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Research Paper

An in depth analysis of the volatility of the Indian stock market in the last decade. How far has sustainability impacted fluctuations in related stocks in the options and future market?

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Abstract: *The stock market analysis led to the various reasons for its volatility. The paper researched the factors which can measure volatility. External and internal market conditions impact the market, but these are not the only factors in India, as in other markets. Fundamentals of the firms and economy are the critical factors, and so is market manipulation. To safeguard small investors, it is necessary to have muscular regulatory bodies in place.*

Research Question: *The paper would attempt to analyze the factors responsible for volatility in the Indian stock market both internal and external. Do they reflect macroeconomic trends? Are they a result of robust fundamentals of firms? How far has climate change impacted the results of Indian firms? Have they had a bearing on the stocks volatility in their present and in the future?*

Key Words: *Options, Macroeconomic indicators, Sustainability, Futures, Stock Market volatility, Fundamentals of a firm, market manipulation, P/E Ratio, P/B Ratio, Debt/Equity ratio, RoE (Return on Equity), Option Trading,*

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I. Introduction

Stock market volatility is a statistical measure of the dispersion of returns for a given security or market index. Generally, the higher the volatility, the riskier the security. The standard deviation or variance between returns from the same security or the market index often measures volatility. There are two ways that volatility can be understood in the Indian context.

1. The index that the Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE)
2. Individual stocks

In the securities market, the word volatility is associated with swings in either direction when the stock market rises and falls more than 1% over a sustained period. The volatility of an index or an asset is an essential factor for pricing options contracts.

Several measures can be used to measure volatility, for example- The beta coefficient and option pricing model. Volatile assets are considered risky ones as the price is less predictable. This indicates that the interest earned may be much higher than less risky assets. It is essential to differentiate between implied volatility, which measures the market's volatility, and historical volatility, which measures price changes over a predetermined period. Thus, volatility is a significant variable in calculating the auction price.

In India, the stock market has reached high levels in the last decade and is continuing its upward trend. Given this phenomenon, it is essential to understand its reasons so that small investors can safeguard their investments rather than getting carried away with huge numbers.

Figure1: Bulls and Bears at work in the Indian stock market

Source: www.zeebiz.com

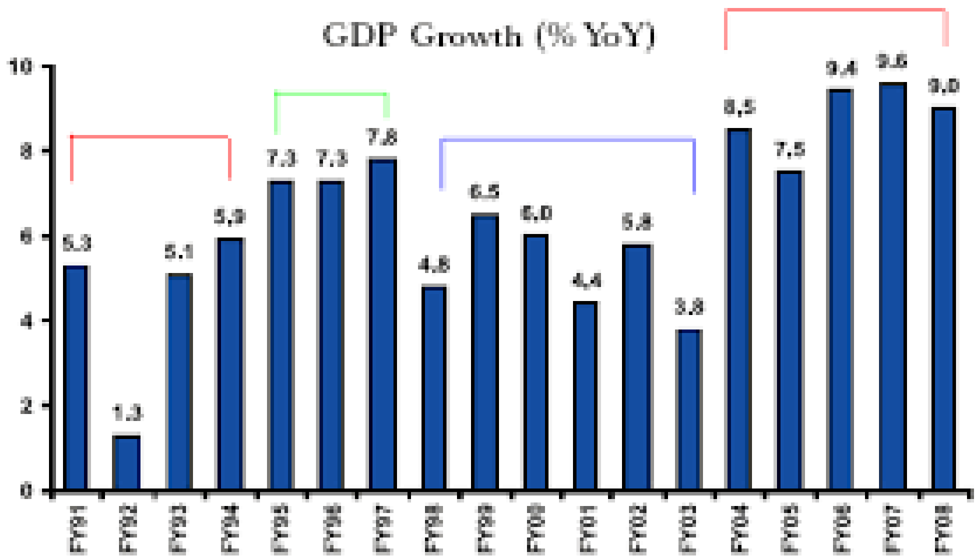
II. Definition

In understanding the stock market's volatility, it is essential to analyze its impact on the country's economy. Being specific about the effects and understanding various macroeconomic indicators are crucial.

2.1 Macroeconomic indicators

The important macroeconomic indicators that the economy monitors are growth indicators like gross domestic product (GDP), per capita income (PCY), national income, inflation rate, balance of payment (BOP), and current account deficit (CAD), to name a few. If development indicators have to be added to this, it is essential to calculate poverty indicators, health status, education status, unemployment figures and inequality. The above stated are a comprehensive measure of the growth and development status of the economy. The Indian economy has achieved GDP growth rates ranging from 6% per annum to approximately 9% per annum since 1991.

Figure 2: GDP growth rate from 1991 to 2008



Source: www.dalalstreet.com

2.2 Sustainability

Sustainability has become an essential concept today when climate change has impacted the world adversely, irrespective of whether the economy is developed or developing. The impact that this has on the growth potential of an economy depends on how viable alternative technologies are that could lead to higher GDP levels. Developing economies must battle low GDP growth and other factors like poverty, unemployment and inequality. Addressing these issues in a sustainable environment can hurt the development of a country's growth. The viability of sustainable practices may be an expensive proposition for developing economies. The adverse climatic conditions have led the United Nations to set out 17 goals that would transform the world. India has also adopted these to reduce the detrimental impact of adverse carbon imprints.

