Chapter-3

Theoretical and Conceptual Framework and Methodology

This chapter consists with two sections (Section 3.1 and 3.2). Section 3.1 describes the theoretical and conceptual framework whereas in section 3.2 the methodology or detail sampling design is discussed.

3.1 Theoretical and Conceptual Framework:

There are some theoretical and conceptual framework which is essential to acquire the knowledge before initiating the work on stock market volatility and the returns. Few of these concepts are explained briefly in the following:

Stock Market Volatility:

Volatility defined in simple terms refers to variations or fluctuation in the price of financial assets such as stocks, exchange rates or interest rates over a period of time. Mullins (2000) has defined volatility as the degree to which the price of a security, commodity, or market rises or falls within a short-term period. People are usually most concerned about volatility during periods when prices decrease or go through a "correction". During an extreme bull market, no one (with the possible exception of investors with short positions) seems to care that the markets are exhibiting volatility.

According to Reddy (1996), market is said to be volatile when the prices of securities or their returns fluctuate widely over a period of time. As opposed to this, in a stable market, prices tend to follow a smooth course and shift gradually from one equilibrium point to another, as the information is gradually assimilated into prices. So, volatility means how drastically the price of an asset tends to rise and fall. The stock market is considered to be volatile when there is a sharp rise and sharp decline in the

markets within a short span of time. Stock return volatility measures the random variability of the stock returns. Stock return volatility is the variation of the stock returns in time (Gangadhar and Reddy, 2009).

While volatility can be expressed in different ways, statistically, the most commonly used measure of volatility is the standard deviation. It measures the deviation of current price from its average price over a period of time. Greater the deviation of current price, greater is the volatility. More specifically, it is the standard deviation of daily stock returns around the mean value and the stock market volatility is the return volatility of the aggregate market portfolio.

Some financial experts have referred to it as speculative bubble, some baby boom effect, whereas some have explained it as 'herd behavior'. According to the view, “Volatility" is called in stock market parlance. This high volatility has given sleepless nights to a lot of investors as well as market regulators.

Alternatively some experts have referred the term ‘volatility’ is simply synonymous with risk, in their view high volatility is to be deplored, because it means that security values are not dependable and the capital markets are not functioning as well as they should. Volatility can be defined as changeability or randomness of asset prices. Theoretically, a change in the volatility of either future cash flows or discount rates causes a change in the volatility of share prices. "Fads" or "bubbles" introduce additional source of volatility (Schwert, 1989).

Volatility is also defined as a statistical measure of the dispersion of returns for a given security or market index. Volatility can either be measured by using the standard deviation or variance between returns from that same security or market index. In other

words, 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 (Pandian, 2009).

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 closing value of the day to closing value of the next day and opening value of the day to opening value of the next day. For computing close to close volatility, the closing values of the Nifty and Sensex are taken. Opening to opening volatility is considered necessary for many market participants because opening prices of shares and the index value reflect any positive or negative information that arrives after the close of the market and before the start of the next day's trading.

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 from one time period to another time period in a particular day.

Volatility Models:

There are broadly four possible approaches for estimating and forecasting volatility. These are: Historical Volatility Models, Implied Volatility Models, Extreme Value Estimators, and Conditional Volatility Models.

Historical Volatility Models:

Volatility is usually an inherently historical measure of risk, based on the estimated sample standard deviation of some time series of observed returns on assets and liabilities. This is the simplest model for capturing the volatility and is widely used. It simply involves calculating the variance or standard deviation of returns over some past period. It is a total risk measure that captures both idiosyncratic as well as systematic risk. Standard deviation measures how widely values (closing prices for instance) are dispersed from the average. Dispersion is the difference between the actual value (closing price) and the average value (mean closing price). The larger the difference between the closing prices and the average price, the higher the standard deviation and the higher the volatility. The closer the closing prices are to the average price, the lower the standard deviation and the lower the volatility. It is a relative measure, i.e., standard deviation of stock returns in one period can be compared with standard deviation of another period to understand which period has been more volatile. This measure is then used as the volatility forecast for the future period (Srivastava and Jain, 2006).

Implied Volatility Models:

A less well-known, but more valuable measure is implied volatility. Implied volatility is a value derived from the option's price. 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. A stock that has a wide trading range (moved around a lot) is said to have a high volatility. A stock that has a narrow trading range (does not move around much) is said to have a low volatility. 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. This measure uses information available from the derivatives of a security and compares it with the price of the underlying security. Greater the deviations of one price from the other, greater is the implied volatility of the concerned security. Another way to look at it is that actual volatility reflects what happened in past, whereas implied volatility reflects what option traders expect will happen in the future (Schwert, 1989).

Extreme Value Estimators:

These estimators are similar to traditional estimators except that these also incorporate high and low prices observed unlike traditional estimators which are based on closing prices of the asset (Pandey, 2005).

Conditional Volatility Models:

Conditional Volatility Models (ARCH/GARCH), unlike the traditional or extreme value estimators, take into account the time-varying nature of volatility. The ARCH and the GARCH models assume conditional heteroscedasticity with homoscedastic unconditional error variance. That is, the changes in variance are a function of the realizations of preceding errors and these changes represent temporary and random departures from a constant unconditional variance. The advantage of GARCH model is that it captures the tendency in financial data for volatility clustering. It, therefore, enables us to make the connection between information and volatility explicit since any change in the rate of informational arrival to the market will change the volatility in the market.

Volatility and its Implications:

Volatility has two aspects. To most economists, volatility results from the arrival of new information in the market. Market participants receive new information and reassess the true value of asset being traded in the market continuously. In an efficient market, the price of the traded asset quickly adjusts to reflect this new information. One result of this process is volatility. Thus, volatility is an evidence of a properly functioning and informationally efficient market (Narayan, 2006). In this sense, volatility is good, not bad. Other positive aspect is that one can make more money if the market moves as per one's expectations. In fact, an option trader will gain only when the underlying asset is volatile. In that case, there is chance of out-of market (a call option whose strike price is higher than the market price of the underlying security, or a put option whose strike price is lower than the market price of the underlying security) option becoming in-the-money (Situation in which an option's strike price is below the current market price of the underlie (for a call option) or above the current market price of the underlie (for a put option). Such an option has intrinsic value. However, one can lose money if the market does not move as per one's expectations.

Nonetheless, volatility, which does not appear to be accompanied by any important news about the firm or market as whole could be harmful and undesirable. Stock return volatility hinders economic performance through consumer spending (Garner, 1988). Stock return volatility affects business investment spending (Gertler and Hubbard, 1989). Further, the extreme volatility could disrupt the smooth functioning of the financial system, and lead to structural and regulatory changes.

The volatility of the market influences the functioning of the capital markets.

Excess volatility prevailing in the market drives away small investors from the market. Besides this, it may strain the market clearing and settlement obligations leading to the investor's loss of confidence, which in turn reduces participation and liquidity of the market.

