CHAPTER – 3

RESEARCH METHODOLOGY
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3.1 NEED FOR THE STUDY
Indian markets have seen a steady rise in level of buyback since its introduction in 1998. With one single announcement made in year 1998, more than 250 buyback announcements have been made by Indian companies till now. The trend of buyback by Indian companies has been on the rise with more than 3000 crores worth of announcements made in financial year 2010-11. A few companies like Reliance Infrastructure, Reliance Industries, Britannia Industries, Godrej Consumer Products, Bhagyanagar India Limited, Bosch India, Finolex Cables and Selan Exploration Technology Limited etc. have frequently opted for buyback route for financial restructuring. Although the level of payout involved for buyback is still very less as compared to other payout methods like dividends, bonus shares etc., yet the level of interest shown by corporate for this activity is worth noting. As a matter of fact, it turned out to be the preferred route of payout by Indian companies in the financial year of great economic fall down i.e. 2008-09 when a total of 45 buyback announcements were made.

Much research work has been undertaken to identify the motivations, trends and impacts of buyback (known as repurchases in majority of western markets) outside Indian capital markets. There are certain proven facts regarding buyback as established by empirical research across the world. However, the need is to check the applicability of this phenomenon pertaining to Indian capital markets.

Other than measuring the possible effects of buyback announcements on shareholders’ returns, effect of such announcements on various financial variables like OPM, EPS, BVMV ratio, DE ratio and on market parameters like liquidity of stocks is equally pertinent. Along with this, there is need for measuring the long term benefits accruing to shareholders as generally claimed by buyback documents and identifying the possible motivations influencing buyback decisions. Besides, the need for understanding the points of differentiation for buyback firms is quite justified.
A few Indian studies undertaken in India have worked mainly on measuring the impact of buyback announcements on share prices. Besides that, no comprehensive study has been undertaken to analyze the various facets of buyback decisions of the company. With a sufficient database of buyback firms being created, it is relevant to carry out research on specific parameters as discussed above.

3.2 OBJECTIVES OF THE STUDY

The study has focused on five different yet integrated objectives to be achieved. These objectives have been specified below as:

1. To identify the dominant motivations for share buyback among Indian companies.
2. To measure the impact of buyback announcements on share prices and liquidity.
3. To assess the impact of buyback on operating profit margin, earnings per share, book value and capital structure of the firm.
4. To determine if any long term benefit to shareholders may occur because of buyback.
5. To discriminate the buyback firms from the non-buyback ones and identify the important discriminators.

3.3 CHAPTER SCHEME

The present study comprises of total of nine chapters. The major coverage of these chapters is as discussed below:

Chapter 1 titled “Introduction to Buyback” presents the meaning, types and legal evolution of buyback in India and across the world. Besides, the trends of buyback announcements for Indian markets has been analysed to understand their overall usage by Indian corporate sector.

Chapter 2 titled “Review of Literature” discusses and highlights the previous work done related to buyback in field of academics all over the world. While Section 1 deals with motivations for share buyback across different continents and markets, Section 2 and 3 focuses upon the post buyback effects in terms of specified
parameters like share prices and liquidity. Section 4 is directed to cover the financial ratios of companies’ pre and post buyback in terms of the performance parameters, valuations and level of debt employment. Section 5 recapitulates the long term benefits accruing to shareholders who plan to stay with the company in post buyback. Section 6 relates to the study of distinguishing features of buyback firms from non buyback ones.

Chapter 3 titled “Research Methodology” mainly specifies the different aspects of basic research design which includes the propositions for various objectives, sample size selection criteria, methods for data collection, tools for analysis and limitations of the study.

Chapter 4 titled “Motivations for Buyback Among Indian Companies” covers the various motivations identified for companies undergoing buyback and determine the dominant motivations influencing buyback decisions of the Indian companies.

Chapter 5 titled “Impact of Buyback Announcements on Share Prices and Liquidity of Shares” discusses the effects of buyback announcements on share prices and liquidity of the sample stocks. It tests the hypothesis of change in stock returns and liquidity levels due to announcements by companies regarding their decision to buyback their shares.

Chapter 6 titled “Impact of Buyback on Various Financial Ratios” explicates the effects of buyback on performance, market valuations and leverage levels of the underlying shares. An investigation into the different values before and after the buyback is used to understand the possible impact of buyback on these interrelated variables.

Chapter 7 titled “Long Term Returns to Shareholders from Buyback” focuses on the long term benefit accruing to shareholders post buyback activity over longer time durations up to three years.

Chapter 8 titled “Discriminating Buyback Firms and Non Buyback Firms” analyses the discrimination between the buyback companies from non
buyback ones in terms of various relevant financial variables. Besides, the main differentiating variables are identified which can be used to classify the buyback companies from their counterparts who do not carry out buyback activity during the same period.

Chapter 9 titled “Findings and Conclusions” summarizes the overall findings of the study in the light of acceptance or rejection of various hypotheses set down to achieve the objectives of the study.

3.4 RESEARCH DESIGN

The present study mainly encompasses the relationship between levels of buyback announced or undertaken and various financial variables. Hence, the research design used for the study can be classified as descriptive research design mainly using secondary data being analysed quantitatively. Both cross-sectional as well as longitudinal data has been used for the purpose of achieving the stated objectives.

3.5 VARIABLES OF THE STUDY

3.5.1 OBJECTIVE 1

The first objective involves measuring the interrelationship and between levels of buyback undertaken and various variables indicating the possible motivations for buyback. The basic aim is to identify the most dominating motivation affecting the levels of buyback carried out by sample under study. The review of literature has clearly specified the different motivations/ reasons for buyback. As the continuous empirical work is being carried out on testing these motivations, these have been categorised as respective hypothesis. These hypotheses are unique with respect to each other with a few overlapping. Still, broadly, they can be classified as:

1. Dividend Substitution Hypothesis
2. Earnings Management Hypothesis
3. Free Cash Flow Hypothesis
4. Employee Stock Options Hypothesis
5. Leverage Hypothesis
6. Takeover Deterrence Hypothesis
7. Undervaluation or Market Signalling Hypothesis

A. INDEPENDENT VARIABLES

For the purpose of representing the different hypothesis/ motivations for buyback announcement decision, it is imperative to develop quantitative variables. For the present study, the following variables shown in Table 3.1 have been identified which represent the respective motivations.

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>HYPOTHESIS</th>
<th>VARIABLES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
</table>
| 1.     | Dividend Substitution Hypothesis  | Dividend Payout Ratio = Dividend paid/Profit After Tax | 1. Equity dividend paid during the financial year closing prior to buyback announcement date  
2. Profit after tax for the financial year closing prior to buyback announcement date |
| 2.     | Earnings Management Hypothesis    | Change in Earnings per Share = EPS (Post Buyback) - EPS (Pre Buyback) | 1. Earnings per share for financial year closing prior to buyback announcement date  
2. Earnings per share for financial year closing after buyback announcement date |
| 2.     | Earnings Management Hypothesis    | Change in Return on Capital Employed = ROCE (Post Buyback) - ROCE (Pre Buyback) | 1. Return on capital employed for financial year closing prior to buyback announcement date  
2. Return on capital employed for financial year closing after buyback announcement date |
<table>
<thead>
<tr>
<th></th>
<th>Hypothesis</th>
<th>Formula</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Free Cash Flow Hypothesis</td>
<td>Operating Cash Flow / Total Assets</td>
<td>1. Operating cash flow for the financial year closing prior to buyback announcement date</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Total assets = Total net fixed assets for the financial year closing prior to announcement date + Total net current assets for the financial year closing prior to buyback announcement date</td>
</tr>
<tr>
<td>3</td>
<td>Free Cash Flow Hypothesis</td>
<td>Cash + Cash Equivalents / Total Assets</td>
<td>1. Cash and bank balance for the financial year closing prior to buyback announcement date</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Total marketable securities for the financial year closing prior to buyback announcement date</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Total assets = Total net fixed assets for the financial year closing prior to buyback announcement date + Total net current assets for the financial year closing prior to buyback announcement date</td>
</tr>
<tr>
<td>4</td>
<td>Employee Stock Options Hypothesis</td>
<td>Employee Stock Options / Total Number of Outstanding Shares</td>
<td>1. Allocation to employee stock options for the financial year closing prior to buyback announcement date</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Total number of shares outstanding for the financial year closing prior to buyback announcement date</td>
</tr>
<tr>
<td>5</td>
<td>Leverage</td>
<td>Changes in</td>
<td>1. Debt equity ratio for the financial year closing prior to buyback announcement date</td>
</tr>
</tbody>
</table>
### B. DEPENDENT VARIABLE

