Chapter 1

Introduction

With the economic reforms ushered in the New Economic policy of July 1991, India made an earnest entry into the process of world economic integration and globalization. Various policy reforms were designed to integrate the Indian economy with the global economy. As a result of liberalization & globalization of the Indian economy, a well functioning stock market became a necessity. Steps were taken to reform the Indian stock market which is crucial part of the financial system. Numerous innovations & structural changes took place. Various kinds of financial innovations, and new risk management strategies evolved. One development that has particularly gained attention has been the extraordinary increase in the use of diverse financial innovations, especially numerous kinds of new derivatives instruments. Against the background of these sweeping changes an intense academic and public debate has begun trying to assess whether these changes provide economic benefits or constitute a threat to financial market stability. It has raised concerns about the economic impact of these new instruments among policy makers, practitioners and economists alike. The regular frequency of occurrence of financial crises in the last two decades and especially the outburst of the US subprime crisis in 2008 has added authority to these concerns. Derivatives are the financial instruments whose value is derived from the price of an underlying item and this underlying item can be equity, index, foreign exchange, interest rate, exchange rate, currency, commodity such as wheat, gold, silver, crude, chana (gram), pepper, etc. or any other asset. When the underlying in the derivative contracts are the financial instruments or indicators like equity, index, currency, interest rate etc, they are called as financial derivatives. When the underlying in the derivative contracts are commodities like gold, silver, chana, copper etc, these are called as commodity derivatives. Derivatives have probably been around for as long as people have been trading with one another. Forward contracting dates back at least to the 12th century and may well have been around even before then. Merchants entered into contracts with one another for future delivery of specified amount of commodities at specified price.
In India derivatives were introduced as a part of capital market reforms to hedge price risk resulting from greater financial integration between nations. These reforms were an integral part of financial sector reforms recommended by the Narasimham Committee Report on financial system in September 1992. These reforms were aimed at enhancing, competition, transparency and efficiency in the Indian financial market.

1.1 Factors driving the Growth of Financial Derivatives in India:

1. Increased volatility in asset prices in financial markets.
2. Increased integration of national financial market with the international markets.
3. Marked improvement in communication facilities and sharp decline in their costs.
4. Development of more sophisticated risk management tools, providing economic agents a wider choice of risk management strategies, and
5. Innovations in the derivatives markets, which optimally combine the risks and returns over a large number of financial assets leading to higher returns, reduced risk as well as transactions costs as compared to individual financial assets.

In India, derivatives were introduced in a phased manner after the recommendations of the L. C. Gupta Committee Report in 1997. Futures, Forwards, Options and Swaps are variants of derivative contracts and these can be further combined with each other or with traditional securities and loan to create hybrid instruments.

Derivatives trading started in Indian markets on 9th June 2000 with the launch of futures contracts in BSE Sensex on the Bombay Stock Exchange (BSE). Derivatives trading started at NSE on 12th June 2000. At the outset, only Index Futures were introduced. Stock futures, stock options and index options were all prohibited. In June 2001, index options trading commenced. Stock options trading started in July 2001 and stock futures trading started in November 2001. Thus, the full set of equity derivatives products was only available in November 2001. Sectoral indices were permitted for derivatives trading in December 2002. During December 2007 SEBI permitted Mini Derivative (F&O) contract on Index (Sensex and Nifty). Further, in January 2008, longer tenure Index options contracts and Volatility Index and in April 2008, Bond
Index was introduced. In addition to the above, during August 2008, SEBI permitted Exchange traded Currency Derivatives.

Since then the futures and options (F&O) segment has been continuously growing in terms of new products, contracts, trade volume and value. At present, NSE has established itself as the market leader in this segment in the country with majority of market share. The F&O segment of the NSE outperformed the cash market segment. It shows the importance of derivatives in the capital market of the economy.

Fig. 1. Trading Volume at F&O and Cash Segment: NSE

![Trading Volume at F&O and Cash Segment: NSE](http://www.futuresindustry.org/volume-.asp)

India’s experience with the equity derivatives market has been extremely positive. As is clear from above figure, the derivatives turnover on the NSE has surpassed the equity market turnover. The turnover of derivatives on the NSE increased from Rs. 23,654 million in 2000–2001 to Rs. 292,482,211 million in 2010–2011, and reached Rs. 157,585,925 million in the first half of 2011–2012. The average daily turnover in these market segments on the NSE has been Rs. 1,151,505 million in 2010–2011 compared to Rs. 723,921 in 2009–2010.

Product wise distribution of turnover on F&O Segment of NSE has been reported in Table 1 below. The data indicates a change in the composition of derivatives turnover.
In year 2006-07, the volume in futures contracts had been approximately 87% of the total turnover at F&O segment but slowly the turnover in options particularly index options has increased and in 2010-11 it has increased to 62.79%. However, the turnover in Stock options has not gained much momentum.

Table 1: Product wise distribution of turnover on F&O Segment of NSE (in %)

<table>
<thead>
<tr>
<th>Year</th>
<th>FUTURES</th>
<th>OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Index</td>
<td>Stock</td>
</tr>
<tr>
<td>2006-07</td>
<td>34.52</td>
<td>52.08</td>
</tr>
<tr>
<td>2007-08</td>
<td>29.19</td>
<td>57.66</td>
</tr>
<tr>
<td>2008-09</td>
<td>32.42</td>
<td>31.60</td>
</tr>
<tr>
<td>2009-10</td>
<td>22.27</td>
<td>29.41</td>
</tr>
<tr>
<td>2010-11</td>
<td>14.90</td>
<td>18.79</td>
</tr>
</tbody>
</table>

Source: www.nseindia.com

Table 2: Futures Contracts Trading volume / value at NSE

<table>
<thead>
<tr>
<th>Year</th>
<th>Index Futures</th>
<th>Stock Futures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of contracts</td>
<td>Turnover (rupee cr.)</td>
</tr>
<tr>
<td>2000-01</td>
<td>90580</td>
<td>2365</td>
</tr>
<tr>
<td>2001-02</td>
<td>1025588</td>
<td>21483</td>
</tr>
<tr>
<td>2002-03</td>
<td>2126763</td>
<td>43952</td>
</tr>
<tr>
<td>2003-04</td>
<td>17191668</td>
<td>554446</td>
</tr>
<tr>
<td>2004-05</td>
<td>21635449</td>
<td>772147</td>
</tr>
<tr>
<td>2005-06</td>
<td>58537886</td>
<td>1513755</td>
</tr>
<tr>
<td>2006-07</td>
<td>81487424</td>
<td>2539574</td>
</tr>
<tr>
<td>2007-08</td>
<td>156598579</td>
<td>3820667.27</td>
</tr>
<tr>
<td>2008-09</td>
<td>210428103</td>
<td>3570111.4</td>
</tr>
<tr>
<td>2009-10</td>
<td>178306889</td>
<td>3934388.67</td>
</tr>
<tr>
<td>2010-11</td>
<td>165023653</td>
<td>4356754.53</td>
</tr>
<tr>
<td>2011-12</td>
<td>146188740</td>
<td>3577998.41</td>
</tr>
</tbody>
</table>

Source: www.nseindia.com
Table 2 shows that the volume in Index futures and Stock futures has been continuously growing in the Indian Stock market. The volume of index futures contracts has increased by 1614% in 2011-12 since its inception in 2000-01. The volume of single stock futures contracts has increased by more than 80% over a period of 10 years. The turnover in stocks futures is more as compared to index futures.