Figure 3: UN proclaims Sustainable goals

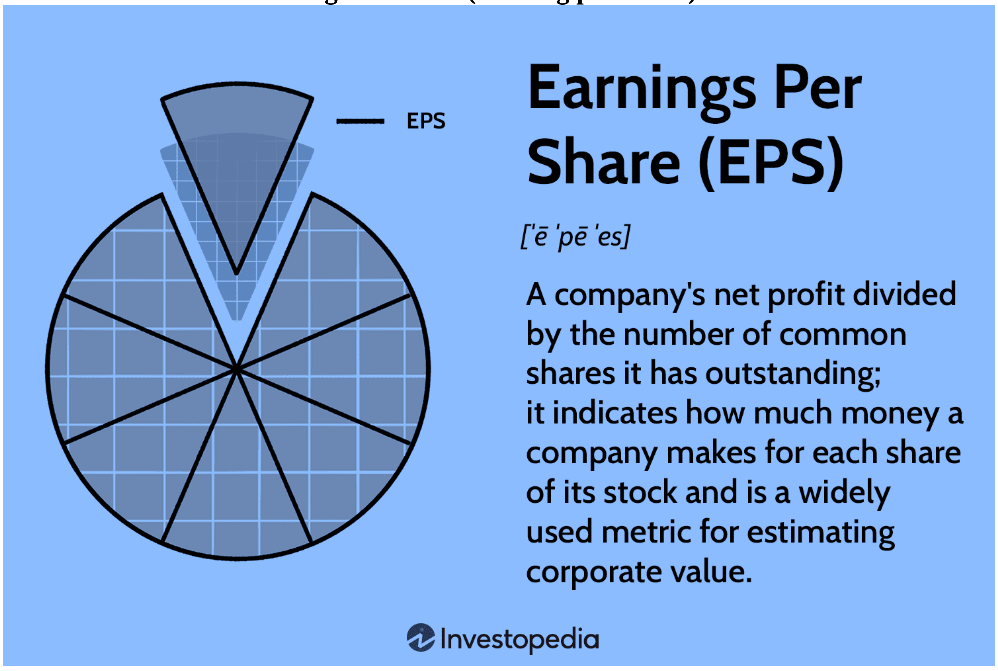
Source: www.unitednation.com

Goals 1 to 6 in the above diagram indicate the end of poverty: zero hunger, health, education, gender equality, clean water and sanitation.
Goals 7 to 12 emphasize using energy to achieve growth, infrastructure, industrialization, reducing inequality, creating sustainable cities and communities, and using techniques that do not add to carbon imprints.
Goals 13 to 17 emphasize methods that economies have adopted to stem the adverse impact of climate adversity on oceans, forests, deserts, marine life, etc.

2.3 Fundamentals of a firm

A firm's fundamentals are information on profitability, revenue, assets, liabilities and growth potential. There are a few elements of quantitative fundamental analysis, such as earnings per share (EPS),

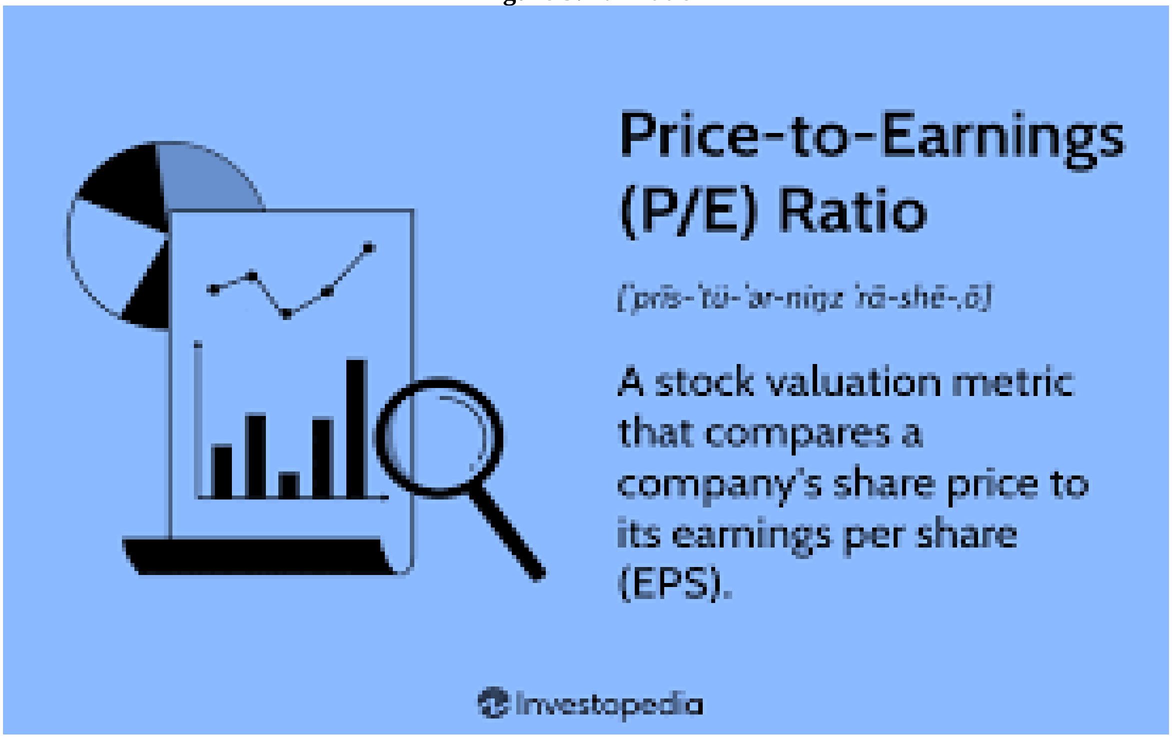
Figure 4: EPS (Earning per Share)



