exchanges if they believe it will benefit investors, When it comes to investor protection, SEBI has the authority to develop legal laws to secure the general public's safety, It also has the authority to control the registration of brokers and other market intermediaries who will deal with investors (Elearnmarkets.com, 2022).

### **3.3 PESTEL Analysis**

Political - India's capital market is extremely vulnerable. India has been politically unstable in the past, but it is now becoming more stable. The capital market is severely affected by the country's political turmoil. As a result of the political upheavals in India, the stock market has changed. The BSE Index, SENSEX, rises and falls in response to both tiny and large pieces of political news, such as news that a certain political party has withdrawn its support from the ruling party, which causes the stock market to crash. India's capital market is underdeveloped and heavily reliant on speculation. The country's political stability is critical to the country's capital market's stability and growth. The country's political imbalance or balance is a major determinant of India's capital market. (Mbaknol.com, 2020) Among the political factors are tax policy and employment laws, Tariffs and trade restrictions, stability in politics

Figure 2 – PESTEL Analysis



Source: (Mbaknol.com, 2020)

Economic - The government of India's economic policies have a close tie with the capital markets. When the yearly budget is announced, the stock market fluctuates in response to the government's economic plans. The capital market reacts positively to policies that help businesses, while the capital market reacts negatively to measures that are not beneficial to businesses and are not welcomed. For example, in the case of the allocation of 3-G spectrum, those companies that received the licence for 3-G saw a sharp increase in their share values, showing that economic policies play a significant role in the growth and decline of the capital market. Similarly, if any taxes on items in the automobile industry are relaxed, the share of the automobile industry rises, effectively strengthening the capital market. Inflation rate (Mbaknol.com, 2020) is one of the economic elements, expansion of the economy, rates of change, rates of interest.

Social - India is a country that celebrates its variety while staying together. India is a socially wealthy country, but the capital market is not as socially conscious. Yes, there is a connection between societal conditions and the stock market. If there is a significant social part, it will have an impact on the capital market, but minor social factors will have no impact. In several cities, for example, there was hostility to the use of fresh produce, and

many outlets were closed. The share prices of Reliance Fresh fell, but the impact was limited to a specific firm; the capital market was unaffected. Social considerations have negligible impact on the Indian capital market. (Mbaknol.com, 2020) Among the social elements are the emphasis on: Safety, Attitudes in the workplace, The rate of population growth, Distribution of ages, Awareness of health.

Technology - Technological elements do not have a significant impact on the capital market. India is a developing country in terms of technology. Like social variables, technological elements can have an impact on an individual firm but not on the entire capital market. Bajaj has a patent on its dts-i technology, which it has included in its new bike, but it has had no impact on the stock market. In India, technological advancement is always on a smaller scale and has negligible impact on the country. R&D activities technology incentives (Mbaknol.com, 2020) are among the technical considerations. The rate of technological advancement & Automation.

Environment - Environmental factors do not play a significant effect in the capital market at first. However, times have changed, and people are becoming more environmentally conscious. This is disturbing them because they do not know whether any company or industry is environmentally friendly or not. Even though an increasing number of people, investors, and corporate leaders are paying attention to these realities, the capital markets continue to regard the environment as a liability. They obfuscate the fact that it is irrelevant to their approach. Markets are even undervaluing environmental performance (Mbaknol.com, 2020).

Legal - Legal factors play a critical influence in the growth and stability of the capital market. The fate of the capital market is decided by legal difficulties linked to any industry or firm. If the Indian government or parliament passes a new regulation that has the potential to disrupt the industry's operations, the industry will be demotivated, and this demonization will lead to the demonization of investors, resulting in a decrease in the capital market. Following the Hardhat Mehta fraud, added laws and regulations were implemented, such as needing a PAN card for trading, questioning investors who invested too much money in a small firm, and so on. These restrictions were intended to protect capital market openness, although investment was discouraged at the time. Legal aspects are needed for the capital market's improvement and stability (Mbaknol.com, 2020).

### **3.4 Portfolio Construction Theories**

Definition of Investment - The pledge of money or capital to buy financial instruments or other assets to earn helpful returns in the form of interest, income, or an increase in the value of the instrument is referred to as an investment. Investing one's hard-earned money is, without a doubt, a risky business. Sure, there seem to be investments which do not appear to have a high chance of failure, but they will not make you a lot of money. The basic concept of investing holds true everywhere: "Great risk equals Great reward," and understanding the goals and channels for investment result in financial security. If one wants to protect his or her money against inflation while also trying to expand it, he or she must choose the proper financial instrument. Investment is both an art and a science, with organized and efficient investment planning being the key to success. There are a variety of investment possibilities available. Mutual funds, fixed deposits, national savings certificates, public provident funds, stock market, gold, silver, and real estate are just few of the investment alternatives available in the market (Sandhar, Neetika Jain and Ruchi Kushwah, 2018).

Definition of Portfolio - Any collection of financial assets, such as stocks, bonds, and cash, is referred to as a portfolio. Individual investors may hold portfolios, while financial experts, hedge funds, banks, and other financial organisations may manage them. It is a widely held belief that a portfolio should be built around the risk tolerance, time horizon, and investment aims of the investor. The financial value of each asset can have an impact on the portfolio's risk/reward ratio, which is referred to as asset allocation. Investors will need to appoint an individual or a team to select, commit to, and manage an impact investment portfolio to be successful. Institutional investors use a variety of organisational structures to form these teams, as seen in the examples below (Sandhar, Neetika Jain and Ruchi Kushwah, 2018).

Definition of Portfolio construction - A portfolio is a collection of assets including stocks, bonds, and money market instruments. Portfolio creation is the process of combining various asset classes to provide the best possible return with the least amount of risk. Diversification of investments spreads risk across a variety of assets. As previously said, this study focuses solely on the construction phase of the investing process, hence knowledge of portfolio construction theory is needed. In particular, the portfolio developed in this thesis is based on the portfolio theory proposed by Markowitz in his pioneering and widely cited work (Markowitz, 1952).

Building the right kind of investment portfolio depending on your long-term financial aims requires careful portfolio construction. A disciplined portfolio construction method can aid you in achieving your aims while balancing risk and return. Sound portfolio building should help you keep and improve your strategic asset allocation approach while also avoiding the problems that often keep investors from achieving their aims.

To diversify your portfolio and reduce risk, your financial adviser may typically advocate investing in more than one asset class while constructing an ideal investment portfolio (portfolio design). Your risk tolerance, investment timeframe, and aims will decide the percentage you distribute to each asset class. Asset allocation is the term for this. By categorising assets into asset classes, the goal is to achieve a balance between risk and return. An investor with a high-risk tolerance and a longer time horizon will often invest in a more aggressive portfolio, such as the one shown below, which includes a larger percentage of shares. Investors who are less risk averse and have a shorter time horizon will typically choose a more conservative asset allocation that includes a higher percentage of bonds and cash.

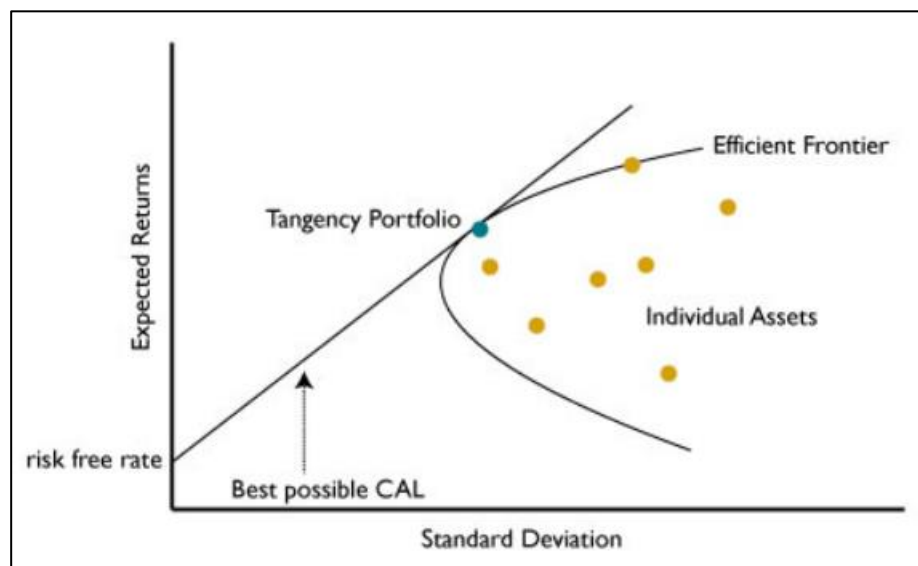
As a result, a brief overview of his portfolio optimization theory is offered, with an emphasis on the two needed inputs: expected return and covariance matrix. When evaluating two stocks with the same return, a rational investor prefers the one with the lower variance, according to (Markowitz, 1952) and most portfolio theory. Similarly, when comparing two stocks with the same variance (risk), a rational investor prefers the one with the higher return. When the comparison is more complicated, such as when one stock has a higher return and variance than another, the investor's risk tolerance plays a role in the decision. The investor must decide whether the increased return is worth the increased risk. Comparing stock portfolios is more difficult, but Markowitz can help (1952).

A stock portfolio could be compared and built in such a way that no other portfolio offers a higher return for the same risk. He named these portfolios efficient since no other portfolio has a lower risk for the same return. He created computer techniques to find all efficient portfolios from a given collection of stocks, i.e., the efficient frontier. All portfolios identified reduce risk for a given level of expected return while maximising expected return for a given level of risk (Sandhar, Neetika Jain and Ruchi Kushwah, 2018).

Markowitz's model is regarded as a classic attempt to construct a complete technique that incorporates the concept of portfolio diversification as a risk-reduction mechanism; yet, it has numerous shortcomings that must be addressed. William F. Sharpe created a simplified

Single Index Model (SIM) for portfolio analysis in 1963, based on Markowitz's concept of index for producing covariance terms. This model estimated the return on an asset as well as the value of an index. Sharpe enhanced Markowitz's concept by introducing the Capital Assets Pricing Model (CAPM) to answer the challenge of deciding an asset's proper, arbitrage-free, fair, or equilibrium price (Fisher and Lorie, 1964). Sharpe's Single Index Model is especially useful for constructing a best portfolio by analysing how and why securities should be included in a best portfolio, with their respective weights calculated based on some key variables that are overlooked.