Volatility also has implications for real economic activity. Capital markets offer a forum to the business community: what projects are likely to succeed, what technologies are likely to flourish, and what products consumers are likely to purchase. If security prices reflect these views accurately, then they give useful signals to corporate managers and business entities who are trying to maximize the value of their firms. However, if the prices really contain large systematic errors, managers of business firms who use these price signals to make decisions are, in fact, responding to noise only. Thus, excess volatility or "noise", which does not appear to be accompanied by any important news about the firm or market as whole, undermines the usefulness of stock prices as "signal" about the true value of a firm. Other effect of volatility is a large amount of wealth of households has been eroded. Investors may equate higher volatility with greater risk and may alter their investment decisions due to increased volatility.

The importance of volatility is that it has the single biggest effect of the amount of extrinsic value in an option's price. When volatility goes up, the extrinsic value of both the calls and the puts increases. This makes all the option prices more expensive. When volatility goes down, the extrinsic value of both the calls and the puts decreases. This makes all of the option prices less expensive.

Factors Responsible for Stock Market Volatility:

Broadly, the factors which result in volatility can be classified into two categories:

endogenous and exogenous. Endogenous factors are those, which emerge from different fields like corporate, economy, and politics within the country. These factors are of two types, micro and macro. Micro factors are specific, like dividend decisions, major expansion plans, and receiving of big contracts, earning per share, company size and book value per share have significant impact upon the value of the stock of that company. Macro level factors affect the whole economic structure of the economy, and thereby, the behaviour of the stock market. The impact of these factors clearly gets reflected in the stock market in terms of volatility. These factors include tax system, interest rate, inflation rate, agriculture and industrial production, bank, GDP, Government expenditure, foreign institutional investment, the exchange rate, union budget, imports growth rate, current account deficit, money supply and foreign currency reserves. Not necessarily, these macro level factors will affect all securities in the same way and with the same degree. They have a variety of degree impact upon different securities. The other factors, which cause volatility, are exogenous. The influence of these factors comes from outside the country. With the integration of different economies in globalized world, these factors are increasingly emerging and occupying prominent place with significant impact on economy. Generally, they are macro in nature. They have become prominent in Indian market with the integration of economy with the international market. The impact of crude oil price in international market and changing monetary variables of trading countries are clearly reflected in Indian stock market. From the index, one cannot conclude, where the market will stand in near future. Volatility of the stock market is the response to tangible and intangible market events.

"The interpretation of daily stock price movements as reaction to announcements

of economic events is commonplace in the media. Commentators often report that stock prices fell because of disappointing unemployment figures or rose because of encouraging news on the inflation front". There are number of factors which result in either rise or fall of stock prices or in other words lead to volatility.

Demand and Supply:

One of the main factors that bring about short-term oscillations in the share prices is the change in demand and supply of a particular share in the stock market. An increase in its demand or decrease in its supply would always tend to raise the price and vice-versa. If at any particular time or day the demand for particular scrip is greater than its supply, the dealers would run short of stock and would begin demanding a higher price. On the other hand, if there are more orders to sell rather than to buy, its price would go down. However, it should be borne in mind in that the supply of shares of a particular company cannot be immediately increased with a change in price, though the stock available in the market at a particular time may vary to a little extent (Garg 1950).

Wholesale Price Index:

Inflation is a consistent increase in the general level of prices, or, alternatively, it is a decrease in the value of money. Inflation is one of those macroeconomic variables that affect every Indian citizen, irrespective of an investor, borrower or lender, almost every day. Inflation is seen as negative news by the stock markets, because it tends to curb consumer spending and therefore corporate profits. It also affects the value of the domestic currency adversely in the foreign exchange markets. The two frequently used measures of inflation in India are based on the WPI and the Consumer Price Index (CPI). Unfortunately, in India we do not have an aggregate CPI appropriate for use as an

indicator of aggregate prices and demand pressures. Thus in this study WPI is used as a proxy to Indian domestic inflation. The WPI is available for all commodities, and for major groups, sub-groups and individual commodities. The basic advantage of this measure of inflation is its availability at high frequency, i.e., on monthly basis thereby enabling continuous monitoring of the price situation for framing policies.

Index of Industrial Production:

A measure of real output or real economic activity often used is Gross domestic Product (GDP) or Index of Industrial Production (IIP). Since, this analysis is based on monthly data and due to the availability of only quarterly, half yearly and yearly GDP data, IIP is chosen as a measure of real output and a proxy to GDP. This IIP is the general IIP computed as the weighted average of all use based IIP, by the Ministry of Statistics and Programme Implementation, Government of India. As IIP numbers present a measure of overall economic activity in the economy and affect stock prices through its influence on expected future cash flows.

Exchange Rate (INR-US$):

Another important macroeconomic variable used in this study has been the exchange rate, which represents the bilateral nominal rate of exchange of the Indian Rupee (Rs.) against one unit of a foreign currency namely US Dollar ($) has been taken to be the foreign currency against which the Indian Rupee exchange rate is considered. This is because the US Dollar has remained to be the most dominating foreign currency used for trading and investment throughout the period of this study. On an average, export-oriented companies are adversely affected by a stronger domestic currency while import-oriented firms benefit from it.

Call Money Rate:

The overnight call money or the inter-bank money market rate is presumably the most closely watched variable in day-to-day conduct of monetary operations and often serves as an operating target for policy purposes. The observations in regard to the relationship between interest rates and stock prices generally suggests that an increase in interest rates increases the opportunity cost of holding money and thereby causing substitution of stocks with interest bearing securities, and hence would result in falling stock prices. This rate is fully market-driven and dependent on the demand-supply equilibrium relationships. Changes in the CMR affect the Indian stock markets by affecting the corporate profits, general demand for goods and services in the economy, relative attractiveness of competing financial assets like shares, bonds, and other fixed-interest investments, the way companies finance their operations and cost of borrowing money for the purchase of shares.

Balance of Trade:

Balance of trade is simply the difference between the value of exports and value of imports of a merchandise of a country during a particular period of time. If the value of exports over a period exceeds its value of imports; it is called favorable balance of trades. The favorable balance of trades indicates good economic condition of the country; which leads to bull phase in stock market.

Interest Rate:

It plays a major role in determining stock market trends. A decline in short- term rate of interest tends to increase the speculators' activity as speculators are anxious to take advantage of the lower rates and borrow money to invest in securities, yielding a

better return. When money is cheap and plentiful, shares receive support and rise in price and vice versa. Theoretically, the relationship between interest rates and stock prices is negative. This is due to the cash flow discounting model according to which, present values of stocks are calculated by discounting the future cash flows at a discount rate. If the discount rate increases, then present values of stocks decline and vice versa. This discount rate is a risk adjusted required rate of return and equal to the level of interest rates in the economy. Therefore, an increase in interest rate lowers present values of stocks directly. Even a relatively small rise in interest rates can have a major effect on present values if it is spread out over several years. In addition, rising interest rates reduce cash flows by reducing the profitability of firms. Due to these two reasons, present values of stocks decline and so do current stock prices. The inverse holds true as well (Apergis and Eleftheriou, 2002).