Table 3: Top Ten Derivative Exchanges Ranked by Number of Contracts Traded/Cleared

<table>
<thead>
<tr>
<th>Rank</th>
<th>Exchange</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Korea Exchange</td>
<td>3748861401</td>
<td>3927956666</td>
</tr>
<tr>
<td>2</td>
<td>CME Group ( includes CBOT &amp; Nymex)</td>
<td>3080497016</td>
<td>3386989978</td>
</tr>
<tr>
<td>3</td>
<td>Eurex ( Includes (ISE)</td>
<td>2642092726</td>
<td>281502018</td>
</tr>
<tr>
<td>4</td>
<td>NYSE Euronext ( Includes all EU &amp; US markets)</td>
<td>2154742282</td>
<td>2283472810</td>
</tr>
<tr>
<td>5</td>
<td>National Stock Exchange of India</td>
<td>1615790692</td>
<td>2200366650</td>
</tr>
<tr>
<td>6</td>
<td>BM&amp;FBovespa</td>
<td>1413753671</td>
<td>1500444003</td>
</tr>
<tr>
<td>7</td>
<td>Nasdaq OMX Group ( Includes all EU &amp; US markets)</td>
<td>1099437223</td>
<td>1295641151</td>
</tr>
<tr>
<td>8</td>
<td>Chicago Board Options Exchange ( includes CFE &amp; C2)</td>
<td>1123505008</td>
<td>1216922087</td>
</tr>
<tr>
<td>9</td>
<td>Multi- commodity Exchange of India( includes MCX – SX)</td>
<td>1081813643</td>
<td>1196322051</td>
</tr>
<tr>
<td>10</td>
<td>Russian Trading systems Stock Exchange</td>
<td>623992363</td>
<td>1082559225</td>
</tr>
</tbody>
</table>

Source: http://www.futuresindustry.org/volume-.asp

National Stock Exchange of India is one of top ten exchanges of the world in terms of number of contracts traded. It ranks as fifth largest exchange in terms of number of contracts traded, the top being the Korean Exchange. NSE has moved up the ladder in terms of its ranking. It ranked as 7th largest exchange in the world in 2009.
Table 4: Global Futures & Options Volume

4.1) Global Futures & Options Volume

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>(% change)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Futures</td>
<td>12049275638</td>
<td>12945211880</td>
<td>7.4%</td>
</tr>
<tr>
<td>Options</td>
<td>10375413639</td>
<td>12027190688</td>
<td>15.9%</td>
</tr>
<tr>
<td>Combined</td>
<td>22424689277</td>
<td>24972402568</td>
<td>11.4%</td>
</tr>
</tbody>
</table>

Source: http://www.futuresindustry.org/volume-.asp

4.2) Global Futures & Options Volume by Category

<table>
<thead>
<tr>
<th>Category</th>
<th>2010</th>
<th>2011</th>
<th>(% change)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equity Index</td>
<td>7416030134</td>
<td>8459520735</td>
<td>14.1%</td>
</tr>
<tr>
<td>Individual Equity</td>
<td>6295265079</td>
<td>7062363140</td>
<td>12.2%</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>3202061602</td>
<td>3491200916</td>
<td>9%</td>
</tr>
<tr>
<td>Foreign Currency</td>
<td>2525942415</td>
<td>3147046787</td>
<td>24.6%</td>
</tr>
<tr>
<td>Ag Commodities</td>
<td>1305531145</td>
<td>991422529</td>
<td>-24.1%</td>
</tr>
<tr>
<td>Energy Products</td>
<td>723614925</td>
<td>814767491</td>
<td>12.6%</td>
</tr>
<tr>
<td>Non-Precious Metals</td>
<td>643645225</td>
<td>435111149</td>
<td>-32.4%</td>
</tr>
<tr>
<td>Precious Metals</td>
<td>174943677</td>
<td>341256129</td>
<td>95.1%</td>
</tr>
<tr>
<td>Other</td>
<td>137655075</td>
<td>229713692</td>
<td>66.9%</td>
</tr>
<tr>
<td>Total Volume</td>
<td>22424689277</td>
<td>24972402568</td>
<td>11.4%</td>
</tr>
</tbody>
</table>

Source: http://www.futuresindustry.org/volume-.asp
The entire data in table 4 is based on the number of contracts traded &/ or cleared at 81 stock exchanges worldwide. Table 4.1 reveals data regarding the futures and options contracts volume globally and table 4.2 reveals data regarding the futures and options contracts volume globally category wise. As is revealed from the above statistics, globally, futures contracts trading volume exceeds that of options contracts trading volume in year 2011 but in India, as is revealed from Table 1, the trend is changing. Earlier there had been more trading in futures contracts, but now the trading volume in options contracts (particularly index options) far exceeds that of futures contracts.

Globally, the trading volume for both futures and options contracts has shown an increase in 2011 relative to year 2010 but there has been a greater percentage increase in trading volume of options contracts.

In India, different derivatives instruments are permitted and regulated by various regulators, like Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI) and Forward Markets Commission (FMC).

SEBI is an apex body for overall development and regulation of securities market. It was set up in 1988 as a non statutory body. Later on it became a statutory body under Securities Exchange Board of India Act, 1992. The act entrusted SEBI with comprehensive powers over practically all the aspects of capital market operations.
The regulatory framework in India is based on the L.C. Gupta Committee Report, and the J.R. Varma Committee Report. It is mostly consistent with the IOSCO principles and addresses the common concerns of investor protection, market efficiency and integrity and financial integrity. IOSCO (International Organization of Securities Commission) is an international organization that brings together the regulators of the world’s securities and futures markets.

Derivatives trading in India can take place either on a separate and independent derivative exchange or on a separate segment of an existing Stock Exchange. Derivative Exchange/Segment function as a Self-Regulatory Organisation (SRO) and SEBI acts as the oversight regulator. The clearing & settlement of all trades on the Derivative Exchange/Segment is done through a Clearing Corporation/House, which is independent in governance and membership from the Derivative Exchange/Segment.

