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# A Study on Performance Evaluation and Computation of Stock Market Index with Special Reference to BSE and NSE

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***Abstract:*** ***The Stock market index in India play a crucial role in the country's economic growth and development. The Investors, policymakers, and market participants closely monitor the performance of stock market indices. In general, people tend to be unaware of Indian indices, their weights, and their composition patterns.***
***This research paper aims to analyze the performance of stock market indices and focuses on important indexes from the Bombay Stock Exchange and the National Stock Exchange while taking into account their development, calculation method, and historical value.***
***This Study is mainly based on three Objectives and data selected and synthesizes for the year 2001 to 2022, due to base year limitations of various indices. By utilizing quantitative analysis methods and examining relevant economic indicators, this paper seeks to provide valuable insights into the Indian stock market Indices and its role as a barometer of economic health. This article makes it simple for people to understand the number of companies that make up the important indices, their weight in the indexes, their performance on a sectoral basis, and other methodologies. Finally, this paper attempts to provide a brief overview of various index which is traded in Indian Stock market.***
***Keywords: Computation Methodology; Economy; Historical Development; Performance Evaluation; Stock Market Indices.***

## I. INTRODUCTION

### *A. Stock Market Index*

Stock market indices act as market barometers. They reflect the behaviors of the stock market (Pandian, 2013). According to the metrics on the website of the Bombay stock exchange, around 5311 companies have listed their shares in the exchange as of January 13, 2023.

The total market capitalization of all the companies is Rs. 2,82,13,564 crores (How Many Companies are listed in the Indian Stock Market ?, n.d.).

As a result, looking at the price of each stock to determine whether the market is rising or falling is impossible. The indices represent the market and provide a comprehensive outline of the market trend (Pandian, 2013). So, A stock market index is created by selecting a group of stocks that are representative of the whole market or a specified sector or segment of the market. An Index is calculated with reference to a base period and a base index value (About Indices, n.d.).

Stock market indexes are useful for a variety of reasons. Some of them are:

1) They provide a historical comparison of returns on money invested in the stock market against other forms of investments such as gold or debt.
2) They can be used as a standard against which to compare the performance of an equity fund.
3) It is a leading indicator of the performance of the overall economy or a sector of the economy.
4) Stock indexes reflect highly up to date information.
5) Modern financial applications such as Index Funds, Index Futures, Index Options play an important role in financial investments and risk management (About Indices, n.d.).

### *B. Methodology for Calculating Stock Market Index:*

Any of the following methods can be used for calculating the index.

 

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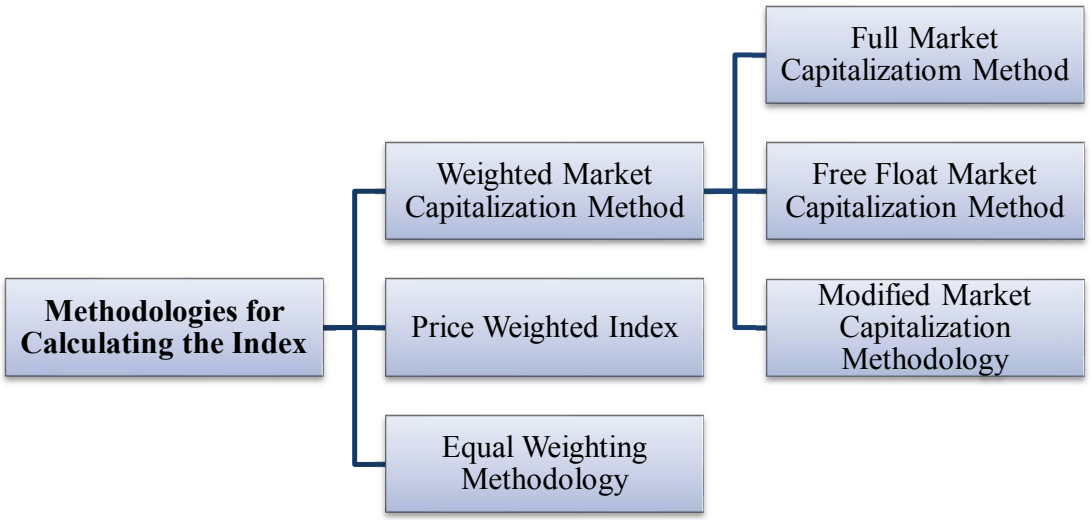


Figure 1: Methodology for calculating stock market index

Source: Author compilation

*1) Weighted Market Capitalization Method*

*a)* Full market capitalization method: Scrips weightage in the index under this method is calculated by multiplying the number of shares outstanding with the market price of the companies share, The shares with the highest market capitalization would have a higher weightage and would be most influential in this type of index. Examples: S&P 500 Index in USA and S&P CNX Nifty in India (Joshi, 2015)(Pathak, 2018).

*b)* Free float market capitalization: It includes only those shares that are readily available in the market for purchase by investors. It does not include full market capitalization. S & P Indices around the world are free- float. All Dow Jones indices except Dow Jones Industrial Average are Free- float (Pathak, 2018).

Free float factor: The BSE has adopted the international practice of assigning a free-float factor to each company. Free-float factors are assigned according to a banding structure consisting of ten bands into which each company falls, based on its percentage of shares in free-float. The banding structure means that the actual free float of a company is not taken as it is but rounded off to the higher multiple of 5 or 10 depending upon the banding structure adopted. For example, the free-float factor is then multiplied with the full market capitalization of the company to arrive at the free-float capitalization. Based on the percentage of a company's free-float capitalization to the total free-float capitalization of the Sensex, weights are assigned to each company. The BSE has taken a lead on free-floating the indices. It made a beginning by launching on July 11, 2001, the country's first free-float index, 'BSE-TECK Index,' an index for technology, entertainment, communication, and other knowledge-based sectors. The BSE has introduced this methodology in the case of the BSE Sensex since September 1, 2003. Now the BSE Sensex is a free float Sensex (Pathak, 2018).

*c)* Modified capitalization weighted: This method seeks to limit the influence of the largest stocks in the index which otherwise would dominate the entire index. This method sets a limit on the percentage weight of the largest stock or a group of stocks. The NASDAQ-100 Index is calculated by using this method (Pathak, 2018).

*2) Price weighted index*

In this method, the price of each stock in the index is summed up which is then equated to an index starting value. An arbitrary date is set as the base and the Laspeyre's Price Index, which measures price changes against a fixed base period quantity weight is used. In the case of a stock split, the market price of the stock falls and this results in less weightage in the index. The Dow Jones Industrial Average and Nikkie 225 are price-weighted indices (Pathak, 2018).

*3) Equal Weighted Index*

In this method, each stock's percentage weight in the index is equal and hence, all stocks have an equal influence on the index movement. The value line index at Kansas City Board of Trade (KCBT) is an equal weighted index (Pathak, 2018).

 

*C. Differences Between the Indices*

To some extent, the indexes differ from one another. Sometimes the Sensex rises by 100 points while the NSE Nifty rises by only 40 points. The following are the essential elements that separate one index from another:

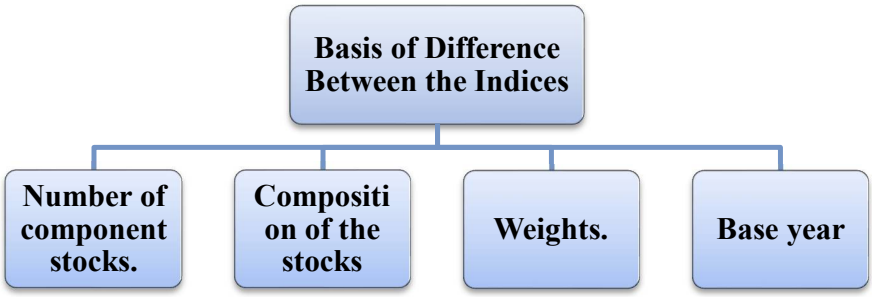


Figure 2: Basis of difference between the indices

Source: Author compilation

1) Number of Component Stocks: The number of stocks in an index determines its behaviors. If the number is large, it indicates that the sample is representative and capable of reflecting market change. It is obvious that the number of scrips varies from index to index, and hence their movements do as well. The BSE National Index is thought to be more representative than the Sensex because in its composition it represents 100 companies stocks.
2) Composition of the Stocks: The index's stock mix should reflect both market movement and macroeconomic changes. An index is maintained by the Centre for Monitoring the Indian Economy. It frequently modifies the index's composition in order to better reflect market fluctuations. Some of the scrips' traded volumes may decrease, while other equities may pique the market's attention. In such a circumstance, the scrip that has lost market value should be removed, and others should be put in its place. For example, in august 1996 Sensex fully revamped and its half of the scrips were changed.
3) Weights: The weight assigned to each company's stock also determines the index's movement. The indices can be weighted by price or value. A price weighted index is calculated by adding the current stock exchange prices and dividing them by the total number of stocks. The total market value of the shares (the number of outstanding shares multiplied by the current market price) acts as the weight in the value weighted index. The value is weighted in most indices throughout the world and in India.
4) Base Year: Variations in the indexes are also caused by the choice of base year. Different indices use a different base year. The base year should be free of any abnormal market changes. The index better represents changes in market movement when the base year is close to the current year. At the same time, an investor cannot make historical comparisons when it is too close.

The base year of Sensex is 1978-79, and the RBI Index of Ordinary Shares is the second oldest, having 1980-81 as the base year. Table 1 gives a summary of the major stock market indices (Pandian, 2013)

Table 1: Major stock market indices

| Indian Indices | Weighting basis | No of stocks | Base Year |
|---|---|---|---|
| Economic Times Index of Ordinary Share Prices | Unweighted | 72 | 1984-85 |
| BSE Sensex | Market Value | 30 | 1978-79 |
| BSE National Index | Market Value | 100 | 1983-84 |
| BSE-200 | Market Value | 200 | 1989-90 |
| Dollex | Market Value | 200 | 1989-90 |
| S & P Nifty (NSE-50) | Market Value | 50 | Nov 1995 |
| S & P Nifty Junior (NSE midcap) | Market Value | 50 | - |
| S & P CNX-500 | Market Value | 500 | 1994 |
| CNX Midcap-200 | Market Value | 200 | 1994 |
| CMIE | Market Value | 72 | June1994 |
| International Indices | | | |
| Dow Jones Industrial Average | Price weighted | 30 | 1928 |
| Nikkei Dow Jones Average | Price Weighted | 225 | 1949 |
| S & P Composite | Market Value | 500 | 1941-42 |

Source: (Pandian, 2013)

*D. Some Important Global Stock Market Indices*

1) The Dow Jones industrial average: It is the most widely watched and quoted index because of its long existence. The Dow has 30 constituents, and it follows the methodology of price-based weightage.
2) The Nasdaq composite index: This index is the market capitalization weightages of prices for all the stocks listed in the Nasdaq stock market. The Nasdaq Composite began on February 8, 1971, with a base of 100.
3) The Nasdaq 100 index: Nasdaq 100 comprises the largest computer, software and telecom stocks. by market capitalization on the Nasdaq. For a company to be included in the Nasdaq 100, it must have a minimum average trading volume of 1,00,000 shares per day and must have been trading on a major exchange for at least a year or two.
4) The S&P 500 index: This index comprises 500 biggest publicly traded companies in the US by market capitalization. Most money managers treat the S&P 500 as a proxy for the US stock market. The S&P 500 tries to cover all major areas of the US economy. To be included, a company must be profitable, the prospective company must not be closely held (at least 50 per cent of its stock should be public) and must have a large trading volume for its shares (not less than a third of its total shares).
5) The FTSE 100: The FTSE 100 consists of the largest 100 companies by full market value listed on the London Stock Exchange. The FTSE 100 is the benchmark index to indicate the performance of the European market. It is a market-capitalization-weighted index that also considers the free-float weightages of individual stocks before including them in the index (Pathak, 2018).