Apart from the above theoretical reason, there are few reasons, which account for the negative relationship between interest rates and stock prices. First, interest rates are risk free returns on bonds and as interest rates on bonds rise, bonds become more attractive and stocks less attractive. Consequently, there is a change in the asset allocation in favour of bonds rather than stocks. This moves funds from the stock market to the bond market, which invariably increases the demand for bonds and reduces the demand for stocks. As a result, the prices of stocks fall. The opposite is also true when interest rates fall and funds are shifted from the bond market to the stock market. Second, corporate profitability is because of increase in interest rates in two ways: (i) companies earnings net of interest rates fall; and (ii) consumers' demand for the products decreases, they pay more to borrow money. As the profitability decreases stock prices decline and

vice versa. Third, if interest rate increases then investors' expectations about the economy and company earnings, which drive the stock market, turn negative. This pushes stock prices down and the reverse is true as well (Chakradhara, 2008). The effects of interest rates changes on a stock's intrinsic value are more complex than outlined earlier because of the existence of other economic variables that interact with interest rates in determining a stock's value. In addition, if the inflation rate is quite high and real interest rates do not exist, then the investors are unlikely to move their funds from the stock market to the bond market in response to an increase in interest rates. Hence, the negative relationship between interest rate and stock price is not necessarily true. The relationship can also be positive due to the following reasons. First, if interest rate increases in response to the economy's growing too rapidly then corporate earnings should also be growing rapidly and so should stock prices. Second, higher interest rate suggests higher anticipated inflation. This leads to a likely increase in corporate pricing power because of which higher growth rates of earnings per share are witnessed by firms. Therefore, when the discount factor is increased in the stock valuation formula, the earnings per share are affected and increased. This implies that lower stock prices are not necessarily warranted (Durre and Giot 2005). Third, a positive relationship can be explained in terms of a changing risk premium. For example, a fall in interest rate could be the result of increased risk or/and precautionary saving as investors move away from risky assets such as stocks towards less risky assets like bonds. However, it is important to note that although the negative relationship between interest rate and stock price is not automatic or perfect but in the long run, it is unavoidable. The above discussion reveals that the relationship between interest rates and stock prices can either be positive or negative.

Political Conditions:

The stock market is one of the most sensitive market and political development or changes in the political set up affect the share prices. The changes in the power or party structure or political leaders and personalities at the centre or states or even changes in their cabinets may bring about changes in share prices, as operators in the stock market are very quick in interpreting the consequences of such developments. The share market is hyper-sensitive to these changes that even a speech by a statesman at a particular time might affect share prices so adversely that within a few hours many a dealers suffer a huge loss and few might even collapse.

Globalisation:

It has also an important influence on share prices. Bullish and bearish movements in an economically big country, like U.S.A. and Japan, tend to produce similar movements in the rest of world, although the "fundamental" economic factors at the moment do not seem to warrant them. Markets anticipate that, sooner or later, the real economy would be affected in a similar fashion, in the rest of the world (Chaudhuri, 2007).

Manipulations and Rumours:

Manipulation in relation to stock market question is difficult to define. It simply conveys the idea of artificially influencing the prices. Wash sales and match orders are the example of such manipulations. Under wash sales, fictitious sales are made by one party to the other with a view to raising the prices of a security or to make it more attractive. One party through manipulations arranges with the other to take the stock, when offered for sale at the inflated prices. Such actions arouse sufficient interest in the

shares and may cause many unknowing parties to purchase shares at inflated prices. But such sales are prohibited by the stock exchanges.

Match orders, similarly refer to the practice of using two or more brokers, one to buy and the other to sell the same stock at the same time and thus cause prices to rise higher or decline further. In such a case the same man is purchasing and selling through the agency of two brokers, who are not aware of the secret of the transactions and seem to be entirely ignorant of the fact that their client has given opposite, but corresponding orders to other brokers. In this way, the dealer may be able to fulfill his objectives, when the desired price level has been stabilized (Dixit, 1986). A stock market is influenced to a great extent by rumours of all kinds. The bulls and the bears in their own interest spread all sorts of rumours, baseless or otherwise and try to bring the market in their own favour. Sometimes these rumours prove to be an intelligent anticipation of events and on other they represent the leakage of certain information. In most cases, they are circulated by persons to suit their own ends and usually it is more difficult to trace their origin. It is evident that the markets saw to and fro not in response to facts and developments, but in response to khabar true or untrue, and slightly true and largely untrue. Bear-Bull fight in the heart of the exchange ring will relay periodically such gossip has caused gyrations in prices and changes in market sentiments (Sonpal, 2006).

Trade Cycles:

In a period of depression, the tendency to dullness prevails in all spheres of the market and there is all-round severe curtailment of production. The pessimistic outlook over the industry in general or any industry in particular brings about a general fall in the prices of securities, as many dealers, who are not financially strong are faced to sell

securities, because of losses in their regular business. On the one hand, during a boom, prices of almost all securities rise. A rise in price tends to coincide with the period of business prosperity and tends to a rise in industrial profits, which as a consequence brings about a rise in share prices. At the same time, an increase in the price of commodities used as raw materials would tend to bring a fall in share prices, unless it happens to coincide with a rise in the price of finished products. In a period of rising prices, the costs of labour equipment and maintenance increase resulting in the possibility of higher profits being lessened which might temporarily bring about a setback in share prices. Traders on the security market keep a constant watch on the commodity markets and their own market attitude is determined to a certain extent by the changes in the shares of industrial companies (Sorab and Caroline, 1990).

Technical Market Position:

Share prices, to a great extent, depend on the technical position of the market. At a particular moment, when share prices in general are stable, its price is likely to speculative interest in particular share, its price is likely to start rising, unless it is counteracted by other powerful factors. When the market has a tendency to rise, a number of bull operators come forward and make purchases in the hope of further rise in prices, even beyond their capacity. A slight decline in the price would force these operators to sell their shares in order to limit their losses to an amount they are able to bear. Such sales would bring about a further depression in prices, and as such situation arises, the market is said to be technically weak (Garg, 1950). Whenever prices have risen to their peak levels and the market is not very strong, on slight unfavourable developments, the market falls to its bottom. When it is expected that a particular happening would push up

the prices of particular share/shares to rise, but sometimes when the event actually happens, the prices instead of rising, fall. In the share market, it is a truism that operators are more interested in anticipation than in the event. It is the thrill of uncertainty that causes the wrangles between bulls and bears (Dixit, 1986).

Public Opinion and Press Publicity:

Share price movements mainly depend on public opinion, i.e., what people think about the present or future of a particular company. Public opinion is often created by the press publicity. At one time one scrip is favoured, while at another the other. As a result of the public opinion often there arises a sudden and increasing demand for a security, which on account of previous ill-fervour or lowness of price has been neglected and this would raise its price in proportion to the new demand created. The power of the press exercises a great influence, not only on the minds of the speculators and investors, but also on the public in general. Practically, all newspapers and commercial and economic journals devote a special column to the share market reviews, which are looked upon by the dealers with great impatience, as they all contribute towards influencing the share prices through change in public opinion. Practical tips appear; indicating whether a particular security is overvalued and should be sold or otherwise, and if a reviewer has established a reputation in the market circles, his opinion affects the price movements to a great extent (Singh, 2008).