1.2 Chronology of Events leading to Derivatives Trading in India

- 1956: Enactment of the securities contracts (Regulation) Act which prohibited all options in securities.
- 1969: Issue of notification which prohibited forward trading in securities.
- 1996: Setting Up of L.C. Gupta Committee to develop regulatory framework for derivatives trading in India.
- 1999: Enactment of the Securities Laws (Amendment) Act which defined derivatives as securities.
- 2000: Withdrawal of 1969 notification
- May 2000: SEBI granted approval to NSE and BSE to commence trading of derivatives
- June 2000: Trading in Index futures commenced.
- June 2001: Trading in equity index options commenced. Ban on all deferral products imposed.


June 2003: Trading of Interest Rate Futures commenced

Sept 2004: Trading in Weekly Options started at BSE.

Jan 2008: Trading of Chhota (Mini) Sensex at BSE & Mini Index Futures & Options at NSE commenced.


1.3 Applications of Financial Derivatives
Some of the applications of financial derivatives can be enumerated as follows:

1.3.1. Management of risk:
This is most important function of derivatives. Risk management is not about the elimination of risk rather it is about the management of risk. Financial derivatives provide a powerful tool for limiting risks that individuals and organizations face in the ordinary conduct of their business.

1.3.2. Efficiency in trading:
Financial derivatives allow for free trading of risk components and that leads to improving market efficiency. Traders can use a position in one or more financial derivatives as a substitute for a position in the underlying instruments. In many instances, traders find financial derivatives to be a more attractive instrument than the underlying security. This is mainly because of the greater amount of liquidity in the market offered by derivatives as well as the lower transaction costs associated with trading a financial derivative as compared to the costs of trading the underlying instrument in cash market.

1.3.3. Speculation:
This is not the only use, and probably not the most important use of financial derivatives. Financial derivatives are considered to be risky. If not used properly, these can lead to financial destruction in an organisation like what happened in Barings Plc. However, these instruments act as a powerful instrument for knowledgeable traders to
expose themselves to calculated and well understood risks in search of a reward, that is, profit.

1.3.4. Price discovery:
Another important application of derivatives is the price discovery which means revealing information about future cash market prices through the futures market. Derivatives markets provide a mechanism by which diverse and scattered opinions of future are collected into one readily discernible number which provides a consensus of knowledgeable thinking.

Derivatives also create new kinds of risks. Several risk factors have been discussed in the literature. We argue that the three key kinds mainly result from reinforcing the factors that are assumed to promote a potentially destabilizing impact on financial market volatility. The use of derivatives additionally increases the lack of transparency in financial markets. This results from the growing complexity and diversity of derivatives as well as from their off-balance sheet character. These characteristics also lead to a greater uncertainty concerning the valuation of derivatives positions. Combined with other key characteristics of derivatives namely: high leverage, low transaction costs & mark-to market valuation might lead to destabilizing the market.

The presence of leverage positions in derivative market increases the potential losses in the event of financial market distress & low transaction costs of derivatives trading accelerates the speed and magnitude at which financial market positions are unwound in distressed times. Another risk factor stemming from the use of derivatives applies to the high degree of concentration in derivatives markets that have increased the scale of intra- and inter market linkages and hence the potential magnitude of adverse spillovers and contagion effects in times of financial market distress. This increased degree of concentration combined with the large amount of potential losses due to the tremendous scale of derivatives positions supposedly increases systemic risk in financial markets since it increases the probability that some kind of trigger event causes a chain of destructive economic consequences which potentially impair financial market stability.

Prices in derivatives and cash markets value the same underlying asset. Therefore, they are linked and will move together if markets are at least partly efficient. Thus, the
information about future prices of the underlying incorporated in the price of the derivative can be shared free of charge by other market participants who have to make their investment, production or consumption decisions. With the help of an efficient price discovery process a more efficient inter temporal allocation of resources can be achieved which is regarded as socially beneficial.

Some authors further assume that there is a lead-lag-relationship between derivatives and cash markets, meaning that price discovery in derivatives markets leads the one in the underlying cash market (see, for example, Debasish and Mishra, 2007; Floros and Vougas, 2007). The rationale for this assumption is attributed to the main characteristics of derivatives trading, namely lower transaction costs and higher financial leverage, in particular. These characteristics supposedly motivate speculators to prefer derivatives markets before cash markets. (Stoll and Whaley (1993)). Due to this additional trading activity, enhances market liquidity and increases the amount of information transmitted through market prices.

Futures markets provide an indication of possible future trend in the stock market. One such indicator is Open Interest (OI) indicator. Open Interest is the total number of options and futures contracts that are not closed on a particular day.

Open interest applies primarily to the futures market; it helps to measure the flow of money into the Futures Market. A rise in open interest in a futures contract along with its price indicates bullishness, which means investors are creating long positions and vice versa.

Increasing open interest means that new money is flowing into the marketplace. The result will be that the present trend (up, down or sideways) will continue.

The open interest position that is reported each day represents the increase or decrease in the number of contracts for that day, and it is shown as a positive or negative number.

Changes in the Open Interest as mentioned earlier can help a trader interpret the future trend of a particular contract.

<table>
<thead>
<tr>
<th>Contract Price</th>
<th>Open Interest (%)</th>
<th>Future Trend(predicts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rising</td>
<td>Rising</td>
<td>Market/Stock is likely to trade strong in the coming days</td>
</tr>
<tr>
<td>Rising</td>
<td>Falling</td>
<td>Market/Stock is likely to see some downside in</td>
</tr>
</tbody>
</table>
Thus, the trend in the futures markets helps predict the trends in the stock markets.

Apart from the need to minimize risk, other motive behind introduction of derivative contracts on Indian stock exchanges has been that of containment of volatility. Derivative instruments have their own merits and demerits. The concern, how the introduction of the futures trading affects the volatility of the underlying assets has been an interesting subject for the investors, exchanges and regulators, because the introduction of the futures trading has significantly altered the movement of the share price in the spot market.

Prices in derivatives and cash markets value the same underlying asset & because of existence of leverage, the spot and futures market prices are linked by arbitrage, i.e., participants liquidating position in one market and taking comparable position at better price in another market or choosing to acquire position in the market with most favorable prices. The main argument against the introduction of the futures trading is that it destabilizes the associated spot market by increasing the spot price volatility. Under risk aversion, higher volatility should lead to higher risk premium. Thus transmission of the volatility from futures to spot market would raise the required rate of return of the investors in the market, leading to misallocation of the resources and the potential loss of the welfare of the economy.

Hence, it is important to study the effect of the futures introduction on spot market volatility.