The sole dependent variable is the buyback as announced by sample companies for a particular financial year. It is measured as the ratio of number of shares announced to be bought back (through public announcement) to number of total outstanding shares as on financial year closing before the announcement date of buyback. It can be represented as:

\[
\text{Buyback Announced} = \frac{\text{Number of Shares Announced to be Bought Back}}{\text{Number of Total Outstanding Shares}}
\]

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Leverage Ratio = Debt Equity Ratio (pre Buyback) – Debt Equity Ratio (post buyback)</th>
<th>year closing prior to buyback announcement date</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Takeover Deterrence Hypothesis</td>
<td>Any takeover announcement</td>
<td>1. Any takeover announcement prior to buyback announcement date</td>
</tr>
<tr>
<td>7. Undervaluation Hypothesis</td>
<td>Market Adjusted Stock Return</td>
<td>1. Annual return on individual security for the financial year closing prior to announcement of buyback</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Annual return on BSE SENSEX for the financial year closing prior to announcement of buyback</td>
</tr>
<tr>
<td>7. Undervaluation Hypothesis</td>
<td>Book Value to Market Value</td>
<td>1. Book value per share for the financial year closing prior to announcement of buyback</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Closing market price per share on the last date of the financial year closing prior to buyback announcement date</td>
</tr>
</tbody>
</table>
3.5.2 OBJECTIVE 2

3.5.2.1 IMPACT ON SHARE PRICES

A. EVENT STUDY METHODOLOGY

The impact of share buyback announcements on share prices has been measured using event study methodology. It is a very popular technique which is used mainly to study the impact of any event on share prices.

The event day is taken as the day the particular news is made public. In case of buyback announcements, the event day is the day the announcement is published in minimum of two newspapers as required by SEBI guidelines. According to event study methodology, any market reaction causing abnormal returns is indicated via change in share prices of the stock post any such announcement. This change in share prices is mainly attributed to the happening of that event which is public announcement in case of buyback of shares. In case of event study methodology, two separate time period windows are created, namely,

a. Estimation period

b. Event period

FIGURE 3.1

ESTIMATION PERIOD AND EVENT PERIOD FOR EVENT STUDY METHODOLOGY

Where,

\( t_b \) = The starting date used in the estimation of a normal security return;

\( t_{pre} \) = The first date used in the calculation of abnormal returns;

\( t_o \) = The event day;

\( t_{post} \) = The last date used in the calculation of abnormal returns.
B. CALCULATION OF ABNORMAL RETURNS

Normal returns are the returns expected for a security in case of non-occurrence of any event. These are generally estimated over a longer period called estimation period rather than using data only for the event period. Generally the estimation period is taken as 100 to 300 days prior to the event. Moreover, a control window is also created at least 10 to 50 days before the happening of the event so as to account for any changes in parameters happening before the event due to the expected event coming in near future. Any abnormal return measured during the event period is mainly attributed to the happening of the event, as no other event is allowed to happen simultaneously with the proposed main event whose effect is planned to be measured. In the case of present study, this main event is public announcement of buyback by respective companies.

C. MARKET MODEL

For developing the estimation model to be used for calculating the expected returns for the event period, various methods have been employed by researchers over a period. However, there are 3 main methods, namely,

a. Mean Adjusted Model
b. Market Adjusted Model
c. Market Model

In case of mean adjusted model, the mean daily return calculated for the estimated period is used as the benchmark of normal return. The actual returns are compared with the mean value so calculated and the difference is taken as the value of abnormal return. Similarly, in market adjusted model, the value of average return on market index used as benchmark is calculated and is used as the normal return value. Again, the actual return during the event period is compared with this average value to calculate the abnormal returns during event period.

The third and most widely used model is the market model which encompasses determination of sensitivity of individual security return with respect to market index. This sensitivity measure is called “Beta” which is obtained using Ordinary Least Square (OLS) regression model using data of individual security
return and the market index return (BSE SENSEX in our case) for the same time period. This study has used data of 160 days for estimation period, i.e., from -180 days to -20 days prior to public announcement of buyback using the following equation of market model:

\[ R_{ij} = \alpha_i + \beta_i (R_{mj}) + \mu_{ij} \text{ for } j = 1,2,3 \ldots \ldots T_{EP} \]

Where,

- \( R_{ij} \) = Return on individual security \( i \) for period \( j \);
- \( R_{mj} \) = Return on market index (BSE-30) for period \( j \);
- \( \alpha_i \) = Intercept;
- \( \beta_i \) = Line slope coefficient;
- \( \mu_{ij} \) = Disturbance term/ residual;
- \( T_{EP} \) = Number of days in estimation period. (160 days in present study case).

D. CALCULATING ABNORMAL RETURNS

Once estimated, the regression parameters are used for forecasting the expected normal returns for the event period of 41 days, i.e. -20 to +20 days. The difference between actual returns (calculated for the stock from actual stock price data) and expected returns (using OLS regression model with benchmark variable as market index or BSE-30) show the abnormal returns so obtained for the event period. The abnormal returns have been calculated with the use of following equation:

\[ AR_{it} = R_{it} - ER_{it} \text{ for } t = 1,2,3\ldots T_{EV} \]

Where,

- \( AR_{it} \) = Abnormal returns for security \( i \) for the day \( t \);
- \( R_{it} \) = Actual returns for security \( i \) for the day \( t \);
- \( ER_{it} \) = Expected returns for the security \( i \) as per market model estimation for the day \( t \);
- \( T_{EV} \) = Number of days in event period (41 days in present study case).
E. **CALCULATING DAY WISE AVERAGE ABNORMAL RETURN**

The abnormal returns so calculated for each security for all the different days of event period are aggregated day wise for all the sample securities. Afterwards, average abnormal return for each day is calculated using the formula as given in equation below.

\[
\text{AAR}_{Nt} = \frac{\sum_{i=1}^{N} \text{AR}_{it}}{N}
\]

Where,

\(\text{AAR}_{Nt}\) = Average abnormal returns for N securities for day t;

\(N\) = Sample size;

\(\sum \text{AR}_{it}\) = Aggregate abnormal returns for N securities for day t.

F. **CALCULATION OF CUMULATIVE AVERAGE ABNORMAL RETURN**

The individual day abnormal return is not sufficient to analyze the trends in share prices over the event period. Hence, the specific day daily average abnormal return as calculated above has to be aggregated over a particular event window of n days which is worked out as below:

\[
\text{CAAR}_{Nn} = \sum_{t=T_{1}}^{T_{2}} \text{AAR}_{Nt}
\]

Where,

\(\text{CAAR}_{Nn}\) = Cumulative average abnormal returns for N securities over n days period;

\(T_{1}\) = Starting day of the event window;

\(T_{2}\) = Ending day of the event window.

G. **STANDARDISING ABNORMAL RETURNS**

Another approach to calculate the abnormal returns is by using the standardised abnormal returns rather than abnormal returns. The basic purpose of standardisation is to ensure equal variance for each abnormal return calculated. Each firm’s daily abnormal return is divided by its estimate of standard deviation
(calculated during estimation period). Dividing the average abnormal return for each day of event period by the standard deviation of all securities in sample N will generate the standardised abnormal return for that day. SAR has been calculated with the help of following formulation:-

\[ \text{SAR}_{it} = \frac{\text{AR}_{it}}{\text{S(AR}_{it} \text{)}} \]

Where,

\[ \text{SAR}_{it} = \text{Standardised abnormal return for security } i \text{ for day } t; \]
\[ \text{AR}_{it} = \text{Average abnormal return for security } i \text{ for day } t; \]
\[ \text{S(AR}_{it} \text{)} = \text{Estimate of standard deviation of security } i \text{ for estimation period } T. \]

H. CALCULATING DAY WISE STANDARDISED AVERAGE ABNORMAL RETURN

The standardising abnormal returns so calculated for each security for all the different days of event period are aggregated day wise for all the securities covered in the sample. Afterwards, standardised abnormal return for each day is calculated by using the formula given in equation below.

\[ \text{SAAR}_{Nt} = \frac{\sum_{i=1}^{N} \text{SAR}_{it}}{N} \]

Where,

\[ \text{SAAR}_{Nt} = \text{Standardised average abnormal returns for } N \text{ securities for day } t; \]
\[ N = \text{Sample size}; \]
\[ \sum \text{SAR}_{it} = \text{Aggregate standardised abnormal returns for } N \text{ securities for day } t. \]

I. CALCULATING CUMULATIVE STANDARDISED AVERAGE ABNORMAL RETURNS

In the manner similar to calculation of cumulative abnormal returns as done for abnormal returns, the standardised abnormal returns also require accumulation.
\[ SCAAR_{Nn} = \sum_{t=T_1}^{T_2} SAAR_{Nt} \]

Where,

- \( SCAAR_{Nn} \) = Standardised cumulative average abnormal return over \( n \) days period;
- \( T_1 \) = Starting day of the event window;
- \( T_2 \) = Ending day of the event window.