Source: www.investopedia.com

P/E ratio (this is a price-to-earnings ratio and is the ratio of a stock's share price to its earnings per share. The P/E ratio is one the most popular valuations of stocks as it indicates whether a stock at its current market price is expensive or cheap)

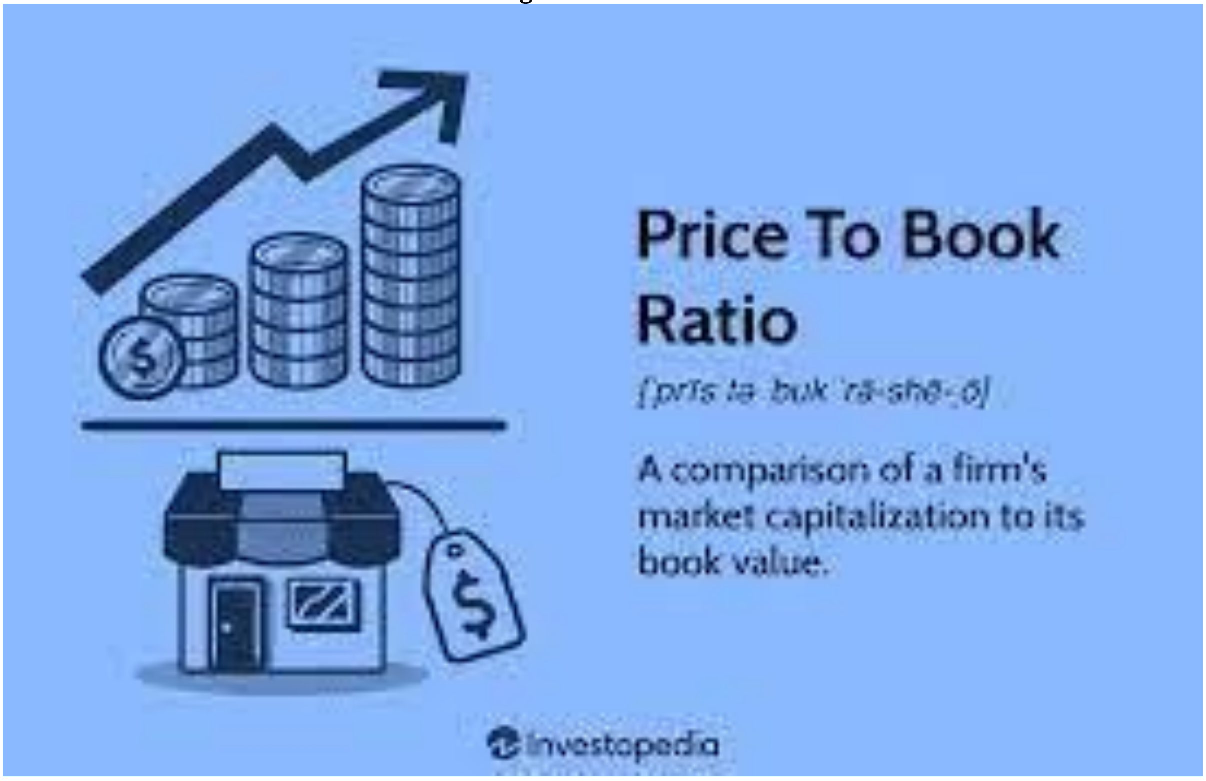
Figure 5: P/E ratio



Source: www.investopedia.com

P/B ratio (is a price-to-book ratio and is used to compare the company's current market value to its book value. The book value is the value of all assets minus liabilities owned by a company),