## II. LITERATURE REVIEW

The study embraces the existing literature about the stock market Index. The study integrated in two sections- first section related with the overview and section second deals with calculation methodology and development of Stock Market Indices in India. So, the literature combines both the sections in one part and studied in chronological order from oldest to latest.

Harvey and Whaley (1992) in their study, investigated the dynamic behavior of market volatility. The study observed that after transaction costs, a trading strategy based upon out of sample volatility changes did not generate economic profits. The study supported the notion that S & P 100 index option market is allocationally efficient.

Poshakwale (2002) in his study, he investigated the random walk hypothesis in the rising Indian stock market by calculating daily returns from an evenly weighted portfolio of 100 equities and a sample of the 38 most regularly traded stocks on the BSE. The daily returns from the Indian stock market, according to this study, did not follow a random walk.

Ho and Tsui (2004) in their study probed the applicability of volatility behavior of aggregate indices to the Sectoral Indices. The study found the leverage effects of equity returns.

Agrawal (2006) in his study tested the impact of the sample size on the distributional characteristic of the stock returns of Nifty and Sensex. The results of this study indicated that the large sample size of daily stock returns did not follow the normal distribution while small sample size of monthly stock returns followed the normal distribution.

Gupta and Kundu (2006) considered the returns and volatility in the Sensex while analyzing the effect of the Union Budgets on the stock market. They discovered that, in comparison to medium-term and long-term average returns, the short-term post-budget period is when budgets had the most influence.

Joshi and Pandya (2008) examined the nature of volatility on the BSE and NSE of the Indian stock market. A model with a large lag factor value indicates that volatility in both markets are very stable and predictable.

Prabahar, et.al (2008) in their study studied the return and risk element of investing in the shares of Indian Information Technology Industry. It was found that the daily average mean returns of the six companies were lower than the daily mean returns of the indices. Besides, the volatilities of the stock returns over the study period were much higher than that of indices. According to this study, the unsystematic risk of IT stocks were higher than the systematic risk.

Sah (2010) in his study, he tried to examine the seasonality of stock market in India. He considered the S&P CNX Nifty as the representative of stock market in India and tested whether seasonality is present in Nifty and Nifty Junior returns using daily and monthly data sets. The study found that daily and monthly seasonality are present in Nifty and Nifty Junior returns. The analysis of stock market seasonality using daily data, he found Friday Effect in Nifty returns while Nifty Junior returns were statistically significant on Friday, Monday and Wednesday. In case of monthly analysis of returns, the study found that Nifty returns were statistically significant in July, September, December and January. In case of Nifty Junior, June and December months were statistically significant. The results established that the Indian stock market is not efficient and investors can improve their returns by timing their investment.

 

Selvam, et.al (2010) in their study studied the market efficiency of the sample companies listed on the BSE PSU Index. The study found that the PSU Index performed well during the study period and the investors of PSU companies earned maximum return through stock market operations.

Sen (2010) analyzed daily time series data of S & P CNX NIFTY. The study attempted to fit the data into GARCH (1,1) model to find conditional variances. According to this study, there were some macroeconomic variables which could influence the market volatility and the scrip level analysis was useful to capture the influence of company specific factors on scrip level volatility. Siddiqui and Gupta (2010), said that there was an impact of various macro-economic factors, both at the Indian and global front, in relation to Indian Stock Markets. The study found that the indices of S & P CNX Nifty and CNX Nifty Junior showed signs of random walk and Indian Stock market did not exhibit weak form of market efficiency.

Srinivasan and Ibrahim (2010) used daily data to study modelling and forecasting the volatility (conditional variance) of the returns of the SENSEX Index of the Indian stock market. The study examines that despite the presence of the leverage effect, the symmetric GARCH model outperforms the asymmetric GARCH models in terms of predicting conditional variance of the SENSEX Index return.

Kumar and Lagesh (2011) investigated price volatility and hedging of four notional commodity futures indices. GARCH (1,1) Model was employed to measure the spot return volatility of respective indices. The analysis of volatility was based on GARCH models by employing hedged return and variance reduction approaches.

Kumar and Mittal (2011) focused on the issue of empirical analysis of co-integration relation with major global indices of the US, UK, Germany, Hong Kong and Japan. This study attempted to understand the connectivity of these markets during the period of sub-prime crisis and post sub-prime revival of these economies. The authors observed that there existed a co-integration relationship among the global indices with long-term stability. It is pointed out that the international investors in the sample countries may use the findings of this study to take decision on their portfolio based on the relationship of global indices.

Madaleno & Pinho (2011) accounts for the time-varying pattern of price shock transmission, exploring stock market linkages using continuous time wavelet methodology. In order to sustain and improve previous results regarding correlation analysis between stock market indices, namely FTSE100, DJIA30, Nikkei225 and Bovespa, he extends here such analysis using the Coherence Morlet Wavelet, considering financial crisis episodes. Results indicate that the relation among indices was strong but not homogeneous across scales, that local phenomena are more felt than others in these markets and that there seems to be no quick transmission through markets around the world, but yes, a significant time delay.

Ali and Afzal (2012) devastating global financial crisis started from United States, spread all over the world and adversely affected real and financial sectors of developed as well as developing countries. This crisis is called the first largest crisis after the recession of 1930s. The prime aim of this study is to envisage the impact of recent global financial crisis on stock markets of Pakistan and India. For this purpose, daily data from 1st January 2003 to 31st August 2010 of KSE-100 and BSE-100 indices, representing stock markets' indices of Pakistan and India respectively, are used.

Ramkumar, et.al (2012) In their article, they tested the 13 BSE sectoral indices and examined market efficiency. According to the study, the returns of eight indices out of twelve, especially the BSE Automobile Index, BSE Bankex, BSE Capital Goods Index, BSE Consumer Durables Index, BSE Health Care Index, BSE Metal Index, BSE PSU Index, and BSE Realty Index, followed normal distribution and gained higher returns.

Das and Pattanayak (2013) to study the effect of corporate fundamental factors on Indian stock market including NSE and BSE. Secondary data collected from the website of NSE and BSE Correlation & Regression. Corporate fundamental factors have a great impact on the share prices of companies registered at NSE and BSE.

Tandon and Malhotra (2013) in his study is undertaken with an attempt to determine the factors that influence stock prices in the context of National Stock Exchange (NSE) 100 companies. A sample of 95 companies is selected for the period 2007-12 and using linear regression model the results indicate that firms' book value, earning per share and price-earnings ratio are having a significant positive association with firm's stock price while dividend yield is having a significant inverse association with the market price of the firm's stock.

Luthra and Mahajan (2014) studied the impact of macroeconomic factors on BSE Bankex. Macroeconomic variables involve GDP growth rate, inflation, gold prices and exchange rate. Bombay Stock Exchange Limited launched the "BSE BANKEX Index". This index includes major public and private sector banks listed on BSE. The BSE BANKEX Index is displayed online on the BOLT trading terminals nationwide. The results conclude that inflation, exchange rate and GDP growth rate affect the BANKEX positively.

 

However, Gold Prices affect BSE Bankex negatively but none of these variables have a significant impact on the stock prices of banks.

Kumar & Kumar (2015), studied about market efficiency in India: An empirical study of Random walk hypothesis of Indian stock market NSE midcap. The existence of random walk for NSE Midcap Index has been examined through auto correlation, Q-statistics and the run test and found that the Indian stock market was not efficient in the weak form during the testing period. Study was found the stock prices in India was not reflected all the information in the past stock prices and abnormal returns can be achieved by investors through exploiting the market inefficiency.

Thenmozhi and Chandra (2015) in their study examines the asymmetric relationship between stock market returns and changes in the India Volatility Index (VIX). The results show that there is a negative correlation between NIFTY returns and changes in the levels of the India VIX, and that returns on two indices move independently of one another during strong upward market movements.

Tanty and Patjoshi (2016), The main focus of this research paper was to examine the nature of the volatility in the Indian stock markets. In this study ARCH and GARCH models have been applied to study the behaviour of stock market volatility. The results of the present study showed that both the stock markets i.e., BSE Sensex and NSE-S&P CNX Nifty exhibit volatility clustering. The descriptive statistics result of both the markets return series suggested that the return series of BSE was positively skewed while that of NSE was negatively skewed.

Kushwah and Munshi (2018), studied about the effect of seasonality over stock exchanges in India. The method of data analysis used in this research work is the descriptive statistics and paired sample t-test. S&P CNX Nifty 50 has been taken as a sample. It was also found that Diwali and Change in calendar year events have an inverse relationship with Nifty returns as they have negative correlation between them. While Budget announcement and changed in financial year events have direct relationship with Nifty returns as there exists a positive correlation between them.

Kumar and Biswal (2019) in their study affirmed the presence of volatility clustering and the effect of leverage because of which the future stock market was impacted by the uplifting news than the terrible news.

Choudhary and Jain (2020), they studied research on volatility pattern of BSE Bankex Index & BSE Sensex index using Exponential weighted moving Average Model". The main aim of the study was to model the volatility patterns of Bombay Stock Exchange (BSE) Sensex and BSE BANKEX Index using EWMA model. S&P BSE BANKEX index moment of last 10 years also represented the great attractions of investors and the high volume of turnovers. To conclude, that volatility of the last 10 years also represented the great attractions of investors and the high volume of turnover.

Dai et.al (2020) in their study examined the implied volatility of the stock market forecasts more accurately than the volatility of the price of oil and other macroeconomic and financial indicators.

## III. RESEARCH GAP

After analyzing and reviewing the literature it is clear that the earlier studies concentrated on estimating individual companies and indices in global stock exchanges as well as on the Indian basis many studies focused on stock market efficiency, volatility, macro-economic factors, institutional specific performance and company specific performance. So, none of the researchers studied different indices on the basis of their calculation methodology, their constituents, historical values, weights and performance in Indian context. Besides, there was no comprehensive study carried out in Indian Stock Markets with respect to Bombay Stock Exchange and National Stock Exchange Indices. In order to fill this gap, the present study was undertaken to analyze these key Indices in Indian Context.

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## IV. OBJECTIVES OF THE STUDY

*1)* To provide a brief and conceptual overview of major stock market index of India.
*2)* To give calculation methodology and development of major stock market index in India.
*3)* To Provide insights and recommendations for investors and policymakers based on the findings.

## V. RESEARCH METHODOLOGY

This work is descriptive in nature and is based on secondary data. Time period has been taken for the study is covered from 2001 to 2022. We have derived their facts and statistics from a variety of data sources, including journals, publications, websites, annual reports, and so on. The majority of the data was obtained from NSE and BSE websites.

On the basis of the data acquired, the researcher examined Indices overall performance. The collected data has been analyzed and interpreted by means of graphical and tabular representation by the use of average, percentage and trend forecasting methods.

## VI. RESULTS AND DISCUSSIONS

Overview, calculation methodology and development of major stock market index in India.

### *A. The BSE Sensitive Index-SENSEX (S&P BSE Sensex)*

The BSE Sensitive Index has long been regarded as a barometer of the daily temperature of Indian stock exchanges. In 1978-79, the stock market was dominated by private-sector firms mostly engaged in commodity production. As a result, a sample of 30 was taken from them. With the passage of time, more private and public enterprises entered the market. Despite the fact that the number of scrips in the Sensex basket has remained constant at 30, new industrial sectors including as services, telecom, consumer goods, and the two- and three-wheeler car industry have been represented. The index's continuity and integrity have been preserved, allowing a comparison of the current market environment to that of a decade ago is simplified, and any bias in market analysis is avoided.