Foreign Institutional Investors:

Stock markets in India were opened to foreign capital flows in 1992. Since then, their investments into Indian equity market have grown by leaps and bounds and there is widespread belief that institutional investors particularly the Foreign Institutional

Investors (FIIs) play a major role in the movements of the leading Indian stock indices. It improves the liquidity of the stock market in an emerging market. Liquidity is enhanced due to the fact that the entry of foreign investors makes it easier to find buyers and sellers. On the other hand, institutions are supposed to move stock prices away from fundamentals and thereby induce stock returns autocorrelation and increase returns volatility. Herding, Positive feedback trading and Contagion are the main arguments put forward for the destabilizing impact on stock prices induced by institutional investors (Mazumdar, 2004).

Therefore, the first channel through which capital inflows cause volatility in the stock market is that of 'Positive feedback trading'. Positive feedback trading or trend behaviour' refers to tendency among fund managers to buy 'winner' stocks and selling 'loser' stocks. It describes the strategy of rushing in when the markets are booming and rushing out when the markets are on the decline. Batra (2003) finds strong evidence that FIIs have been positive feedback investors at the aggregate level on daily basis. Investors can be positive feedback traders for rational reasons or because of behavioural biases. Investors with such strategies are often viewed to be destabilizing because their sales lead the market to fall further and their purchases increase prices further. Besides contributing to the volatility of stock returns, it is argued that such trading leads to destabilizing capital flows. This is because equity investors rush into countries whose stock markets are booming and flee from countries whose stock markets are falling. The second channel through which capital inflow causes volatility in the stock market is herding mentality. Herding behaviour is defined as the tendency of fund managers and investors to follow other fund managers trading behaviour, ignoring their own information. In India, Batra

(2003) has found that foreign investors have a tendency to herd on the equity market. The third channel through which capital inflow causes stock market volatility is through contagion effect. Contagion is best defined as a significant increase in cross linkages after a shock to an individual country (or a group of countries). Fund managers often use contagion strategies, i.e., they sell assets in one country when a crisis hits another country in the same region. The contagion channel is an extension of the herd behaviour of fund managers. While herding attracts funds to one region of the world, contagion precipitates exit of fund manager from the same region in times of crisis.

The Information Boom:

The speed of media (measured by the time required to send news from site to the viewer) has gone up tremendously in recent times. Hoards of Business news channel (Star News, Zee News, CNBC Asia, Jain TV, DD News etc.) are providing information on the movements of stock round the clock. With screen based trading the information is also available with investors. The news feed is provided by Reuter and Bloomberg keep the investor updated every minute. Such increase reporting of stock movements generally increases the demand for stocks. This has resulted in markets adjusting to such information faster than before which in turn increase market volatility.

Sentiment:

It has an all pervading influence on the stock price movements. When it is a dull day in the stock exchange and the tendency is downward, buyers become panicky and refrains from buying, otherwise, it is beyond one's comprehension as to what happened with the company overnight. Due to this downward tendency more sellers than buyers are noticed and this state of affairs further brings down the prices and a new low level of

price is created. Before the market takes a turn for the better, a transition period appears and wise investors with liquidity money available with them come into buy shares and without any reason, the sentiment is changed for the better and prices begin to move up (Dixit, 1986).

Psychological Issues on Stock Prices:

Stock prices are also greatly influenced by human behaviour. Greed is one trait that can cause stock prices to increase more than it should. New information can elicit a frantic market, may cause an increase in prices, and may make investors disregard rational valuation, preferring instead to buy the stock to ensure they are not left behind. Fear can cause significant decreases in stock prices when investors rush for the exit in an effort to avoid losses. While expressing his views on the subject Keynes (1936) said, "It might have been supposed that competition between expert professionals, possessing judgment and knowledge beyond that of average private investor, would correct the vagaries of the ignorant individual left to himself. It happens, however, that they are concerned, not with what an investment is really worth to a man who buys it "for keeps", but what the market will value it at, under the influence of mass psychology, three months or a year hence." Hence share prices are moved by mass psychology. It is not the psychology of millions of people, including the so-called experts, independently: it is largely a question of mass psychology (Sinha, 2007).

Expectations and Foresight:

Expectations and foresight of investors as well speculators determine the magnitude of price fluctuations to a large extent. If market participants anticipate changes in either fundamental factors or other factors correctly, and if the change or anticipated

change comes about gradually, the prices move in a smooth fashion from one point of equilibrium to another. On the contrary, when the anticipations prove to be either too optimistic or too pessimistic, or the changes in these factors or anticipations about them undergo a sudden change, the prices move erratically, rather than move in a smooth fashion resulting in greater price fluctuations (Black, 1986).

State Policy:

In an economy like India, which is committed to democratic socialism, planned development and state control of regulation, state policy plays a vital role in the stock markets. State measures as reflected in legislation, budgets, industrial policy, foreign trade strategy, foreign aid and investment prospects, taxation proposals, custom duties, fiscal measures, policy towards multinationals and foreign investment, etc. affect the share prices to a great extent.

Central Budget:

Operators watch the presentation of the Central Budget with great anxiety. An imposition of a duty or an enhancement of taxes would affect share prices according to its repercussions on the minds of the investors. For example, the bears try to convince themselves and others that the budget cannot be good as is made out. The bulls maintain that the budget is bound to be favourable and buy shares themselves and persuade their friends to buy also. Bears and their friends are thus pitted against the bulls and their friends. Their gamble imparts vivacity and vigour to the stock markets. Prices move upward down, often times wildly. Whichever side has greater confidence in its expectations and greater guts in its operations succeeds in influencing the prices in direction favourable to itself (Thomas and Shah, 2002).

The Feedback Effect:

In feedback theory, the stock price increase forms a vicious circle whereby the initial increase (decrease) propels further price increase (decrease). This can be explained by the fact that an increase in the stock prices leads to a better sentiment for that stock which increases the demand and thus the price. This cycle continues increasing the stock price more than what it would have under the Efficient Market Hypothesis (EMH). Though this may seem quite perfect but this leads to a spiraling effect and increased volatility in stock markets. A test can be carried out to check the difference in volatility of stocks while they are rising as opposed to their fall. It is also seen that these feedback loops have different intensities during a Bull run and a Bear run.

The number of speculators in relation to other traders also influences the extent of fluctuations. The traditional role of a speculator is to act as a buyer when there is excess supply and as a seller when there is excess demand. On the contrary, if speculators choose to buy, when there is excess demand, and sell, when there is excess supply, the demand supply imbalance gets further widened and as a result, the extent of price fluctuations would be greater. If number of speculators in relation to other traders is more, speculators, instead of mitigating the magnitude of price change, influence the direction of price change (Reddy, 1996).

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 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 different kinds of investment positions when conditions change (Dixit, 1986).