Figure 3 – Capital Asset Pricing Model (CAPM)

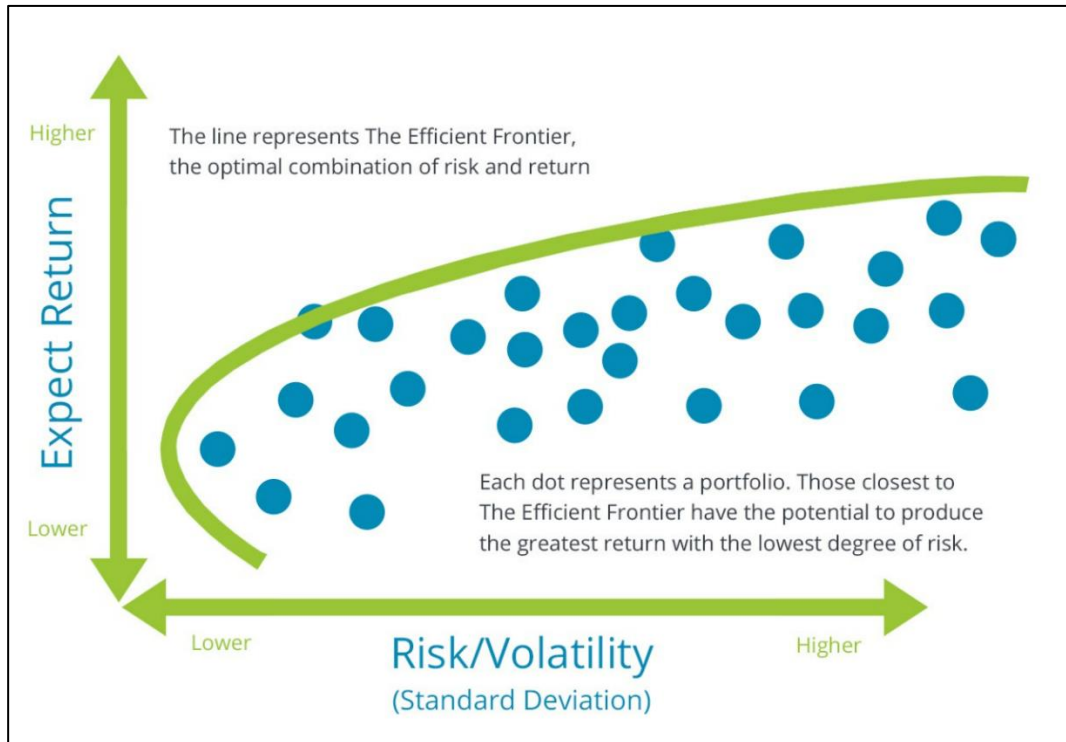


Source: (Lin and VanderLinden, 2006)

Modern Portfolio Theory - There is no such thing as the ideal investment, but for modern investors, developing a strategy that supplies high returns while posing a minimal risk is a top aim. While this characteristic appears simple today, it did not exist until the second part of the twentieth century (GuidedChoice.com, 2021). In 1952, an economist called Harry Markowitz produced his dissertation on "Portfolio Selection," a study that featured insights that would change the landscape of portfolio management four decades later (GuidedChoice.com, 2021).

Figure 4 – Modern Portfolio Theory (MPT)





Source: (GuidedChoice.com, 2021)

His Modern Portfolio Theory (MPT) has remained a popular investing approach as the philosophical antithesis of traditional stock selection, and when used appropriately, this portfolio management tool can result in a broad, lucrative investment portfolio. Markowitz set up that a diversified portfolio is less volatile than the sum of its parts, rather than focusing on the risk of each individual asset. While the volatility of each asset may be high, the overall volatility of the portfolio can be low (GuidedChoice.com, 2021).

The basics of MPT remain true more than 60 years after its start. Let us look at this popular portfolio management method and see what makes its principles so effective (GuidedChoice.com, 2021). Before we can look at MPT's tenets, we need to know who the man behind it is. Markowitz's name has become a household name in the financial world, and his work has influenced much of modern financial and retirement planning advice. Harry Markowitz had a long and famous career as an economist before becoming a Nobel Laureate.

Markowitz was born on August 24, 1927, in Chicago, Illinois, and showed an early interest in physics, astronomy, and philosophy, with a particular interest in David Hume's theories. Throughout his college years at the University of Chicago, he would pursue his interest in Hume's views. T. Koopmans (GuidedChoice.com, 2021) invited Markowitz to

join the Cowles Commission for Research in Economics (now the Cowles Foundation at Yale University) while he was still a student (GuidedChoice.com, 2021).

Markowitz pursued his studies at the University of Chicago with a focus in Economics after getting his bachelor's degree. Markowitz studied under some of the most well-known academics of the period, including Milton Friedman, Jacob Marschak, and Leonard "Jimmie" Savage, during his time there. Markowitz joined the RAND Corporation in 1952, and his work "Portfolio Selection" was published in the Journal of Finance the following year. He worked on a number of modelling problems while at RAND and then transferred to General Electric. Markowitz returned to RAND for a second time after leaving GE (GuidedChoice.com, 2021).

While applied mathematics progressed, researchers lacked the computing resources to put these new, ground-breaking ideas into practise. An analytical thinker was charged with writing unique pieces of computer code whenever they wished to investigate a novel notion. This prompted Markowitz and his colleagues to create SIMSCRIPT, a powerful computer simulation language that enabled these researchers to reuse code. Markowitz formed Consolidated Analysis Centres, Inc. after leaving RAND for the second time, where he and his team produced a proprietary, improved version of SIMSCRIPT that would later be marketed publicly (GuidedChoice.com, 2021).

Markowitz's "Portfolio Selection" was published in 1952, but he has continued to get honours and prizes in a variety of fields in the 60 years afterwards. His focus, on the other hand, has been on the application of mathematics and computer approaches to real-world situations, particularly business decisions with uncertainty. In 1990, he was awarded the Nobel Memorial Prize in Economic Sciences for MPT (GuidedChoice.com, 2021), which he developed while teaching finance at Baruch College of the City University of New York.

The Operations Research Society of America (now Institute for Operations Research and the Management Sciences, INFORMS) awarded him the John von Neumann Theory Prize the following year for his contributions to the theory of three fields: portfolio theory, sparse matrix methods, and simulation language programming (SIMSCRIPT) (GuidedChoice.com, 2021). Harry Markowitz was also selected "Man of the Century" by Pensions & Investments Magazine. One of the brilliant minds behind Guided Choice is Markowitz. His idea has shaped the backbone of our proprietary investing strategy as co-founder and Chief Architect (GuidedChoice.com, 2021).

MPT's Beginnings - Markowitz authored his dissertation on the use of mathematics in stock market analysis while working on his PhD. Markowitz found flaws in the prevailing understanding of stock prices while conducting his research. The core concepts of what would become the MPT came to Markowitz while reading a chapter from John Burr Williams's Theory of Investment Value (GuidedChoice.com, 2021), according to his own account. Prior to the invention of MPT, investment was based on individual stocks; investors would search available assets for "sure bets"-assets that would offer good returns without exposing the investor to excessive risk. These "sure bet" equities were found using expected net present value (NPV), while securities were assessed by discounting future cash flows. (GuidedChoice.com, 2021) Stocks that could generate more money at a faster rate were highly valued.

This was something that Markowitz did not agree with. The "present value" hypothesis had flaws; by this logic, choosing the "best" portfolio meant picking a single stock with the highest predicted NPV. That strategy was hazardous by nature, and while economists believed a well-diversified portfolio was best, there was no means for investors to buy this diversity. If one believes a stock's price changes randomly, statistical measures such as mean and variance can be used to create more diverse portfolios, according to Markowitz. An investor could evaluate correlation in the case of two or more securities (GuidedChoice.com, 2021).

Harry Markowitz developed a formula that allows an investor to quantitatively trade off risk tolerance and return expectations, resulting in the best portfolio (GuidedChoice.com, 2021). This hypothesis was built around two basic ideas: one. The goal of any investor is to maximise return for a given degree of risk. 2. By diversifying a portfolio with individual, unrelated securities, risk can be lessened. MPT is based on the premise that risk-averse investors prefer a portfolio with lower risk for a given level of return. Investors will only embark on high-risk investments if they can expect a higher profit, according to this theory.

Consider the following illustration: A "rational investor" is given the option of choosing between two investments: A and B. Each year, the value of both is predicted to rise by 6%. Investment B, on the other hand, is twice as volatile as Investment A, which means its value varies twice as much as Investment A's. So long as both alternatives produce a comparable expected return, MPT argues that a rational investor will always choose the less volatile asset, in this case Investment A. The overall risk of a portfolio is calculated as a function of the variances of each asset as well as the correlations between each pair of assets.

Asset correlations have an impact on total portfolio risk, resulting in a lower standard deviation than a weighted sum.

Markowitz used these findings to develop a management system that would revolutionise modern investment procedures, and he published his new theory in the *Journal of Finance* in 1952. An investor can hold a high-risk asset, mutual fund, or securities under the MPT-or mean-variance analysis-if the risk is minimised by all underlying assets. The portfolio is balanced in such a way that it has a lower overall risk than some of its underlying investments. Markowitz divided risk into two categories (GuidedChoice.com, 2021). Risk is defined as the average range of an asset's price variation.

Risk has two components - Individual stock returns have two components of risk, according to MPT. Systematic Risk: This relates to market risks that cannot be mitigated through diversification, or the likelihood that the entire market and economy would experience losses that hurt investments. MPT does not claim to be able to mitigate this form of risk because it is inherent to an entire market or market sector (GuidedChoice.com, 2021). Unsystematic risk: Unsystematic risk, also known as particular risk, is specific to individual stocks and can be diversified as the number of stocks in your portfolio grows. The risk of each asset contributes extraordinarily little to overall portfolio risk in a well-diversified combination of assets-or portfolio. Rather, individual asset covariances dictate more of the overall portfolio risk (GuidedChoice.com, 2021).

As a result, by combining a diversified portfolio of assets, investors can lower individual asset risk. The Efficient Frontier - While the advantages of diversification are obvious, investors must decide on the level of diversification that is right for them. The Efficient Frontier, a graphical representation of all conceivable combinations of risky assets for a best level of return given a given degree of risk (GuidedChoice.com, 2021), can be used to calculate this. Investors can build a portfolio with the lowest possible risk at any level of return. Investors can build a portfolio that gives the best return for every degree of risk.

Any portfolio that lies outside the Efficient Frontier is regarded sub-optimal for one of two reasons: it has too much risk compared, and it has too insignificant risk compared to its return. When contrasted to the level of risk, a portfolio that is below the Efficient Frontier does not give enough return. For the defined rate of return, portfolios situated to the right of the Efficient Frontier have a higher level of risk. Investors can build at least one portfolio from all accessible investments at any point on the Efficient Frontier that includes the

estimated risk and return for that point. A portfolio that is found towards the top of the curve is efficient because it supplies the highest projected return for a given level of risk. The Efficient Frontier is a powerful example of the power of diversification. Because investors can change the amount and qualities of assets to suit their needs, there is no one Efficient Frontier (GuidedChoice.com, 2021).

**Sharpe's Single Index Model** - According to Sharpe's Model, the link between each pair of securities can be indirectly quantified by comparing each security to a common factor 'market performance index' that is shared by all securities. This alleviates the burden of Markowitz's mean-variance approach's enormous input needs and complicated calculations. While the Markowitz Model requires  $n(n-1)/2$  data inputs, the Sharpe's Model only requires  $(3n+2)$  data inputs, specifically, return estimates for each security, expected return on market index estimates, and return variance estimates. This is the essence of Sharpe's Model, which has led to it being seen as superior to the Markowitz Model by financial analysts and scholars (Yahayah and Ikani, 2021)

$R_i = \alpha_i + \beta_i R_m + e_i$ . Where,  $R_i$  - expected return on security I,  $\alpha_i$  - intercept of the straight line or alpha co-efficient,  $\beta_i$  - slope of straight line or beta co-efficient,  $R_m$  - the rate of return on market index,  $e_i$  - error term. The variance of the security has two components namely, systematic risk or market risk and unsystematic risk. The variance described by the index is referred to systematic risk. The unexplained variance is known as residual variance or unsystematic risk.