### 3.5.2.2 IMPACT ON LIQUIDITY

#### A. EVENT WINDOWS

These are the various collections of days’ pre and post the event date for which the daily mean values of liquidity measures have been calculated. In the present study, overall nine different event windows have been utilised which have been configured to measure the liquidity impacts over a range of periods both pre and post buyback announcements. Since the objective is to check out for impact on liquidity for both short and long time periods, diverse event windows have been introduced. The basic idea is to measure any significant change in liquidity of the shares due to buyback announcement over different time periods. There are three different types of event windows constituted for the purpose (Refer to Table 3.2). Firstly are the windows which compare liquidity before and after the event.

**TABLE 3.2**

<table>
<thead>
<tr>
<th>SR. NO.</th>
<th>PRE EVENT WINDOWS</th>
<th>POST EVENT WINDOWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>- 120 to – 30 days</td>
<td>31 to 120 days</td>
</tr>
<tr>
<td>2</td>
<td>-90 to -31days</td>
<td>31 to 90 days</td>
</tr>
<tr>
<td>3</td>
<td>- 61 to -2 days</td>
<td>2 to 61 days</td>
</tr>
<tr>
<td>4</td>
<td>-31 to -2 days</td>
<td>2 to 31 days</td>
</tr>
<tr>
<td>5</td>
<td>-11 to -2 days</td>
<td>2 to 11 days</td>
</tr>
<tr>
<td>6</td>
<td>-5 to -1 days</td>
<td>1 to 5 days</td>
</tr>
</tbody>
</table>
The second set of event windows attempt to measure the change in liquidity of
the stock as the date of event approaches. These windows also help in understanding
the nature of markets as per market efficiency hypothesis.

**TABLE 3.3**

**EVENT WINDOWS CONSTITUTION FOR MEASURING LIQUIDITY CHANGES WHILE APPROACHING EVENT DATE**

<table>
<thead>
<tr>
<th>SR. NO.</th>
<th>PRE EVENT WINDOWS</th>
<th>POST EVENT WINDOWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>-91 to -62 days</td>
<td>-61 to -32 days</td>
</tr>
<tr>
<td>8</td>
<td>-61 to -32 days</td>
<td>-31 to -2 days</td>
</tr>
</tbody>
</table>

Finally, the third set of windows attempt to measure the long term sustenance
of the change in liquidity effect, if any, during post event time periods.

**TABLE 3.4**

**EVENT WINDOWS CONSTITUTION FOR MEASURING LIQUIDITY CHANGES POST EVENT DATE**

<table>
<thead>
<tr>
<th>SR. NO.</th>
<th>PRE EVENT WINDOWS</th>
<th>POST EVENT WINDOWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>2 to 31 days</td>
<td>31 to 60 days</td>
</tr>
<tr>
<td>10</td>
<td>2 to 61 days</td>
<td>31 to 90 days</td>
</tr>
</tbody>
</table>

**B. LIQUIDITY MEASURES**

The study employs three different measures of liquidity for analysis. These include:

**i. MEAN VOLUME**

This is an absolute measure of liquidity. The daily trading volume of the stock
is added and averaged over the duration of the corresponding event window.

The change in trading volume $MVOL_{it}$ is calculated as:

$$MVOL_{it} = \ln (MVOL_{it})_{after} - \ln (MVOL_{it})_{before}$$

**ii. MARKET ADJUSTED DAILY MEAN VOLUME**

It is a relative measure of liquidity which adjusts the individual stock trading
volume to market volume by taking a ratio of both the variables. In present
study, BSE 30 daily volumes (popularly known as SENSEX) have been utilized as market volumes. Here, $Vol_{it}$ is the mean trading volume for stock $i$ at time period $t$, while $Vol_{mt}$ is the mean market volume for the SENSEX over the same time period. The ratio of $Vol_{it}$ and $Vol_{mt}$ are calculated and averaged over the given time period of the corresponding event window. The resultant ratios are compared for different event windows using this measure as represented as $MAVOL_{it}$ is calculated as:

$$MAVOL = \ln \left( \frac{MVOL_{it}}{MVOL_{mt}} \right)_{after} - \ln \left( \frac{MVOL_{it}}{MVOL_{mt}} \right)_{before}$$

iii. **AMIVEST LIQUIDITY RATIO**

This measure calculates the amount of trading volume associated with 1% change in stock returns over a given time period. In other words, it can be specified as the amount of volume of the stock that can be traded with just 1% absolute change in stock prices. This measure is a ratio of trading volume on a given trading day of stock $i$, i.e., $VOL_{it}$ to the absolute value of the stock returns in percentage terms $|R_{it}|$. The measure so calculated is averaged over the given time period as per the corresponding event window. A higher Amivest measure shows high liquidity and vice versa.

$$ALR_{it} = \ln \left( \frac{VOL_{it}}{|R_{it}|} \right)_{after} - \ln \left( \frac{VOL_{it}}{|R_{it}|} \right)_{before}$$

### 3.5.3 OBJECTIVE 3

#### 3.5.3.1 OPERATING PROFIT MARGIN

It is a direct measurement of operating profitability of the organization. Taken as ratio of operating profits to net sales, it measures the operating efficiency of the organization. It signifies how well the company is able to manage its main operations or activities which are the sources of overall revenue. An organization can optimize its operations and its operating profit margin by reducing the operating costs as it will ensure higher availability of profits for non operating expenses as well.

#### 3.5.3.2 EARNINGS PER SHARE

Measured as the ratio of profit after taxes divided by number of outstanding equity shares, this ratio is a direct measurement of amount of profits available to shareholders as their net income. Profit after tax is calculated after deduction of all non operating expenditure including interest on debt and taxes paid/ to be paid from
operating profits of the company. Thus, higher the profitability, higher the earnings per share. However, how much out of earnings per share is realized by shareholders as dividend is another decision taken by the company.

3.5.3.3 BOOK VALUE TO MARKET VALUE RATIO

Basically a ratio of an accounting value and its corresponding market figure, this ratio provides a direct comparison of net worth to market capitalization on per share basis. This ratio is the closest approximate of Tobin’s Q, a popular measure of under or over valuation. Tobin’s Q is a measure involving market value of assets and replacement cost of assets. These two figures are not so easily available and hence, an alternative measure is to move to liability side of the balance sheet. Book value per share is the outcome of ratio of two most commonly used values, i.e. net worth (equity capital + reserves and surplus) to number of outstanding shares, whereas market price per share is a market driven phenomenon and is available easily from capital market sources. The closing market price of the shares as on Bombay Stock Exchange on the last day of the particular financial year is taken as the measure of effective market price. The level of market price a particular company is able to drive in a capital market symbolizes directly the confidence of investors. Hence, higher the book value to market value ratio, the better is the investment scenario for an investor.

3.5.3.4 DEBT EQUITY RATIO

Most popular financial ratio to measure financial leverage, this ratio establishes the relationship between total outstanding long term debts vis-a-vis net worth of the organization. It is an important ratio as a balancing act has to be established by firms in managing the level of debt usage within a particular defined range. Any excess or under usage of debt leads to imbalance resulting into higher cost of capital and lack of confidence among various stakeholders, particularly shareholders.

3.5.4 OBJECTIVE 4

A. BUY AND HOLD ABNORMAL RETURNS

The Buy and Hold Abnormal Returns (BHAR) are calculated by measuring the returns accruing to sample firms over a period of 1, 2 and 3 years from the date of start of buyback by respective sample firm.
\[
\text{MRsim} = \frac{\text{CMP}_{d+1} - \text{CMP}_d}{\text{CMP}_d}
\]
\[
\text{MRcim} = \frac{\text{CMP}_{d+1} - \text{CMP}_d}{\text{CMP}_d}
\]

Where,
- \( \text{MR}_{\text{sim}} \) = Monthly return on sample firm \( i \) for month \( m \);
- \( \text{MR}_{\text{cim}} \) = Monthly return on control firm \( i \) (corresponding to sample firm \( s_i \));
- \( \text{CMP}_d \) = Closing market price for the day \( d \) (i.e. date of start of buyback);
- \( \text{CMP}_{d+1} \) = Closing market price one month after the day \( d \) (i.e. date of start of buyback).