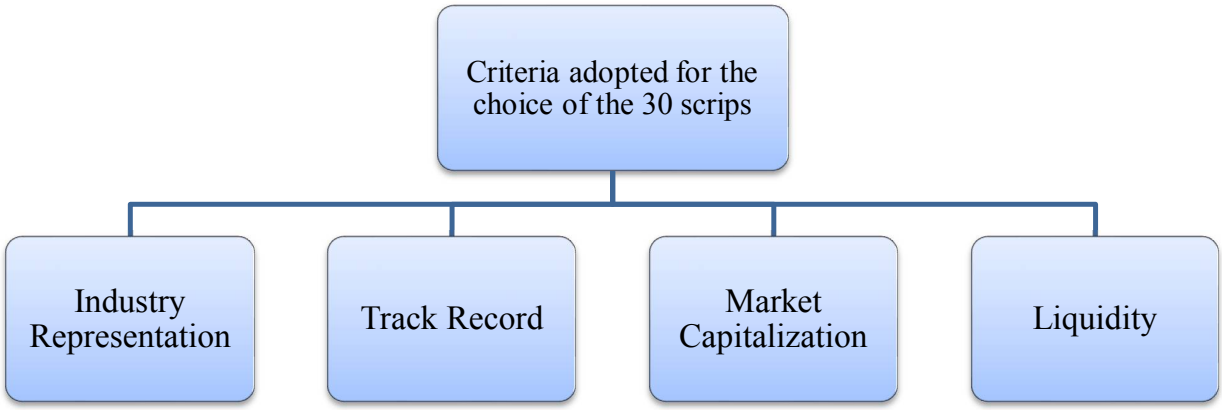



Figure No. 3: Criteria for Selection of scrips of Sensex

Source: Author Compilation

The criteria adopted for the choice of the 30 scrips are discussed below;

*1)* Industry representation: The index should be able to capture the macro-industrial environment through individual stock price fluctuations. The stock of the company should reflect the current situation of the industry as well as its future prospects: Companies chosen should be industry representatives. A business-like ACC, for example, represents the cement sector.

*2)* Track record: The company should have an acceptable track record of good performance in terms of corporate governance and dividend payment. The company should have a listing history of at least one year on the BSE.

*3)* Market capitalization: The market capitalization of a stock reveals its genuine value by multiplying the number of outstanding shares by the price. The price of a stock indicates its demand and potential for growth. The number of outstanding shares is determined by the equity base. The stock should be among the top 100 by total market capitalization. Based on free float, the weight of each Sensex stock should be at least 0.5% of the index. The market capitalisation would be averaged over the previous six months.

*4)* Liquidity: The liquidity factor is determined by the frequency of trades, average daily trades, and average daily turnover. Except for severe circumstances such as scrip suspensions, the scrip should have been traded on every trading day for the previous year. For the past year, the stock should have been among the top 150 listed by average number of trades and average value of shares moved per day.

Revision of Sensex: The Index Committee sets the policy framework for the maintenance of index. The committee consists of experts on capital market segments. They include academicians, fund managers from leading mutual funds, financial journalists, market participants, independent governing board members and exchange administration. The committee meets once in a quarter. Based on the performance of a particular scrip and industry, representation of an existing scrip is excluded from the indices and a new scrip is included. If the index constituents change, the notification of the incoming and exiting scrips is made six weeks before the actual implementation of the index adjustment (Pandian, 2013).

So, the 30 scrips which is seen today in Sensex was not same all the time. They excluded time to time and new will be added on different criteria, it became started in 1986, when 4 scrips replaced then 1992, 1 scrip then 1996 was a huge year and 15 scrips replaced, 1998, 4 scrips, 2000, 4 scrips, 2001, 1 scrips, 2002, 4 scrips, 2003, 5 scrips, 2004, 2 scrips, 2005, 2 scrips, 2006, 1 scrips, 2007, 2 scrips, 2008, 2 scrips, 2009, 2 scrips, 2010, 2 scrips, 2011 1 scrips and 2012, 1 scrips replaced.

Table no 2: Basic Facts About Sensex

| Easy Facts | |
|---|---|
| Base year: | 1978-79, 1st April 1979 |
| Base value | 100 |
| Launch date | 01-Jan-86 1985-86 |
| Calculation method: | Free Float market capitalization method |
| Constituent count | 30 |

Source: BSE website

Sensex calculation methodology: Free float methodology has been adopted for the calculation of Sensex from 1 September 2003. Major indices providers like HSCL, FTSE, STOXX, S&P and Dow Jones use the free-float methodology. Initially, the index was calculated based on the 'full market capitalization. The free-float technique only analyses a company's free-float market capitalization. The proportion of total shares issued by the company that are readily available for trading in the market is described as free-float market capitalization. For this purpose, the following holdings are eliminated.

*a)* Holdings by founders/directors/acquirers which have control element.
*b)* Holdings by persons/bodies with 'controlling interest.
*c)* Government holding as promoter/acquirer.
*d)* Holding through FDI route.
*e)* Strategic stakes by private corporate bodies/individuals.
*f)* Equity held by associate/group companies (cross holdings).
*g)* Equity held by Employees' Welfare Trusts.
*h)* Locked-in-shares and shares which would not be sold in the open market in normal course.

The free-float factor for each company is calculated based on the detailed information submitted by the companies in the prescribed format to the BSE. To calculate the free-float market, multiply the market capitalization by the free-float factor. A free-float factor of say 0.60 means that only 60% of the market capitalization of the company is considered for the calculation of Sensex.

Table 3: Component of BSE Sensitive Index based on Free Float Factor

| Sr. No. | Company | Industry | Free Float factor |
|---|---|---|---|
| 1 | Asian Paints | Paints | 0.5 |
| 2 | Axis Bank | Banking | 0.9 |
| 3 | Bajaj Finance | Finance | 0.4 |
| 4 | Bajaj Finserv | Finance | 0.4 |
| 5 | Bharti Airtel | Telecom | 0.4 |
| 6 | HCL Technologies | Software | 0.4 |
| 7 | HDFC | Finance | 1.0 |
| 8 | HDFC bank | Banking | 0.7 |
| 9 | HUL | FMCG | 0.4 |
| 10 | ICICI Bank | Banking | 1.0 |
| 11 | Indusand Bank | Banking | 0.8 |
| 12 | Infosys | Software | 0.8 |
| 13 | ITC | Food and Tobacco | 1.0 |
| 14 | Kotak Mahindra Bank | Banking | 0.7 |
| 15 | L & T | Engineering | 1.0 |
| 16 | M&M | Automobiles | 0.8 |

| | | | |
|---|---|---|---|
| 17 | Maruti Suzuki | Automobiles | 0.4 |
| 18 | Nestle | Food and Beverages | 0.4 |
| 19 | NTPC | Power | 0.5 |
| 20 | Power Grid | Power | 0.5 |
| 21 | Reliance Ind. | Energy | 0.5 |
| 22 | SBI | Banking | 0.4 |
| 23 | Sun Pharma | Pharmaceuticals | 0.5 |
| 24 | Tata Motors | Automobiles | 0.5 |
| 25 | Tata Steels | Steel | 0.7 |
| 26 | TCS | Software | 0.3 |
| 27 | Tech Mahindra | Software | 0.6 |
| 28 | Titan | Retailing | 0.5 |
| 29 | Ultratech Cement | Cement | 0.4 |
| 30 | Wipro | Software | 0.3 |

Source: (List of BSE Sensex 30 Companies, n.d.)

Sensex calculation: Example Deepak Mohoni, a stock market expert, invented the word Sensex in 1989. The BSE Sensitive Index was at 750 points at the time. It's a combination of the phrases Sensitive and Index (BSE SENSEX, n.d.).
For the sake of calculation, we suppose that the Index consists of only two stocks: Stock A and Stock B. Company A has 800 free floating shares, whilst Company B has just 1000. Now suppose the market price of stock A is Rs. 120 per share, So free floating market capitalization will be 96,000 (i.e. 800 shares of Rs. 120), Similarly If stock B is Rs. 200 per share
Its free float market capitalization is 2,00,000 (i.e., 1000 shares of Rs. 200).
Now the free float market capitalization of the Index (comprising of Stock A and Stock B in this case) is Rs. 296000. Suppose If the market capitalization of the stock in the index was Rs. 60,000 during the base year, logically assume that an index market capitalization of Rs. 60,000 is equal to an index value of 100.
So, Index = Base value* Current market capitalization/Base market capitalization.
It would be Rs. (2,96,000/60,000)*(100) that is 493.33 points. Sensex works similarly.

Table: 4: Sensex 30 companies list based on their weights

| Sr. No. | Name | Industry | Weights (%) |
|---|---|---|---|
| **1** | RIL | Integrated Oil & Gas | 11.95 |
| **2** | HDFC Bank | Banks | 10.38 |
| **3** | ICICI Bank | Banks | 9.37 |
| **4** | HDFC | Personal Products | 7.1 |
| **5** | Infosys | IT Consulting & Software | 6.5 |
| **6** | ITC | Cigarettes,Tobacco Products | 5.48 |
| **7** | TCS | IT Consulting & Software | 4.79 |
| **8** | L&T | Construction & Engineering | 4.16 |
| **9** | Kotak Mahindra Bank | Banks | 4.1 |
| **10** | Axis Bank | Banks | 3.43 |
| **11** | HUL | Housing Finance | 3.23 |
| **12** | SBI | Banks | 3.2 |
| **13** | Bharti Airtel | Telecom Services | 2.8 |
| **14** | Bajaj Finance | Holding Companies | 2.46 |
| **15** | Asian Paints | Furniture,Furnishing,Paints | 1.97 |
| **16** | Maruti Suzuki India | Cars & Utility Vehicles | 1.72 |
| **17** | M&M | Cars & Utility Vehicles | 1.68 |
| **18** | Titan Co | Other Apparels & Accessories | 1.65 |

| | | | |
|---|---|---|---|
| **19** | HCL Tech | IT Consulting & Software | 1.62 |
| **20** | Sun Pharma | Pharmaceuticals | 1.52 |
| **21** | UltraTech Cement | Cement & Cement Products | 1.27 |
| **22** | Tata Steel | Iron & Steel/Interm.Products | 1.27 |
| **23** | NTPC | Electric Utilities | 1.2 |
| **24** | Power Grid | Electric Utilities | 1.19 |
| **25** | Bajaj Finserv | Finance (including NBFCs) | 1.19 |
| **26** | Nestle India | Packaged Foods | 1.14 |
| **27** | IndusInd Bank | Banks | 1.01 |
| **28** | Tech Mahindra | IT Consulting & Software | 0.94 |
| **29** | Dr Reddy's Labs | Pharmaceuticals | 0.87 |
| **30** | Wipro | IT Consulting & Software | 0.81 |

Source: (Sensex 30 Companies: Their Weightage in The Index , n.d.)