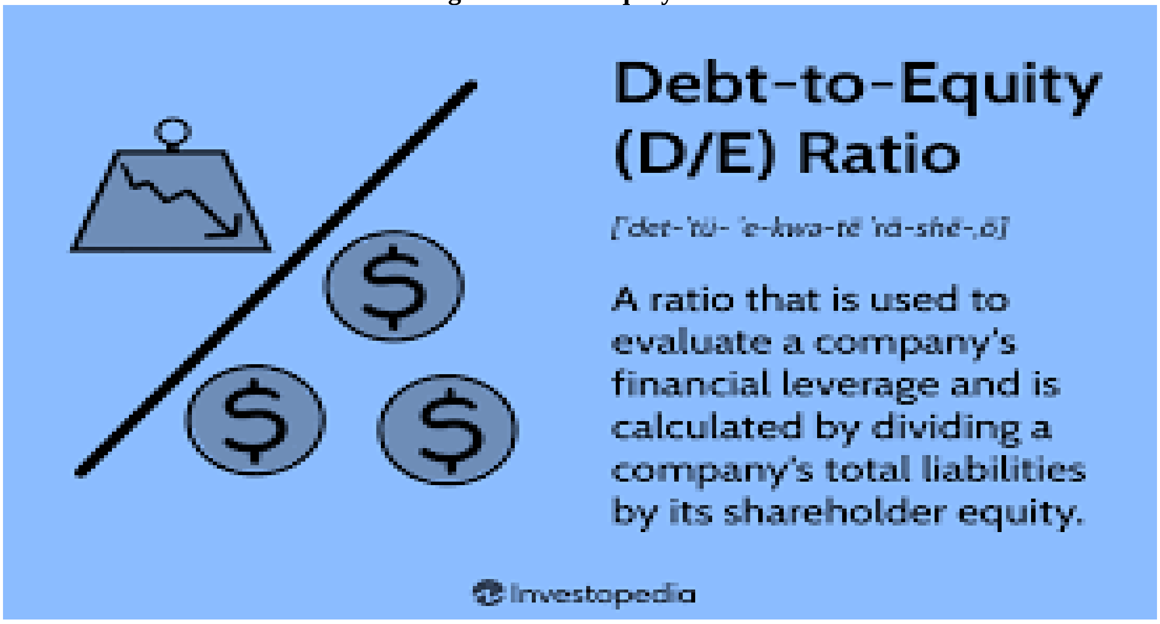
Figure 6: P/B ratio



Source: www.investopedia.com

Debt/equity ratio (this is a financial and liquidity ratio that indicates how much debt and equity a company uses. It shows the capital structure of a company and is calculated by dividing the company's debt by shareholders' equity)

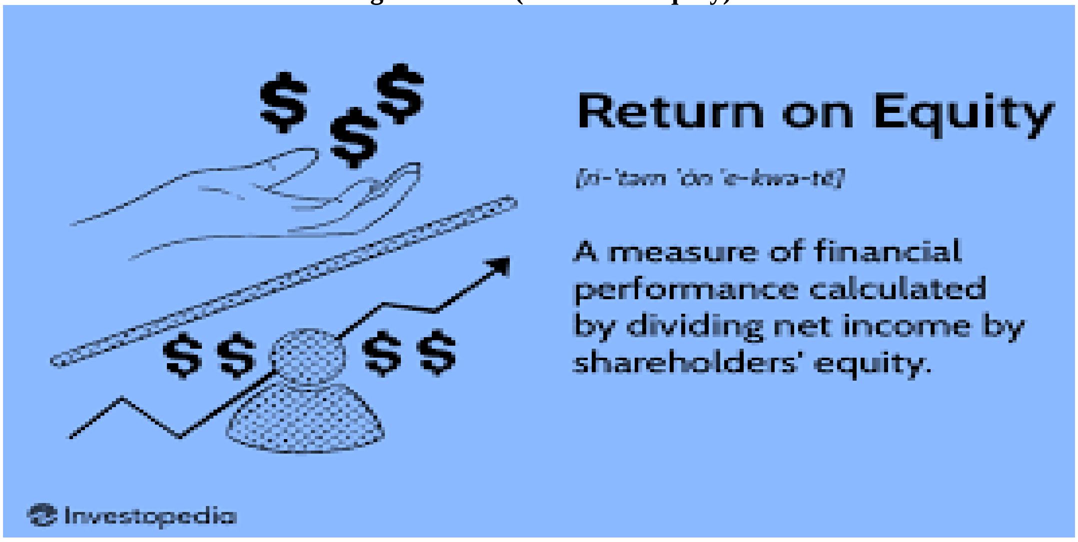
Figure 7: Debt/Equity ratio



Source: www.investopedia.com

And RoE(Return on Equity) (this is a return on equity and is a measure of the company's net income divided by the shareholders' equity. RoE is gauged by a corporation's profitability and how efficiently it generates profits. The higher the RoE, the better a company can convert its equity financing into profits).

Figure 8: RoE (Return on Equity)