In 2002, Warren Buffet, the founder of the famous investment company Berkshire Hathaway Inc. and the world richest man in 2008, warned his shareholders about the possible risks stemming from the use of derivatives. He called them “time bombs, both for the parties that deal in them and the economic system” and “financial weapons of mass destruction” (Berkshire Hathaway Inc., 2002., p. 13 and 15). His strong words have got a lot of public and political attention and are willingly cited when the potential negative impact of derivatives is up for discussion. The astonishing growth in

<table>
<thead>
<tr>
<th></th>
<th>the coming days</th>
<th>Market/Stock should not be entered as of now</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falling</td>
<td>Rising</td>
<td></td>
</tr>
<tr>
<td>Falling</td>
<td>Falling</td>
<td>Market/Stock can be entered, as its likely to go up</td>
</tr>
</tbody>
</table>
derivatives trading since the nineties has given additional support for these kinds of concerns.

Derivatives were introduced for participants as hedging instruments. In India most derivative traders describe themselves as hedgers and Indian laws generally require derivatives to be used for hedging purpose only (Sarkar, 2006).

Although a large part of derivatives trading is mainly used for hedging purposes – the other points are still far from clear, neither theoretically nor empirically. In practice it is very difficult to differentiate a hedger from a speculator.

The question of whether or not derivatives trading does increase financial market volatility and whether or not such an increase in volatility is economically harmful and constitutes a threat to financial market stability is still under controversy. A clarification of this question is important because depending on the respective impact of derivatives trading, suitable policy measures may be taken regarding derivatives and their markets.

Now, what actually is volatility? In simplest terms, the variability of return is called volatility.

In financial terms, volatility is the degree to which the price of a security, commodity, or market rises or falls within a short-term period.

Greater this deviation or variability, greater is the volatility. At a more fundamental level, volatility can indicate the strength or conviction behind a price move.

‘Volatility’ & ‘Risk’ are two different terms which often are used interchangeably. But there is a difference between these terms. Risk is the probability of losing the purchasing power of the investment whereas; Volatility is the measurement of the change in price over a given period of time.

Volatility refers to the amount of uncertainty or risk about the size of changes in a security's value. A higher volatility means that a security's value can potentially be spread out over a larger range of values. This means that the price of the security can change dramatically over a short time period in either direction. A lower volatility means that a security's value does not fluctuate dramatically, but changes in value at a steady pace over a period of time. The higher the volatility, the more likely it is that the underlying asset will trade higher (or lower) than the exercise price by the expiry date.
Volatility is difficult to analyze because it means different things to different people. People are rarely precise when they talk about volatility. Also, there is a lot of misinformation about volatility. They consider volatility to be another name for loss. But this is not right. Volatility indicates ups and downs in the prices of securities which could result in either loss or profit. However negative aspect of volatility overpowers the positive aspect. People are more concerned about the loss as a result of volatile market.

Volatility in the stock return is an integral part of stock market with the alternating bull and bear phases. In the bullish market, the share prices soar high and in the bearish market share prices fall down and these ups and downs determine the return and volatility of the stock market.

Pricing of securities depends on volatility of each asset. An increase in stock market volatility brings a large stock price change of advances or declines. Its not financial market volatility itself but only excessive volatility, that is, extreme and fundamentally not justified. Asset price fluctuations may potentially impair financial market stability.

Volatility can be categorized as:

A) Historical Volatility & Implied volatility

*Historical volatility:* Historical volatility is that volatility which is predicated on the basis of information in the past or the past data. Thus, only past data forms the basis of volatility at present.

*Implied Volatility:* A less well-known, but more valuable measure is implied volatility. Unlike historical volatility which is predicted by the past, Implied Volatility is predicted by the market.

This measure is the result of an important fact about derivatives: the price of the derivative along with the price of the underlying security produces two observations of the security's price. Arbitrageurs have used this fact to profit by determining whether a security is improperly priced relative to its derivative. Students of the financial markets can use the information provided by a security's observed prices along with the security's observed derivative prices to generate important information. An analyst can determine such volatility at virtually any instant in time.
B) Inter day or Intraday volatility

*Inter–day Volatility*: The variation in share price return between the two trading days is called inter–day volatility. Inter–day volatility is computed by close to close and open to open value of any index level on a daily basis.

*Intra–day Volatility*: The variation in share price return within the trading day is called intra–day volatility. It indicates how the indices and shares behave in a particular day.

1.4. Real economic effects of financial market volatility:

1. Rises and falls in asset prices are associated with changes in household wealth and thus consumption spending.
2. Equity price changes alter the propensity to invest because they change the relation between the market value of corporate or individual assets and their replacement cost.
3. Equity price changes have an impact on the balance sheet of firms, therefore altering corporate spending.
4. Asset price booms and busts also affect international capital flows which in turn alter currency values.

Investors interpret a raise in stock market volatility as an increase in the risk of equity investment and consequently they shift their funds to less risky assets. It has an impact on business investment spending and economic growth through a number of channels. Changes in not only local but also global economic and political environment influence the share price movements and show the state of stock market to the general public.

The developing economies are facing many impediments in their financial markets, and with many other factors, high volatility in prices is a major factor of erosion of capital from markets. As due to this the investors becomes fearful and run away from the market. Though it is not the sign of inefficiency of market but it poses a threat to ‘crash’ the market due to high volatility. High volatility creates high uncertainty in a stock market and individual security prices and these may curtail the prices and associated return.

In year 2012, in view of economic uncertainties in India and abroad global rating agency Standard & Poor's (S&P) scaled down India's credit rating outlook from ‘stable’ (BBB+) to ‘negative' (BBB-) with a warning of a downgrade if there is no improvement in the fiscal situation and political climate. This would be just one step
away from junk bond status. In 83% cases negative rating has turned to junk status. Reasons for such act outlook are high inflation, weak government fiscal position, slow domestic economic growth and the euro zone sovereign debt crisis which could impact the economy. If this happens, India would not be able to attract foreign investment.

If demonstrated action is not taken to contain the fiscal deficit and the Indian economy gets the ‘junk’ tag, several pension funds and foreign institutional investors or FIIs invested in India would have no option but to pull out because they are not permitted to remain invested in a country whose sovereign rating is ‘junk’. Once they leave, they are legally mandated to stay out for at least a year, even if the rating changes earlier. (Business Standard, 12th July 2012). Thus, uncertainty has an adverse effect on investment which will further worsens and create a vicious circle.

1.5. Causes of Volatility

The stock market volatility is caused by number of factors such as change in inflation rate, interest rate, financial leverage, corporate earnings, dividends yield policies, bonds prices and many other macroeconomic, social and political variables such as international trends, economic cycle, economic growth, budget, general business conditions, credit policy etc. Volatility is driven by trading volume followed by arrival of new information regarding new floats, or any kind of private information that incorporate into market stock prices.

Amongst the literature of most relevance to the whole volatility issues is ‘Market Volatility’ of Robert Shiller (1990). Shiller is a firm advocate of the popular model explanation of stock market volatility. The popular models are a qualitative explanation of price fluctuations. In short, it proposes that investor reactions, due to psychological or sociological beliefs, exert a great influence on the market than good economic sense arguments.

Low volatility is preferred as it reduces unnecessary risk borne by investors thus enables market traders to liquidate their assets without large price movements.