Table 5: Indices and its ratio

| Year | High | Low | Close | PE Ratios | PB Ratios | Dividend Yield |
|---|---|---|---|---|---|---|
| 1998-99 | 4322.00 | 2741.22 | 3739.96 | 12.86 | 2.26 | 1.82 |
| 1999-2000 | 6150.69 | 3183.47 | 5001.28 | 19.76 | 3.40 | 1.23 |
| 2000-2001 | 5542.81 | 3436.75 | 3604.38 | 23.89 | 3.60 | 1.25 |
| 2001-02 | 3759.96 | 2594.87 | 3469.35 | 16.55 | 2.38 | 1.95 |
| 2002-03 | 3538.49 | 2828.48 | 3048.72 | 14.51 | 2.23 | 2.21 |
| 2003-04 | 6249.60 | 904.44 | 5590.60 | 16.18 | 2.82 | 2.03 |
| 2004-05 | 6954.86 | 4227.50 | 6492.82 | 16.56 | 3.32 | 2.00 |
| 2005-06 | 11356.95 | 6118.42 | 11279.96 | 16.98 | 4.16 | 1.48 |
| 2006-07 | 14723.88 | 8799.01 | 13072.10 | 20.72 | 4.88 | 1.31 |
| 2007-08 | 21206.77 | 12425.52 | 15644.44 | 22.61 | 5.47 | 1.04 |
| 2008-09 | 17735.70 | 7697.39 | 9708.50 | 15.66 | 3.38 | 1.52 |
| 2009-10 | 17793.01 | 9546.29 | 17527.77 | 20.13 | 3.75 | 1.24 |
| 2010-11 | 21108.64 | 15960.15 | 19445.22 | 21.60 | 3.58 | 1.11 |
| 2011-12 | 19811.14 | 15135.86 | 17404.20 | 18.50 | 3.42 | 1.41 |
| 2012-13 | 20203.66 | 15748.98 | 18835.77 | 17.09 | 2.97 | 1.64 |
| 2013-14 | 22467.21 | 17448.71 | 22386.27 | 17.38 | 2.78 | 1.50 |
| 2014-15 | 30024.74 | 22197.51 | 27957.49 | 18.73 | 2.94 | 1.29 |
| 2015-16 | 29094.61 | 22494.61 | 25341.86 | 20.18 | 2.85 | 1.39 |
| 2016-17 | 29824.62 | 24523.20 | 29620.50 | 20.62 | 2.84 | 1.43 |
| 2017-18 | 36443.98 | 29241.48 | 32968.68 | 23.78 | 3.05 | 1.22 |
| 2018-19 | 38989.65 | 32972.56 | 38672.91 | 23.71 | 3.03 | 1.19 |
| 2019-20 | 42273.87 | 25638.90 | 29468.49 | 26.44 | 2.95 | 1.18 |
| 2020-21 | 52516.76 | 27500.79 | 49509.15 | 28.10 | 2.92 | 0.98 |
| 2021-22 | 62245.43 | 47204.50 | 58568.51 | 19.53 | 3.51 | 0.94 |
| 2022-23 | 63245.43 | 50921.22 | 58991.52 | 22.91 | 3.32 | 1.20 |
| 2023-24 | 62562.67 | 58793.08 | 61932.47 | 23.05 | 3.29 | 1.25 |

Source: BSE website

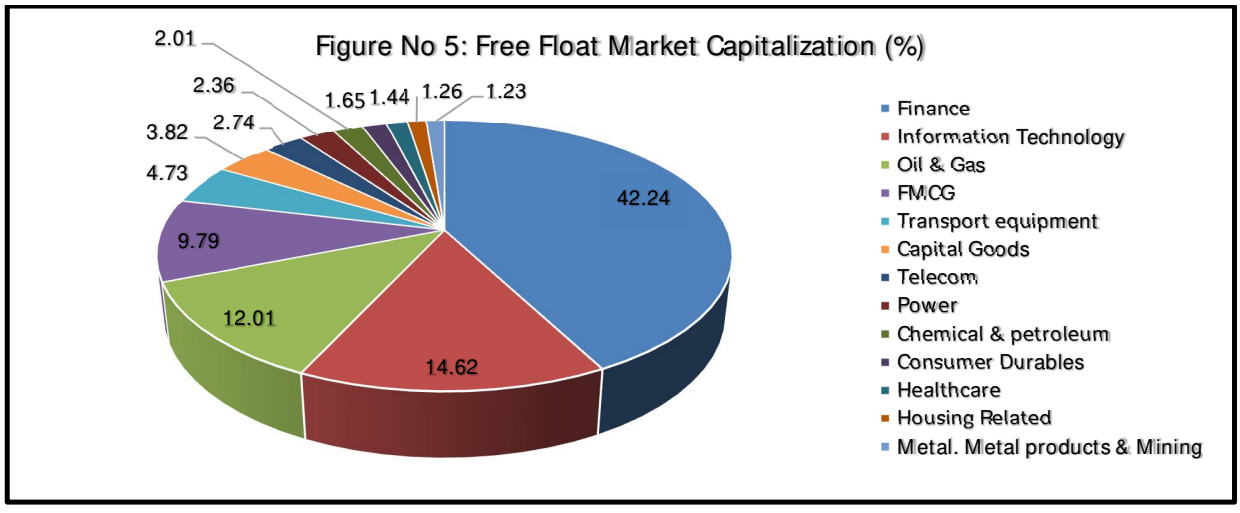
From the given table it is clear that Sensex started from 1985 from around 500 points and till today it reached 61932 points, as in 38 years' time period. Although it faces many ups and downs, it has been shown in above given table.


Source: Author Compilation based on BSE website

Table 6: S&P BSE Sensex Sector wise market capitalization

| Sr. No. | Sensex/Sectors | Free Float Market Capitalization (%) |
|---|---|---|
| | S & P BSE SENSEX | 100 |
| 1 | Finance | 42.24 |
| 2 | Information Technology | 14.62 |
| 3 | Oil & Gas | 12.01 |
| 4 | FMCG | 9.79 |
| 5 | Transport equipment | 4.73 |
| 6 | Capital Goods | 3.82 |
| 7 | Telecom | 2.74 |
| 8 | Power | 2.36 |
| 9 | Chemical & petroleum | 2.01 |
| 10 | Consumer Durables | 1.65 |
| 11 | Healthcare | 1.44 |
| 12 | Housing Related | 1.26 |
| 13 | Metal. Metal products & Mining | 1.23 |

Source: BSE website




Source: Author Compilation

The timeline below depicts the rise of the SENSEX throughout Indian stock market history. This has been explained in the given below table through event wise in chronological order.

Table No 7: Sensex Development based on event study.

| Date and Year | Sensex Point | Event |
|---|---|---|
| 25th July 1990 | 1,000 | Following a favourable monsoon and excellent corporate performance, Sensex reached the four-digit mark for the first time and finished at 1,001. |
| 15th January 1992 | 2,000 | The SENSEX surpassed 2,000 and finished at 2,020, trailed by the liberal economic policy efforts. |
| 29th February1992 | 3,000 | It surpassed the 3,000-milestone following Manmohan Singh's market-friendly budget announcement. |
| 30th March 1992 | 4,000 | The SENSEX surpassed the 4,000 mark as investors anticipated a more open export-import strategy. The Harshad Mehta scam hit the markets at that time, and the SENSEX saw unrelenting selling. |
| 11th October 1999 | 5,000 | The SENSEX surpassed 5,000 points after the Bhartiya Janata Party-led alliance won the 13th Lok Sabha election. |
| 11th February 2000 | 6,000 | The SENSEX surpassed 6,000 points and reached an all-time high of 6,006 points as a result of the information technology boom. |
| 21st June 2005 | 7,000 | The announcement of the Ambani brothers' settlement bolstered investor mood, allowing the SENSEX to surpass 7,000 points. |
| 8th September2005 | 8,000 | In early trade, the SENSEX broke beyond the 8,000 mark, mainly to risk-taking by foreign and domestic funds. |
| 9th December 2005 | 9,000 | The SENSEX surpassed 9,000 after a frenetic purchasing binge by overseas institutional investors, which was largely supported by local operators and ordinary investors. |
| 7th February 2006 | 10,000 | SENSEX touched 10,003 points during mid-session. |
| 11th December 2007 | 20,000 | The SENSEX eventually closed above 20,000 points due to aggressive purchasing by funds. |
| 16th May 2014 | 25,000, | For the first time, the SENSEX surpassed the 25,000 mark. |
| 4th March 2015 | 30,000 | Following the Reserve Bank of India's decision to decrease repo rates, the Sensex has surpassed the 30000 level. |
| 9th August 2018 | 38,000 | SENSEX broke beyond 38,000 for the first time during intraday trade, closing at 38,024.37. |
| 23rd May 2019 | 40,000, | For the first time, the SENSEX surpassed 40,000 points. (The Lok Sabha election results for 2019 were being published.) |
| 21st January 2021 | 50,000 | The SENSEX crossed 50,000 mark with an all-time high of 50,181 at around 1:31 PM. |
| 24th September 2021 | 60,000, | The SENSEX crossed 60,000 mark with an all-time high of 60,218 at around 9:30 AM |

Source: (BSE SENSEX, n.d.)

*B. BSE-100*

The BSE Sensitive Index reflects the movement of only 30 scrips. To describe the movement of stock prices on a wider basis, the BSE constructed an index known as the BSE National Index on 3 January 1989. The fiscal year 1983-84 was chosen as the base year. This index re-designated as the BSE-100 index on 14 October 1996, it is known as the BSE-100 as it contains 100 stocks.

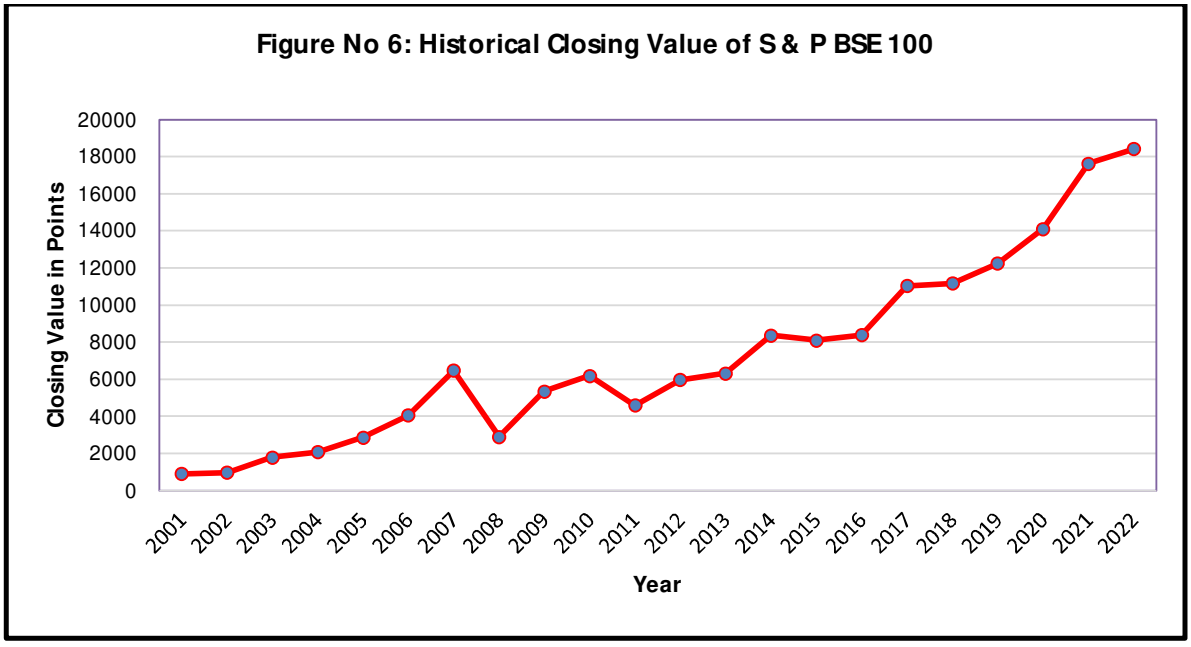
Coverage: Initially, the 100 to be included in BSE-100 were selected from five major stock exchanges-Mumbai, Calcutta, Delhi, Ahmedabad and Chennai. The criteria for selection were market activity, due representation of various industry groups, and representation of trading activity on major stock exchanges. With the passage of time, the growth of information technology ensured that there was little or no difference in prices of the index scrips across the exchanges.