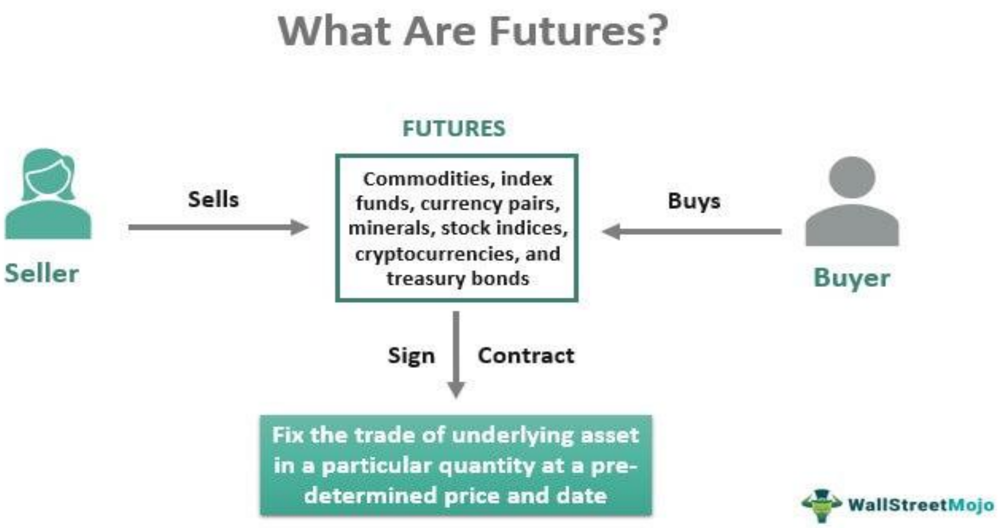
Source: www.investopedia.com

At times, there may not be any link between the volatility of the share and fundamentals. Still, at the same time, there may be periods in which expected development in fundamentals influences price dynamics in financial markets. The volatility of a share has implications for policy making.
Fundamental analysis is essential in predicting the long-term trends in the market. It enables an investor to understand the price that the stock should reach. It also helps find good companies for investment that have a strong growth potential. This analysis is constructive in evaluating the stock's intrinsic value as it combines external events and influences, financial statements and industry trends.

2.4 Futures

Futures are derivative contract agreements to buy or sell a specific commodity asset or security at a set future date for a set price. These contracts are traded on futures exchanges. The reason that it's called futures is that the buyer and the seller of the contract are agreeing to a price today for some asset or security that is to be delivered in the future. These are also financial contracts that obligate the buyer to purchase an underlying asset, such as a commodity, currency or stock index, at a predetermined price and date in the future. They are used to hedge against price fluctuations, speculate on market moments, and manage risk. This strategy, also called hedging strategy, helps *reduce the risk* experienced by investors and corporations. More often than not, the futures depend on the current valuation of the stock or asset.

Figure 9 : Futures



Source : www.wallstreetMojo.com

2.5 Options

Option refers to a financial instrument based on the value of underlined securities such as stocks, indexes and exchange-traded funds (ETF). An options contract offers the buyer the opportunity to buy or sell depending on the type of contract they hold, which is usually the underlying asset. Unlike futures, the holder is not required to purchase or sell the asset if they decide against it. It is precisely what the word signifies, meaning they have the right or an option to buy or sell or not to do so.

Each option contract will have a specific expiration date by which the holder must exercise their option. The stated price on an option is known as the strike price. Options are typically bought and sold through online and detailed brochures. Financial derivatives give buyers the right but not the obligation to buy or sell an underlying asset at an agreed-upon price and date. Options trading can be used for both hedging and speculation, with strategies ranging from simple to complex.

These are versatile financial products where the buyer pays a premium for the rights granted by the contract. There are two types of options:

- Call option- this allows the holder to ***buy*** the asset within a specific time frame
- Put option - this allows the holder to ***sell*** the asset within a particular time frame

Each call option has a bullish buyer and a bearish seller, while a put option has a bearish buyer and a bullish seller. Traders and investors buy and sell options for several reasons. These are:

- Option speculation
- Hedging (reduces the risk of exposure)
- Generation of income

There are two types of options:

1. American option - can be exercised at any time between the date of purchase and the expiration date.
2. European option - can only be exercised at the expiration date.

Figure 10 - Option trading

Source: www.themotleyfool.com

2.6 Stock market volatility

The standard deviation measures volatility or the variance of a stock's or a market index annualized return over a given period and shows the range in which its price may increase or decrease. The cost of a stock fluctuates rapidly in a short period, hitting new highs and lows. It is said to have high volatility. The higher the volatility, the riskier the security. When the stock market rises and falls more than 1 per cent over a sustained period, it is called a volatile market.

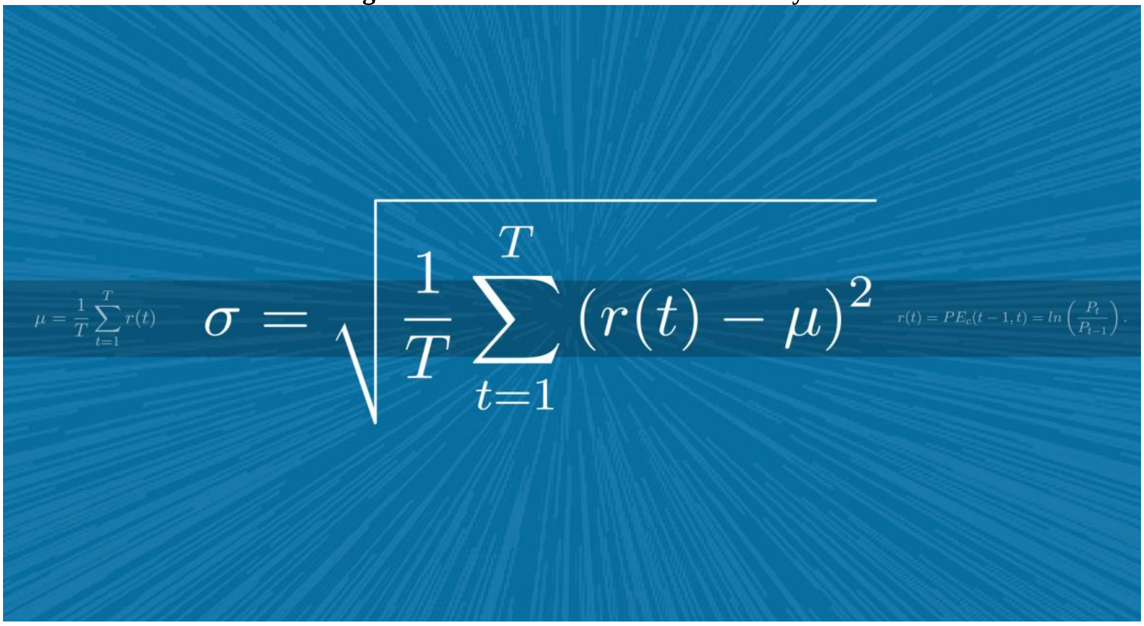
- Volatility represents how large an asset's price swings around the mean price. It is a statistical measure of its dispersion of returns.
- There are several ways to measure volatility, including beta coefficient, option pricing models and standard deviation of returns.
- Volatility points toward the riskiness of the asset as the prices are unpredictable.
- Implied volatility measures the market's volatility, while historical volatility measures price changes over predetermined periods.