It is important to estimate volatility since volatility is a key parameter used in many financial applications, from derivatives valuation to asset management and risk management. Volatility measures the size of the errors made in modeling returns and
other financial variables. It was discovered that, for vast classes of models, the average size of volatility is not constant but changes with time and is predictable.

Volatility of returns in financial markets can be a major stumbling block for attracting investment in small developing economies. High returns and low level of volatility is taken to be a symptom of a developed market. India with long history and China with short history, both provide as high a return as the US and the UK market could provide but the volatility in both countries is higher (M.T. Raju, Anirban Ghosh, 2004).

There are a number of other things that cause volatility. Amongst other things that cause volatility is arbitrage. Arbitrage is the simultaneous or almost simultaneous buying and selling of an asset to profit from price discrepancies. Arbitrage causes markets to adjust prices quickly. This has the effect of causing information to be more quickly assimilated into market prices. This is a curious result because arbitrage requires no more information than the existence of a price discrepancy.

Another obvious reason for market volatility is technology. This includes more timely information dissemination, improved technology to make trades and more kinds of financial instruments. The growing linkages of national markets in currency, commodity and stock with world markets and existence of common players, have given volatility a new property – that of its speedy transmissibility across markets. Due to liberalization of the global markets, the domestic market is affected not just by its own forces or internal factors but the global factors too, make an equal impact. The global economic slowdown in September 2008 is the biggest instance of such an interlink age. The Indian economy was fully affected by the US housing bubble. The crash in US economy sent a wave of pessimism all round the globe.

The faster information is disseminated, the quicker markets can react to both negative and positive news. Improved trading technology makes it easier to take advantage of arbitrage opportunities, and the resulting price alignment arbitrage causes. Finally, more kinds of financial instruments allow investors more opportunity to move their money to more kinds of investment positions when conditions change.

Speculation: Another reason for market volatility is speculation. Speculation is the act of trading in an asset, or conducting a financial transaction, that carries significant risk of losing most or all of the initial outlay, in expectation of a substantial gain. This
involves buying and selling of financial instruments and make money from the anticipated price fluctuation. Speculation causes deviation of price from their intrinsic value.

The volatility on the stock exchanges may be thought of as having two components:
1) The volatility arising due to information based price changes; and
2) Volatility arising due to noise trading/speculative trading, i.e., destabilizing volatility.

Participants in financial markets may be real investors or they may be speculators. Real investors invest on the basis of fundamental factors but speculators speculate on short run price changes to make early profits. It is often difficult to identify the nature of transaction as a hedge or speculative transaction. In general, speculative activities have a major role in destabilizing the stock markets. Volatility due to speculators may take alarming proportions.

Both hedgers and speculators are attracted to the futures market, which trade on the basis of their expectations of the future price movements in the derivatives as well as the underlying market. There are conflicting views regarding the impact of futures contracts on volatility of spot market. Many studies have been made to find out the impact of futures on volatility. Studies have shown mixed results. Some studies have reported an increase in volatility and some report decrease or either no effect on volatility.

Theoretically, what effect the trading of derivatives might have on the underlying market dependents largely on the assumptions that we make about the market participants. One of the key assumptions relates to the ability of the futures contracts to attract either the more informed or uninformed traders to the market. Investors / Speculators are attracted to the futures’ markets due to the low costs of transaction inherent in them as compared to the spot markets.

To own a futures contract, investors only have to put up a small fraction of the value of the contract as margin. Thus, investors can trade a much larger amount of the asset instead of buying it outright. Low transaction costs facilitate investors’ participation and imply higher liquidity, and this is a sine qua non condition for the participation of
traders in any market, as it guarantees their ability to enter and exit their positions in a timely fashion.

1.5.1. Derivatives lead to increase in volatility:

Increase in Volatility in spot market due to futures market can be attributed to both rational & uninformed traders. However, volatility due to informed traders is not harmful. Informed investors rationally process all fundamentals-related information such as earnings, dividends, cash flows and so on and condition their trades upon it which increases volatility. On the other hand, uninformed traders, trade on information other than fundamentals which increases volatility. This type of trading has been called as “noise trading” (Black, 1986; De Long et al., 1990), and involves any trading strategy based on non fundamental indicators, including for example, technical analysis and investor-sentiment. The presence of noise trading is really a concern to the policy makers.

The presence of noise trading can cause prices to deviate substantially from fundamentals (De Long et al., 1990) and give rise to jump-volatility (Becketti and Sellon Jr., 1989), i.e., occasional and sudden extreme fluctuations in prices. Such shocks can lead to potentially destabilizing outcomes—a highly volatile environment with abrupt price swings would result in a high probability of market bubbles and crashes.

In the absence of noise traders, volatility would be expected to follow a more normal pattern in its distribution, which Becketti and Sellon Jr. (1989) have termed “normal volatility”. From a practical perspective, such an increase in volatility should be welcome; since the dominance of rational investors in futures markets would suggest that any deviations from the fundamentals at the spot level would be arbitraged away, leading to greater stabilization in capital markets. Another positive effect of this is that the domination of the futures markets by rational investors will lead to a boost in the liquidity of spot markets, thus reducing market frictions at the spot level. The volatility which is of major concern is volatility due to noise traders. Futures market provides him/her with an additional route to apply his/her non-fundamental trading strategies.

If the futures’ prices are “wrong” (over- or under-priced), this will be reflected into the underlying spot market, affecting pricing there too. The wild swings in prices irrespective of fundamentals expected will tend to amplify volatility at the spot market level, enhancing its riskiness.
1.5.2. Derivatives lead to Decrease in volatility:

Derivatives not only lead to increase in volatility but have a stabilizing effect too. Index futures reduce volatility and stabilize the cash market by providing low cost contingent strategies that enable investors to minimize portfolio risk by transferring speculators from the spot to the futures market. Index futures enable investors to trade large volumes at lower transaction costs, improving risk sharing and thereby reducing volatility (Cox, 1976; Stein, 1987; Ross, 1989, Chan et al., 1991).

The model developed by Froot and Perold (1991) demonstrates that futures markets cause an increase in the market depth due to the presence of more market makers in the futures segment than in the cash market and the more rapid dissemination of information. Volatility decreases since there is more rapid processing of information. Many authors, e.g., Anthony, Miller, Homes and Tomset also suggest that market participants prefer trading in the derivatives markets as compared to the trading in the spot market, because of market frictions like transaction costs, capital requirements, etc. These factors are also mentioned by Faff and Hiller to suggest that speculators have an incentive to migrate to the derivatives market and move their “risky” deeds to the derivatives markets, thus causing some reduction in noise in the market and leading to lower volatility in the underlying market.

Now the question is why are we so concerned about the stock market volatility? Does the Stock Market affect the economy? If yes, how?