So the prices of the BSE have been used to calculate the index from 14 October 1996. The dollar-linked version of BSE-100 which is known as Dollex-100 was introduced in May 1992.
Method of compilation: Like the BSE Sensitive Index, the BSE-100 also uses the free-float methodology.

Table No 8: S&P BSE 100 Sector wise Market Capitalization

| | | |
|---|---|---|
| | S & P BSE 100 | 100 |
| 1 | Finance | 33.76 |
| 2 | Information Technology | 11.84 |
| 3 | Oil & Gas | 10.13 |
| 4 | FMCG | 10.09 |
| 5 | Transport Equipments | 5.88 |
| 6 | Healthcare | 4.20 |
| 7 | Capital Goods | 4.13 |
| 8 | Metal, Metal Products and Mining | 3.06 |
| 9 | Housing Related | 2.63 |
| 10 | Power | 2.42 |
| 11 | Telecom | 2.13 |
| 12 | Consumer Durables | 1.88 |
| 13 | Chemical & Petrochemical | 1.87 |
| 14 | Miscellaneous | 1.72 |
| 15 | Diversified | 0.99 |
| 16 | Transport Services | 0.81 |
| 17 | Agriculture | 0.62 |
| 18 | Tourism | 0.53 |
| 19 | Textile | 0.23 |
| 20 | Media & Publishing | 0.22 |

Source: BSE website




Source: Author Compilation based on BSE website

*C. BSE-200*

With the growth of industrialization there was a substantial increase in number of companies listed on the BSE. The number of companies listed increased from 992 in 1980 to about 3,200 by the end of March 1994. The need for a new broad-based index series reflecting market trends and newly emerged industry groups in a more effective way was felt. This led to the construction of two index series, viz., the BSE-200 and the Dollex-200 since 27 May 1994.

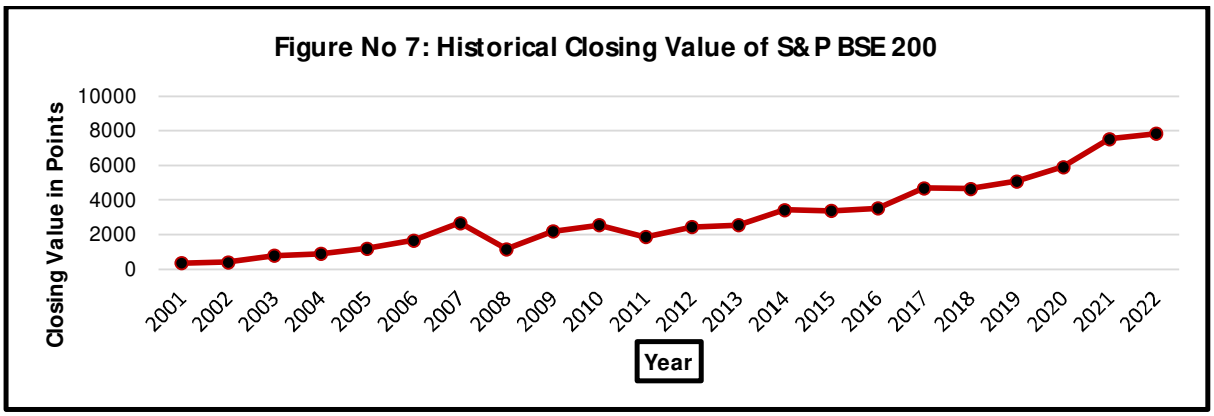
Coverage: The selection of companies is based on market capitalization, trade volumes, and certain other fundamental factors.

Method of compilation: The fiscal year 1989-90 was chosen as the base year. The free float methodology is adopted for computation in line with other BSE indices.

Table No 9: S&P BSE 200 Sector wise Market Capitalization.

| Sl. No. | Index/Sectors | Free Float market Capitalization % |
|---|---|---|
| | S&P BSE 200 | 100 |
| 1 | Finance | 32.2 |
| 2 | Information Technology | 10.88 |
| 3 | Oil & Gas | 9.57 |
| 4 | FMCG | 9.34 |
| 5 | Transport Equipments | 6.42 |
| 6 | Healthcare | 5.09 |
| 7 | Capital Goods | 4.81 |
| 8 | Metal, Metal Products and Mining | 3.41 |
| 9 | Housing Related | 3.05 |
| 10 | Chemical & Petrochemical | 2.44 |
| 11 | Power | 2.43 |
| 12 | Telecom | 2.21 |
| 13 | Consumer Durables | 1.84 |
| 14 | Miscellaneous | 1.7 |
| 15 | Diversified | 0.93 |
| 16 | Transport Services | 0.91 |
| 17 | Agriculture | 0.7 |
| 18 | Tourism | 0.46 |
| 19 | Utilities | 0.29 |
| 20 | Media and Publishing | 0.2 |
| 21 | Textile | 0.2 |
| 22 | Others | 0.2 |

Source: BSE website




Source: Author Compilation based on BSE website

*D. DOLLEX-200*

The BSE also calculates a dollar-linked version of the BSE-200 index, with historical data available on the BSE website.

*E. BSE-500*

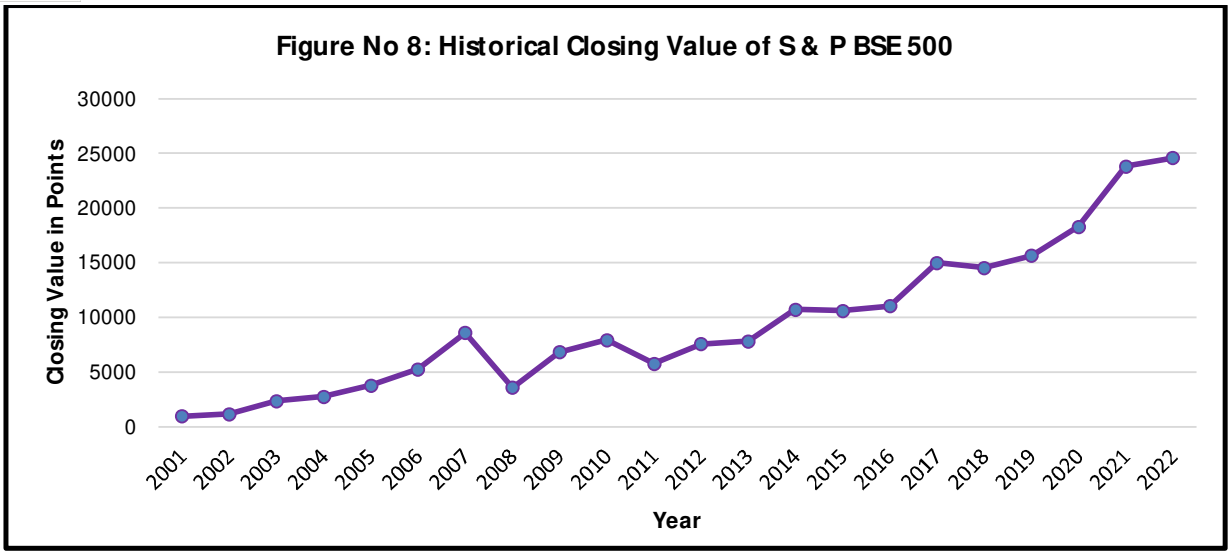
The BSE constructed a new index called BSE-500 in August 1999. As the name suggests, it consists of 500 scrips in its basket. While developing this index, the changing patterns of the economy and the market were kept in mind. The index represents nearly 93 per cent of the total market capitalization on BSE. All the 20 major industries in the economy are represented. The base year for the index is 1999. On 16 August 2005, the calculation methodology was made a free float one.

1) Selection of the constituents: The general guidelines for the selection of constituents in BSE-500 are given on the BSE website.
2) Trading frequency: The scrip's trading frequency should be at least 75% of the trading days in the previous three months. Exceptions are made for a variety of circumstances, including scrip suspension, etc.
3) Rank: The BSE ranks the companies on the basis of market capitalization and liquidity of the scrips. The company's scrip should come within the top 750 companies as ranked by the BSE.
4) Industry representation: The selected scrip should give a fair and balanced representation of the industry to which it belongs.
5) Track record: The company should meet the track record norms fixed by the BSE to be included in the index.

Table No 10: S&P BSE 500 sector wise Market Capitalization.

| Sl. No. | Index/Sectors | Free Float market Capitalization % |
|---|---|---|
| | S&P BSE 500 | 100 |
| 1 | Finance | 30.30 |
| 2 | Information Technology | 10.39 |
| 3 | FMCG | 8.86 |
| 4 | Oil & Gas | 8.74 |
| 5 | Transport Equipments | 6.39 |
| 6 | Capital Goods | 5.92 |
| 7 | Healthcare | 5.64 |
| 8 | Housing Related | 3.57 |
| 9 | Metal, Metal Products and Mining | 3.35 |
| 10 | Chemical & Petrochemical | 2.98 |
| 11 | Power | 2.39 |
| 12 | Telecom | 2.19 |
| 13 | Consumer Durables | 2.06 |
| 14 | Miscellaneous | 1.95 |
| 15 | Transport Services | 0.95 |
| 16 | Agriculture | 0.95 |
| 17 | Diversified | 0.93 |
| 18 | Tourism | 0.65 |
| 19 | Textile | 0.37 |
| 20 | Media and Publishing | 0.33 |
| 21 | Utilities | 0.26 |
| 22 | Others | 0.19 |

Source: BSE website




Source: Author Compilation based on BSE website

*F. BSE Sectoral Indices*

The BSE's sectoral indices are listed below:

*1)* BSE Auto Index
*2)* BSE BANKEX
*3)* BSE Capital Goods Index
*4)* BSE Consumer Durables Index
*5)* BSE FMCG Index
*6)* BSE Healthcare Index
*7)* BSE IT Index
*8)* BSE Metal Index
*9)* BSE Oil & Gas Index
*10)* BSE Power Index
*11)* BSE Realty Index

.

*G. NSE-S&P CNX NIFTY*

The India Index Services Product Ltd (IISL) and Credit Rating Information Services of India Ltd (CRISIL) created this index. The latter has a strategic partnership with the S&P rating services. As a result, the index is known as the S&P CNX Nifty. The NSE-50 index was launched on April 22, 1996, with the following goals:

*1)* To reflect market movements more accurately.
*2)* To provide fund managers with an instrument to measure portfolio returns vis-à-vis market returns.
*3)* To serve as a foundation for the introduction of index-based derivatives.

The Nifty replaced the prior NSE-100 index, which was created as a stopgap measure while the automated trading system stabilized. The Nifty 50 index is a 50-company index that reflects general market conditions. The free float market capitalization approach is used to calculate the Nifty 50 Index. The Nifty 50 can be used to benchmark fund portfolios, create index funds, ETFs, and structured products, among other things. Nifty50 USD, Nifty50 Total Returns Index, and Nifty50 Dividend Points Index are index variants (NIFTY 50 Index, 2023).