- Volatility is an essential variable for calculating options prices.

One way to measure an asset's variation is to plot the percentage moves daily. On the other hand, historical volatility is based on historical pricing and represents the degree of variability in the returns of an asset. This is continuously measured and expressed as a percentage.

Variance captures the dispersion of returns around the mean of an asset. At the same time, volatility is a measure of that variance bounded by a specific period that could be daily, weekly, monthly or yearly. It is helpful to think of volatility as the annualized standard deviation.

Figure 11: Formula to calculate volatility



Source: www.anevissolution.com

T- time period
□ - Standard Deviation
µ - Mean

The formula above is used to calculate volatility where the standard deviation is a square root of the variance.
Variance is calculated in the following manner:

1. Find the mean of the data set
2. Calculate the difference between each data value and the mean called deviation. Negative numbers are allowed.
3. Square the deviations. This will eliminate the negative values.
4. Add the squared deviations
5. Divide the sum of the squared deviations

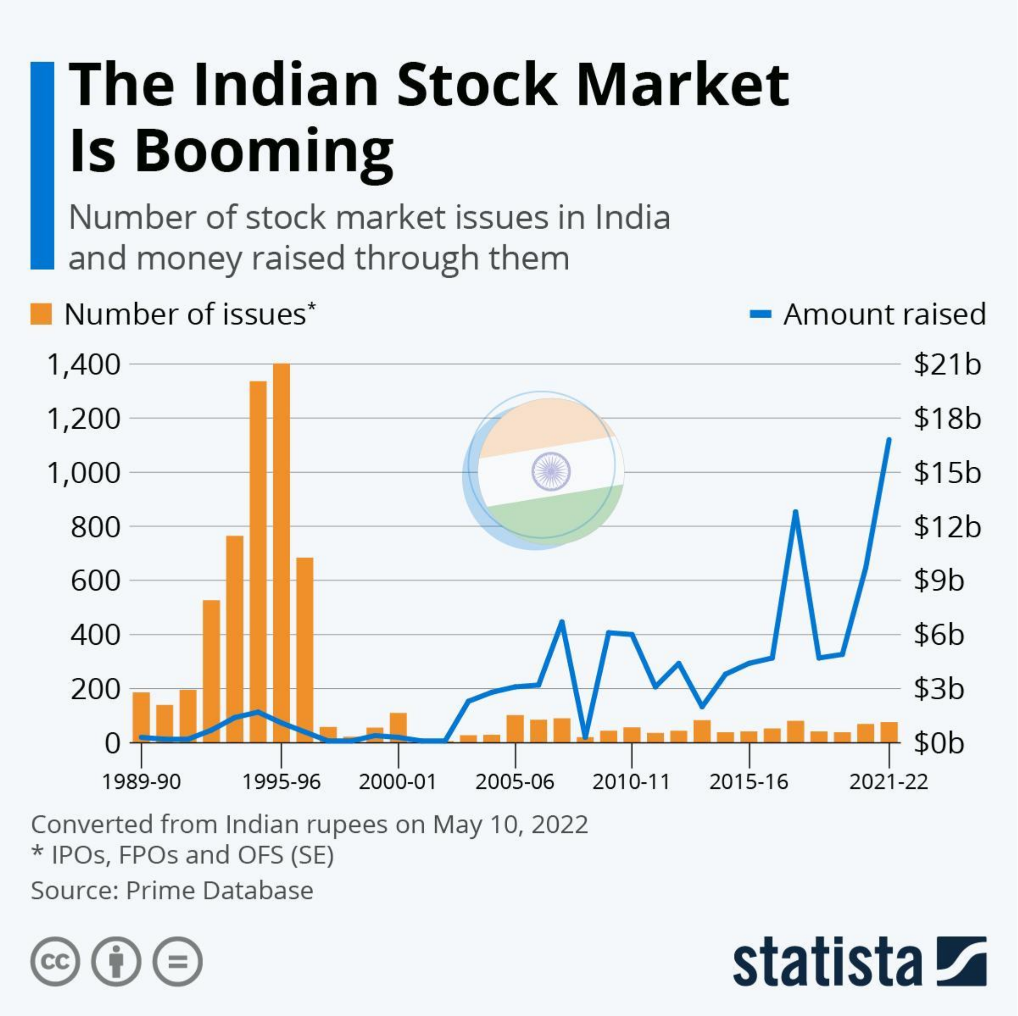
Types of volatility

Implied volatility, also known as projected volatility, is a critical metric for options traders as it allows them to decide how volatile the market will be. This helps the traders to calculate probability. The implied volatility arises from an option's price and represents future volatility expectations. As suggested, traders can not use past performance to indicate future performance. They have to estimate the potential of the options in the market.

Historical volatility measures the fluctuation of security by measuring price changes over a predetermined period. This is different from implied volatility as it is not forward-looking. It is typically based on the changes from one clothing price to the next. This measure can range from 10-180 trading days.