Systematic Risk =  $\beta_i^2 * \sigma_m^2$  (Variance of market index), Unsystematic Risk ( $\sigma_{e_i}^2$ ) = Total variance - Systematic Risk =  $\sigma_i^2 - \text{Systematic Risk}$ . Thus, Total Risk = Systematic Risk ( $\beta_i^2 * \sigma_m^2$ ) + Unsystematic Risk ( $\sigma_{e_i}^2$ ). From this, the portfolio variance can be derived as follows:  $\sigma_p^2 = \sum X_i \beta_i^2 \sigma_m^2 + \sum X_i^2 \sigma_{e_i}^2$ . Where,  $\sigma_p^2$  = Variance of Portfolio,  $\sigma_m^2$  = Expected Variance of Index,  $e_i^2$  = Variation in Security's return not related to the market index,  $X_i$  = the part of stock i in the portfolio

**Single Index Model Assumptions** - The Sharpe's Single Index Model (Yahayah and Ikani, 2021) is based on the following assumptions: one. All investors' expectations are the same, 2. Each security's risk and return are calculated using a consistent holding term, 3. A security's price movement is not only determined by the nature of the other securities. They are also influenced by business and economic conditions in general, 4. Some securities' market proxies are likely to be indices to which the returns of each security are correlated, 5. The random disturbance term 'ei' has a finite variance and an expected value of zero (0).

It has no relationship with the return on market portfolio ( $R_m$ ) or the error term ( $e_i$ ) for any other asset.

The Benefits of Using a Single Index Model - SIM has the following advantages (Yahayah and Ikani, 2021): a) The model is straightforward to comprehend and implement, b) If one owns 'n' securities, only  $(3n+2)$  estimates are required, whereas Markowitz's model requires  $n(n+1)/2$  estimates, c) It calculates the return on a security as well as the index value, d) It considerably facilitates the acquisition of the following inputs needed to apply Markowitz's model: i) Each security's expected return, ii) Each security's return variance, iii) The return covariance of each pair of securities, e) This explains why a security should be 'included' or 'excluded' from a portfolio while it is being built.

Single Index Model Limitations - William Sharpe's Single Index Model does not consider market uncertainty as time passes; instead, it optimises for a single point in time. This model posits that security prices move in lockstep solely due to market co-movement. However, there are variables other than general business and market conditions that influence the movement of securities together, including as industry-specific factors (Yahayah and Ikani, 2021).

Evolution of CAPM - When we look back to the 1960s, we can see how little we knew about risk, both theoretically and empirically. Since 1602 when the East India Company shares were sold in Amsterdam (Vega *et al.*, 1957) and as insurance markets became more organised in the 1700s, both stock and options have been in existence. Insurance firms have relied on risk spreading for decades. After a long history of real risk sharing and risk bearing in systematised capital markets, CAPM appeared at a time when the fundamental facts about return and risk in financial markets were still being explored and the concept of decision-making under uncertain circumstances was still relatively new. Only in the 1940s and 1950s did studies on decision-making under uncertainty and investor risk choices become available. (Markowitz, 1952) created the concept of portfolio management, which described how to consider risk and return in the decision-making process.

When academics began performing scientific investigations utilising market data, the rigorous measurement of risk and return was born. When they initially did research on the securities listed on the NYSE, (Fisher and Lorie, 1964) said, "It is astonishing to find that there have been no measures of the rates of return on investments in common stocks that could be deemed precise and final." After accounting for the premium on equity risk, (Roger and Siquefield, 1976) presented the results on long-term returns.

(Modigliani and Miller, 1958) contended that the cost of an asset is decided by the cost of capital rather than how it is funded, implying that the cost of capital affects the cost of shareholders' capital. He also highlighted that because the cost of equity is computed from predicted dividend growth rates, this method is subjective. The CAPM, on the other hand, proved that there is no necessity for a relationship between future growth rate and cost of capital. Risk was not considered a major part in the cost of capital calculation prior to the CAPM. "No clear explanation as to what determines the extent of the risk and how it varies in response to changes in other variables has yet been presented," they added.

It may come as a surprise to learn that CAPM has a religious part. According to (Lin and VanderLinden, 2006), analogies to CAPM can be found in the Bible in the context of the kingdom of God parables. The duality in parables is related to the gain – loss decision making in financial theory and practise. Parables that supply insight into investor reactions could be useful in explaining asset pricing premium difficulties. Parables also contribute to financial education by simplifying difficult issues.

In the parables, there is no distinction between financial and genuine investment. Financial investment has a more erratic pattern than real investment. More than technical analysis, the Holy Bible discusses the fundamentals of investing. "Biblical finance" may only cover a few parts of financial theories, but it is an important part of the field that makes it fuller and more significant. A thorough examination reveals that parables help to financial education and practise. The CAPM model is based on Harry Markowitz's "mean-variance model" or model of portfolio selection. If the firms can predict future cash flows, this model sets up a link between the asset price and the expected rate of return (Grossman and Helpman, 2015)

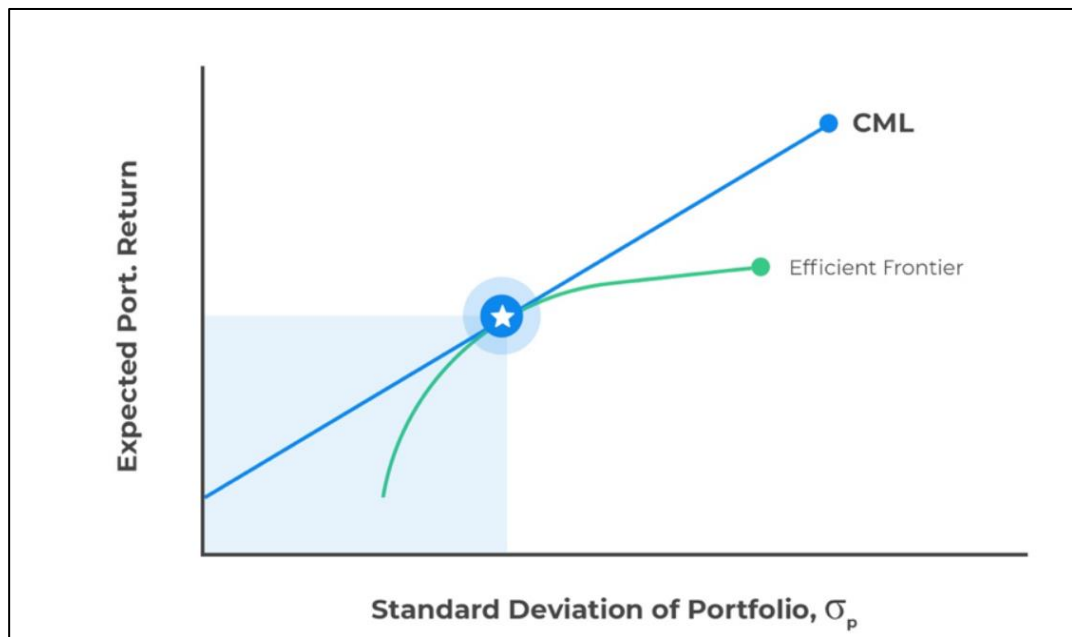
CAPM Model - The suggested CAPM model treats 'risk' as a single variable that affects a security's returns, and it also explains why different securities' expected returns differ.  $E(R_i) = R_f + \beta \{(R_m) - R_f\}$ . Where, a.  $E(R_i)$  denotes the expected rate of return on an asset, b.  $R_f$  denotes the return on risk-free assets available in the market or zero-beta portfolio, c.  $\beta$  denotes the systematic risk associated with the security, d.  $(R_m) - R_f$  denotes the added market premium on the investment on that particular security.

$R_f$  assets, also known as zero beta assets, are treasury bills or gilt-edged securities issued by the government of a country that carry no risk. According to the CAPM model, the total rate of return expected from an investment route includes the risk-free return plus

the added return expected from it, as well as the risk, which is unique to each asset (Fisher and Lorie, 1964).

Capital Market Line - The capital market line (CML) specifies the expected return on a portfolio for an individual investor. On efficient portfolios, there is a linear connection between risk and return (Gavlakova and Gregova, 2013). Security Market Line - The CAPM is represented graphically by the Security Market Line. The graph depicts the link between risk (as assessed by the beta coefficient) and expected return. The x-axis and y-axis, respectively, show the Beta and expected return. The risk-free rate is shown at the start of the line. The slope of the SML decides the market risk premium. The difference between the risk-free rate and the expected return is the expected return. With the increase in the risk premium, the slope will become steeper (Ninan *et al.*, 2018).

Figure 5 – Capital Market Line



Source: (Ninan *et al.*, 2018)

Assumptions of CAPM - The main assumptions of CAPM are: return and risk are the only two decision parameters; an investor's choice will rely only on the first two statistical instances of a normally distributed asset return variable; risk-averse investor; investors with homogeneous expectations; risk-averse investor; risk-averse investor; risk-averse investor; risk-averse investor; risk-averse investor; risk-averse investor; risk-averse investor; risk-averse investor; risk-averse investor; risk-averse investor; risk-



averse investor; risk-averse investor; risk-averse A price taker is an investor who works in asset markets; asset quantity is predetermined; assets are fully divisible; All investors have the same investment time horizon; there is a perfect capital market; an investor can lend and borrow money at the same rate of interest; transaction costs, information, and taxes are not present. Return on the market, beta, and risk-free rate of return are all CAPM parameters supplied by (Laubscher, 2002). The capacity of an asset pricing model to assess variations in risk and return trends of securities over time decides its efficiency (Hussain and Islam, 2017).

Sharpe also proposed that total risk be divided into two categories: systematic risk, which cannot be diversified because it will earn a higher return than a pure interest rate and is linked to economic activity, and unsystematic risk, which can be diversified and earns a risk-free rate of return and is unrelated to any economic activity. Bajpai concluded that there is a linear relationship between risk and return for a hazardous security. CAPM explains that risk variables other than systematic risk of stocks are not recognised, but that they can be diversified.

According to the Capital Asset Pricing Model, systematic risk has value in a market where an investor has associated expectations about covariance and returns of individual assets, when trading and taxes are not restricted, and where transaction costs are not present. Market return is a crucial factor to consider when evaluating variances in individual stock returns. However, CAPM is a carefully examined equilibrium model that is a simplified version of reality. CAPM, on the other hand, is currently the topic of intense debate and scientific investigation (Saji, 2014).

Asset prices alone should not be considered a sufficient reason to use monetary policy to smooth out asset price cycles. Small and large-scale prudential measures could better address financial stability concerns arising from asset price bubbles, and the effectiveness of these policies would enhance when implemented in the context of a strong macroeconomic plan (Singh and Pattanaik, 2012). The criteria on the primitives of a consistent time economy under which equilibrium conforms to the Consumption-Based Capital Asset Pricing Model (CCAPM) extend Ingersoll, Ross, and Cox (1985) equilibrium characterization of interest rate to multi-operator economies (Duffie and Zame, 1989). Furthermore, skewness is one of the most underappreciated characteristics of security returns distribution (Mukherjee and Metia, 2001).

Even if the model does not best explain the current reality, it may be able to predict the investor's future behaviour. CAPM is used as a benchmark to learn how capital markets work and how investors' reasoning and asset values differ from quick answers. When an investor can hold diversified portfolios, the CAPM model, which focuses on stand-alone risk, is deceiving (Perold, 2004)

CAPM is a well-known measure of deciding the expected return on stock that is widely used by investors on the National Stock Exchange (NSE). Individual stocks can be analysed to see if they are overvalued or undervalued using CAPM when deciding whether to sell or buy a particular security. Whereas it was discovered that CAPM is not particularly useful in the NSE since the difference between real and expected returns is exceptionally large at a reasonable level of risk (Ratra, 2017). Furthermore, using CAPM, it is impossible to show that expected returns on low-yielding common stock differ from expected returns on high-yielding common stock (Singh, Jain and Yadav, 2016).

During the period 1995-2006, momentum profits were prevalent in India. Models focused on risk, such as Fama-French and CAPM, were unable to account for the phenomenon. Individualistic risk has a positive relationship with momentum as a source of momentum, offering support to behavioural aspects. Choosing the stocks that have performed well in the last three and six months when constructing portfolios can help investors and fund managers make significant gains. High force returns are decided not only by excellent execution of winner portfolios, but also by poor execution of failure portfolios. High momentum returns are driven not just by robust performance by winning portfolios, but also by deficient performance by loser portfolios (Ansari and Khan, 2012).