Another factor operating in the share market is insider trading by promoters and executives of companies. When this assumes a large dimension, it is destabilizing; it distorts the market. Furthermore, not always is the published data on performance of reliable companies. There is much window-dressing. Accounts are also falsified deliberately, to mislead the investor to give a rosy picture of a company's financial position. Auditors collude with the company promoters and executives. Recent experience shows that these evils are present in the highly developed countries too, with fairly good laws to regulate the functioning of companies and investment institutions in the interest of the investor (Simha, 2002).

In addition to the above mentioned factors there are number of other following factors which affect share values to a greater or lesser degree.

Wars and Crisis Situation:

War is mighty upheaval that brings about changes in all spheres of business activity and the share market is not free from its consequences. Share prices change all around to a great extent, when fear, baseless or otherwise, grips the share market and the international politics displaces business at the steering wheel (Sorab and Caroline, 1990).

Climate for Production and Productivity:

Frequent shortages of raw material and components of production have affected the production adversely which bring about a fall in share prices. Industrial climate, strikes and lock outs in a particular industry or industry in general also adversely affect

the share prices in that industry. Inadequate and erratic power supply or coal supply is another constraint to the production which affects production and share prices adversely. Transport bottlenecks such as shortage of wagons and trucks disrupt the supply of raw materials and production is interrupted, thereby causing the share prices to fall. Constraints to production and productivity adversely affect share prices while incentives restore confidence of the share markets.

Arbitrage:

It also causes volatility. 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.

Natural Calamities:

The natural calamities like floods, droughts due to failure of monsoons, earthquakes, explosions, devastation and disaster affect the share prices to a great extent. Even the death of an important shareholder, who holds a number of shares, would also affect share prices as the holdings of the deceased person may be sold on the stock market and when such selling would take place on a large scale, prices in that particular market would fall. Prices in other markets might also fall in sympathy, but only for a very short period (Sorab and Caroline, 1990).

Holidays:

The working days preceding a long holiday such as Christmas and Durga Puja have been noticed as periods of inactivity and more often dull conditions are found as the

operators are in a holiday mood. But during the holidays a large number of orders accumulate, which are to be transacted on the opening day and hence a heavy turnover often takes place; and if other conditions are favourable prices tend to rise (Dutta and Mahapatra, 2008).

Uncertainty:

The movement of stock prices is also affected by a vague future. Prices do tend to bounce around a bit due to market apprehension and the unpredictable future. Because of the ambiguity of a company's future, volatility in stock prices is possible even without new information (Barua and Varma, 1983).

Economic Strength of Market and Peer:

Company stocks have the propensity to track with the market, as well as with their sector or industry contemporaries. A lot of leading investment firms put significant importance on overall market and sector movements as major factors involved in the movement of prices. An example would be when a negative outlook for one stock affects other similar ones due to mere association with each other, dragging the demand for the whole sector along the way (Obaidullah, 1992).

Company Specific Factors:

The factors such as quality and credibility of promoters, competence and professionalism of management, policies with regard to financing, investment and dividend decisions and other various variables like dividend per share, earning per share company size, and book value of share influence the security prices of the companies. These are discussed in detail as follows.

Dividend and Earnings:

Earnings of a company occupy a supreme position in determination of the values of industrial shares. It has often been noticed that at times when the dividend has been announced, the values of the company's share have flared up and if the dividend announcement happens to be much more than what was expected, it further stimulates the prices to a greater extent. Contrary would be the case if due to some reasons the company's earnings are going to fall, which will not enable a company to maintain its former level of dividends. But at times it may be noted that the prices of certain shares might actually fall when the company in question has declared a higher dividend than expected. It is because that the speculators much in advance to the declaration of dividends and prices as a consequence go up to a very high and artificial level and by the time the dividends are declared, these prices reach their top limits and it is at that time that the speculators sell out quickly with a view to collect their profits and this large scale selling might cause prices to fall down. A change in company's earnings and dividend announcement is, thus, accompanied by change in share values and any limitation of dividend by any legislative enactment is likely to bring about a collapse in share values.

Price Earnings Ratio (P/E):

P/E ratio expresses the relationship between the market price of a company's share and its earnings per share. It indicates the extent to which the earnings of each share are covered by its price. The ratio helps an investor to make an approximate calculation of the time required to recover his investment in a company share. The price earnings ratio has a positive relationship with market price.

Price to Book Value Ratio (P/B):

The price to book value ratio measures a company's market price in relation to its book value. Book value is also known as net asset value per share because it measures the amount of assets, which the corporation has on behalf of each equity share. Book value shows the investment per share made in the business by the shareholders. A high book value usually indicates that the company has a good record of past performance, i.e., high reserves, therefore, high market price.

Dividend Yield (DY):

This is the return earned by an equity shareholder by way of dividends. Dividend yield is computed as: Dividend Yield = (Dividend Per Share/ Market Price) x100

Trading Volume (TV):

The number of shares or contracts traded in a security or an entire market during a given period of time. It is simply the amount of shares trade hands from seller to buyer as a measure of activity. Trading volume and volatility are indicators of the current stock market activity on one hand and a potential source of information for the future behavior of stock market on the other hand.

Change in the Capital Structure of Companies:

Share prices move up and down in cyclic motion in conformity with the general movement in prices, as a company passes through periods of boom and depressions. But this general tendency is more often counteracted by a change in capital structure of the company, such an increase in the share capital of the company, issue of shares on bonus terms, issue of fresh debentures, redemption of debentures, making up of partly paid share fully paid, reorganizing the rights of different classes of shareholders such as

converting deferred into ordinary and so on. Different schemes of capital reorganization may affect the market in different ways. For example, when fresh debentures are issued, it is regarded as a sign of weakness by the Indian investing public, and operators on the Stock Exchange feel that in future the company would not be able to maintain its old level of dividends as much of the money of the company would be utilized in paying interest to debentures holders. Though in such occasions they forget that very often flourishing businesses need extra capital to make it more successful and that may ultimately pay higher dividends to the shareholders. On the other hand, the redemption of debentures is usually regarded as a good sign as the company after paying off its debts would be able to declare higher dividends as it shall no longer be required to pay interest on debentures and the amount so saved may be used in increasing the dividends to be distributed to the shareholders. Thus, at such times share values would show a rising tendency.

Change in Ownership:

Whenever there happens to be a change in the ownership and management of a concern its share values might fluctuate. Changes in the Board of Directors of a company also affect the prices of the shares of that particular company and may bring about the repercussions of far reaching importance. The death of responsible and influential member of the Board may cause share value to fall, particularly so if he himself holds a large number of shares of that company. Frequent resignations of directors from the Board may also create suspicion in the minds of the operators regarding the financial stability of the company and cause a setback in share values (Grewal, 2000).