B. **CALCULATION OF ABNORMAL RETURN**

Subsequently, the monthly return of Control Company is subtracted from sample company monthly return to calculate the abnormal return of Sample Company. The monthly abnormal returns are calculated for each sample company in this manner by the formula given in equation below:

\[
\text{AR}_{\text{sim}} = \text{MR}_{\text{si}} - \text{MR}_{\text{ci}}
\]

Where,
- \( \text{AR}_{\text{sim}} \) = Abnormal monthly return for sample firm \( i \) for the month \( m \);
- \( i \) = 1,2,3…N (sample size);
- \( m \) = 1,2,3…36 months;

C. **CALCULATION OF CUMULATIVE ABNORMAL YEARLY RETURN**

Besides, the abnormal returns are calculated on cumulative basis at the end of year 1, 2 and 3 for all sample companies.

\[
\text{CAR}_{\text{siy}} = (1 + \text{AR}_{\text{si}1})(1 + \text{AR}_{\text{si}2}) \ldots \ldots (1 + \text{AR}_{\text{si12}})
\]

Where,
- \( \text{CAR}_{\text{siy}} \) = Cumulative Abnormal Return for Sample Firm \( i \) for year for \( y=1, 2 \) and 3;
- \( \text{AR}_{\text{si}1} \ldots \ldots \text{AR}_{\text{si}12} \) = Abnormal Monthly Return for Sample firm \( i \) for months 1 to 12 for the year \( y \).
D. CLASSIFICATION AS PER BOOK VALUE TO MARKET VALUE RATIO

In order to carry out deeper analysis of long run abnormal return accruing to shareholders, the sample securities have been divided into four different categories on basis of their Book Value to Market Value (BVMV) ratio. For this purpose, the 1st quartile, median and 3rd quartile was calculated after arranging them in increasing order of BVMV ratio values. Then, the securities were segregated on basis of their falling into any of the four respective groups as follows:

1. Glamour Stocks : Falling below 1st quartile, having lowest BVMV ratio.
2. Low Value Stocks : Falling between 1st quartile and median, having BVMV ratio closer to one.
3. Medium Value Stocks : Falling between median and 3rd quartile, having BVMV ratio on higher side.
4. High Value Stocks : Falling above 3rd quartile, having maximum BVMV ratio of the complete lot.

3.5.5 OBJECTIVE 5

A. DEPENDENT VARIABLE

There would be only two categories of the individual dependent variable with a value of 1 in case of a buyback firm and with a value of 2 in case of a non buyback firm.

B. INDEPENDENT VARIABLES

From different studies, a number of variables have been identified to be relevant for conducting discriminant analysis for buyback and non buyback firms. The most commonly used variables have been identified and selected for analysis. The selected variables can be classified into five broader categories, namely:

CATEGORY 1: CAPITAL STRUCTURE

Capital structure involves considering the level of leverage being employed by the firm with respect to the level of capital employment and its total assets.

1. Ratio of Total Debt to Capital Employed
2. Ratio of Total Debt to Total Assets

**CATEGORY 2: LIQUIDITY**
Liquidity emphasizes upon the availability of cash and assets easily convertible into cash.
1. Current Ratio
2. Quick Ratio
3. Cash to Total Assets

**CATEGORY 3: MARKET EXPECTATIONS**
It implies the expectations of investors from firms where they are putting their money to earn returns.
1. Book Value to Market Value Ratio
2. Dividend Payout Ratio

**CATEGORY 4: SCALE OF OPERATIONS**
Scale of operations measuring size of the company through measurement of level of shares outstanding and level of assets held.
1. Total Shares Outstanding
2. Total Assets

**CATEGORY 5: PROFITABILITY**
It denotes the returns accruing in terms of assets held, revenue earned and earnings available for shareholders per share.
1. Return on Total Assets
2. Growth in Earnings Per Share
3. Growth in Total Revenue
### Table 3.5
**Description of Variables Representing Different Discriminating Criteria**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Discriminating Criteria</th>
<th>Variables</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1.     | Capital Structure        | Ratio of Total Debt to Capital Employed = Total debt (secured and unsecured) / Capital Employed | 1. Total debt employed for the financial year closing prior to announcement of buyback  
2. Capital employed for the financial year closing prior to announcement of buyback |
| 2.     | Capital Structure        | Ratio of Total Debt to Total Assets = Total Debt (secured and unsecured) / Total Assets | 1. Total debt employed for the financial year closing prior to announcement of buyback  
2. Total assets = Total net fixed assets for the financial year closing prior to buyback announcement date + Total net current assets for the financial year closing prior to buyback announcement date |
| 3.     | Liquidity                | Current Ratio = Current Assets / Current Liabilities | 1. Current assets employed for financial year closing prior to buyback announcement date  
2. Current liabilities employed for financial year closing prior to buyback announcement date |
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4.</strong></td>
<td><strong>Liquidity</strong></td>
<td><strong>Quick Ratio = Quick Assets / Current Liabilities</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Quick assets employed for financial year closing before buyback announcement date</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Current Liabilities employed for financial year closing before buyback announcement date</td>
</tr>
<tr>
<td><strong>5.</strong></td>
<td><strong>Liquidity</strong></td>
<td><strong>Cash to Total Assets = Cash and Cash Equivalents / Total Assets</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Cash and bank balance for financial year closing before buyback announcement date</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Total marketable securities for financial year closing before buyback announcement date</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Total assets = Total net fixed assets for financial year closing before buyback announcement date + Total net current assets for financial year closing before buyback announcement date</td>
</tr>
<tr>
<td><strong>6.</strong></td>
<td><strong>Market Expectations</strong></td>
<td><strong>Book value to Market Value ratio= Book value/ Market Price of equity shares</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Book value of equity shares for financial year closing before buyback announcement date</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Market Price of shares on the last date for financial year closing before buyback announcement date</td>
</tr>
<tr>
<td><strong>7.</strong></td>
<td><strong>Market Expectations</strong></td>
<td><strong>Dividend Payout Ratio= Dividend paid/Profit</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Equity dividend paid for financial year closing before buyback announcement date</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>8.</strong> Scale of Operations</td>
<td>After Tax</td>
<td>1. No. of outstanding equity shares for the financial year closing prior to buyback announcement date</td>
</tr>
<tr>
<td></td>
<td>Total Common Shares Outstanding</td>
<td>2. Profit after tax for the financial year closing before buyback announcement date</td>
</tr>
<tr>
<td><strong>9.</strong> Scale of Operations</td>
<td>Total Assets</td>
<td>1. Total assets = Total net fixed assets for the financial year closing prior to buyback announcement date + Total net current assets for the financial year closing prior to buyback announcement date</td>
</tr>
<tr>
<td><strong>10.</strong> Profitability</td>
<td>Return on Total Assets = Profit after Tax / Total Assets</td>
<td>1. Profit after tax for the financial year closing prior to buyback announcement date</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Total = Total net fixed assets for the financial year closing prior to buyback announcement date + Total net current assets for the financial year closing prior to buyback announcement date</td>
</tr>
<tr>
<td><strong>11.</strong> Profitability</td>
<td>Growth in Earnings Per Share</td>
<td>1. Earnings per share over a period of three financial years preceding the announcement date</td>
</tr>
<tr>
<td><strong>12.</strong> Profitability</td>
<td>Growth in Total Revenue</td>
<td>1. Total Income from sales over a period of three financial years preceding the announcement date</td>
</tr>
</tbody>
</table>
3.6 PERIOD OF THE STUDY

The period of the study has been from 1999 to 2011. All the buyback announcements made during this period have been covered. However, for purpose of objective 4, the period under study is from 1999 to 2008 where the effects of buyback undertaken have been measured over a period of three years following completion.

3.7 SAMPLING DESIGN

3.7.1 SAMPLE SIZE

The universe of the study was the number of listed companies on Bombay Stock Exchange (BSE). The population of study was the companies making announcement on BSE for buyback of shares. However, the attempt had been to include all the announcing companies as a part of sample, yet due to unavailability of data for many companies, the sample size has been limited. Thus, out of total 237 announcements made on BSE over a span of 13 years (i.e. from 1998 to 2011), 69 announcements didn’t materialise into actual buyback due to variety of reasons. Besides, another 26 announcements were truncated as the public announcement dates for them were unavailable. Hence, a final sample of 142 buyback announcements was framed for usage. However, due to specific data needs, this number has been further reduced to ensure fulfillment of desired objectives in some cases.

Due to specific data needs of each objective, the sample size usage was specific to a particular objective. Moreover, for purpose of objectives 3, 4 and 5, equivalent control samples were used for controlling effect of exogenous variables. The objective wise sample usage has been specified under Table 3.6.

<table>
<thead>
<tr>
<th>OBJECTIVE NUMBER</th>
<th>SAMPLE SIZE</th>
<th>CONTROL SAMPLE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>135</td>
<td>Nil</td>
</tr>
<tr>
<td>2</td>
<td>142</td>
<td>Nil</td>
</tr>
<tr>
<td>3</td>
<td>107</td>
<td>107</td>
</tr>
<tr>
<td>4</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>5</td>
<td>104</td>
<td>104</td>
</tr>
</tbody>
</table>
3.7.2 SELECTION CRITERIA FOR CONTROL SAMPLES

A. OBJECTIVE 3

For measuring the possible effect of buyback on the various variables related to capital structure and valuations, the effect of buyback on the mean values of such variables across the selected sample has been measured and evaluated. To ensure shielding of results against any possible size effect, industry effects and performance effects, two different control samples have been selected. An initial sample of effective 142 announcements was truncated to 107 with the exclusion of companies whose data was not available or were identified as outliers.