Table No 11: Portfolio Characteristics

| | |
|---|---|
| Methodology | Free Float Market Capitalization |
| No of Constituents | 50 |
| Launch Date | April 22, 1996 |

| | |
|---|---|
| Base Date | November 03, 1995 |
| Base Value | 1000 |
| Calculation Frequency | Real-Time |
| Index Rebalancing | Semi-Annually |

Source: NSE website

Table No 12: Sector Representation with their weights

| Sl. No. | Sector | Weight in percentage |
|---|---|---|
| 1 | Financial Services | 38.44 |
| 2 | Information Technology | 12.74 |
| 3 | Oil, Gas and Consumable Fuels | 12.15 |
| 4 | Fast Moving Consumer Goods | 9.73 |
| 5 | Automobile and Auto Components | 5.52 |
| 6 | Healthcare | 3.80 |
| 7 | Construction | 3.60 |
| 8 | Metals and Mining | 3.43 |
| 9 | Consumer Durables | 3.04 |
| 10 | Telecommunication | 2.47 |
| 11 | Power | 2.05 |
| 12 | Construction Materials | 1.90 |
| 13 | Services | 0.65 |
| 14 | Chemicals | 0.48 |

Source: NSE website

Index Re-Balancing: The index is rebalanced every six months. The deadlines are January 31 and July 31 of each year, i.e. The average data for the six months ending on the cut-off date is used for the semi-annual evaluation of indices. The market is given four weeks' notice from the date of modification.

Index Governance: All NSE indices are managed by a professional crew. The NSE Indices Limited Board of Directors, the Index Advisory Committee (Equity), and the Index Maintenance Sub-Committee form a three-tier governance structure (NIFTY 50 Index, 2023).

Table No 13: Key Indices list of NSE

| Broad Market | Sectoral Indices | Thematic Indices |
|---|---|---|
| Nifty 50 | Nifty Bank | Nifty CPSE |
| Nifty Next 50 | Nifty IT | Nifty Commodities |
| Nifty 100 | Nifty PSU Bank | Nifty Energy |
| Nifty 200 | Nifty FMCG | Nifty Shariah 25 |
| Nifty 500 | Nifty Private Bank | Nifty 100 Liquid 15 |
| Nifty Midcap 50 | Nifty Metal | Nifty Infrastructure |
| Nifty Midcap 100 | Nifty Financial Services | Nifty Corporate Group |
| Strategy Indices | Fixed Income | |
| Nifty 100 Equal Weight | Nifty 10yr Benchmark G-Sec | |
| Nifty 50 PR 1x Inverse | Nifty 8-13yr G-Sec | |
| Nifty 50 PR 2x Leverage | Nifty 4-8yr G-Sec | |
| Nifty 50 Value 20 | Nifty 11-15yr G-Sec | |
| Nifty 100 Quality 30 | Nifty 15yr and above G-Sec | |
| Nifty Low Volatility 50 | Nifty Composite G-Sec | |
| Nifty Alpha 50 | Nifty 1D Rate | |

Source: NSE website

Table No 14: Nifty 50 company stocks with their sector representation and weightage

| Sl. No. | Company Name | Stock Symbol | Sector | Weightage (%) |
|---|---|---|---|---|
| 1 | Reliance Industries Ltd. | RELIANCE | Oil Gas & Consumable Fuels | 10.32 |
| 2 | HDFC Bank Ltd. | HDFCBANK | Financial Services | 9.38 |
| 3 | ICICI Bank Ltd. | ICICIBANK | Financial Services | 8.08 |
| 4 | Housing Development Finance Corporation Ltd. | HDFC | Financial Services | 6.34 |
| 5 | Infosys Ltd. | INFY | Information Technology | 5.63 |
| 6 | ITC Ltd. | ITC | Fast-Moving Consumer Goods | 4.73 |
| 7 | Tata Consultancy Services Ltd. | TCS | Information Technology | 4.16 |
| 8 | Larsen & Toubro Ltd. | LT | Construction | 3.6 |
| 9 | Kotak Mahindra Bank Ltd. | KOTAKBANK | Financial Services | 3.59 |
| 10 | Axis Bank Ltd. | AXISBANK | Financial Services | 2.97 |
| 11 | Hindustan Unilever Ltd. | HINDUNILVR | Fast-Moving Consumer Goods | 2.77 |
| 12 | Bharti Airtel Ltd. | BHARTIARTL | Telecommunication | 2.47 |
| 13 | Bajaj Finance Ltd. | BAJFINANCE | Financial Services | 2.11 |
| 14 | State Bank of India | SBIN | Financial Services | 2.08 |
| 15 | Asian Paints Ltd. | ASIANPAINT | Consumer Durables | 1.65 |
| 16 | Maruti Suzuki India Ltd. | MARUTI | Automobile and Auto Components | 1.44 |
| 17 | HCL Technologies Ltd. | HCLTECH | Information Technology | 1.42 |
| 18 | Titan Company Ltd. | TITAN | Consumer Durables | 1.39 |
| 19 | Mahindra & Mahindra Ltd. | M&M | Automobile and Auto Components | 1.38 |
| 20 | Sun Pharmaceutical Industries Ltd. | SUNPHARMA | Healthcare | 1.34 |
| 21 | UltraTech Cement Ltd. | ULTRACEMCO | Construction Materials | 1.1 |
| 22 | Tata Steel Ltd. | TATASTEEL | Metals & Mining | 1.1 |
| 23 | Tata Motors Ltd. | TATAMOTORS | Automobile and Auto Components | 1.08 |
| 24 | NTPC Ltd. | NTPC | Power | 1.03 |
| 25 | Power Grid Corporation of India Ltd. | POWERGRID | Power | 1.02 |
| 26 | Nestle India Ltd. | NESTLEIND | Fast-Moving Consumer Goods | 0.98 |
| 27 | IndusInd Bank Ltd. | INDUSINDBK | Financial Services | 0.95 |
| 28 | Bajaj Finserv Ltd. | BAJAJFINSV | Financial Services | 0.92 |
| 29 | JSW Steel Ltd. | JSWSTEEL | Metals & Mining | 0.86 |
| 30 | Tech Mahindra Ltd. | TECHM | Information Technology | 0.8 |
| 31 | Grasim Industries Ltd. | GRASIM | Construction Materials | 0.8 |
| 32 | Hindalco Industries Ltd. | HINDALCO | Metals & Mining | 0.8 |
| 33 | Oil & Natural Gas Corporation Ltd. | ONGC | Oil Gas & Consumable Fuels | 0.78 |
| 34 | Dr. Reddy's Laboratories Ltd. | DRREDDY | Healthcare | 0.76 |
| 35 | Wipro Ltd. | WIPRO | Information Technology | 0.72 |
| 36 | Britannia Industries Ltd. | BRITANNIA | Fast-Moving Consumer Goods | 0.68 |
| 37 | HDFC Life Insurance Company Ltd. | HDFCLIFE | Financial Services | 0.66 |
| 38 | Adani Enterprises Ltd. | ADANIENT | Metals & Mining | 0.66 |
| 39 | SBI Life Insurance Company Ltd. | SBILIFE | Financial Services | 0.65 |
| 40 | Adani Ports and Special | ADANIPORTS | Services | 0.65 |

| | | | | |
|---|---|---|---|---|
| | Economic Zone Ltd. | | | |
| 41 | Bajaj Auto Ltd. | BAJAJ-AUTO | Automobile and Auto Components | 0.63 |
| 42 | Coal India Ltd. | COALINDIA | Oil Gas & Consumable Fuels | 0.62 |
| 43 | Cipla Ltd. | CIPLA | Healthcare | 0.6 |
| 44 | Apollo Hospitals Enterprise Ltd. | APOLLOHOSP | Healthcare | 0.57 |
| 45 | Tata Consumer Products Ltd. | TATACONSUM | Fast-Moving Consumer Goods | 0.57 |
| 46 | Eicher Motors Ltd. | EICHERMOT | Automobile and Auto Components | 0.57 |
| 47 | Divi's Laboratories Ltd. | DIVISLAB | Healthcare | 0.52 |
| 48 | UPL Ltd. | UPL | Chemicals | 0.48 |
| 49 | Bharat Petroleum Corporation Ltd. | BPCL | Oil Gas & Consumable Fuels | 0.43 |
| 50 | Hero MotoCorp Ltd. | HEROMOTOCO | Automobile and Auto Components | 0.42 |

Source: (IPOcentral, n.d.)

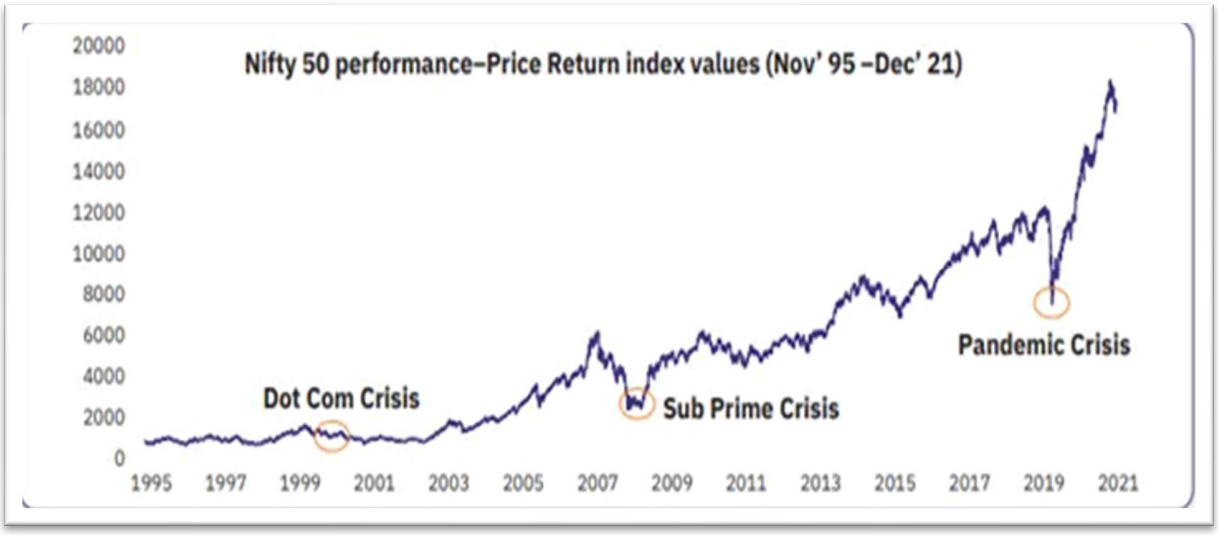



Figure No: 9 Historical Performance of Nifty 50

Source: (Quantum Mutual Fund, n.d.)

*H. CNX NIFTY JUNIOR/Nifty Next 50*

CNX Nifty Junior comprises 50 stocks. This is an index built out of the 50 large, liquid stocks next to S&P CNX Nifty. It is a market capitalization weighted index. It is not as liquid as the S&P CNX Nifty. The CNX Nifty Junior is the second rung of growth stocks, which are not as established as those in the S&P CNX Nifty. As with the S&P CNX Nifty, stocks in the CNX Nifty Junior are filtered for liquidity, so they are the most liquid of the stocks excluded from the S&P CNX Nifty. Buying and selling the entire CNX Nifty Junior as a portfolio is possible. The maintenance of the S&P CNX Nifty and the CNX Nifty Junior are always disjointed i.e., a stock will never appear in both indices at the same time.

The Nifty Next 50 Index includes 50 companies from the Nifty 100 after eliminating the Nifty 50. The Nifty Next 50 is calculated using the free float market capitalization approach, in which the index level reflects the entire free float market value of all the stocks in the index relative to a specific base market capitalization value. The Nifty Next 50 Index can be used to benchmark fund portfolios, create index funds, ETFs, and structured products, among other things. Nifty Next 50 Total Returns Index is an index variant (Nifty Next 50 Index, n.d.).