Changes in Share Prices on Issue of Bonus and Rights Shares:

The issue of bonus shares by a company has a bullish effect on its prices. Expectations of a bonus issue create a climate of optimism and arouse amongst investors hopes of getting steep capital appreciation and higher dividends. The market looks upon the issue of bonus shares as an indication of a company's bright future prospects. These market expectations are based on sound logic and reasoning. Companies do not normally issue bonus shares unless they are confident of maintaining the dividend rate on the expanded equity capital resulting from the bonus issue, and unless they are reasonably certain that the future expansion of the company justifies an expansion in its equity base (Gupta, 2006). Rights shares are generally issued either at par or at a small premium. They are invariably priced at a level far below the prevailing market price. If rights shares are issued exclusively to the existing shareholders, and if they are attractively priced carrying only a low premium, they are generally well received by the market and exert an upward pressure on the company's share price. A rights issue presents an opportunity for the shareholder to increase the size of his shareholding at a relatively low cost and with no change in his proportionate ownership of the company. The attractiveness of rights issue also depends upon the reasons for its issue. If the rights issue is made for the purpose of raising funds for expansion, then it will have favourable impact on the investment quality and the price of the company's share. On the other hand, a rights issue is made for augmenting working capital, or for meeting unexpected costs, or for tiding over tight credit and money conditions, is not likely to be well-received by the market as it exposes a company's financial difficulties (Wei and Zhang 2006).

Company Profits:

The profits earned by the companies tend to affect the decision of the investors. The companies doing well in their business activities are likely to attract more investors, thereby resulting in high demand of their shares. However, the entities not doing well may result in investors selling their shares on the market. Selling en masse will result in more shares flooding the market and consequently bringing the price down - an abundance of a commodity leads to price decline (Chaudhuri and Swarup, 1999).

Market Capitalization:

The worth of a company should not be assessed from the price of its stock. It is the market capitalization of the company, rather than the stock, that is more important. We need to multiply the stock price with the total number of outstanding in the market to get the market cap of a company and that is the worth of the company (Malakar and Gupta, 2002).

Company News:

The way investors interpret news coming out of companies is also a major influence on share prices. Positive news about a company can increase buying interest in the market, while a negative press release can ruin the prospects of a stock. If, for example, a company puts out a warning that business conditions are tough, shares will often drop in value. If, however, a director buys shares in the firm, it may be a signal that the company's prospects are improving. Hence, various factors causing volatility in stock prices are raising interest rates, high inflation fuelled by firm global crude oil prices; slow down in the economy and in corporate earnings, fluctuations in currency markets, sluggish pace of economic reforms, political instability, and crash in assets prices across

the board, political tension and possible terrorist attacks. Market movements can be driven by political, economic, social and most importantly, psychological factors.

Profitability:

Profitability is the ability of a business to earn profit. A profit is what is left of the revenue a business generates after it pays all expenses directly related to the generation of the revenue. Profitability of a company or business can be measured by using profitability ratios. Profitability ratios are a class of financial metrics that are used to assess a company's ability to generate earnings as compared to its expenses and other relevant costs incurred during a specific period of time. Investor and creditors can use profitability ratios to judge a company's return on investment based on its relative level resources and assets. To measure profitability of a firm there are several profitability ratios such as profit margin ratio, gross margin ratio, return on assets, return on capital employed etc. The study here uses profit margin ratio to measure the profitability of a company which is mostly used in empirical studies. The profit margin ratio, also called the return on sales ratio or gross profit ratio, is a profitability ratio that measure the net profit earned with each rupees sales generated by comparing the net profit and net sales of a company. The profit margin ratio can be calculated by dividing net profit by net sales.

3.2 Methodology of the Study:

Research methodology is based on the following two sub-sections viz; data selection methodology (in sub-section 3.2.1) and methodology for data analysis (in sub-section 3.2.2).

3.2.1 Data Selection Methodology:

The present study is based on secondary data. In this present study NSE listed

sectoral indices are considered. There are eleven sectoral indices in National Stock Exchange in India viz; CNX AUTO, CNX BANK, CNX ENERGY, CNX FINANCE, CNX FMCG, CNX IT, CNX MEDIA, CNX PHARMA, CNX PSU BANKS, CNX REALTY, CNX METAL. From these sectoral indices, six sectoral indices are selected for the study period April 1, 2005 to April 1, 2014.

Basis for Sector Selection:

For selection of the sectors a composite index has been constructed by considering three crucial variables percentage of traded value, percentage of market representation and percentage of sectoral representation with assigning equal weights. Finally, a ranking has been done on the basis of composite value of the sectoral indices. Based on percentage of traded value 60 per cent of the total sectoral indices are selected. The selected sectors are Banking sector, IT sector, Financial sector, Automobile sector, FMCG sector and Energy sector which are in top six ranks as per the composite index value. This is already mentioned in the introductory chapter.

Sector-wise Selected Companies:

Based on market capitalization top 15 companies or firms are selected from each sector. Finally from the above six sectors 90 companies are selected. However, data of some selected companies for some periods of the total study period are not available and finally these companies are dropped. The details are already mentioned in the introductory chapter.

3.2.2 Methodology for Data Analysis:

The research method used in this study is explained as follows;

The stock return is calculated using the following formula

$$r_t = ln\left(\frac{c_t}{c_{t-1}}\right) \qquad (1)$$

$$r_t = \ln(c_t) - (c_{t-1})$$

Where

r_t = stock returns

c_t= closing price at time period t

c_{t-1}= closing price at time period t-1.

ln = natural logarithm

Normality Test:

The data is to be first tested for normality (i.e. whether the returns follow a normal distribution). In statistics Jarque-Bera test is a goodness of fit measure of departure from normality, based on sample kurtosis and skewness. The test statistic JB (Jarque-Bera) is defined as

$$\text{JB Statistic} = T\left\{\frac{S^2}{6} + \frac{(k-3)^2}{24}\right\} \sim \chi^2_{2\ df} \qquad (1.1)$$

T = No. of observations

S = Skewness coefficient

K = Kurtosis coefficient

JB test of normality is the test of the joint null hypothesis if S & K are 0 and 3 respectively. Reject H_0 if the observed value of JB statistic is greater than the table value. Rejecting H_0 implies the data series does not follow normal distribution.

Stationary Test:

It is well accepted fact that many financial time series contain a unit root, i.e. the series are non-stationary. Stationary time series is one whose mean, variance and

covariance are unchanged by time shift. Non-stationary time series have time varying mean or variance or both. Knowledge of non-stationary of the time series is significant in the modeling of economic relationships because standard statistical techniques that assume stationarity may give invalid inferences in the presence of stochastic trends. In case of non-stationary data, ordinary least squares can produce spurious results. Therefore, prior to modeling any relationship, non-stationarity must be tested. The most popular unit root tests are ADF (Augmented Dickey - Fuller, 1979) test and Phillips-Perron (1988) test.

The test simply includes AR (1) process:

$$r_t = \alpha r_{t-1} + \varepsilon_t \qquad (2.1)$$

Where r_t is a return series, α is a parameter and ε_t is a white noise error term, which follows normal distribution with zero mean and constant variance.