III. Factors that have impacted Indian stock market in the last decade

Figure 12 :The impact of indians stock market in the last decade



Source: www.statista.com

Some of the factors that cause volatility are:
1. Surprising event
2. Economic certainty
3. Changes in investors sentiment

Historically, markets have bounced back from decline. Other factors that need to be considered are increasing consumer expectations or customizations, faster delivery, instant gratification, long-term debt ratio, earning volatility, asset growth, size and dividend policy, and market risk.

The factors that could be the reason for the Indian stock market to be volatile are global and domestic. The global factors would include:

- The aftermath of the worldwide recession of 2008
- The indecisive political period of the UPA 2 government
- The demonetization under the NDA government
- The hasty implementation of the GST
- The COVID pandemic (2020-2022)
- The Russian-Ukraine war (2022 onwards)
- The high inflation rate that was experienced by the world led to restrictive policies concerning interest rates
- Israel- Hamas war
- Altercations in the Red Sea

Despite the above negatives, the Indian stock market has been booming and has reached extremely high levels. There are two major stock exhachages in India; The Bombay Stock Exchange which was incorporated on 9 th

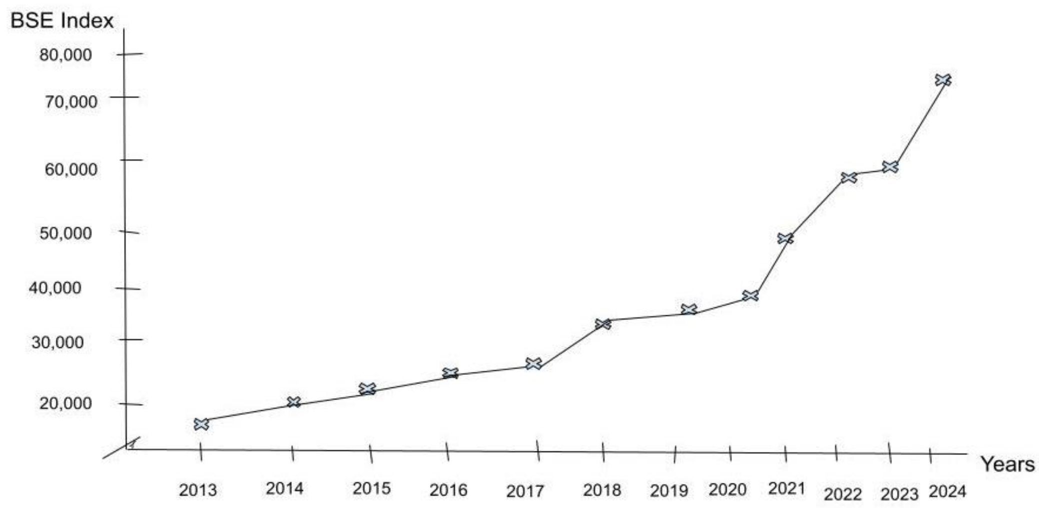
July, 1885 and NSE(National Stock Exchange) which was incorporated in 1992 and commenced operations 1994. The NSE was the first exchange in India to implement electronic trading. It is one of the most technologically advanced stock exchanges in the world. It was become an integral institution in the nations journey toward economic goal and development. The benchmark index of the NSE is the NIFTY 50, which comprises of 50 well established and liquid stocks from different sectors. When, according to the BSE index, it had 71,645.30 on 1st February 2024.