Table No. 15: Portfolio Characteristics

| | |
|---|---|
| Methodology | Periodic Capped Free Float |

| | |
|---|---|
| No. of Constituents | 50 |
| Launch Date | December 24, 1996 |
| Base Date | November 04, 1996 |
| Base Value | 1000 |
| Calculation Frequency | Real-Time |
| Index Rebalancing | Semi-Annually |

Source: NSE website (Nifty Next 50 Index, n.d.)

Table No. 16: Sector Representation

| Sector | Weight (%) |
|---|---|
| Financial Services | 19.35 |
| Fast Moving Consumer Goods | 14.67 |
| Capital Goods | 11.45 |
| Consumer Services | 8.17 |
| Chemicals | 8.02 |
| Construction Materials | 6.58 |
| Oil, Gas, & Consumable Fuels | 5.94 |
| Power | 4.89 |
| Metal & Mining | 4.58 |
| Consumer Durables | 3.94 |
| Automobile and Auto Components | 3.15 |
| Realty | 2.56 |
| Services | 2.55 |
| Textiles | 1.82 |
| Healthcare | 1.46 |
| Telecommunication | 0.89 |

Source: NSE website

Table No 17: Top 10 Constituents by Weightage

| Sr. No. | Company's Name | Weight (%) |
|---|---|---|
| 1 | Bharat Electronics Ltd. | 3.73 |
| 2 | Cholamandalam Investment and Finance | 3.56 |
| 3 | Pidilite Industries Ltd. | 3.18 |
| 4 | Godrej Consumer Products Ltd. | 3.13 |
| 5 | Bank of Baroda | 3.00 |
| 6 | Hindustan Aeronautics Ltd. | 2.96 |
| 7 | Info Edge (India) Ltd. | 2.84 |
| 8 | Siemens Ltd. | 2.83 |
| 9 | ICICI Lombard General Insurance Company Ltd. | 2.82 |
| 10 | Indian Oil Corporation Ltd. | 2.75 |

Source: NSE website

*I. S&P CNX Defty*

Defty is a dollar denominated index based on the S&P CNX Nifty. Computations are done using the S&P CNX Nifty index calculated on the NEAT trading system of NSE. If the S&P CNX Nifty rises by 3 percent, it means that the Indian stock market rose by 3 percent, measured in rupees. If the S&P CNX Defty rises by 3 per cent, it means that the Indian stock market rose by 3 percent, measured in dollars.

*J. S&P CNX 500 Equity Index*

The S&P CNX 500 Equity Index comprises 500 stocks and is market capitalization is weighted. Stocks are selected based on their market capitalization, industry representation, trading interest and financial performance. The S&P CNX 500 companies are disaggregated into 72 industries. Industry weights in the index reflect the industry weights in the market. The base year for the index is the calendar year 1994 with the base index value being 1000.

Table No. 18: Portfolio Characteristics

| | |
|---|---|
| Methodology | Free Float Market Capitalization |
| No. of Constituents | 502 |
| Launch Date | --- |
| Base Date | January 01, 1995 |
| Base Value | 1000 |
| Calculation Frequency | Real-Time |
| Index Rebalancing | Semi-Annually |

Source: NSE website (Nifty Next 50 Index, n.d.)

Table No. 19: Sector Representation

| Sector | Weight (%) |
|---|---|
| Financial Services | 31.83 |
| Information Technology | 9.88 |
| Oil, Gas, & Consumable Fuels | 8.96 |
| Fast Moving Consumer Goods | 8.36 |
| Automobile and Auto Components | 6.20 |
| Healthcare | 5.42 |
| Capital Goods | 4.49 |
| Consumer Durables | 3.56 |
| Metals & Mining | 3.32 |
| Construction | 2.75 |
| Power | 2.69 |
| Consumer Services | 2.49 |
| Chemicals | 2.45 |
| Construction Materials | 2.23 |
| Telecommunication | 2.12 |
| Services | 1.41 |
| Realty | 0.96 |
| Textiles | 0.38 |
| Media, Entertainment & Publication | 0.33 |
| Diversified | 0.11 |
| Forest Materials | 0.06 |

Source: NSE website

Table No 20: Top 10 Constituents by Weightage

| Sr. No. | Company's Name | Weight (%) |
|---|---|---|
| 1 | HDFC Bank Ltd. | 9.18 |
| 2 | Reliance Industries Ltd. | 6.43 |
| 3 | ICICI Bank Ltd. | 5.21 |
| 4 | Infosys Ltd. | 3.61 |
| 5 | ITC Ltd. | 3.06 |
| 6 | Tata Consultancy Services Ltd. | 2.61 |

| | | |
|---|---|---|
| 7 | Larsen and Toubro Ltd. | 2.42 |
| 8 | Kotak Mahindra Bank Ltd. | 2.03 |
| 9 | Axis Bank Ltd. | 1.95 |
| 10 | State Bank of India | 1.77 |

Source: NSE website

*K. CNX MID-CAP*

CNX Mid-Cap is computed using the market capitalization weighted method. Selection of scrips in the index is based on the following criteria: All stocks which comprise more than 5 per cent market capitalization of the universe (after sorting the securities in descending order of market capitalization), shall be excluded in order to reduce the skew in the weights of the stocks in the universe.

*L. CNX Segment Indices*

To provide investors with a better perspective of the stock market performance of the various the Indian corporate sector, NSE has constructed different segment indices such as:

*1)* CNX MNC (Multinational Corporations) Index
*2)* CNX PSE (Public Sector Enterprises) Index
*3)* CNX IBG (Indian Business Groups) Index
*4)* CNX Energy Index
*5)* CNX Pharma Index
*6)* CNX Infrastructure Index
*7)* CNX PSU Bank Index
*8)* CNX Realty Index

## VII. FINDINGS AND SUGGESTIONS

Today in India, maximum index is calculated based on free float market capitalization, due to this the real value of a company can be seen in stock market. it may be possible that a company market capitalization will be high, but its free flow market capitalization will we low in comparison to other company due to not freely availability of its share in the market. Here we explain index wise findings in given lines.

*1)* In Sensex we found that HDFC, ICICI Bank, ITC and L&T companies free float factor is 1.0, which shows that all shares of these companies are freely available for general public for trading purposes. Reliance Industries Limited have the Maximum weightage in Sensex which is 11.95 percent than after HDFC Bank 10.38 percent and ICICI Bank 9.37 percent and so on. From figure no 4 it can be seen that closing value of Sensex increases continue basis from financial year 2002-03 to 2007-08 after it a huge fall seen in year 2008-09 after it from year 2009-10 it starts rising, 2019-2020 have witnessed a fall due to covid 19 pandemic after this year Sensex increases on normal basis which is based on market sentiments till year 2022-23. When we are going through Sector basis in Sensex, we find that Finance area have 42.24 percent free float market capitalization, after it IT area with 14.62 percent than after Oil & Gas Area with 12.01 percent.

*2)* In BSE 100, when we are going through Sector basis, we got that finance area have 33.76 percent free float market capitalization, after it IT area with 11.84 percent than after Oil & Gas Area with 10.13 percent. By figure no 6 BSE 100 index maximum jump in year 2007. Then it falls rapidly in 2008 then increases till 2010 then slight fall in 2011 after it continuously increases till 2022 and 2021 have been witnessed maximum increase year.

*3)* In BSE 200, when we are going through sector basis, we got that finance Area have 32.2 percent free float market capitalization, after it IT area with 10.88 percent. By the figure no 7 BSE 200 index also show maximum jump in year 2007 then it falls in 2008 then increase till 2010 then slight fall in 2011 after it continuously increases till 2014 and shows almost constant position in 2015 and 2016 after it continuously increase till 2022 whereas 2021 was the year of maximum increase.

*4)* In BSE 500, when we are going through sector basis, we got that finance Area have 30.30 percent free float market capitalization, after it IT area with 10.39 percent. By the figure no 8 BSE 500 index shows maximum jump in 2007 than it falls in 2008 then slight increase till 2010 then slight fall in 2011 and shows almost constant position in 2013 and increases in 2014 and shows constant position till 2016 after it increases from 2017 on constant basis till 2022 and 2021 was the maximum increase year.

5) In Nifty 50, when we are going through sector basis, we got that financial services area have 38.44 percent weight, after it IT area with 12.74 percent then after it Oli, Gas and Consumable fuels area with 12.15 percent. In the company Criteria Reliance Industries Ltd. maintain top position with 10.32 percent weight after it HDFC Bank Ltd. With 9.38 percent and ICICI Bank Ltd. With 8.08 percent. By the figure no 9 index shows maximum jump in 2007 than it falls in 2008 due to economic crisis then slight increase till 2010 then slight fall in 2011 and shows almost constant position in 2013 to 2014 and also increase in 2015 then fall in 2016 after it increases till 2018 and huge fall shown in 2019 due to pandemic crisis after it will showing a high jump in 2021.
6) In Nifty Next 50, when we are going through sector basis, we find that financial services area has 19.35 percent weight, after it Fast Moving Consumer Goods area with 14.67 percent then after Capital Goods area with 11.45 percent weight. In the company Criteria Bharat Electronics Ltd maintain top position with 3.73 percent weight.
7) In S & P CNX 500 Equity Index, when we are going through sector basis, we got that financial services area have 31.83 percent weight, after it IT area with 9.88 percent then after Oil, Gas and Consumable Fuels with 8.96 percent weight. In the company Criteria HDFC Bank Ltd. maintains the top position with 9.18 percent after it Reliance Industries Ltd. With 6.43 percent, then after ICICI Bank Ltd. With 5.21 percent.

## VIII. RECOMMENDATIONS

Those investors who want to invest in Sensex, Reliance industries ltd. is the best option for him, yet stock market prediction is not possible due to many factors, but after computation of some facts and figures, we can guess to some extent. Banking companies like HDFC and ICICI bank are also good companies for the investor and policy maker for their policy formulation. The Finance and IT Area is the most enriching area and has huge potential and growing opportunity, so investors also can invest in these sector stocks with high growth opportunity. For investment in Nifty company's stock Reliance Industries Ltd. again maintain top position with high weight and high free float market capitalization base, so Indian stock market have huge potential to grow and capacity to give higher returns on investment made by investors, only need is that the investors should got proper awareness and knowledge about functioning of stock market indices and on that fluctuation basis policy makers also maintain their policy strengthen and chances to grow rapidly in the Indian context.