The researchers tackled the asset pricing model and risk-return factor under CAPM. Asset pricing models developed after the CAPM, such as Fama and French's five-factor model and Arbitrage Pricing Model, gained an advantage over the CAPM model due to their capacity to explain elements that the CAPM model could not assess. (Bajpai and Sharma, 2015) clearly said that the Arbitrage Pricing Model, rather than the CAPM, may provide investors with superior insight into their projected rate of return, as the APT model supplies a better assessment of the return generating process and performs better forecasting.

## 4. Practical Part

The Nifty 50 index's stocks are examined in the thesis. Utilizing the Capital Asset Pricing Model to analyse securities is the major goal of the study. Investors today struggle to choose securities that meet their needs while also offering the best return with the lowest level of risk. Thus, the thesis's aim is to evaluate the stocks using the CAPM Model and to aid investors in choosing the assets that should be included in their portfolios. Only secondary data is considered in the thesis when analysing the scripts. Secondary information is taken from the National Stock Exchange website and the Yahoo Finance website. These websites have information on the historical daily stock prices of fifty businesses from the Nifty 50 Index. The 364-day Treasury Bill's risk-free rate of return (RF) of 6.23% is considered when calculating expected return. The primary goal of the thesis is to use the CAPM Model to decide which equities are undervalued and overvalued. As a result, the data will be analysed to supply the outcomes. The insights provided in the result and discussion chapter are used to build the conclusion.

### 4.1 Analysis of securities using CAPM Model

Table 1 - List of 50 Companies

<b>Sr. No.</b>	<b>Scripts</b>
1	ACC Ltd.
2	Adani Enterprises Ltd.
3	Adani Green Energy Ltd.
4	Adani Transmission Ltd.
5	Ambuja Cements Ltd.
6	Avenue Supermarts Ltd.
7	Bajaj Holdings & Investment Ltd.
8	Bandhan Bank Ltd.
9	Bank of Baroda
10	Berger Paints India Ltd.
11	Biocon Ltd.
12	Bosch Ltd.
13	Cholamandalam Investment and Finance Company Ltd.

14	Colgate Palmolive (India) Ltd.
15	DLF Ltd.
16	Dabur India Ltd.
17	FSN-commerce Ventures Ltd.
18	GAIL (India) Ltd.
19	Gland Pharma Ltd.
20	Godrej Consumer Products Ltd.
21	HDFC Asset Management Company Ltd.
22	Havells India Ltd.
23	ICICI Lombard General Insurance Company Ltd.
24	ICICI Prudential Life Insurance Company Ltd.
25	Indian Oil Corporation Ltd.
26	Indus Towers Ltd.
27	Info Edge (India) Ltd.
28	Interglobe Aviation Ltd.
29	Jubilant foodworks Ltd.
30	Larsen & Toubro Infotech Ltd.
31	Lupin Ltd.
32	Marico Ltd.
33	Mindtree Ltd.
34	Muthoot Finance Ltd.
35	NMDC Ltd.
36	One 97 Communication Ltd.
37	PI Industries Ltd.
38	Pidilite Industries Ltd.
39	Piramal Enterprises Ltd.
40	Procter & Gamble Hygiene & Health care Ltd.
41	Punjab National Bank
42	SBI Cards and Payment services Ltd.
43	SRF Ltd.
44	Siemens Ltd.
45	Steel Authority of India Ltd.

46	Torrent Pharmaceuticals Ltd.
47	United Spirits Ltd.
48	Vedanta Ltd.
49	Zomato Ltd.
50	Zydus Lifesciences Ltd.

Source: (nseindia.com, 2021)

The table 1 represents the list of companies selected for analysis. The above listed companies were selected from Nifty 50 index that includes 50 companies from different sectors.

## 4.2 Steps for calculation of CAPM Model

There are four steps for analysing scripts through CAPM Model. These steps are as follows:

### Step 1: Calculation of actual return, risk, and beta for each security.

Table 2 - Calculation of Actual Return, Risk and Beta

SR. NO.	SCRIPTS	Return (RI')	Risk ( $\sigma$ )	Beta ( $\beta$ )
1	ACC Ltd.	10.25	18.01	1.19
2	Adani Enterprises Ltd.	65.62	104.61	7.14
3	Adani Green Energy Ltd.	282.42	246.01	-8.96
4	Adani Transmission Ltd.	245.08	319.81	3.28
5	Ambuja Cements Ltd.	13.61	22.15	1.36
6	Avenue Supermarts Ltd.	45.31	17.01	0.88
7	Bajaj Holdings & Investment Ltd.	24.35	23.40	1.61
8	Bandhan Bank Ltd.	-14.90	15.69	0.50
9	Bank of Baroda	-0.15	31.93	2.32
10	Berger Paints India Ltd.	37.67	13.73	-0.02
11	Biocon Ltd.	26.67	33.31	-0.39

12	Bosch Ltd.	12.31	29.40	1.35
13	Cholamandalam Investment and Finance Company Ltd.	38.74	31.70	1.82
14	Colgate Palmolive (India) Ltd.	14.88	9.66	0.17
15	DLF Ltd.	10.03	31.69	1.76
16	Dabur India Ltd.	20.49	10.26	0.16
17	FSN-commerce Ventures Ltd.	-9.96	5.48	0.17
18	GAIL (India) Ltd.	7.79	24.06	1.58
19	Gland Pharma Ltd.	50.07	0.00	0.00
20	Godrej Consumer Products Ltd.	22.86	18.03	0.12
21	HDFC Asset Management Company Ltd.	27.19	32.48	-0.91
22	Havells India Ltd.	33.91	21.83	1.42
23	ICICI Lombard General Insurance Company Ltd.	19.32	17.35	-0.43
24	ICICI Prudential Life Insurance Company Ltd.	13.90	16.54	0.61
25	Indian Oil Corporation Ltd.	13.79	30.78	1.53
26	Indus Towers Ltd.	10.87	31.50	1.46
27	Info Edge (India) Ltd.	35.00	28.21	1.29
28	Interglobe Aviation Ltd.	18.87	60.72	3.32
29	Jubilant foodworks Ltd.	27.66	3059.8 0	0.53
30	Larsen & Toubro Infotech Ltd.	14.51	26.43	2.05
31	Lupin Ltd.	12.59	29.35	0.11
32	Marico Ltd.	23.84	15.48	0.49
33	Mindtree Ltd.	55.24	54.78	2.84
34	Muthoot Finance Ltd.	32.00	32.74	0.69
35	NMDC Ltd.	6.48	30.00	2.05
36	One 97 Communication Ltd.	-20.33	5.31	-0.91
37	PI Industries Ltd.	93.08	218.18	9.44
38	Pidilite Industries Ltd.	32.16	0.12	0.73
39	Piramal Enterprises Ltd.	28.37	35.99	1.48
40	Procter & Gamble Hygiene & Health care Ltd.	25.62	21.90	1.32

41	Punjab National Bank	-8.81	32.03	2.04
42	SBI Cards and Payment services Ltd.	22.10	0.60	0.64
43	SRF Ltd.	61.48	87.88	4.75
44	Siemens Ltd.	15.24	31.31	1.71
45	Steel Authority of India Ltd.	12.05	57.00	4.08
46	Torrent Pharmaceuticals Ltd.	30.59	29.76	0.39
47	United Spirits Ltd.	20.68	32.58	0.37
48	Vedanta Ltd.	21.00	60.25	4.02
49	Zomato Ltd.	-5.66	10.37	1.31
50	Zydus Lifesciences Ltd.	18.05	31.08	0.97

Source: Own Calculation

The table no. 2 indicates the return, risk and beta values of 50 companies. For calculation of return, the daily stock prices of securities have been taken into consideration. The return has been calculated using three day moving average method for preceding 10 years. The three day moving average method refers to the average of the closing prices of stocks for three consecutive days. Further, the annual return has been calculated using the following formula:

$$R_i = \frac{\text{Opening Price} - \text{Closing Price}}{\text{Closing Price}} \times 100 \quad (6)$$

The mean has been calculated in order to obtain return of a particular security for past 10 years using values derived from calculation of annual return. From the analysis, it is found that Adani Green Energy Ltd. has the highest return of 282.42% along with the high risk of 246.01%, whereas One 97 communication Ltd. has the lowest return of -20.33% with the risk of 5.31%.

Besides return, the risk of securities is also determined. The total risk has been measured by the Standard deviation of each stock. Standard deviation is a measure of the dispersion of a set of data from its mean. Pidilite Industries Ltd. has risk of 0.12% which is lower as compare to the risk of other companies. While Gland Pharma Ltd. has no risk and it provided 50.07% return in preceding 10 years. Jubilant foodworks Ltd. has a risk of 3059.80% which is highest among other scripts.

The systematic risk of the stock has been measured using the beta. Beta is measured by dividing the covariance between the returns of the security and the return of the market by the variance of market returns. Beta is measure of volatility or systematic risk associated with stock returns. If the beta value of the stocks is 1 then it means that change in the price of the stock is strongly correlated with the market. A stock has a beta of less than 1 indicates that it is less volatile than the market. Beside this, the stock's price is more volatile than the market when the beta of the stock is greater than 1. The stock which has beta greater than 1 is always not desirable as the volatility in the return of the stock is high.

The PI Industries Ltd. has the highest beta value of 9.44 which means it is highly volatile. Adani Enterprises Ltd.(7.14), SRF Ltd.(4.75), Steel Authority of India Ltd.(4.08), Interglobe Aviation Ltd.(3.32), Adani Transmission Ltd.(3.28), Mindtree Ltd.(2.84), Bank of Baroda (2.32), Larsen and Toubro Infotech Ltd.(2.05) and Punjab National Bank(2.04) have the beta values greater than 1 which represents the high volatility. Adani Green Energy Ltd.(-8.96), HDFC Asset Management Company Ltd.(-0.91), One 97 communication Ltd.(-0.91) and CICI Lombard General Insurance Company Ltd.(-0.43) have negative beta which indicates lower volatility.