While, the first control sample is of the firms whose book value is within a range of ± 20% of value of sample firm for balance sheet preceding the financial year of announcement of buyback. It has been used for the comparison of sample firms’ performance as measured via operating profit margin (OPM) and earnings per share (EPS) vis-a-vis control firms with relatively comparable accounting book valuations. For the second control sample, that firm was selected whose operating profit margin (OPM) for the previous quarter before announcement is within ± 20% of the sample firm. This control sample is used for the comparison of firms’ valuations measured via book value to market value (BVMV) ratio and for comparison of level of leverage measured via debt equity (DE) ratio. The presence of any significant difference in values of various variables across sample firms and control firms can be attributed to buyback announcements and its completion.

B. OBJECTIVE 4

The control sample companies are selected meticulously through a two step procedure in order to provide the right benchmark for sample companies for comparison and ultimately the calculation of abnormal returns. In the first step, firms are selected from the same industry as the sample companies and with book value within 70% to 130% of sample company. In the second step, out of the selected companies, the company with Book Value to Market Value (BVMV) ratio within 70% to 130% of sample firm is selected and finalised. Thus, the initial sample of 142 companies was reduced by 50 companies. These 50 firms were the ones who either made buyback announcements in year 2009-2011 and after that or those who made announcements in 2008-2009, yet their data could not be collected for next 3 years.
C. **OBJECTIVE 5**

For objective 5, a sample of 104 firms was taken as the final sample for which the data relating to various variables as discussed earlier was collected and analysed. An equal number of control units were to be identified as companies belonging to the same industry as the sample companies and having market capitalisation falling in the range of 70% to 130% of the sample unit. Besides, they are expected to have not announced any buyback programme during the year of announcement of buyback by the respective sample unit. Thus, the complete sample was ultimately expanded to 104 sample units and 104 control units, i.e. a total of 208 data units. Out of 208 units, 26 units were identified as outliers and removed by using the standard method of identifying any value which is more than mean ± 2.5 times the standard deviation of the variable distribution. Hence, a final sample of 182 units was taken for analysis.

3.8 **SOURCES OF SECONDARY DATA COLLECTION**

The secondary data mainly comprises of daily share prices, daily volume of transactions, financial figures, and financial ratios, amount of shares bought back or announced to be bought back, BSE daily SENSEX values and volume of transactions on BSE. These values have been obtained from following sources:

A. CMIE PROWESS database.
B. Annual reports and websites of companies.
C. Websites of SEBI, BSE, NSE, moneycontrol, indiainfoline.

3.9 **STATISTICAL TECHNIQUES FOR DATA ANALYSIS**

The usage of various basic and advanced techniques for data analysis depends upon the type of objective to be achieved and the variables to be studied. The relevant techniques used for the study have been defined as follows:

3.9.1 **SINGLE VARIABLE TESTS**

3.9.1.1 *t*-Test for Means of Single Sample
This test has been used to measure whether the sample mean of various financial variables and financial ratios of buyback companies is significantly different from zero. Moreover, t-test has also been applied to measure the level of difference of adjusted sample means from zero, where adjusted mean is the difference between values of sample mean and control sample mean. There have been three different means calculated for this purpose. The first mean is unadjusted sample mean, while second is industry adjusted sample mean and the third one is performance adjusted sample mean. The values of sample mean in all the three cases have been tested at 1% and 5% level of significance.

A. TESTING SIGNIFICANCE OF ABNORMAL RETURNS

i. FOR AVERAGE ABNORMAL RETURNS (AAR_{Nt}) AND CUMULATIVE AVERAGE ABNORMAL RETURN (CAAR_{Nn})

The Average Abnormal Returns (AAR_{NT}) of individual security follows t-statistic with basic assumption of following normal distribution:

$$t = \frac{\text{AAR}_{Nt}}{\text{S(AR}_{NT})}$$

Where,

AAR_{Nt} = Average abnormal returns of N securities for the day t of event window;

S(AR_{NT}) = Estimate of standard deviation of N securities for estimation period T.

Assuming that the residuals are not correlated across times, also called as cross-sectional independence, S(AR_{NT}) can be best estimated as:

$$S(\text{AR}_{NT}) = \sigma^2(\text{AR}_{NT}) = \sigma^2 \left( \frac{\sum_{t=1}^{N} \text{AR}_{NT}}{N} \right) = \left( \frac{1}{N^2} \right) \sum_{t=1}^{N} \sigma^2(\text{AR}_{iT})$$

Where,

N = Number of securities;

T = Particular day of event window.
Similarly, Cumulative Average Abnormal Return (CAAR$_{Nn}$) for $N$ firms over an event window of $n$ days also follows the $t$-test statistic with basic assumption of independence of abnormal returns across firms.

\[
t = \frac{\text{CAAR}_{Nn}}{\text{SE}}
\]

Where,
- $\text{SE} = \text{Standard Error of mean for } N \text{ securities over } n \text{ days period}$
- $N = \text{Number of days in the event window}$

ii. FOR STANDARDISED AVERAGE ABNORMAL RETURNS (SAAR$_{Nt}$) AND CUMULATIVE STANDARDISED AVERAGE ABNORMAL RETURN (SCAAR$_{Nn}$)

For Standardised Average Abnormal Returns, the test statistic of the hypothesis for a particular day of average standardised abnormal returns to be equal to zero is computed as:

\[
z = \frac{\text{SAAR}_{NT}}{\text{SE}_{\text{SAAR}}}
\]

Where,
- $\text{SE}_{\text{SAAR}} = \frac{1}{\sqrt{N}}$;
- $N = \text{Number of securities}$;
- $T = \text{Particular day of event window}$.

Similarly, the calculations of test statistic for SCAAR is similar to that of CAAR$_{Nn}$, but follows a unit normal distribution.

\[
z = \frac{\text{SCAAR}_{Nn}}{\text{SE}}
\]

Where,
- $\text{SE} = \text{Standard Error of mean for } N \text{ securities over } n \text{ days period}$
- $n = \text{Number of days in the event window}$
3.9.1.2 t-Test for Paired Samples

This test was employed to measure the changes in means of the various financial variables and financial ratios before and after the buyback announcements. Just like single sample t-test, these measurements were done for three different sets of data. These include:

1. For sample of buyback firms, the difference in mean values before and after the buyback announcement was analysed over different event windows.

2. Comparison of mean values of sample buyback firms with 1st Control sample firms before and after buyback announcement over different event windows.

3. Comparison of mean values of sample buyback firms with 2nd Control sample firms before and after buyback announcement over different event windows.

A. WILCOXON SIGNED RANK SUM TEST

In order to supplement and validate the results obtained through comparison of mean values for paired samples, Wilcoxon Signed Rank Sum test has been applied for all the various financial variables and financial ratios. This non parametric test is normally used under conditions similar to those of Paired Sample t-test. Thus, it is calculated for sample means, adjusted values for 1st control sample and for adjusted values of 2nd control sample.

3.9.2 MULTIPLE VARIABLE TESTS

3.9.2.1 MULTIPLE REGRESSION ANALYSIS

Multiple Regression Analysis (MRA) is a technique to determine the relative influence of two or more than two independent variables (called as predictors) on a single dependent variable (called as criterion). It is generally used in cases where the dependent variable as well as independent variables follow metric scaling, i.e. they are either interval or ratio scaled. The objective of analysis is to predict the coefficients or weights of each independent variable in respect of the overall equation. The coefficients denote the relative contribution of the independent variable to the overall prediction. Generally, it is used in cases where the dependent and independent variables are metric, however, under certain circumstances, it can be used to include
non metric data either as independent variables or as dependent variables. The general form of Multiple Regression Analysis is as follows:

\[ Y_i = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + \ldots \ldots + b_k X_k + e_i \]

Where,

- \( Y_i \) = Dependent variable;
- \( b_0 \) = Constant;
- \( X_1, X_2, X_3 \ldots \ldots X_k \) = Independent variables;
- \( b_1, b_2, b_3 \ldots \ldots b_k \) = Regression coefficient of independent variables;
- \( k \) = Number of Independent variables;
- \( e_i \) = Error or residual term.