With plummeting share prices making headline news, it is worth considering the impact of the Stock market on the economy. How much should we worry when share prices fall? How does it impact on the average consumer? And how does it affect the economy?

1.6. Economic Effects of Stock Market:

Stock market is an important part of the economy of a country. The stock market plays a play a pivotal role in the growth of the industry and commerce of the country that eventually affects the economy of the country to a great extent. That is reason that the government, industry and even the central banks of the country keep a close watch on the happenings of the stock market. The stock market is important from both the industry’s point of view as well as the investor’s point of view.
1.6.1. **Investment:**
The stock market is primarily the place where the companies get listed to issue the shares and raise the fund. Firms who are expanding and wish to borrow often do so by issuing more shares – it provides a low cost way of borrowing more money. Stock market also helps traders who raise the fund for the businesses by investing in the stocks. A well functioning stock market attracts foreign investment. An increase in stock market volatility implies increase in the riskiness of investment & hence hampers foreign investment as well. Falling share prices can hamper firms/ country’s ability to raise finance on the stock market.

1.6.2. **Effect on Pensions:**
Anybody with a private pension or investment trust will be affected by the stock market, at least indirectly. Pension funds invest a significant part of their funds on the stock market. Therefore, if there is a serious fall in share prices, it reduces the value of pension funds. This means that future pension payouts will be lower. If share prices fall too much, pension funds can struggle to meet their promises. The important thing is the long term movements in the share prices. If share prices fall for a long time then it will definitely affect pension funds and future payouts.

1.6.3. **Confidence:**
Often share price movements are reflections of what is happening in the economy. e.g. recent falls have been based on fears of a US recession and global slowdown. However, the stock market itself can affect consumer confidence. Bad headlines of falling share prices are another factor which discourage people from spending. On its own it may not have much effect, but combined with falling house prices, share prices can be a discouraging factor.

1.6.4. **Wealth Effect:**
The first impact is that people with shares will see a fall in their wealth. If the fall is significant it will affect their financial outlook. If they are losing money on shares they will be more hesitant to spend money; this can contribute to a fall in consumer spending. However, the effect should not be given too much importance. Often people who buy shares are prepared to lose money; their spending patterns are usually independent of share prices, especially for short term losses.
Stock market volatility indicates the degree of price variation between the share prices during a particular period. A certain degree of market volatility is unavoidable, even desirable, as the stock price fluctuation indicates changing values across economic activities and it facilitates better resource allocation. But frequent and wide stock market variations cause uncertainty about the value of an asset and affect the confidence of the investor. The risk averse and the risk neutral investors may withdraw from a market at sharp price movements. Extreme volatility disrupts the smooth functioning of the stock market.

1.7. Measures to control volatility: The following measures have been adopted to control volatility:

1.7.1. Circuit breakers:
A system of coordinated trading halts and/or price limits on equity markets and equity derivative markets designed to provide a cooling-off period and avert panic selling during large, intraday market declines. It is a measure used by some major stock and commodities exchanges to restrict trading temporarily when markets rise or fall too far, too fast. The Exchange has implemented index-based market-wide circuit breakers in compulsory rolling settlement with effect from July 02, 2001. In addition to the circuit breakers, price bands are also applicable on individual securities.

The index-based market-wide circuit breaker system applies at 3 stages of the index movement, either way viz. at 10%, 15% and 20%. These circuit breakers when triggered, bring about a coordinated trading halt in all equity and equity derivative markets nationwide. The market-wide circuit breakers are triggered by movement of either the BSE Sensex or the NSE S&P CNX Nifty, whichever is breached earlier.

- In case of a 10% movement of either of these indices, there would be a one-hour market halt if the movement takes place before 1:00 p.m. In case the movement takes place at or after 1:00 p.m. but before 2:30 p.m. there would be trading halt for ½ hour. In case movement takes place at or after 2:30 p.m. there will be no trading halt at the 10% level and market shall continue trading.
- In case of a 15% movement of either index, there shall be a two-hour halt if the movement takes place before 1 p.m. If the 15% trigger is reached on or after
1:00 p.m. but before 2:00 p.m., there shall be a one-hour halt. If the 15% trigger is reached on or after 2:00 p.m. the trading shall halt for remainder of the day.

- In case of a 20% movement of the index, trading shall be halted for the remainder of the day.

1.7.2. Pre Trading Session:

Pre trading /Pre open session has been introduced by SEBI in July 2010 to discover opening price. Its main motive is to eliminate/ minimize opening volatility on prices of securities. The opening price will be the equilibrium price based on the demand & supply of the security and not based on the price of the first trade for the security. Thus, it allows for overnight news in securities to be suitably reflected in the opening price. The pre-open session is of the duration of 15 minutes i.e. from 9:00 am to 9:15 am. The pre-open session is comprised of Order Collection period and Order Matching period. After completion of order matching there shall be silent period to facilitate the transition from pre-open session to the normal market. All Securities forming part of BSE Sensex and NSE Nifty are subject to pre Trading Session.

1.7.3. Increase in Market timing (trading hours):

To align Indian markets with those of the international markets & to facilitate the assimilation of any economic information that flow in from other global markets, discussions have been going on to increase market timings from 9 am to 5 pm. At present, trading hours at stock exchanges are between 9.55 a.m and 3.30 p.m. The extension of market hours may help in effectively assimilating information and thereby make Indian markets efficient in terms of better price discovery, reduction in volatility and impact cost.

Presently, the exchange-traded equity derivatives market is open from 9:55 am to 3:30 pm and the market timings are co-terminus with those of the underlying cash market. While exchange-traded currency derivatives market operates from 9:00 am to 5:00 pm, exchange-traded commodity futures market operates from 10:00 am till 11:30 pm.

Market timings of various products / markets in India:

<table>
<thead>
<tr>
<th>Product</th>
<th>Market Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Market</td>
<td>9:55 am to 3:30 pm</td>
</tr>
<tr>
<td>Equity Derivatives</td>
<td>9:55 am to 3:30 pm</td>
</tr>
</tbody>
</table>
Currency Derivatives 9:00 am to 5:00 pm
Commodity Derivatives 10:00 am to 11:30 pm
Power Exchange 10:00 am to 12:00 noon

Apart from increase in market timings, to control volatility, discussions are also going on to keep markets open for 6 days a week rather than 5, Saturday being thought upon to be considered as trading day. At present markets are open from Monday to Friday. The information which accumulates after the close of trading session on Friday is reflected in prices when markets reopen on Monday. As a result, the variance of returns displays a tendency to increase. Thus, to minimize such impact, it is being considered to increase the trading days from 5 days at present to 6 days.