### Step 2: Calculation of expected return as per CAPM Model.

Table 3 - Calculation of Expected Return

SR. NO.	SCRIPTS	Return (RI')	Beta ( $\beta$ )	RF+ (Rm-RF)* $\beta$
1	ACC Ltd.	10.25	1.19	14.17
2	Adani Enterprises Ltd.	65.62	7.14	53.81
3	Adani Green Energy Ltd.	282.42	-8.96	-53.44
4	Adani Transmission Ltd.	245.08	3.28	28.11
5	Ambuja Cements Ltd.	13.61	1.36	15.29
6	Avenue Supermarts Ltd.	45.31	0.88	12.12
7	Bajaj Holdings & Investment Ltd.	24.35	1.61	16.95
8	Bandhan Bank Ltd.	-14.90	0.50	9.57
9	Bank of Baroda	-0.15	2.32	21.66
10	Berger Paints India Ltd.	37.67	-0.02	6.08



11	Biocon Ltd.	26.67	-0.39	3.62
12	Bosch Ltd.	12.31	1.35	15.22
13	Cholamandalam Investment and Finance Company Ltd.	38.74	1.82	18.34
14	Colgate Palmolive (India) Ltd.	14.88	0.17	7.36
15	DLF Ltd.	10.03	1.76	17.96
16	Dabur India Ltd.	20.49	0.16	7.29
17	FSN-commerce Ventures Ltd.	-9.96	0.17	7.36
18	GAIL (India) Ltd.	7.79	1.58	16.75
19	Gland Pharma Ltd.	50.07	0.00	6.23
20	Godrej Consumer Products Ltd.	22.86	0.12	7.05
21	HDFC Asset Management Company Ltd.	27.19	-0.91	0.16
22	Havells India Ltd.	33.91	1.42	15.67
23	ICICI Lombard General Insurance Company Ltd.	19.32	-0.43	3.38
24	ICICI Prudential Life Insurance Company Ltd.	13.90	0.61	10.30
25	Indian Oil Corporation Ltd.	13.79	1.53	16.45
26	Indus Towers Ltd.	10.87	1.46	15.93
27	Info Edge (India) Ltd.	35.00	1.29	14.84
28	Interglobe Aviation Ltd.	18.87	3.32	28.38
29	Jubilant foodworks Ltd.	27.66	0.53	9.75
30	Larsen & Toubro Infotech Ltd.	14.51	2.05	19.89
31	Lupin Ltd.	12.59	0.11	6.95
32	Marico Ltd.	23.84	0.49	9.51
33	Mindtree Ltd.	55.24	2.84	25.18
34	Muthoot Finance Ltd.	32.00	0.69	10.83
35	NMDC Ltd.	6.48	2.05	19.89
36	One 97 Communication Ltd.	-20.33	-0.91	0.14
37	PI Industries Ltd.	93.08	9.44	69.11
38	Pidilite Industries Ltd.	32.16	0.73	11.07
39	Piramal Enterprises Ltd.	28.37	1.48	16.10

40	Procter & Gamble Hygiene & Health care Ltd.	25.62	1.32	15.01
41	Punjab National Bank	-8.81	2.04	19.81
42	SBI Cards and Payment services Ltd.	22.10	0.64	10.48
43	SRF Ltd.	61.48	4.75	37.88
44	Siemens Ltd.	15.24	1.71	17.62
45	Steel Authority of India Ltd.	12.05	4.08	33.42
46	Torrent Pharmaceuticals Ltd.	30.59	0.39	8.85
47	United Spirits Ltd.	20.68	0.37	8.70
48	Vedanta Ltd.	21.00	4.02	33.00
49	Zomato Ltd.	-5.66	1.31	14.95
50	Zydus Lifesciences Ltd.	18.05	0.97	12.67

Source: Own Calculation

After the calculation of return, risk and beta, the expected return is calculated for each company. The expected return is the amount of profit or loss which an investor anticipates to receive from an investment made by him/her. Expected return is calculated by multiplying the risk premium with beta of particular security and after that the value generated from multiplication of risk premium and beta is added with risk free rate of return. Here, the risk premium is nothing but the difference between market return and risk free rate of return where the risk free rate of return is the least rate of return earned by an investor from an investor who holds zero risks. The risk-free rate of return on the 364 days Treasury Bill is taken for the purpose of calculation which is 6.23%. Table no. 3 represents that PI Industries Ltd. has the highest expected return of 69.11% whereas the Adani Green Energy Ltd. has the lowest expected return of -53.44% along with lowest beta -8.96.

Adani Enterprises Ltd. has witnessed an expected return of 53.81% which is lower than PI Industries but higher as compare to remaining companies. SRF Ltd. has an expected return of 37.88% with the beta of 4.75. Gland Pharma Ltd. has an expected return of 6.23% with no volatility. Zydus Lifesciences Ltd. reported an expected return of 12.67% and has a beta of 0.97 which in turn indicates that the company is less volatile as compare to market. Avenue Supermarts Ltd., Pidilite Industries Ltd., Muthoot Finance Ltd., SBI Cards and Payment services Ltd., ICICI Prudential Life Insurance Company Ltd., Jubilant foodworks Ltd., Bandhan Bank Ltd., Marico Ltd., Torrent Pharmaceuticals Ltd., United Spirits Ltd.,

FSN-commerce Ventures Ltd., Colgate Palmolive (India) Ltd., Dabur India Ltd., Godrej Consumer Products Ltd. & Lupin Ltd. have an expected return of 12.12%, 11.07%, 10.83%, 10.48%, 10.30%, 9.75%, 9.57%, 9.51%, 8.85%, 8.70%, 7.36%, 7.36%, 7.29%, 7.05%, 6.95% respectively and these stocks are less volatile than market as their beta values are less than 1.

Steel Authority of India Ltd. and Vedanta Ltd. have reported an expected return of more than 30%. However, their beta values are high. This indicated that the stocks which have higher amount expected returns are more volatile in nature. While the stocks which have lower amount of expected return are less risky.

### Step 3: Calculation of Alpha for each security.

Table 4 - Calculation of Alpha

Sr. No.	Scripts	Required Return	Actual Return	Beta	Alpha	Invest/Disinvest
1	ACC Ltd.	14.17	10.25	1.19	-3.92	Disinvest
2	Adani Enterprises Ltd.	53.81	65.62	7.14	11.81	Invest
3	Adani Green Energy Ltd.	-53.44	282.42	-8.96	335.86	Invest
4	Adani Transmission Ltd.	28.11	245.08	3.28	216.96	Invest
5	Ambuja Cements Ltd.	15.29	13.61	1.36	-1.68	Disinvest
6	Avenue Supermarts Ltd.	12.12	45.31	0.88	33.19	Invest
7	Bajaj Holdings & Investment Ltd.	16.95	24.35	1.61	7.40	Invest
8	Bandhan Bank Ltd.	9.57	-14.90	0.50	-24.47	Disinvest
9	Bank of Baroda	21.66	-0.15	2.32	-21.81	Disinvest
10	Berger Paints India Ltd.	6.08	37.67	-0.02	31.59	Invest
11	Biocon Ltd.	3.62	26.67	-0.39	23.04	Disinvest
12	Bosch Ltd.	15.22	12.31	1.35	-2.90	Disinvest
13	Cholamandalam Investment and Finance Company Ltd.	18.34	38.74	1.82	20.40	Invest

14	Colgate Palmolive (India) Ltd.	7.36	14.88	0.17	7.52	Invest
15	DLF Ltd.	17.96	10.03	1.76	-7.93	Disinvest
16	Dabur India Ltd.	7.29	20.49	0.16	13.20	Invest
17	FSN-commerce Ventures Ltd.	7.36	-9.96	0.17	-17.32	Disinvest
18	GAIL (India) Ltd.	16.75	7.79	1.58	-8.96	Disinvest
19	Gland Pharma Ltd.	6.23	50.07	0.00	43.84	Invest
20	Godrej Consumer Products Ltd.	7.05	22.86	0.12	15.81	Disinvest
21	HDFC Asset Management Company Ltd.	0.16	27.19	-0.91	27.04	Invest
22	Havells India Ltd.	15.67	33.91	1.42	18.24	Invest
23	ICICI Lombard General Insurance Company Ltd.	3.38	19.32	-0.43	15.94	Invest
24	ICICI Prudential Life Insurance Company Ltd.	10.30	13.90	0.61	3.60	Invest
25	Indian Oil Corporation Ltd.	16.45	13.79	1.53	-2.66	Disinvest
26	Indus Towers Ltd.	15.93	10.87	1.46	-5.06	Disinvest
27	Info Edge (India) Ltd.	14.84	35.00	1.29	20.16	Invest
28	Interglobe Aviation Ltd.	28.38	18.87	3.32	-9.52	Disinvest
29	Jubilant foodworks Ltd.	9.75	27.66	0.53	17.91	Invest
30	Larsen & Toubro Infotech Ltd.	19.89	14.51	2.05	-5.38	Disinvest
31	Lupin Ltd.	6.95	12.59	0.11	5.64	Invest
32	Marico Ltd.	9.51	23.84	0.49	14.33	Invest
33	Mindtree Ltd.	25.18	55.24	2.84	30.06	Invest
34	Muthoot Finance Ltd.	10.83	32.00	0.69	21.17	Disinvest
35	NMDC Ltd.	19.89	6.48	2.05	-13.41	Disinvest
36	One 97 Communication Ltd.	0.14	-20.33	-0.91	-20.47	Disinvest

37	PI Industries Ltd.	69.11	93.08	9.44	23.97	Invest
38	Pidilite Industries Ltd.	11.07	32.16	0.73	21.08	Invest
39	Piramal Enterprises Ltd.	16.10	28.37	1.48	12.27	Invest
40	Procter & Gamble Hygiene & Health care Ltd.	15.01	25.62	1.32	10.61	Invest
41	Punjab National Bank	19.81	-8.81	2.04	-28.62	Disinvest
42	SBI Cards and Payment services Ltd.	10.48	22.10	0.64	11.63	Disinvest
43	SRF Ltd.	37.88	61.48	4.75	23.60	Invest
44	Siemens Ltd.	17.62	15.24	1.71	-2.38	Disinvest
45	Steel Authority of India Ltd.	33.42	12.05	4.08	-21.37	Disinvest
46	Torrent Pharmaceuticals Ltd.	8.85	30.59	0.39	21.74	Invest
47	United Spirits Ltd.	8.70	20.68	0.37	11.98	Invest
48	Vedanta Ltd.	33.00	21.00	4.02	-12.00	Disinvest
49	Zomato Ltd.	14.95	-5.66	1.31	-20.61	Disinvest
50	Zyventus Lifesciences Ltd.	12.67	18.05	0.97	5.38	Invest

Source: Own Calculation

The table no. 4 indicates the Calculation of alpha values for all the companies of Nifty 50. Here, the calculation of Alpha values are done by subtracting actual return from required return where required return refers to expected return. From the 50 companies, it is suggested that one should invest in those companies whose alpha is positive and disinvest from those companies whose alpha is negative. The Adani Green Energy Ltd., Adani Transmission Ltd., Gland Pharma Ltd., Avenue Supermarts Ltd. and Berger Paints India Ltd. are top five companies selected on the basis of the alpha method as their alpha has high positive values compare to other companies.

Adani Green Energy Ltd., Adani Transmission Ltd., Gland Pharma Ltd., Avenue Supermarts Ltd., Berger Paints India Ltd., Mindtree Ltd., HDFC Asset Management Company Ltd., PI Industries Ltd., SRF Ltd., Torrent Pharmaceuticals Ltd., Pidilite Industries Ltd., Cholamandalam Investment and Finance Company Ltd., Info Edge (India) Ltd.,

Havells India Ltd., Jubilant foodworks Ltd., ICICI Lombard General Insurance Company Ltd., Marico Ltd., Dabur India Ltd., Piramal Enterprises Ltd., United Spirits Ltd., Adani Enterprises Ltd., Procter & Gamble Hygiene & Health care Ltd., Colgate Palmolive (India) Ltd., Bajaj Holdings & Investment Ltd., Lupin Ltd., Zydus Lifesciences Ltd. and ICICI Prudential Life Insurance Company Ltd. have a positive alpha value. Therefore, the investors are recommended to invest in these stocks as these stocks have given more return than the anticipated return.

While investors are suggested to disinvest from Biocon Ltd., Muthoot Finance Ltd., SBI Cards and Payment services Ltd., Ambuja Cements Ltd., Siemens Ltd., Indian Oil Corporation Ltd., Bosch Ltd., ACC Ltd., Indus Towers Ltd., Larsen & Toubro Infotech Ltd., DLF Ltd., GAIL (India) Ltd., Interglobe Aviation Ltd., Vedanta Ltd., NMDC Ltd., FSN-commerce Ventures Ltd., One 97 Communication Ltd., Zomato Ltd., Steel Authority of India Ltd., Bank of Baroda, Bandhan Bank Ltd. and Punjab National Bank as these stocks have reported lower return as compare to anticipated return which means investors are not getting the expected amount of return from the investment made by them.