**A. MODEL DEVELOPMENT AND ASSUMPTION TESTING**

On the basis of independent and dependent variables identified and defined, the multiple regression model was developed as :-

\[
\frac{BB}{NOS} = b_1 \frac{DP}{PAT} + b_2 (EPS_{t+1} - EPS_t) + b_3 (ROCE_{t+1} - ROCE_t) + \\
b_4 \frac{CASH + CASHEQUIVALENTS}{TA} + b_5 \frac{OCF}{TA} + b_6 \frac{ESO}{NOS} + \\
b_7 (DE_{t+1} - DE_t) + b_8 TA + b_9 (R - R_m) + b_{10} \frac{BV}{MP}
\]

Where,

- \( t \) = Financial year closing prior to buyback announcement date;
- \( BB_t \) = Number of shares announced to be bought back;
- \( NOS_t \) = Total number of outstanding shares;
- \( DP_t \) = Dividend paid during the year;
- \( PAT_t \) = Profit after tax;
- \( EPS_{t+1} \) = Earnings per share for financial year closing post announcement date;
- \( EPS_t \) = Earnings per share for financial year closing prior to announcement date;
- \( CASH_t \) = Cash and bank balance;
- \( OCF_t \) = Operating cash flows;
DE_{t+1} = Debt equity ratio for financial year closing post buyback announcement date;
DE_t = Debt equity ratio for financial year closing prior to buyback announcement date;
R_{it} = Return on individual security for financial year closing prior to buyback announcement date;
R_{mt} = Return on market index (SENSEX in present study) for financial year closing prior to buyback announcement date;
BV_t = Book value per share;
MP_t = Closing market price per share on last date of financial year closing prior to announcement date;
CASH EQUIVALENTS_t = Marketable securities.

However, the model development is not complete without testing the basic assumptions of discriminant analysis. The four basic assumptions of were tested as follows:

i. Normality

ii. Homoscedasticity

iii. Linearity

iv. Independence of Error Term

i. NORMALITY

The basic assumption of normality to be tested requires the shape of the data distribution for an individual metric variable to be following a normal distribution. This is important, as in case of large deviation from the normal distribution, all resulting statistical tests are invalid. Although, normality is to be tested at univariate (single variable) level and also at multivariate (multiple variables together) level, yet testing it at univariate level is sufficient enough for conducting any multivariate analysis.

a. GRAPHICAL ANALYSIS OF NORMALITY

The normal probability plot is a highly recommended tool for testing normality through graphical analysis. A normal probability plot of each independent and dependent variable compares the cumulative distribution of actual data values of a variate with respect to the cumulative distribution of a
normal distribution. Besides, the histogram and normal probability plot of residuals is used to identify any deviations from normality.

b. STATISTICAL TESTS OF NORMALITY
There are many tests available to check the normality of a given variable, like Chi Square test, Shapiro-Wilks Test and a modification of the Kolmogorov-Smirnov test. Shapiro-Wilks test is commonly used in case of small sample sizes, i.e up to 50 units, while Kolmogorov-Smirnov test is used for sample sizes greater than 50 units. According to Kolmogorov-Smirnov, the null hypothesis assumes the variable to be following a normal distribution which is tested at 1% level of significance. Besides, Chi Square test and basic test of significance level of skewness of each variable can be used to validate the results of Kolmogorov-Smirnov.

ii. HOMOSCEDASTICITY
It is a measure of the level of correlation of dependence between variables, whereby dependent variables are assumed to show evidence of equal variance across the independent variable. Since, there are different values of dependent variables for every value of independent variable, these different values are assumed to possess equal variances across each value of independent variable. Only, if this equality of variances is present, the relationship is said to be homoscedastic.

a. GRAPHICAL ANALYSIS OF HOMOSCEDASTICITY
Since, the dependent variable is metric, hence, the most commonly used test for measuring the equality of variances across two groups of dependent variables, i.e. Levene test cannot be applied. Thus, the relevant measure in this case is the “Residual”. The residual is the difference between actual and predicted values of dependent variables. There are different forms of residuals as obtained under output, i.e. Standardised Residual and Studentised Residual. Whereas standardised residual is obtained by dividing the residual by its standard error, studentised residual is a form of standardised residual in which the standard deviation of the residual for observation i is computed from regression estimates omitting the ith observation in the calculation of regression estimates. It is the most commonly used form of standardised
residual. Plotting the values obtained for studentised residual against the standardised predicted values of dependent variable on a scatter diagram, the scattering of dots represents the level of homoscedasticity among variables. In case of no particular patterns resulting from such scatter diagrams, we can easily be assured about equal variance of dependent variable over the various independent variables.

b. **REMEDIES FOR NON NORMALITY and HETEROSCEDASTICITY**

The univariate non normality can be corrected using any of the various data transformations. Following data transformations have been tried on variables failing the test of normality in original form.

a. Inverse transformation  
b. Square Root transformation  
c. Logarithm transformation  

That transformation which satisfies the normality condition is selected and the transformed variable is finally used for model development in discriminant analysis. Correcting an independent variable for non normality also ensures a simultaneous correction for heteroscedasticity as well.

iii. **LINEARITY**

The basic assumption of linearity requires a linear relationship between an independent variable and a dependent variable. It is the third yet important assumption which presumes presence of correlation among various variables. Thus, the correlation measure can be used only if there is a linear relationship. Hence, it is sensible to examine any departure from linearity and take corrective action if required.

a. **GRAPHICAL ANALYSIS OF LINEARITY**

The partial regression plots being drawn between every single individual independent variable and the dependent variable are being used for depicting the linearity relationships between various variables used in the analysis. These plots depict the unique relationship between the dependent variable and independent variables. In such cases, the trend
line describing the relationship between two variables is either sloping up or down depending upon whether the regression coefficient for that independent variable is either positive or negative.

b. **REMEDIES FOR NON LINEARITY**

In case of identification of a non linear relationship among any two variables, suitable action like squaring the values, taking logarithm of values or calculating the square root of values of either of the variables is the possible remedy for correcting the presence of non linear relationships.

iv. **INDEPENDENCE OF ERROR TERMS OR RESIDUALS**

Another basic assumption of multiple regression analysis is the independence of error terms or residuals as obtained through running of regression model. It means that the residuals obtained should not have any time based dependence or there should not be any correlation between error terms obtained for different sample units. Thus, the residual for observation \( i \) should be independent of residual for observation \( j \). This concept is also called as autocorrelation.

a. **GRAPHICAL ANALYSIS OF INDEPENDENCE OF ERROR TERM OR RESIDUAL**

The most common method of identifying any pattern or sequencing in residuals obtained from different observations or sample units is the plot of different observations in terms of residuals. Studentised Residuals are plotted vis-a-vis the observations or sample units (a nominal scaled variable) on a scatter plot. In case of random scattering of dots without any pattern or time based sequencing, the residuals are assumed to be independent of each other.

b. **STATISTICAL TESTS FOR INDEPENDENCE OF ERROR TERMS OR RESIDUALS**

Durbin Watson test has been applied to analyze the presence of autocorrelation among residuals. The basic hypothesis usually tested under Durbin Watson is as follows:
H_0: \rho = 0 \text{ and } H_1: \rho > 0

The test statistic is

\[d = \frac{\sum_{i=2}^{n} (e_i - e_{i-1})^2}{\sum_{i=1}^{n} e_i^2}\]

Where,

\[e_i = Y_i - \hat{Y}_i\]

\(Y_i\) and \(\hat{Y}_i\) are respectively the observed and predicted values of dependent variable \(Y\) for individual observation \(i\).

As \(d\) becomes smaller as the serial correlations increases. Upper and lower critical values, \(d_U\) and \(d_L\) have been tabulated for different values of \(k\) (the number of explanatory variables) and \(n\) (sample size).

If \(d < d_L\) reject \(H_0: \rho = 0\)

If \(d > d_U\), do not reject \(H_0: \rho = 0\)

If \(d_L < d > d_U\), test is inconclusive.