1.7.4. The Market Surveillance system:
Market Surveillance systems have been developed and consolidated on a continuous basis. Some of the surveillance systems and risk containment measures that have been put in place are briefly given below:

- Risk containment measures in the form of elaborate margining system and linking of intra-day trading limits and exposure limits to capital adequacy;
- Reporting by stock exchanges through periodic and event driven reports;
- Establishment of independent surveillance cells in stock exchanges;
- Inspection of intermediaries;
- Suspension of trading in scrips to prevent market manipulation;
- Formation of Inter Exchange Market Surveillance Group for prompt, interactive and effective decision making on surveillance issues and co-ordination between stock exchanges;
- Implementation of On-line automated surveillance system (Stock Watch System) at stock exchanges.

Though the minimum measures for risk containment have been specified by the SEBI, the overall responsibility for risk containment lies with the exchanges. Exchanges have been directed to take further measures as required. Some additional measures taken by the exchanges for risk containment, are intra-settlement and inter-settlement scrip-wise limits on broker positions in addition to the overall limits specified by the SEBI,
enforcement of early pay-ins by members with large positions and member-wise adhoc margins.

1.8. Measuring Volatility

Measuring volatility presents some problems. Even simple measures of volatility are relatively complex. Further, any measurement of volatility requires a lot of information. Consequently, using any measure of volatility has both advantages and disadvantages.

1.8.1. Standard Deviation:

The most common measure of volatility is standard deviation. To calculate the standard deviation, we have to first determine a time frame for returns we wish to measure. That is, we must determine whether we wish to measure the volatility of hourly returns, daily returns, monthly returns, etc. Standard deviation is a measure of dispersion from the mean. The more is the deviation, the more is volatility and vice versa.

\[
\sigma = \sqrt{\frac{\sum_{i=1}^{n} (r_i - \bar{r})^2}{n-1}}
\]

Where:
- \( r_i \) = rate of return on ith day
- \( \bar{r} \) = the average rate of return for the month
- \( i \) = the day identifier for the month (i.e. for a month, i goes from 1 to 30 or 31)

The primary advantage with standard deviation is that everybody is familiar with and understands it. It is easy to calculate, and is readily available from a number of sources (e.g., spreadsheets, calculators, etc.). However, there are a number of problems with this measure. As the time frame decreases, the measure's validity is less certain. One also needs to calculate the mean return for the period analyzed. Further, we must specify a time frame for the returns, and the relevant time period. Consequently, it is historical in nature. Therefore, it homogenizes the information i.e. every piece of information old or new is given equal weight.

By using standard deviation, the assumption, that all past prices have an equal relevance in the shaping of the volatility of the future is applied. Intuitively this
assumption is too crude as more recent volatility is likely to have more relevance than that of several years ago and should hence be given a relatively higher weight in the calculation. A simple way to counter this problem is done by only using the last 30 days to calculate the historical volatility and this model is actually widely used by actors in the financial markets. The model weighs volatility older than 30 days as 0 and puts equal weight on the volatility of the last 30 days. This model is however still crude and more sophisticated models are frequently used moving into the area covered by models such as the Exponential Weighted Volatility models. If we are interested in what the volatility is this instant, the standard deviation as a measure is of little use.

Stock prices volatility has received a great attention from both academicians and practitioners over the last two decades because it can be used as a measure of risk in financial markets. Over recent years, there has been a growth in interest in the modelling of time-varying stock return volatility. Many economic models assume that the variance, as a measure of uncertainty, is constant through time. However, empirical evidence rejects this assumption. Economic time series have been found to exhibit periods of unusually large volatility followed by periods of relative tranquility (Engle, 1982). In such circumstances, the assumption of constant variance (homoskedasticity) is inappropriate (Nelson, 1991). The time series are found to depend on their own past value (autoregressive), depend on past information (conditional) and exhibit non-constant variance (heteroskedasticity). It has been found that the stock market volatility changes with time (i.e., it is “time-varying”) and also exhibits positive serial correlation or “volatility clustering”. Large changes tend to be followed by large changes and small changes tend to be followed by small changes, which mean that volatility clustering is observed in financial returns data. This implies that the changes are non-random. These characteristics of time series data can be adequately captured by ARCH/ GARCH models.

To fully comprehend the GARCH model introduced by Bollerslev (1986) there should be a clear understanding of the underlying assumptions and models from which GARCH is derived. In its simplest form, an autoregressive model is a model in which we use the statistical properties of the past behaviour of a variable y to predict its behaviour in the future. An overview of these models is given below:
1.8.2. Autoregressive Model:
An autoregressive model is a model in which you use the statistical properties of the past behavior of a variable to predict its behaviour in the future. In other words, we can predict the value of the variable \( y_t \) by looking at the sum of the weighted values that \( y_{t-1} \) took in previous periods plus an error term given by \( e_t \). An AR model with one lag of term is called as AR (1) model. The AR (1) model is given by the following equation:
\[
y_t = b_0 + b_1 y_{t-1} + e_t
\]
where,
- \( b_0 \) is the constant
- \( b_1 \) is the weight
- \( y_{t-1} \) = value of \( y \) one period ago
- \( e_t \) = error term
An autoregressive model with weighted sum of previous (\( p \)) lags of \( y \) is called an AR(p) model (where p=1,2……n).

1.8.3. Moving Average model:
A simple linear combination of white noise processes that makes a variable \( y_t \) dependent on the current and previous values of a white noise disturbance term can be given as:
\[
y_t = b_0 + b_1 e_{t-1} + e_t
\]
where,
- \( b_0 \) is the constant
- \( b_1 \) is the weight
- \( e_{t-1} \) = value of error one period ago
- \( e_t \) = error term.
An MA model with weighted sum of previous (\( q \)) lags of \( y \) is referred to as MA(q) model (where q=1,2….n).

1.8.4. ARMA Model:
By combining AR & MA models described above, we get a model or a tool for predicting future values of a variable \( y_t \) which is referred to as an autoregressive moving average model, or ARMA( \( p, q \) ). This model states that the current value of some series \( y_t \) depends linearly on its own previous values (AR) plus a combination of current and previous values of a white noise error term (MA).
The ARMA(1,1) model is given by:

\[ y_t = b_0 + b_1 y_{t-1} + \alpha_1 e_{t-1} + e_t \]

An ARMA model with (p) lags of \( y_t \) and (q) lags of \( e_t \) will be called as ARMA(p,q) model.

1.8.5. Exponentially Weighted Moving Average (EWMA) Model:

The weakness with simple variance is that all returns get the same weight. So we face a classic trade-off: we always want more data but the more data we have the more our calculation is diluted by distant (less relevant) data. The exponentially weighted moving average (EWMA) improves on simple variance by assigning weights to the periodic returns. By doing this, we can both use a large sample size but also give greater weight to more recent returns. EWMA method, which is, in effect, a restricted version of the ARCH(\infty) model of Engle (1982). This approach forecasts the conditional variance at time \( t \) as a linear combination of the lagged conditional variance and the squared unconditional shock at time \( (t - 1) \). The EWMA model calculates the conditional variance as:

\[ \sigma_t^2 = \lambda \sigma_{t-1}^2 + (1 - \lambda) \epsilon_t^2 \]

where \( \lambda \) is the decay parameter.