## IX. CONCLUSION

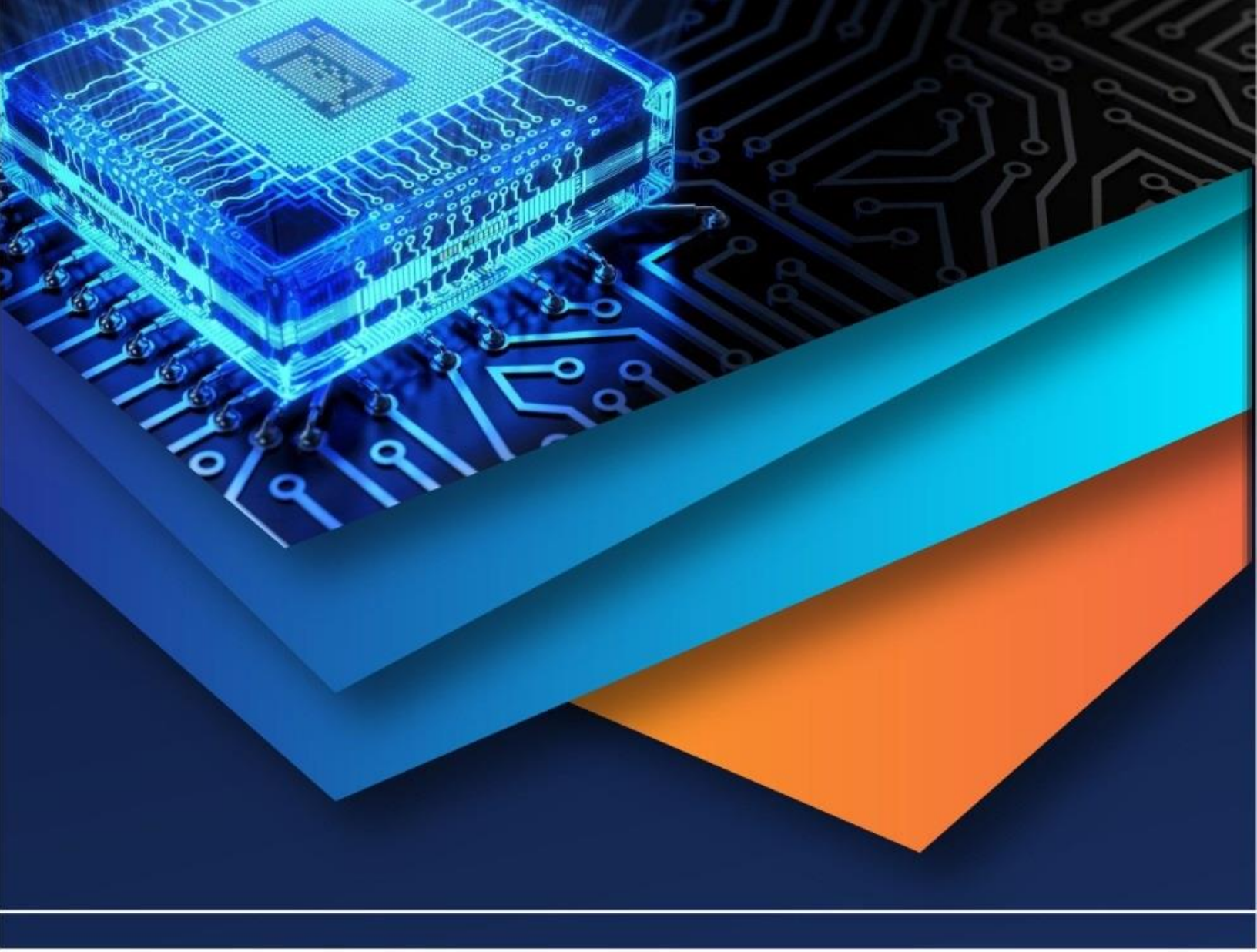
Although in this paper author try to provide a conceptual knowledge to all the investors who want to invest in stock market with showing development and calculation of some important indices of BSE and NSE, yet many of the Indian people unaware about stock market index. its working procedure and trading pattern by this paper they can easily understood the mechanism of the market. By the different index findings, we can say that 2008 was the time period of crisis where all the indices have been fallen rapidly and 2019 was the covid time period where maximum scrips face huge losses in the stock market, yet stock market revive very quickly after pandemic in 2019 and jump with expectations to grow speedily in future context. So, by this paper we find that calculation of indices is technical, and it is beyond the general person's knowledge, it is advisable that those persons have good knowledge about stock market they can directly enter in it but those have not they can enter through broker.

## REFERENCES

[1] About Indices. (n.d.). Retrieved from nseindia.com: https://www.nseindia.com/products-services/about-indices
[2] Agrawal, G. (2006). Impact of Sample Size on the Distribution of Stock Returns-an Investigation of Nifty & Sensex. In Indian Institute of Capital Markets 9th Capital Markets Conference Paper.
[3] Ali, R., & Afzal, M. (2012). Impact of global financial crisis on stock markets: Evidence from Pakistan and India. Journal of Business Management and Economics, 3(7), 275-282.
[4] BSE SENSEX. (n.d.). Retrieved from en.wikipedia.org: https://en.wikipedia.org/wiki/BSE_SENSEX
[5] Chandra, A., & Thenmozhi, M. (2015). On asymmetric relationship of India volatility index (India VIX) with stock market return and risk management. Decision, 42, 33-55.
[6] Choudhary, R. and Jain, N. (2020), Research on Volatility Pattern of BSE BANKEX Index & BSE SENSEX Index using Exponential weighted moving Average Model, International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9 Issue-4.
[7] Dai, Z., Zhou, H., Wen, F., & He, S. (2020). Efficient predictability of stock return volatility: The role of stock market implied volatility. The North American Journal of Economics and Finance, 52, 101174.
[8] Das, N., & Pattanayak, J. K. (2013). The Effect of Fundamental Factors on Indian Stock Market: A Case Study of Sensex and Nifty. IUP Journal of Applied Finance, 19(2).
[9] Gupta, P. K., & Siddiqui, S. (2010). Weak form of market efficiency: Evidences from selected NSE indices. Available at SSRN 1355103.

[10] Gupta, A. and Kundu, D. (2006), "A Study of the Impact of Union Budgets on Stock Prices in India", The ICFAI Journal of Applied Finance, Vol. 12, No. 10, pp. 65-76
[11] Harvey, C. R., & Whaley, R. E. (1992). Market volatility prediction and the efficiency of the S & P 100 index option market. Journal of Financial Economics, 31(1), 43-73.
[12] Ho, K. Y., & Tsui, A. K. (2004, July). An analysis of the sectoral indices of Tokyo Stock Exchange: A multivariate GARCH approach with time varying correlations. In Stochastic Finance, Autumn School and International Conference.
[13] How Many Companies are listed in the Indian Stock Market ? (n.d.). Retrieved from Motilaloswal: ),(https://www.motilaloswal.com/blog-details/how-many-companies-are-listed-in-the-indian-stock-market/20955
[14] IPOcentral. (2023). Retrieved from ipocentral.in: https://ipocentral.in/nifty-50-stock-list weightage/#:~:text=Dollar%20(CAD)., Nifty%2050%20Sector%20Weightage,%2C%20and%203.8%25%20to%20Healthcare.
[15] Joshi, P. and Pandya, K. (2008), "Exploring Movements of Stock Price Volatility in India", The ICFAI Journal of Applied Finance, Vol.14, No.3, pp. 5-33
[16] Joshi, S. K. (2015). Security Analysis and Portfolio Management (Investment Management) (Fifth Revised Edition ed.). New Delhi: Kalyani Publishers.
[17] Kumar, A., Biswal, S. K., & Swain, P. K. (2019). A dynamic association between stock markets, Forex, gold and oil prices in Indian context. Revista ESPACIOS| Vol, 40(06).
[18] Kumar, D. S., & Kumar, L. (2015). Market efficiency in India: an empirical study of random walk hypothesis of Indian stock market–NSE midcap. ZENITH International Journal of Multidisciplinary Research, 5(1).
[19] Kumar, S., & Lagesh, M. A. (2011). Spot Return Volatility and Hedging with Futures Contract: Empirical Evidence from the Notional Commodity Futures Indices of India. IUP Journal of Behavioral Finance, 8(2), 70.
[20] Kumar, V., & Mittal, P. (2011). Johansen Co-integration Analysis of Indian and Major Global Stock Market Indices. Nice Journal of Business, 9.
[21] Kushwah, S. V., & Munshi, M. S. (2018). The effect of seasonality over stock exchanges in India. Amity Journal of Management, 4(2), 46-53.
[22] List of BSE Sensex 30 Companies. (n.d.). Retrieved from www.equitymaster.com: https://www.equitymaster.com/india-markets/bse-replica.asp
[23] Luthra, M., & Mahajan, S. (2014). Impact of Macro factors on BSE Bankex. International Journal of Current Research and Academic Review, 2(2), 179-186.
[24] NIFTY 50 Index. (2023, July). Retrieved from www.nseindia.com: https://www.nseindia.com/products-services/indices-nifty50-index
[25] Nifty Next 50 Index. (n.d.). Retrieved from www.nseindia.com: https://www.nseindia.com/products-services/indices-niftynext50-index
[26] Pandian, P. (2013). Security Analysis and Portfolio Management (Second Edition ed.). New Delhi: Vikas Publishing House Private Limited.
[27] Pathak, B. V. (2018). Indian Financial System (Fifth Edition ed.). Noida: Pearson India.
[28] Pant, B., & Bishnoi, T. R. (2001). Testing random walk hypothesis for Indian stock market indices. In Research Paper Presented in UTI Capital Market Conference Proceedings (pp. 1-15).
[29] Pinho, C., & Madaleno, M. (2011). On the influence of expectations over international stock returns and macroeconomic variables. International Review of Accounting Banking and Finance, 3(2).
[30] Poshakwale, S. (2002). The random walk hypothesis in the emerging Indian stock market. Journal of Business Finance & Accounting, 29(9-10), 1275-1299.
[31] Prabahar, R., Dhinakaran, J., & Pandian, P. (2008). Return and risk analysis of indian information technology sector stocks. The ICFAI Journal of Financial Risk Management, 5, 41-49.
[32] Quantum Mutual Fund. (n.d.). Retrieved from https://www.google.com/imgres?imgurl=https%3A%2F%2Fwww.quantumamc.com%2Fassets%2Fimages%2FQN50E_FAQ.WEBP&tbnid=r5RDdA8ttGdWqM&vet=1&imgrefurl=https%3A%2F%2Fwww.quantumamc.com%2Fequity-funds%2Fquantum-nifty-etf-fund&docid=9xWSsyW_fTU8LM&w=602&h=198&source=
[33] Rajesh, M., & Bhaskar, K. (2015). Impact of fundamental factors on share price movements-A study on select listed companies of Indian manufacturing industries in Bombay Stock Exchange. Indian Journal of Applied Research, 5(3), 208-211.
[34] Ramkumar, R. R., Selvam, M., Vanitha, S., Gayathri, J., & Karpagam, V. (2012). An analysis of market efficiency in sectoral indices: A study with a special reference to Bombay Stock Exchange in India. European Journal of Scientific Research, 69(2), 290-297.
[35] Sah, A. N. (2009). Stock market seasonality: A study of the Indian stock market. NSE India–Research Papers.
[36] Selvam, M., Indhumathi, G., & Rajesh Ramkumar, R. (2010). Analysis of Market Efficiency of BSE-PSU Index. SNS Journal of Finance, 1(3), 1-10.
[37] Sen, S. S. (2010). On the Volatility of S&P CNX NIFTY. Indian Journal of Finance, 4(5), 53-57.
[38] Sensex 30 Companies: Their Weightage in The Index [2023]. Retrieved from getmoneyrich.com: https://getmoneyrich.com/stocks-with-high-weightage-in-sensex/
[39] Srinivasan, P.; and Ibrahim, P. (2010), "Forecasting Stock Market Volatility of BSE30 Index Using Garch Models", Asia Pacific Business Review, Vol. VI, No. 3, pp. 47-60.
[40] Tandon, K., & Malhotra, N. (2013). Determinants of stock prices: Empirical evidence from NSE 100 companies. International Journal of Research in Management & Technology, 3(3), 2249-9563.
[41] Tanty, G., & Patjoshi, P. K. (2016). A study on stock market volatility pattern of BSE and NSE in India. Asian Journal of Management, 7(3), 193-200.
[42] Tsoukalas, D. (2000). An Autoregressive Heteroskedastic in the Mean (ARCH-M) Analysis of International Stock Market Indexes. Managerial Finance, 26(12), 46-56.
[43] Yuan, R., Xiao, J.Z. and Zou, H. Mutual Funds" Ownership and Firm Performance: Evidence from China. Journal of Banking & Finance. 32,



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