Dickey and Fuller (1979) actually consider three different regression equations that can be used to test for the presence of unit root:

$$\Delta r_t = \rho r_{t-1} + \varepsilon_t \qquad (2.2)$$

$$\Delta r_t = \omega_0 + \rho r_{t-1} + \varepsilon_t \qquad (2.3)$$

$$\Delta r_t = \omega_0 + \rho r_{t-1} + \omega_1 t + \varepsilon_t \qquad (2.4)$$

The difference between the three regressions concerns the presence of the deterministic elements ω_0 and $\omega_2 t$. The first is a pure random walk model, the second adds an intercept term or drift term and the third includes both the drift and a linear time trend. In this test the null hypothesis is $H_0: \rho = 0$ or $\alpha = 1$ which implies r_t series contains a unit root. The alternative hypothesis is $H_1: \rho < 0$ or $\alpha < 1$ which implies r_t

series is stationary. If ε_t violates the above assumptions then Augmented Dicky-Fuller test has to be used to test for stationarity.

The Augmented Dicky-Fuller test simply includes AR (p) terms of the Δr_t as regressor

$$\Delta r_t = \rho r_{t-1} + \sum_{i=1}^{p} \beta_i \Delta r_{t-i} + \varepsilon_t \quad (2.5)$$

$$\Delta r_t = \omega_0 + \rho r_{t-1} + \sum_{i=1}^{p} \beta_i \Delta r_{t-i} + \varepsilon_t \quad (2.6)$$

$$\Delta r_t = \omega_0 + \rho r_{t-1} + \omega_1 t + \sum_{i=1}^{p} \beta_i \Delta r_{t-i} + \varepsilon_t \quad (2.7)$$

Volatility Modeling:

To examine the nature of volatility and the relationship between returns and volatility GARCH-M (Generalized Auto Regressive Conditional Heteroscadasticity) model is used. Engle (1982) introduced the ARCH model in his study "Autoregressive Conditional Heteroscedasticity with estimates of the Variance of United Kingdom Inflation" as the first formal model, which seemed to capture the phenomena of changing variance in time series data. Bollerslev (1986) extends Engle's (1982) ARCH process by allowing the conditional variance to follow an ARMA process. This model is known as a generalized ARCH model, or GARCH model. Engle, Lilien and Robins (1987) extend the basic ARCH framework to allow the mean of a sequence to depend on its own conditional variance. This class of model, called the ARCH in mean (ARCH –M) model, is particularly suited to the study of asset markets. The basic insight is that risk-averse

agents will require compensation for holding a risky asset. The GARCH –M model form as follows:

$$r_t = \omega + \theta h_t + \sum_{i=1}^{p} \emptyset_i \, r_{t-i} + \varepsilon_t + \sum_{i=1}^{q} \delta_i \, \varepsilon_{t-i} \qquad \ldots\ldots\ldots \quad (3)$$

Where r_t is the daily returns on equity and r_{t-i} represents lag returns and h_t represents conditional variance which are considered as regressors and ε_t represent random shocks. The conditional variance equation is formed as:

$$\varepsilon_t = v_t \sqrt{h_t} \qquad v_t \sim iid(0,\ 1)$$

$$h_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \, \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \beta_j \, h_{t-i} \qquad \text{GARCH (p, q)} \qquad \ldots.(3.1)$$

Where, $\alpha_0 > 0,\ \alpha_i \geq 0,\ \beta_j \geq 0$ and $\alpha_i + \beta_j < 1$.

A significant ARCH coefficient (α_1) indicates that there is significant impact of previous period shocks on current period volatility. The ARCH coefficient (α_i) is also treated as recent "news" component which explains that recent news has a significant impact on price changes which implies the impact of yesterday's news on today's volatility.

The GARCH coefficient (β_i) measures the impact of last period variance on current period volatility. A significant GARCH coefficient (β_i) indicates the presence of volatility clustering. A positive β_i indicates that positive stock price changes are associated with further positive changes and vice versa. A relatively higher values of $\beta_1$implies a larger memory for shocks. The GARCH coefficient (β_1) also treated as old "news" component, which implies that the news, which is old by more than one day,

plays a significant role in volatility. The sum of the ARCH and GARCH coefficients i.e. ($\alpha_i + \beta_i$) indicates the extent to which a volatility shock is persistent over time. A persistent volatility shock raises the asset price volatility.

A positive coefficient θ indicates that the return is positively related to volatility process. In other words, higher value of θ represents greater the impact of conditional variance on returns.

To examine the leverage effect EGARCH (Exponential Generalised Auto Regressive Conditional Heteroscadasticity) model can be used. Though ARCH and GARCH models respond to good and bad news or positive and negative shocks and quite useful in forecasting and measuring volatility but these models are unable to capture the "leverage effect" or asymmetric information. The rational and underlying logic of asymmetric or "leverage effect is that the distribution of stock return is highly asymmetric. An interesting future of asset prices is that "bad news" (negative shocks) seems to have a more pronounced effect on volatility than that of "good news" (positive shocks) of the same magnitude, that is, bad news is followed by larger increase in price volatility than good news of the same magnitude. It is known that the magnitude of the response of asset prices to shocks depends on whether the shock is negative or positive. To demonstrate this point Engle and Ng (1990) mapped the relationship between the conditional variance of asset returns to exogenous shocks, which resulted in what they termed a news impact curve. Nelson (1991) proposed an exponential GARCH model or EGARCH model that is the earliest extension of the GARCH model that incorporates asymmetric effects in returns from speculative prices based on a logarithmic expression

of the conditional variability of variable under analysis. The conditional variance equation in the EGARCH (1,1) model is

$$\ln(h_t) = \alpha_0 + \alpha_1 \frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}} + \lambda_1 \left(\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right) + \beta_1 \ln(h_{t-1}) \qquad (4)$$

Where, h_t is an asymmetric function of past $\mathcal{E}_t$ and α_0, α_1 λ_1 and β_1 re constant parameters.

Note that the left hand side is the log of the conditional variance. This implies that the leverage effect is exponential, rather than quadratic and that forecasts of the conditional variance are guaranteed to be nonnegative. In this model specification, β_1 is the GARCH term that measures the impact of last period's forecast variance. A positive β_1 indicates volatility clustering implying that positive stock price changes are associated with further positive changes and vice versa. If $\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}$ is positive the effect of the shock on the log of the conditional variance is (α_1+λ_1). If $\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}$ is negative, the effect of the shock on the log of conditional variance is (-α_1+λ_1). λ_1 measures the leverage or asymmetric effect. λ_1 is expected to be negative implying that bad news has a bigger impact on volatility than that of good news of the same magnitude.

To examine the relationship between firm size, volatility and returns, the following panel regression model is used.

$$r_{it} = \alpha_1 + \theta_1 D_1 + \theta_2 D_2 + \theta_3 D_3 + \beta_1 h_{it} + \delta_1 P_1 + \delta_2 P_2 + \varepsilon_{it} \quad \ldots\ldots\ldots (5)$$

Where

i stands for i th cross sectional unit, i = 1, 2, ...,N

t stands for t th time period t = 1, 2, ...,T

r_{it} is the predicted return of i^{th} firms at t^{th} periods.

h_{it} is the conditional variance of i^{th} firms at t^{th} periods.