**B. ESTIMATION OF REGRESSION MODEL AND ASSESSMENT OF MODEL FIT**

In this step, there are three basic decisions are to be taken before running the regression model so as to estimate the regression coefficients and thereby getting the final output for analysis. The three decisions/ tasks to be completed are:

i. Selection of Method For Estimation of Regression Model

ii. Assessment of Overall Model Fit

iii. Identification of Outliers and Influential Observations

**i. SELECTION OF METHOD FOR ESTIMATION OF REGRESSION MODEL**

The most commonly used methods for considering the values of independent variable are Sequential Search Methods and Confirmatory Specification. The difference between two methods lie in terms of the methodology adopted for inclusion of independent variables for estimation of regression model. While under Confirmatory Specification, all the variables are taken together in one go, there are
different approaches available for inclusion under Sequential Search Methods. There are choices of using Stepwise Estimation, Forward Addition and Backward Elimination. The choice of any of the two methods depends upon various considerations, yet the important ones to be considered are Multicollinearity and Level of Control.

a. MULTICOLLINEARITY
   In case of high multicollinearity among variables, confirmatory specification should be used.

b. LEVEL OF CONTROL OVER INCLUSION/REMOVAL
   In case, the empirical research has already identified and specified the variables to be included, confirmatory specification should be used. There is a loss of control over selection of variables under sequential search methods as they use definite criteria in terms of addition/removal of a particular variable for estimation of regression model.

ii. ASSESSMENT OF OVERALL MODEL FIT
   It is very important to assess whether the regression model developed and the regression coefficients estimated possess the required predictive accuracy. Besides, by taking one sample from the entire population, generalizations have to be developed for the entire population. These concerns have to be addressed by using suitable statistical tests. These tests are generally in two basic forms, i.e. a test of the variation explained and a test of each regression coefficient.

a. TESTING OF COEFFICIENT OF DETERMINATION ($R^2$)
   Coefficient of Determination or $R^2$ denotes the amount of variation as explained by the regression model. The hypothesis being tested is whether $R^2$ is greater than zero and F ratio is calculated as per the equation below.

   $$ F_{retio} = \frac{\text{Sum of Squares}_{\text{regression}}}{\text{Degrees of Freedom}_{\text{regression}}} = \frac{\text{SS}_{\text{regression}}}{\text{df}_{\text{regression}}} = \frac{\text{Sum of Squares}_{\text{residual}}}{\text{Degrees of Freedom}_{\text{residual}}} = \frac{\text{SS}_{\text{residual}}}{\text{df}_{\text{residual}}} $$
Where,

\[ df_{\text{regression}} = \text{Number of estimated coefficients (Including Intercept) } - 1; \]
\[ df_{\text{residual}} = \text{Sample size - Number of estimated regression coefficients (including intercept)}. \]

In simple terms, F ratio as calculated above is the ratio of explained variance to unexplained variance. Thus, for this ratio to be significant, F value should be as high as possible and must be statistically significant.

In case of multiple regression analysis, adding a variable will increase the prediction levels and the value of \( R^2 \) even if the predictor variable added is insignificant. This problem is classified as over fitting and is particularly grave in case if the number of sample units is closer to the number of independent variables. Thus, in order to address this concern, an adjusted \( R^2 \) is automatically calculated which makes an adjustment based on the number of independent variables relative to the sample size. The interpretation of Adjusted \( R^2 \) is similar to that of \( R^2 \) and higher values of adjusted \( R^2 \) are desired for in order to improve the prediction accuracy of the model.

b. SIGNIFICANCE TESTING OF INDIVIDUAL REGRESSION COEFFICIENTS

There are two null hypothesis created for the purpose of identifying the role of each individual independent variable in terms of its influence to predict dependent variable. The null hypothesis being created are:

Hypothesis 1: The constant term \( (b_0) \) value obtained from model is due to sampling error and the real constant term appropriate to the population is zero.

Hypothesis 2: The regression coefficients \( (b_1,…,b_{10}) \) do not differ significantly from zero.

Both these hypothesis are tested by using t-test. The t value of a coefficient is calculated by dividing the estimated value of coefficient divided by the standard error. Thus, it represents the number of standard errors that the coefficient is from zero. The output obtained from most of statistical packages including SPSS shows the significance level for coefficient’s t value showing the significance level at which the
confidence interval would include zero. With significance values lower than .01 or .05 rejects the null hypothesis at 1% and 5% respectively.

iii. IDENTIFICATION OF OUTLIERS AND INFLUENTIAL OBSERVATIONS

Outliers are observations with a unique combination of characteristics which are easily identifiable to be distinctly different from other observations. In other words, these are specific observations or cases which have values significantly different from other values of any of the independent variables. They are problematic as they distort the data analysis by having a marked effect through their abnormally high or low values.

Outliers are identified on univariate basis through an analysis of scatter plot of each and every individual independent variable. They are dots in such figures which are at the maximum distance away from the trend line drawn on such a plot. The statistical way of identifying outliers is by STANDARDISING the values by taking a mean of 0 and a standard deviation of 1. In this case, outliers are identified as cases where the values are higher than ±2.5 or ± 3 standard deviations from the mean value. Similarly, influential observations are identified as the observations whose residuals are not so large to be classified as outliers, yet having a good impact on the pattern of values of independent variables and hence influence the results in some unique manner.

Bivariate identification of outliers is done by drawing scatter plots by taking two independent variables at a time and by forming an elliptical orbit around the scatter plot. The values lying too far outside such orbits are identified as outliers.

Outliers are also identified in case of multivariate analysis like multiple regression through the usage of a popular measure called Mahalanobis D² measure. This measure calculates the distance of each observation from the mean center of all observations providing a single value for each observation. D² measure is divided by number of variables (df) involved which is used to calculate the t value. Thus observations having D²/df higher than 3 or 4 are identified as possible outliers.
There is no hard and fast rule for giving some specific treatment to outliers and influential observations. It depends upon the level of influence it exercises on data patterns. In case of high influence of outliers especially on individual variables, the only treatment is deletion of such cases from overall set of sample observations.

3.9.2.2 TWO GROUP DISCRIMINANT ANALYSIS

The review of previous work carried out on the stated objective points to usage of Discriminant Analysis. Discriminant Analysis is a multivariate technique used in case of categorical dependent variable and metric (ratio or interval scaled) independent variables. In case, the dependent variable has only two categories, it is classified as two group discriminant analysis. It is generally expressed mathematically as given in Equation (1) as:

\[ D = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + \ldots + b_k X_k \]

Where,
\[ D = \text{Discriminant score;} \]
\[ b_0 = \text{Constant} \]
\[ b_1, b_2, b_3 \ldots b_k = \text{Discriminant coefficients;} \]
\[ X_1, X_2, X_3 \ldots \ldots X_k = \text{Independent variables.} \]

STEPS IN DISCRIMINANT ANALYSIS

A. Develop the Discriminant Analysis Model.

B. Run the Model Using Values Of Various Variables Using Some Suitable Data Analysis Software.

C. Assess Validity of Discriminant Analysis.

A. DEVELOP THE DISCRIMINANT MODEL

The basic discriminant model as developed using the categorical dependent and multiple metric independent variables is as follows:

\[ D = b_0 + b_1 \frac{TD_t}{CE_t} + b_2 \frac{TD_i}{TA_t} + b_3 \frac{CA_t}{CL_t} + b_4 \frac{QA_t}{CL_t} + b_5 \frac{CASH+t-CASHEQUIVALENTS_t}{TA} + b_6 \frac{BV_t}{MP_t} + b_7 \frac{DP_t}{PAT_t} + b_8 TCSO_t + b_9 TA_t + b_{10} \frac{PAT_t}{TA_t} + b_{11} GEPS + b_{12} GR \]

Where,
\( t \) = Financial year closing before buyback announcement date;

\( TD_t \) = Total debt;

\( CE_t \) = Capital employed;

\( TA_t \) = Total assets;

\( CA_t \) = Current assets;

\( CL_t \) = Current liabilities;

\( QR_t \) = Quick assets;

\( CASH_t \) = Cash and bank balance;

\( DP_t \) = Dividend paid during the year;

\( PAT_t \) = Profit after tax;

\( TCSO_t \) = Total common shares outstanding;

\( GEPS \) = Growth rate of EPS over the last three years preceding \( t \);

\( GR \) = Growth rate in TR over the last three years preceding \( t \);

\( \text{CASH EQUIVALENTS}_t \) = Marketable securities.

However, the model development is not complete without testing the basic assumptions of Discriminant Analysis. The three basic assumptions of Discriminant Analysis to be tested include:

i. Normality

ii. Homoscedasticity

iii. Linearity

i. **NORMALITY**

The basic assumption of normality to be tested requires the shape of the data distribution for an individual metric variable to be following a normal distribution as discussed earlier for multiple regression analysis.

a. **GRAPHICAL ANALYSIS OF NORMALITY**

The normal probability plot is a highly recommended tool for testing normality through graphical analysis. A normal probability plot compares
the cumulative distribution of actual data values of a variate with respect to the cumulative distribution of a normal distribution.

b. STATISTICAL TESTS OF NORMALITY
There are many tests available to check the normality of a given variable, like, Chi Square test, Shapiro-Wilks Test and a modification of the Kolmogorov-Smirnov test. Shapiro-Wilks test is commonly used in case of small sample sizes, i.e. up to 50 units, while Kolmogorov-Smirnov test is used for sample sizes greater than 50 units. According to Kolmogorov-Smirnov, the null hypothesis assumes the variable to be following a normal distribution which is tested at 1% level of significance.

ii. HOMOSCEDASTICITY
It is a measure of the level of correlation of dependence between variables, whereby dependent variables are assumed to show evidence of equal variance across the dependent variable. Since there are different values of independent variables for every value of dependent variable, these different values are assumed to possess equal variances across each categorical value of dependent variable. Only, if this equality of variances is present, the relationship is said to be homoscedastic.