#### Step 4: Valuation for each security

Table 5 - Valuation of Securities

SR. NO.	Scripts	Required Return	Actual Return	Valuation
1	ACC Ltd.	14.17	10.25	Overvalued
2	Adani Enterprises Ltd.	53.81	65.62	Undervalued
3	Adani Green Energy Ltd.	-53.44	282.42	Undervalued
4	Adani Transmission Ltd.	28.11	245.08	Undervalued
5	Ambuja Cements Ltd.	15.29	13.61	Overvalued
6	Avenue Supermarts Ltd.	12.12	45.31	Undervalued
7	Bajaj Holdings & Investment Ltd.	16.95	24.35	Undervalued
8	Bandhan Bank Ltd.	9.57	-14.90	Overvalued
9	Bank of Baroda	21.66	-0.15	Overvalued
10	Berger Paints India Ltd.	6.08	37.67	Undervalued
11	Biocon Ltd.	3.62	26.67	Undervalued

12	Bosch Ltd.	15.22	12.31	Overvalued
13	Cholamandalam Investment and Finance Company Ltd.	18.34	38.74	Undervalued
14	Colgate Palmolive (India) Ltd.	7.36	14.88	Undervalued
15	DLF Ltd.	17.96	10.03	Overvalued
16	Dabur India Ltd.	7.29	20.49	Undervalued
17	FSN-commerce Ventures Ltd.	7.36	-9.96	Overvalued
18	GAIL (India) Ltd.	16.75	7.79	Overvalued
19	Gland Pharma Ltd.	6.23	50.07	Undervalued
20	Godrej Consumer Products Ltd.	7.05	22.86	Undervalued
21	HDFC Asset Management Company Ltd.	0.16	27.19	Undervalued
22	Havells India Ltd.	15.67	33.91	Undervalued
23	ICICI Lombard General Insurance Company Ltd.	3.38	19.32	Undervalued
24	ICICI Prudential Life Insurance Company Ltd.	10.30	13.90	Undervalued
25	Indian Oil Corporation Ltd.	16.45	13.79	Overvalued
26	Indus Towers Ltd.	15.93	10.87	Overvalued
27	Info Edge (India) Ltd.	14.84	35.00	Undervalued
28	Interglobe Aviation Ltd.	28.38	18.87	Overvalued
29	Jubilant foodworks Ltd.	9.75	27.66	Undervalued
30	Larsen & Toubro Infotech Ltd.	19.89	14.51	Overvalued
31	Lupin Ltd.	6.95	12.59	Undervalued
32	Marico Ltd.	9.51	23.84	Undervalued
33	Mindtree Ltd.	25.18	55.24	Undervalued
34	Muthoot Finance Ltd.	10.83	32.00	Undervalued
35	NMDC Ltd.	19.89	6.48	Overvalued

36	One 97 Communication Ltd.	0.14	-20.33	Overvalued
37	PI Industries Ltd.	69.11	93.08	Undervalued
38	Pidilite Industries Ltd.	11.07	32.16	Undervalued
39	Piramal Enterprises Ltd.	16.10	28.37	Undervalued
40	Procter & Gamble Hygiene & Health care Ltd.	15.01	25.62	Undervalued
41	Punjab National Bank	19.81	-8.81	Overvalued
42	SBI Cards and Payment services Ltd.	10.48	22.10	Undervalued
43	SRF Ltd.	37.88	61.48	Undervalued
44	Siemens Ltd.	17.62	15.24	Overvalued
45	Steel Authority of India Ltd.	33.42	12.05	Overvalued
46	Torrent Pharmaceuticals Ltd.	8.85	30.59	Undervalued
47	United Spirits Ltd.	8.70	20.68	Undervalued
48	Vedanta Ltd.	33.00	21.00	Overvalued
49	Zomato Ltd.	14.95	-5.66	Overvalued
50	Zydus Lifesciences Ltd.	12.67	18.05	Undervalued

Source: Own Calculation

The table no. 5 is showing information about the undervaluation and overvaluation of all the securities. There are some securities which are undervalued whereas some securities which are overvalued. The Investors are suggested to invest in undervalued securities as there are chances that the return of those securities is to be increased in the future. The securities which are overvalued that should not be purchased by the Investors as it is overvalued.

The undervalued securities include Adani Green Energy Ltd., Adani Transmission Ltd., PI Industries Ltd., Adani Enterprises Ltd., SRF Ltd., Mindtree Ltd., Gland Pharma Ltd., Avenue Supermarts Ltd., Cholamandalam Investment and Finance Company Ltd., Berger Paints India Ltd., Info Edge (India) Ltd., Havells India Ltd., Pidilite Industries Ltd., Muthoot Finance Ltd., Torrent Pharmaceuticals Ltd., Piramal Enterprises Ltd., Jubilant foodworks Ltd., HDFC Asset Management Company Ltd., Biocon Ltd., Procter & Gamble Hygiene &

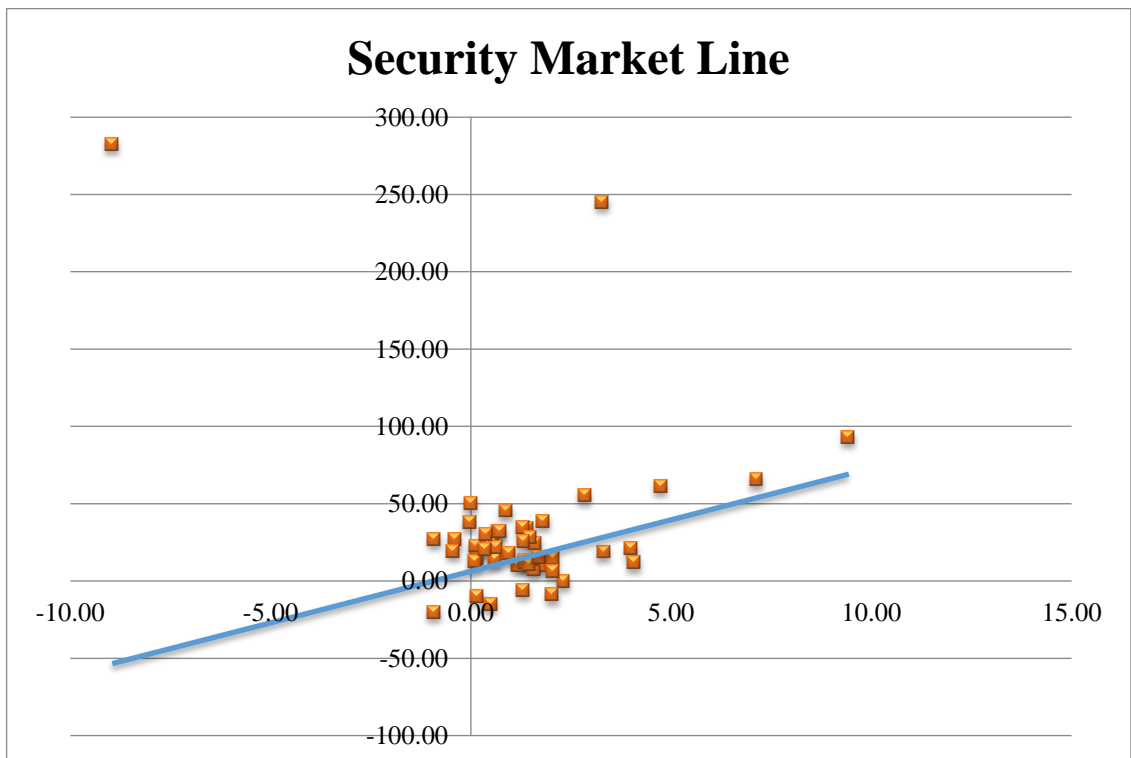


Health care Ltd., Bajaj Holdings & Investment Ltd., Marico Ltd., Godrej Consumer Products Ltd., BI Cards and Payment services Ltd., United Spirits Ltd., Dabur India Ltd., ICICI Lombard General Insurance Company Ltd., Zydus Lifesciences Ltd., Colgate Palmolive (India) Ltd., ICICI Prudential Life Insurance Company Ltd. and Lupin Ltd. The investors should invest in undervalued stocks as these stocks have potential to provide more return.

The overvalued securities contain Vedanta Ltd., Interglobe Aviation Ltd., Siemens Ltd., Larsen & Toubro Infotech Ltd., Indian Oil Corporation Ltd., Ambuja Cements Ltd., Bosch Ltd., Steel Authority of India Ltd., Indus Towers Ltd., ACC Ltd., DLF Ltd., GAIL (India) Ltd., NMDC Ltd., Bank of Baroda, Zomato Ltd., Punjab National Bank, FSN-commerce Ventures Ltd., Bandhan Bank Ltd. and One 97 Communication Ltd. The investors should disinvest from overvalued stocks as these stocks' market value is higher than the original value.

### Formation of Security Market Line

Figure 6 - Security Market Line for Nifty 50



Source: Own Calculation

The figure 1 indicates that from 50 companies, those companies who are above the SML line are undervalued and the companies below the SML line are overvalued. So, the investors are suggested to invest in the companies who are undervalued. The stocks which fall above the security market line provide higher return and more risky in nature whereas the stocks which fall under security market line gives lower return with low risk.

Adani Green Energy Ltd., Adani Transmission Ltd., PI Industries Ltd., Adani Enterprises Ltd., SRF Ltd., Mindtree Ltd., Gland Pharma Ltd., Avenue Supermarts Ltd., Cholamandalam Investment and Finance Company Ltd., Berger Paints India Ltd., Info Edge (India) Ltd., Havells India Ltd., Pidilite Industries Ltd., Muthoot Finance Ltd., Torrent Pharmaceuticals Ltd., Piramal Enterprises Ltd., Jubilant foodworks Ltd., HDFC Asset Management Company Ltd., Biocon Ltd., Procter & Gamble Hygiene & Health care Ltd., Bajaj Holdings & Investment Ltd., Marico Ltd., Godrej Consumer Products Ltd., BI Cards and Payment services Ltd., United Spirits Ltd., Dabur India Ltd., ICICI Lombard General Insurance Company Ltd., Zydus Lifesciences Ltd., Colgate Palmolive (India) Ltd., ICICI Prudential Life Insurance Company Ltd. and Lupin Ltd. fall above the security market line. Thus, investors are recommended to invest in these stocks for earning maximum return.

The stocks which fall below the security market line consist Vedanta Ltd., Interglobe Aviation Ltd., Siemens Ltd., Larsen & Toubro Infotech Ltd., Indian Oil Corporation Ltd., Ambuja Cements Ltd., Bosch Ltd., Steel Authority of India Ltd., Indus Towers Ltd., ACC Ltd., DLF Ltd., GAIL (India) Ltd., NMDC Ltd., Bank of Baroda, Zomato Ltd., Punjab National Bank, FSN-commerce Ventures Ltd., Bandhan Bank Ltd. & One 97 Communication Ltd. as these stocks have given lower return in past 10 years and there are slight possibility that these stocks, prices are going to increase in future.

## 5. Results and Discussion

The last financial crisis to hit the world was the global recession of 2008, but the coronavirus crisis is unique compared to other crises. Since the Covid-19 attack, markets have been dominated by fear and uncertainty. It has caused global markets to plunge to depths unseen since the Global Financial Crisis of 2008. As the BSE Sensex and Nifty 50 fell by 38%, there was a strong correlation with the trends and indices of the global market. The overall market cap fell by an astonishing 27.31% since the beginning of the year 2020. The stock market has reflected the emotions that this pandemic inflicted on both domestic and foreign investors. A number of industries including hospitality, tourism and entertainment have been negatively affected and the stocks of these businesses have fallen more than 40% (Ravi, 2020)

Beside Covid-19, Russia and Ukraine war has also affected stock market. The countries and their economies rely on each other for numerous things like oil, trade, services, investment and many more. Therefore, if there has been any big geopolitical event occurs in any part of the world then it will also have an impact on the markets of other countries. As the war between Russia and Ukraine has significant impact on other countries. The markets have been volatile across Asia and the oil prices have been highly increased.