A higher lambda indicates slower decay in the series. If we reduce the lambda, we indicate higher decay; the weights fall off more quickly.

1.8.6. The ARCH Model:

Prior to the ARCH model introduced by Engle (1982), the most common way to forecast volatility was to determine the standard deviation using a fixed number of the most recent observations. As we know linear models are based on certain assumptions and when these assumptions are violated, we use non linear models such as ARCH/GARCH.

Time series data shows certain characteristics like heteroskedasticity (non constant variance), volatility clustering, leptokurtosis and reversion towards the mean. Linear models are not able to capture these characteristics of the time series data.

The variance of time series data is not constant, i.e. homoskedastic, but rather a heteroskedastic process, it is unattractive to apply equal weights considering we know recent events are more relevant. Moreover, it is not beneficial to assume zero weights for observations prior to the fixed timeframe. The ARCH model overcomes these
assumptions by letting the weights be parameters to be estimated thereby determining the most appropriate weights to forecast the variance. The Conditional volatility models such as ARCH & GARCH incorporate time varying second order moments, where the series at any time period \( t \) is decomposed into its conditional mean and conditional variance. Both conditional mean and conditional variance depends on all past information available up to period \( t-1 \). The acronym ARCH stands for Autoregressive Conditional Heteroskedasticity. The term heteroskedasticity" refers to changing volatility (i.e., variance). But it is not the variance itself which changes with time according to an ARCH model; rather, it is the conditional variance which changes in a specific way, depending on the available data. The conditional variance quantifies uncertainty about the future observation.

An ARCH (1) model, where the conditional variance depends only on one lagged square error term, is given by:

\[
    h_t = \alpha_0 + \alpha_1 e^2_{t-1}
\]

where,

\( h_t \) = conditional variance

\( \alpha_0 \) = constant term

\( \alpha_1 \) = weight

\( e^2_{t-1} \) = lagged squared error term

We can capture more of the dependence in the conditional variance by increasing the number of lags, \( p \), giving us an ARCH(\( p \)) model.

**ARCH Shortcomings**

Even though the ARCH model is useful but has its own shortcomings. For instance, we do not know how many lags, \( p \), we should apply for the best results. The potential number of lags required to capture all of the dependence in the conditional variance could be very large thus making the model not very parsimonious.

Intuitively, the more parameters we have in the model, the more likely it will be that one of them will have a negative estimated value.

**1.8.7. The GARCH Model:**

Empirically, the family of GARCH (generalized ARCH) models has been very successful in describing the financial data. ARCH and GARCH models treat heteroskedasticity as a variance to be modeled. Of these models, the GARCH (1, 1) is
often considered by most investigators to be an excellent model for estimating conditional volatility for a wide range of financial data (Bollerslev, Ray and Kenneth, 1992).

The GARCH specification, firstly proposed by Bollerslev (1986), formulates the serial dependence of volatility and incorporates the past observations into the future volatility. GARCH model was first used to model the autoregressive and time varying nature of Inflation.

GARCH model overcomes the limitations of the ARCH model. Unlike the ARCH model, the Generalized Autoregressive Centralized Heteroskedasticity model (GARCH), introduced by Bollerslev (1986) only has three parameters that allows for an infinite number of squared errors to influence the current conditional variance. This makes it much more parsimonious than the ARCH model which is why it is widely employed in practice. Like the ARCH model, the conditional variance determined through GARCH is a weighted average of past squared residuals. However, the weights decline gradually but they never reach zero. Essentially, the GARCH model allows the conditional variance to be dependent upon previous own lags. Using the GARCH approach, the conditional standard deviation is the measure of volatility, and distinguishes between the predictable and unpredictable elements in the price process. This leaves only the stochastic component and is hence a more accurate measure of the actual risk associated with the price.

The GARCH(1,1) model is given by:
\[ \sigma_t^2 = \alpha_0 + \alpha_1 e_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \]

**GARCH Shortcomings**

Though, in most of the cases, the ARCH and GARCH models are apparently successful in estimating and forecasting the volatility of the financial time series data, they cannot capture some of the important features of the data. The most interesting feature not addressed by these models is the “leverage effect” where the conditional variance tends to respond asymmetrically to positive and negative shocks in returns. They fail to capture the fat-tail property of financial data. This has lead to the use of non-normal distributions (Student-t, Generalized Error Distribution and Skewed Student-t ), within many nonlinear extensions of the GARCH model which have been proposed. Such as the Exponential GARCH (EGARCH) of Nelson (1991) the so-called GJR model of Glosten, Jagannathan, and Runkle (1993) and the Asymmetric Power ARCH
(APARCH) of Ding, Granger, and Engle (1993), to better model the fat-tailed (the excess kurtosis), skewness and leverage effect characteristics.

The symmetric GARCH class models only consider the magnitude of the returns, but not the direction. Investors act differently depending on whether a share moves up or down which is why volatility is not symmetric in relation to directional movements. Market declines forecast higher volatility than comparable market increases. This is referred to as the leverage effect.

Both ARCH and GARCH fail to capture this fact and as such may not produce accurate forecasts. Recent models building on ARCH and GARCH such as the Threshold ARCH (TARCH), Exponential GARCH (EGARCH) model have tried to overcome this problem. However, in the present study we are not concerned about the asymmetries of the data. The study utilizes GARCH (1,1) equation to model the volatility of the Indian stock market.

1.9. Motivation of the Study:

Generally, two types of arguments prevail in the existing literature. One school of thought argues that derivatives trading increases stock market volatility due to high degree of leverage, low transaction costs and hence increases speculation & destabilizes the market. On the other hand, another school of thought claims that futures market plays an important role in price discovery, enhances market efficiency and reduces asymmetry information of spot market and has beneficial effect on the underlying cash market. This gives rise to the controversy among the researchers, academicians and investors on the effect of derivatives on the underlying market volatility.

A lot of studies have been made to study the effect of index futures on stock market volatility. Not many studies analyse the impact of futures trading in individual stocks on the volatility of the underlying. The studies which have been made previously produce mixed results. The results varied depending on the time period studied and the country studied.

Most of the studies made earlier considered a short time frame for study. This study makes an attempt to provide generalizations about the impact of derivatives on stock market volatility in India by studying the nature of volatility over a longer frame of time. The present study is focused to know the impact of derivatives (both Index Futures & Stock Futures) on the volatility of cash market in India. It also addresses the
issue of whether introduction of derivatives (Index Futures & Stock Futures) have been the only factor responsible for the change in volatility or there are other factors which affect the volatility of the stock market. In India, trading in derivatives contracts has been in existence for the last eleven years, which is a substantial time period to provide some major inputs on its implications.