D_1 = 1 for small size firm or 0 otherwise

D_2 = 1 for medium size firm or 0 otherwise

D_3 = 1 for large size firm or 0 otherwise

$P_1 = h_t$ for medium size firms or 0 otherwise

$P_2 = h_t$ for large size firms or 0 otherwise

Since D_1, D_2 & D_3 are intercept dummies and P_1 & P_2 are slope dummies.

Hausman Test:

The Hausman specification test compares fixed and random effect models under the null hypothesis that individual effects are uncorrelated with any regressor in the model (Hausman, 1978). If the null hypothesis of no correlation is not violated, LSDV and GLS are consistent, but LSDV is inefficient; otherwise, LSDV is consistent but GLS is inconsistent and biased (Greene, 2008). The estimates of LSDV and GLS should not differ systematically under the null hypothesis. The Hausman test uses that "the covariance of an efficient estimator with its difference from an inefficient estimator is zero" (Greene, 2008).

$$LM = (b_{LSDV} - b_{random})' \widehat{W}^{-1} (b_{LSDV} - b_{random}) \sim \chi^2(k) \dots\dots\dots (6)$$

$$\widehat{W} = Var[(b_{LSDV} - b_{random})] = Var\,(b_{LSDV}) - Var\,(b_{random})$$

is the difference in the estimated covariance matrices of LSDV (robust model) and GLS (efficient model). This test statistic follows the chi-squared distribution with *k* degrees of freedom.

The formula says that a Hausman test examines if "the random effects estimate is insignificantly different from the unbiased fixed effect estimate" (Kennedy, 2008). If the

null hypothesis of no correlation is rejected, we may conclude that individual effects are significantly correlated with at least one regressors in the model and thus the random effect model is problematic. Therefore, we need to go for a fixed effect model rather than the random effect counterpart. A drawback of this Hausman test is, however, that the difference of covariance matrices *W* may not be positive definite. Then, we may conclude that the null is not rejected assuming similarity of the covariance matrices renders such a problem.

To analyze the long run relationship and short run dynamic interaction among the variables of interest the study here employs the OLS based Autoregressive Distributed Lag (ARDL) co-integration technique. The ARDL model used in this study is expressed as follows:

$$
\begin{aligned}
D(ln(\mathrm{CV}))_t = {} & \beta_1 + \beta_2 \ln(CV)_{t-1} + \beta_3 \ln(CMR)_{t-1} + \beta_4 \ln(ER)_{t-1} + \beta_5 \ln(IIP)_{t-1} \\
& + \beta_6 \ln(TV)_{t-1} + \beta_7 \ln(WPI)_{t-1} + \beta_8 (Net\ FII)_{t-1} + \beta_9 \left(\frac{P}{B}\right)_{t-1} \\
& + \beta_{10} (Div.Yield)_{t-1} + \beta_{11} \left(\frac{P}{E}\right)_{t-1} + \beta_{12} (\mathrm{TB})_{t-1} \\
& + \sum_{i=1}^{p} \gamma_{1i}\, D(ln(\mathrm{CV}))_{t-i} + \sum_{i=0}^{q} \gamma_{2i}\, D(ln(\mathrm{CMR}))_{t-i} + \sum_{i=0}^{q} \gamma_{3i}\, D(ln(\mathrm{ER}))_{t-i} \\
& + \sum_{i=0}^{q} \gamma_{4i}\, D(ln(\mathrm{IIP}))_{t-i} + \sum_{i=0}^{q} \gamma_{5i}\, D(ln(\mathrm{ST}))_{t-i} + \sum_{i=0}^{q} \gamma_{6i}\, D(ln(\mathrm{WPI}))_{t-i} \\
& + \sum_{i=0}^{q} \gamma_{7i}\, D(\mathrm{Net\ FII})_{t-i} + \sum_{i=0}^{q} \gamma_{8i}\, D\left(\frac{\mathrm{P}}{\mathrm{B}}\right)_{t-i} + \sum_{i=0}^{q} \gamma_{9i}\, D(\mathrm{Div.Yield})_{t-i} \\
& + \sum_{i=0}^{q} \gamma_{10i}\, D\left(\frac{\mathrm{P}}{\mathrm{E}}\right)_{t-i} + \sum_{i=0}^{q} \gamma_{11i}\, (TB)_{t-i} + \varepsilon_t \quad \ldots\ldots \quad (7)
\end{aligned}
$$

Where,

D denotes the first difference operator,

β_1 is the drift component,

ε_t is the usual white noise residuals.

CV = Conditional Variance

CMR = Call Money Rate

IIP = Index of Industrial Production

ER = Exchange Rate

TV = Trading Volume

WPI = Wholesale Price Index

Net FII= Net Foreign Institutional Investment

P/B = Price to Book value

Div. Yields = Dividend Yields

P/E = Price Earnings Ratio

The left-hand side is conditional variance that is derived after estimation of GARCH model and it is treated as stock market volatility. The expression with the summation sing (γ_{1i} - $\gamma_{11\ i}$) represents the short run dynamics of the model whereas the remaining expression ($\beta_2 - \beta_{12}$) corresponds to the long run relationship.

To investigate the presence of long-run relationships among the variables bound testing procedure is used, Pesaran, et al. (2001).The bound testing procedure is based on the F-test. The F-test is actually a test of the hypothesis of non-existence of long run relationship among the variables against the existence or presence of long run relationship among the variables, denoted as:

Ho: $\beta2 = \beta3 = \beta4 = \beta5 = \beta6 = \beta7 = \beta8 = \beta9 = \beta10 = \beta11 = \beta12 = 0$

i.e., there is long run relationship among the variables.

Ha: $\beta2 \neq \beta3 \neq \beta4 \neq \beta5 \neq \beta6 \neq \beta7 \neq \beta8 \neq \beta9 \neq \beta10 \neq \beta11 \neq \beta12 \neq 0$

i.e., there is no long run relationship among the variables.

The ARDL bound test is based on the Wald-test (F-statistic). Pesaran et al. (2001) give two critical values for the co-integration test. The lower critical bound assumes all the variables are I(0) meaning that there is no co-integration relationship between the examined variables. The upper bound assumes that all the variables are I(1) meaning that there is co-integration among the variables. When the computed F-statistic is greater than the upper bound critical value, then the H_0 is rejected (there is long run relationship among the variables). If the F-statistic is below the lower bound critical value, then the H_0 cannot be rejected (there is no long run relationship among the variables). When the computed F-statistics falls between the lower and upper bound, then the results are inconclusive.

To examine the relationship between volatility and industrial profitability the following panel regression model is used

$$h_{it} = \omega_{1i} + \gamma\pi_{it} + \varepsilon_{it} \qquad (8)$$

Where

i stands for i th cross sectional unit, i = 1, 2, ...,N

t stands for t th time period t = 1, 2, ...,T

π_{it} is the profits of the industries or sectors.

$\omega_{1i} = \omega_1 + u_i$ i = 1, 2... N