Table 1: BSE Index

Years	BSE Index	NSE 50
1 st February,2012	17,300.58	5,385.20
1 st February,2013.	19,781.19	5,693.05
1 st February,2014.	21,202.89	6,276.60
1 st February,2015.	22,609.42	8,901.50
1 st February,2016.	24,824.83	6,987.05
1 st February,2017.	28,141.64	8,879.60
1 st February,2018.	35,906.66	10,492.85
1 st February,2019.	36,469.43	10,792.50
1 st February,2020.	39,735.53	11,700.89
1 st February,2021.	48,600.61	14,281.07
1 st February,2022.	58,862.57	17,576.30
1 st February,2023.	59,708.08	17,900. 69
1 st February,2024.	71,645.30	21,697.47

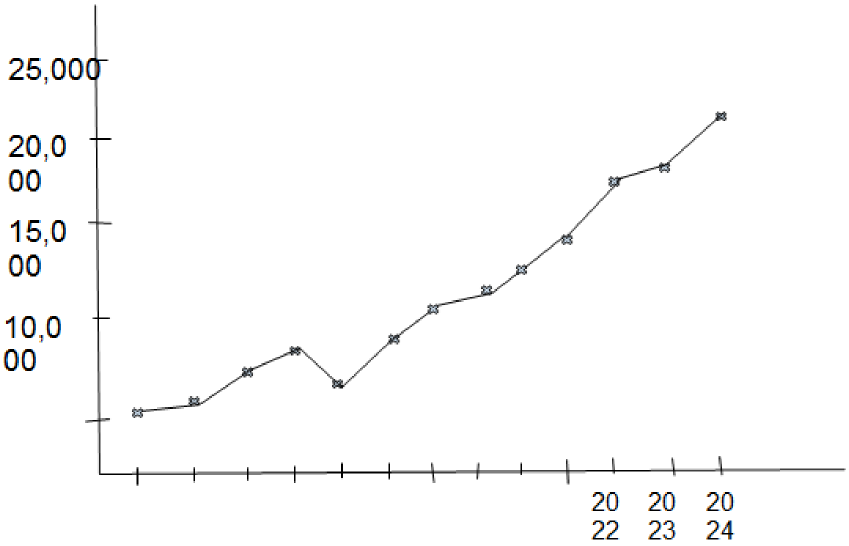
Source: www.bseidex.com ; www.NIFTY50

Graph 1: Volatility of BSE index from 2013- 2024



Source: authors own

Graph 2: Volatility of NIFTY 50 from 2012- 2024



Source: authors own

Besides the factors mentioned above, which are familiar to most of the world's economies, additional factors for India would be the political stability of the economy that has been ensured under the prime ministership of Mr Modi. The volatility till 2014-15 could be due to the uncertain political scenario. But after that, at least as far as political stability is concerned, it has been positive for the economy. Demonetisation, GST implementation, and the impact of COVID-19 affected the Indian economy adversely.

Despite these adverse impacts, the BSE index has continuously increased. This is indicated in graph 1. Thus, factors other than those listed above are responsible for the continuous upturn.

IV. Does the stock market movement reflect fundamentals of the company and the economy

It is unclear whether the only factors responsible for the upswings in the stock index are entirely due to the robustness of the macroeconomic indicators and the firms' fundamentals. These are essential factors, but to say they are the only ones is incorrect. There have been instances when research has indicated that big players have managed the stock market. Besides the above, 'market sentiments' play an important role in investing in the stock market. When the market is in the 'bull phase', the expectation is that it will continue to be so, and many small investors enter the market. If the market is in the 'bear phase', the investors would like to withdraw their money from the market, leading to a downturn in the indices. India has a watch body called SEBI (Security and Exchange Board of India), which can debar firms from participating in the stock market. This body has made significant progress in enhancing transparency and investor protection but has been criticized for failing market manipulation in India. One of the reasons is that the size of the Indian stock market makes it challenging for SEBI to monitor and detect any unusual activities or market manipulations. SEBI has to depend on the stock exchange to provide market data, which can be incomplete and delayed, making it difficult for SEBI to respond to any market manipulation quickly.

There is a comprehensive legal framework involved. Though SEBI has the power to investigate and penalize, the legal framework could be more robust, making it easier for SEBI to take strict actions. SEBI has been criticized for its lack of coordination with other regulatory bodies like the Reserve Bank of India and the Insurance Regulatory and Development Authority, leading to gaps in regulatory oversight and making it easier for market manipulators to exploit these gaps. To prevent the above SEBI, one needs to take several steps.

1. We are investing more in technology and infrastructure to improve its surveillance capabilities.
2. It needs to work with the government to strengthen the legal framework governing the securities market. This could include higher and stricter penalties.
3. SEBI must streamline its investigation and enforcement processes to reduce response time and resolve cases quickly.
4. SEBI needs to collaborate more closely with other regulatory bodies.

V. Conclusion

Understanding the stock market volatility requires an analysis of dispersion, standard deviation and variance as the primary statistical tools. But more than this, internal and external factors govern the movement of the stock market. In India, as indicated in *Graph 1*, the Indian stock market has moved by almost 50,000 points from 2012 to 2023. All of this is partially due to the fundamentals of the firms and the fundamentals of the economy. Various external factors have been detrimental to any economy's growth over the last decade. India has overcome all of this and has risen to great heights with a GDP growth ranging anywhere between 5-7% during the period under consideration, clearly indicating that there are other factors at play which are more critical, like market sentiments, faith in the solid political systems along with some amount of manipulations by big players.

The government has tried to control excessive investment in the stock market by appointing a regulatory body, SEBI, as it can hurt small investors. This body has managed to enforce specific rules and regulations, but more is required, as stated above. This prerequisite for the better functioning con is trolling excessive volatility and safeguarding small investors' interests.

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