a. STATISTICAL TESTS FOR HOMOSCEDASTICITY
The most commonly used test for measuring the equality of variances across two groups of dependent variables is Levene test, however, in case of discriminant analysis, Box’s M statistic using F value is the preferred choice. In the final output table of SPSS, the value to be observed for testing the equality of variances is the significance for F value whereby the null hypothesis of equal variances of two groups is tested. Lower the value of F statistic, the higher is the possibility of acceptance of null hypothesis.

b. REMEDIES FOR NON NORMALITY AND HETEROSCEDASTICITY
The univariate non normality can be corrected using any of the various data transformations. Following data transformations have been tried on variables failing the test of normality in original form.
1) Inverse transformation
2) Square Root transformation
3) Logarithm transformation

That transformation which satisfies the normality condition is selected and the transformed variable is finally used for model development in discriminant analysis. Correcting an independent variable for non normality also ensures a simultaneous correction for heteroscedasticity as well.

iii. LINEARITY

The basic assumption of linearity requires a linear relationship between an independent variable and a dependent variable. It is the third yet important assumption which presumes presence of correlation among various variables. Thus, the correlation measure can be used only if there is a linear relationship. Hence, it is sensible to examine any departure from linearity and take corrective action, if required.

a. GRAPHICAL ANALYSIS OF LINEARITY

The scatter plots matrix has been used for depicting the linearity relationships between various variables used in the analysis. The dependent variable in case of discriminant analysis is non metric in nature. Hence, the scatter plots of each independent variable against all other independent variables taken individually are drawn to identify the presence of any non linear relationships among various variables.

b. REMEDIES FOR NON LINEARITY

In case of identification of a non linear relationship among any two variables, suitable action like squaring the values, taking logarithm of values or calculating the square root of values of either of the variables is the possible remedy for correcting the presence of non linear relationships.
B. **RUN THE MODEL USING SUITABLE ANALYTICAL SOFTWARE**

The data collected as per the model above is entered into SPSS input sheet and two group discriminant analysis is run to generate the required output. The output so generated is analysed to identify the relevant discriminating variables between selected buyback and non buyback firms. However, before running the model, the decision of selecting a particular method for model estimation has to be taken.

i **METHOD FOR MODEL ESTIMATION**

The next step is to decide about the method to be adopted for model estimation. There are two options available, i.e, Simultaneous Estimation and Stepwise Estimation. In the present study, simultaneous estimation method has been used which involves computing the discriminant function by taking all the variables in a contemporaneous manner. The statistical significance of the overall model has been tested using Wilks’ Lambda. This will test the overall discriminatory power of the discriminant function to derive discriminant Z score that is significantly different between the groups.

C. **ASSESS THE VALIDITY OF DISCRIMINANT MODEL**

The discriminant analysis requires collection of data for two different yet analogous databases. The first selection of units is the sample of buyback firms who have actually undergone buyback and have not just announced it without any execution. Similarly, another sample of units has been collected called as the “Control” units which are similar in number. These are identified as companies belonging to the same industry as the sample companies having market capitalisation falling in the range of 70% to 130% of the sample unit and have not announced any buyback programme for the year of announcement of buyback by the respective sample unit. Thus, the total sample consists of n number of sample units and an equal number of control units.

In order to access the validity of the discriminant model so developed, the total sample has been divided into two parts. One part of the sample called the Estimation or Analysis sample is used for the estimation of the discriminant function. The second part, called the Holdout or Validation sample is reserved for validating the discriminant function. In the present study, the total sample has been divided in two
equal parts with the sample units and control units also getting bifurcated in the same ratio. Thus, the analysis sample is used for estimating the discriminant function while, the validation sample is used for developing the classification matrix. In the present case, 70 % of total sample units have been reserved for estimation Sample while 30 % are kept for holdout Sample. Using random sampling approach with help of SPSS, out of total sample size of 182 effective sample units, 128 units have been kept as estimation sample while the remaining 54 have been used as holdout sample to check validity of estimation model.

The discriminant weights estimated by using the analysis sample are multiplied by the values of the independent variables in the holdout sample to generate the discriminant scores for the cases in the holdout sample. The cases are then assigned to each respective category on basis of discriminant score as per an appropriate decision rule. The hit-ratio or the percentage of cases correctly assigned to each respective category is calculated and analysed. The hit ratios so calculated for both estimation sample and the holdout sample are going to be compared with any of the suitable chance criterion. The most commonly used criteria are proportional chance criterion and maximum chance criterion. According to proportional criterion, the proportions of estimation sample and holdout sample are squared and added to reach at the base criterion. In maximum chance criterion, it is the proportion of sample units in larger sample (either estimation or holdout) which is used as the base criterion. However, the base criterion has to be multiplied by 1.25 in order to reach at the required hit ratio figure in both the cases, which means that the hit ratio as calculated for both the estimation and holdout sample must be higher by at least 25% of base criterion arrived at by using either of the two criteria. Besides, another measure used to assess validity of discriminant model is Press’s Q statistic. It is measured using the actual number of cases correctly classified and the number of groups of dependent variable.

\[
PRESS \ 'sQ = \frac{\left[ N - (nK)^2 \right]}{N(K - 1)}
\]

Where,

\[
N = \text{Total sample size};
\]
Another measure which needs to be analysed is discriminant weights also referred to as discriminant coefficients. Obtaining the discriminant coefficient for each variable meets the second part of our objective whereby the coefficients are analysed quantitatively irrespective of their signs (positive or negative) to determine their relative importance in classifying the available data into buyback and non-buyback companies.

3.10 RESEARCH HYPOTHESIS

The various research hypotheses formulated for purpose of achieving different objectives have been outlined as follows:

3.10.1 OBJECTIVE 1

Hypothesis 1: At least one of the regression coefficients ($b_1$…..$b_{10}$) differs significantly from zero.

3.10.2 OBJECTIVE 2 PART 1

In pursuit of second objective, the relevant hypothesis to be tested to measure the impact of buyback announcements on share prices and liquidity of underlying stocks are as follows:

Hypothesis 1 : The average abnormal returns (AAR) for day $t$ in an event window are not equal to zero.

Hypothesis 2 : The Standardised Average Abnormal Returns (SAAR) for day $t$ in an event window are not equal to zero.

Hypothesis 3 : The Cumulative Average Abnormal Returns (CAAR) for $t$ days in an event window is not equal to zero.

Hypothesis 4 : The Standardised Cumulative Average Abnormal Returns (SCAAR) for $t$ days in an event window is not equal to zero.

3.10.3 OBJECTIVE 2 PART 2

Hypothesis 1 : There is a significant change in liquidity of the stock before and after the buyback announcement;
Hypothesis 2: There is a significant change in liquidity of the stock pre buyback announcement;

Hypothesis: There is a significant change in liquidity of the stock post buyback announcement;

3.10.4 OBJECTIVE 3

There have been eight different hypotheses being put under testing for all the four different variables:

Hypothesis 1: There has been a significant difference in value of OPM of sample firms before and after the buyback announcements

Hypothesis 2: There has been a significant difference between values of OPM of sample firms when adjusted for OPM of control sample firms before and after the buyback announcements

Hypothesis 3: There has been a significant difference in value of EPS of sample firms before and after the buyback announcements

Hypothesis 4: There has been a significant difference between values of EPS of sample firms when adjusted for EPS of control sample firms before and after the buyback announcements

Hypothesis 5: There has been a significant difference in value of BVMV ratio of sample firms before and after the buyback announcements

Hypothesis 6: There has been a significant difference between values of BVMV ratio of sample firms when adjusted for BVMV ratio of control sample firms before and after the buyback announcements

Hypothesis 7: There has been a significant difference in value of DE ratio of sample firms before and after the buyback announcements

Hypothesis 8: There has been a significant difference between values of DE ratio of sample firms when adjusted for DE ratio of second control sample firms before and after the buyback announcements
3.10.5 OBJECTIVE 4

Hypothesis 1 : There is abnormal return earned by existing shareholders over long term following buyback of shares by the company.

3.10.6 OBJECTIVE 5

Hypothesis 1 : The discriminant coefficients (b1…..b12) differ significantly from zero.

3.11 LIMITATIONS OF THE STUDY

Although every effort was made to make the study quite comprehensive and elaborate, yet following limitations could not be avoided in spite of best efforts:

1. The number of companies announcing buyback in Indian capital markets is not too big, thereby limiting the size of total sample.

2. Lack of availability of single source of data for public announcements as both BSE and SEBI have incomplete information on their websites.

3. Calculation of many relevant variables likes Tobin q and bid ask spread is not possible for Indian capital markets, hence best possible substitutes were used for analysis.

4. There is lack of sufficient background research on buyback of equity shares in Indian scenario.