The Indian stock market has been taking a hit due to the potential tightening of policy measures with respect to the war between Russia and Ukraine. The share prices of Tata Motors, Motherson Sumi Systems and Dr. Reddy's Laboratories were falling down because of the tension between Russia and Ukraine (Chopra, 2022). Beside this, the down fall has also been reported in benchmark indices such as Sensex and Nifty 50. The Sensex fell by 1500 point and closed at 52,842 whereas Nifty 50 index closed at 15,863 with drop of 382 points on March 7 owing to Russia-Ukraine war. This kind of massive crash has been witnessed by Indian stock market during covid-19 pandemic in March 2020 when Indian government declared entire economy would be shut down except for a small number of essential services. In addition to this, Foreign Institutional Investors have been pulling out money from Indian stock market as concerns related to geopolitical tension between Russia and Ukraine along with worries regarding rising crude oil prices (Das, 2022).

Assessment of the security's performance is based on the practical part of the thesis. The analysis of the security is based on historical stock prices which are collected from the website of National Stock Exchange and Yahoo finance. The securities have been analysed

using CAPM Model given by William Sharpe. The risk-free rate of return on the 364 days Treasury Bill is taken for the purpose of calculation which is 6.23%. The risk-free rate refers to the rate of return given by an investment which carries zero risk. According to (Pratt and Grabowski, 2014), risk-free rate is the return available on the security that the market regards as free of the risk default.

As per analysis, the Adani Green Energy Ltd. has return of 282.42% which is highest as compared to other companies. While One 97 Communication Ltd. has the lowest return of -20.33%. Jubilant food works Ltd. has highest risk of 3059.80 and Pidilite Industries Ltd. has lower risk of 0.12%. Gland Pharma Ltd. has reported no risk. PI Industries Ltd. is highly volatile stock as it has highest beta value of 9.44 and Adani Green Energy Ltd. has lowest beta value of -8.96.

The findings from CAPM Model are as follows:

SML Line Method - The following are the five companies selected based on SML line which is derived from risk and returns of the scrips and market:

Table 6 - Top Five Companies (SML Line Basis)

<b>Sr. No.</b>	<b>Scripts</b>
1	Adani Green Energy Ltd.
2	Adani Transmission Ltd.
3	PI Industries Ltd.
4	Adani Enterprises Ltd.
5	SRF Ltd..

Source: Own Calculation

The table no. 6 indicates that Adani Green Energy Ltd., Adani Transmission Ltd., PI Industries Ltd., PI Industries Ltd., Adani Enterprises Ltd. and SRF Ltd. are selected in top 5 companies as per security line method. Adani Green Energy Ltd. has reported highest return of 282.42%. While Adani Transmission Ltd. has provided 245.08% return in past ten years. PI Industries Ltd., Adani Enterprise Ltd. and SRF Ltd. have provided return of 93.08%, 65.62% & 61.48% respectively. The beta values of Adani Green Energy Ltd., Adani Transmission Ltd., PI Industries Ltd., Adani Enterprise Ltd. and SRF Ltd. are -8.96, 3.28, 9.44, 7.14 and 4.75 respectively.

Alpha Method - The following are the five companies selected on the basis of Alpha method which is derived from actual return and required return of the scrips:

Table 7 - Top Five Companies (Alpha Method Basis)

<b>Sr. No.</b>	<b>Scripts</b>
1	Adani Green Energy Ltd.
2	Adani Transmission Ltd.
3	Gland Pharma Ltd.
4	Avenue Supermarts Ltd.
5	Berger Paints India Ltd.

Source: Own Calculation

The table no. 7 shows that Adani Green Energy Ltd., Adani Transmission Ltd., Gland Pharma Ltd., Avenue Supermarts Ltd. and Berger Paints India Ltd. are selected in top 5 companies as per alpha method. Adani Green Energy Ltd. has reported highest alpha value of 335.86. While Adani Transmission Ltd. has alpha value of 216.96. Gland Pharma Ltd., Avenue Supermarts Ltd. and Berger Paints India Ltd. have alpha value of 43.84, 33.19 & 31.59 respectively. The risk associated with Adani Green Energy Ltd., Adani Transmission Ltd., Avenue Supermarts Ltd. and Berger Paints India Ltd. include - 246.01%, 319.81%, 17.01% & 13.73% respectively. Gland Pharma Ltd. has reported no risk.

## **6. Conclusion**

The Indian stock market is massively affected by coronavirus crisis. There are many industries such as hospitality, tourism and entertainment have been negatively affected by Covid-19 pandemic. Apart from Covid-19 crisis, Russia and Ukraine war has also affected stock market. The Indian stock market has been taking a hit due to the potential tightening of policy measures with respect to the war between Russia and Ukraine. The stock prices of indices have been dropped down. Moreover, Foreign Institutional Investors have been pulling out money from Indian stock market due to the war between Russia and Ukraine. As a result of the same, the investors are confused and suffering from problem in making effective investment decision.

Most of the Investors face a lot of difficulties in choice of securities to be included in the portfolio for obtaining maximum return at minimum risk. Therefore, the aim of the thesis is to help the Investors in selection of securities by analysing the securities using CAPM Model. The thesis also focuses on perceiving the practical application of the CAPM Model by comparing the actual risk and return with the estimated risk and return. It also analyses the performance of companies of selected index and aid the investors in making the investment decision. The CAPM Model decides the risk and return relationship of a security along with its pricing behaviour. The thesis considers fifty companies from Nifty 50 index for the purpose of analysis. The analysis is based on secondary data which includes daily stock prices of scripts for the period of past 10 years i.e., from 2012 to 2022. The adjusted closing prices will be taken into consideration for the purpose of analysis because it considers the effect of other factors like dividends, stock splits etc. as compare to closing prices. The daily stock prices have been analysed using three days moving average method to obtain return.

The introduction chapter of thesis describes how the securities are valued before development of Capital Asset Pricing Model and it also describes the importance of Capital Asset Pricing Model. The data as well as method used for analysis are described under the head of objectives and methodology chapter. The overview of Indian stock market and the information regarding various portfolio construction theories are explained in literary part of thesis. In addition to this, the impact of political factors, economic factors, social factors, technological factors, environmental factors and legal factors on stock market are also described in literary part. After getting in depth understanding about topic, the practical part

is carried out. The practical part consists analysis of 50 securities of Nifty 50 Index using CAPM Model given by William Sharpe. The process of analysis includes 4 steps. The step 1 is about calculation of return, risk and beta for each security. The expected return is calculated using CAPM Model in step 2. The step 3 includes calculation of Alpha values for each security. The valuation of each security is determined in step 4. Further, the security market line is also formed. The insights about analysis are covered under result and discussion chapter.

From the analysis, it has been found that the Adani Green Energy Ltd. has achieved highest return as compared to other companies while One 97 Communication Ltd. has recorded the lowest return among fifty companies of Nifty 50 index. In terms of risk, Jubilant food works Ltd. is riskier script as it has reported highest risk. Gland Pharma Ltd. has reported no risk. In addition to that, Pidilite Industries Ltd. has seen lower risk among remaining companies. PI Industries Ltd. is highly volatile stock with highest beta value of 9.44 and Adani Green Energy Ltd. has lowest beta value of -8.96. Further, top five companies have been selected from Nifty 50 index based on Alpha Method as well as SML Method according to CAPM Model. The alpha method shows whether to invest or disinvest from securities. While security market line shows undervalued and overvalued securities. Adani Green Energy Ltd., Adani Transmission Ltd., Gland Pharma Ltd., Avenue Supercars Ltd., and Berger Paints India Ltd. have been selected in top five companies based on alpha method as the alpha value of these stocks are higher as compared to other companies. In addition to Alpha Method, Security Market Line has been formed based on beta and return of securities. The securities which fall above the SML line are undervalued and the securities which falls below the SML line are overvalued. The investors are recommended to invest in those stocks which are undervalued as those stocks have potential to grow in future. Adani Green Energy Ltd., Adani Transmission Ltd., PI Industries Ltd., Adani Enterprises Ltd. and SRF Ltd. have been selected in top five companies with higher actual return among others as per Security Market Line Method. In this way, the CAPM Model suggests whether the securities are undervalued or overvalued which helps the Investors in making effective investment decision and in fulfilling their needs in best manner.

The scope of further study includes the below mentioned points: The thesis uses CAPM Model for analyzing the securities. However, the analysis can be extended by other researchers using Sharpe Index Model, Modern Portfolio Theory, Arbitrage Pricing Theory and Multifactor Theory for the construction of portfolio. Beside this, the thesis considers 50

companies from Nifty 50 index as sample for purpose of analysis. In future, the analysis can be conducted for other indices of NSE & BSE such as Nifty next 50, Nifty smallcap 50, Nifty midcap 50, NSE 100, Nifty Auto, Nifty IT, S&P BSE 100 and S&P BSE Bankex etc.



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## 8. Appendix

<b>Calculation of Return, Risk and Beta for Nifty 50</b>		
<b>Years</b>	<b>Closing Price</b>	<b>Returns</b>
2011-2012	5240.061842	
2012-2013	5518.682329	5.32%
2013-2014	5989.909568	8.54%
2014-2015	7959.977778	32.89%
2015-2016	7986.846761	0.34%
2016-2017	8415.393884	5.37%
2017-2018	10026.21856	19.14%
2018-2019	10853.5873	8.25%
2019-2020	11499.87778	5.95%
2020-2021	11991.78788	4.28%
2021-2022	16651.71895	38.86%
<b>Mean</b>		12.8934%
<b>Standard deviation</b>		12.4408%
<b>Variance</b>		1.5477%

<b>Calculation of Return, Risk and Beta for Adani Enterprises Ltd.</b>							
<b>Years</b>	<b>Closing Price</b>	<b>Returns</b>	<b>Benchmark Return</b>	<b>(Ri-RI')</b>	<b>(Rm-RM')</b>	<b>(Ri-RI')(Rm-RM')</b>	<b>(Rm-RM')<sup>2</sup></b>
2011-2012	64.51668439						
2012-2013	30.68556424	-52.44%	5.32%	-118.06%	-7.58%	8.94%	0.57%
2013-2014	30.16903423	-1.68%	8.54%	-67.31%	-4.35%	2.93%	0.19%
2014-2015	71.70104267	137.66%	32.89%	72.04%	20.00%	14.41%	4.00%
2015-2016	52.20156006	-27.20%	0.34%	-92.82%	-12.56%	11.65%	1.58%
2016-2017	41.81662156	-19.89%	5.37%	-85.52%	-7.53%	6.44%	0.57%
2017-2018	78.31037275	87.27%	19.14%	21.65%	6.25%	1.35%	0.39%
2018-2019	123.0477588	57.13%	8.25%	-8.50%	-4.64%	0.39%	0.22%
2019-2020	169.04939	37.39%	5.95%	-28.24%	-6.94%	1.96%	0.48%
2020-2021	364.1513714	115.41%	4.28%	49.79%	-8.62%	-4.29%	0.74%
2021-2022	1538.896556	322.60%	38.86%	256.97%	25.97%	66.73%	6.74%
					<b>Total</b>	<b>110.52%</b>	<b>15.48%</b>
<b>Mean</b>		65.6247%	12.8934%				
<b>Standard deviation</b>		104.6136%	12.4408%				
<b>Variance</b>		109.4401%	1.5477%				
<b>Beta</b>		7.1405					
<b>Covariance</b>		12.2795%					
<b>Beta using Index variance</b>		7.933896703					

SR. NO.	SCRIPTS	RF	RI'	RM'	BETA	VARIANCE OF RI'	VARIANCE OF RM'	SD OF RI'	SD OF RM'	(RI-RI')*(RM-RM')	COVARIANCE	CAPM
1	ACC Ltd.	6.23	10.25	12.89	1.19	324.30	154.77	18.01	12.44	18.44	2.05	14.17
2	Adani Enterprises Ltd.	6.23	65.62	12.89	7.14	10944.01	154.77	104.61	12.44	110.52	12.28	53.81
3	Adani Green Energy Ltd.	6.23	282.42	12.89	-8.96	60521.80	154.77	246.01	12.44	-68.10	-7.57	-53.44
4	Adani Transmission Ltd.	6.23	245.08	12.89	3.28	102275.84	154.77	319.81	12.44	29.90	3.32	28.11
5	Ambuja Cements Ltd.	6.23	13.61	12.89	1.36	490.72	154.77	22.15	12.44	21.03	2.34	15.29
6	Avenue Supermarts Ltd.	6.23	45.31	12.89	0.88	289.31	154.77	17.01	12.44	7.33	0.81	12.12
7	Bajaj Holdings & Investment Ltd.	6.23	24.35	12.89	1.61	547.50	154.77	23.40	12.44	24.90	2.77	16.95
8	Bandhan Bank Ltd.	6.23	-14.90	12.89	0.50	246.05	154.77	15.69	12.44	3.82	0.42	9.57
9	Bank of Baroda	6.23	-0.15	12.89	2.32	1019.71	154.77	31.93	12.44	35.84	3.98	21.66
10	Berger Paints India Ltd.	6.23	37.67	12.89	-0.02	188.52	154.77	13.73	12.44	-0.35	-0.04	6.08
11	Biocon Ltd.	6.23	26.67	12.89	-0.39	1109.36	154.77	33.31	12.44	-6.05	-0.67	3.62
12	Bosch Ltd.	6.23	12.31	12.89	1.35	864.64	154.77	29.40	12.44	20.87	2.32	15.22
13	Cholamandam Investment and Finance Company Ltd.	6.23	38.74	12.89	1.82	1004.71	154.77	31.70	12.44	28.13	3.13	18.34
14	Colgate Palmolive (India) Ltd.	6.23	14.88	12.89	0.17	93.26	154.77	9.66	12.44	2.62	0.29	7.36
15	DLF Ltd.	6.23	10.03	12.89	1.76	1004.35	154.77	31.69	12.44	27.25	3.03	17.96
16	Dabur India Ltd.	6.23	20.49	12.89	0.16	105.17	154.77	10.26	12.44	2.46	0.27	7.29
17	FSN-commerce Ventures Ltd.	6.23	-9.96	12.89	0.17	29.99	154.77	5.48	12.44	0.06	0.01	7.36
18	GAIL (India) Ltd.	6.23	7.79	12.89	1.58	578.69	154.77	24.06	12.44	24.45	2.72	16.75
19	Gland Pharma Ltd.	6.23	50.07	12.89	0.00	0.00	154.77	0.00	12.44	0.00	0.00	6.23
20	Godrej Consumer Products Ltd.	6.23	22.86	12.89	0.12	324.96	154.77	18.03	12.44	1.90	0.21	7.05
21	HDFC Asset Management Company Ltd.	6.23	27.19	12.89	-0.91	1055.00	154.77	32.48	12.44	-6.93	-0.77	0.16
22	Havells India Ltd.	6.23	33.91	12.89	1.42	476.36	154.77	21.83	12.44	21.94	2.44	15.67
23	ICICI Lombard General Insurance Company Ltd.	6.23	19.32	12.89	-0.43	300.97	154.77	17.35	12.44	-3.46	-0.38	3.38
24	ICICI Prudential Life Insurance Company Ltd.	6.23	13.90	12.89	0.61	273.56	154.77	16.54	12.44	10.89	1.21	10.30
25	Indian Oil Corporation Ltd.	6.23	13.79	12.89	1.53	947.27	154.77	30.78	12.44	23.73	2.64	16.45
26	Indus Towers Ltd.	6.23	10.87	12.89	1.46	992.04	154.77	31.50	12.44	21.60	2.40	15.93
27	Info Edge (India) Ltd.	6.23	35.00	12.89	1.29	795.73	154.77	28.21	12.44	20.01	2.22	14.84
28	Interglobe Aviation Ltd.	6.23	18.87	12.89	3.32	3686.57	154.77	60.72	12.44	51.46	5.72	28.38
29	Jubilant foodworks Ltd.	6.23	27.66	12.89	0.53	936.24	154.77	3059.80	12.44	8.17	0.91	9.75
30	Larsen & Toubro Infotech Ltd.	6.23	14.51	12.89	2.05	698.66	154.77	26.43	12.44	31.73	3.53	19.89
31	Lupin Ltd.	6.23	12.59	12.89	0.11	861.60	154.77	29.35	12.44	1.66	0.18	6.95
32	Marico Ltd.	6.23	23.84	12.89	0.49	239.60	154.77	15.48	12.44	7.61	0.85	9.51
33	Mindtree Ltd.	6.23	55.24	12.89	2.84	3000.95	154.77	54.78	12.44	44.01	4.89	25.18
34	Muthoot Finance Ltd.	6.23	32.00	12.89	0.69	1071.96	154.77	32.74	12.44	10.68	1.19	10.83
35	NMDC Ltd.	6.23	6.48	12.89	2.05	899.92	154.77	30.00	12.44	31.73	3.53	19.89
36	One 97 Communication Ltd.	6.23	-20.33	12.89	-0.91	28.20	154.77	5.31	12.44	-0.35	-0.04	0.14
37	PI Industries Ltd.	6.23	93.08	12.89	9.44	47602.73	154.77	218.18	12.44	146.06	16.23	69.11
38	Pidlite Industries Ltd.	6.23	32.16	12.89	0.73	151.20	154.77	0.12	12.44	11.25	1.25	11.07
39	Piramal Enterprises Ltd.	6.23	28.37	12.89	1.48	1295.08	154.77	35.99	12.44	22.94	2.55	16.10
40	Procter & Gamble Hygiene & Health care Ltd.	6.23	25.62	12.89	1.32	479.61	154.77	21.90	12.44	20.40	2.27	15.01
41	Punjab National Bank	6.23	-8.81	12.89	2.04	1026.23	154.77	32.03	12.44	31.55	3.51	19.81
42	SBI Cards and Payment services Ltd.	6.23	22.10	12.89	0.64	35.54	154.77	0.60	12.44	9.74	1.08	10.48
43	SRF Ltd.	6.23	61.48	12.89	4.75	7722.37	154.77	87.88	12.44	73.52	8.17	37.88
44	Siemens Ltd.	6.23	15.24	12.89	1.71	980.44	154.77	31.31	12.44	26.46	2.94	17.62
45	Steel Authority of India Ltd.	6.23	12.05	12.89	4.08	3248.54	154.77	57.00	12.44	63.15	7.02	33.42
46	Torrent Pharmaceuticals Ltd.	6.23	30.59	12.89	0.39	885.41	154.77	29.76	12.44	6.08	0.68	8.85
47	United Spirits Ltd.	6.23	20.68	12.89	0.37	1061.70	154.77	32.58	12.44	5.74	0.64	8.70
48	Vedanta Ltd.	6.23	21.00	12.89	4.02	3630.19	154.77	60.25	12.44	62.18	6.91	33.00
49	Zomato Ltd.	6.23	-5.66	12.89	1.31	107.45	154.77	10.37	12.44	1.34	0.15	14.95
50	Zyventus Lifesciences Ltd.	6.23	18.05	12.89	0.97	965.95	154.77	31.08	12.44	14.97	1.66	12.67

<b>SR. NO.</b>	<b>SCRIPTS</b>	<b>BETA</b>	<b>CAPM</b>	<b>ACTUAL RETURN</b>
1	ACC Ltd.	1.19	14.17	10.25
2	Adani Enterprises Ltd.	7.14	53.81	65.62
3	Adani Green Energy Ltd.	-8.96	-53.44	282.42
4	Adani Transmission Ltd.	3.28	28.11	245.08
5	Ambuja Cements Ltd.	1.36	15.29	13.61
6	Avenue Supermarts Ltd.	0.88	12.12	45.31
7	Bajaj Holdings & Investment Ltd.	1.61	16.95	24.35
8	Bandhan Bank Ltd.	0.50	9.57	-14.90
9	Bank of Baroda	2.32	21.66	-0.15
10	Berger Paints India Ltd.	-0.02	6.08	37.67
11	Biocon Ltd.	-0.39	3.62	26.67
12	Bosch Ltd.	1.35	15.22	12.31
13	Cholamandalam Investment and Finance Company Ltd.	1.82	18.34	38.74
14	Colgate Palmolive (India) Ltd.	0.17	7.36	14.88
15	DLF Ltd.	1.76	17.96	10.03
16	Dabur India Ltd.	0.16	7.29	20.49
17	FSN-commerce Ventures Ltd.	0.17	7.36	-9.96
18	GAIL (India) Ltd.	1.58	16.75	7.79
19	Gland Pharma Ltd.	0.00	6.23	50.07
20	Godrej Consumer Products Ltd.	0.12	7.05	22.86
21	HDFC Asset Management Company Ltd.	-0.91	0.16	27.19
22	Havells India Ltd.	1.42	15.67	33.91
23	ICICI Lombard General Insurance Company Ltd.	-0.43	3.38	19.32
24	ICICI Prudential Life Insurance Company Ltd.	0.61	10.30	13.90
25	Indian Oil Corporation Ltd.	1.53	16.45	13.79
26	Indus Towers Ltd.	1.46	15.93	10.87
27	Info Edge (India) Ltd.	1.29	14.84	35.00
28	Interglobe Aviation Ltd.	3.32	28.38	18.87
29	Jubilant foodworks Ltd.	0.53	9.75	27.66
30	Larsen & Toubro Infotech Ltd.	2.05	19.89	14.51
31	Lupin Ltd.	0.11	6.95	12.59
32	Marico Ltd.	0.49	9.51	23.84
33	Mindtree Ltd.	2.84	25.18	55.24
34	Muthoot Finance Ltd.	0.69	10.83	32.00
35	NMDC Ltd.	2.05	19.89	6.48
36	One 97 Communication Ltd.	-0.91	0.14	-20.33
37	PI Industries Ltd.	9.44	69.11	93.08
38	Pidilite Industries Ltd.	0.73	11.07	32.16
39	Piramal Enterprises Ltd.	1.48	16.10	28.37
40	Procter & Gamble Hygiene & Health care Ltd.	1.32	15.01	25.62
41	Punjab National Bank	2.04	19.81	-8.81
42	SBI Cards and Payment services Ltd.	0.64	10.48	22.10
43	SRF Ltd.	4.75	37.88	61.48
44	Siemens Ltd.	1.71	17.62	15.24
45	Steel Authority of India Ltd.	4.08	33.42	12.05
46	Torrent Pharmaceuticals Ltd.	0.39	8.85	30.59
47	United Spirits Ltd.	0.37	8.70	20.68
48	Vedanta Ltd.	4.02	33.00	21.00
49	Zomato Ltd.	1.31	14.95	-5.66
50	Zydus Lifesciences Ltd.	0.97	12.67	18.05



