SIGNALING EFFECT OF DIVIDEND DECISION ON THE MARKET PRICE OF SELECT LISTED COMPANIES

SUMMARY OF THESIS

SUBMITTED TO THE UNIVERSITY OF LUCKNOW FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN BUSINESS ADMINISTRATION

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DEPARTMENT OF BUSINESS ADMINISTRATION UNIVERSITY OF LUCKNOW LUCKNOW 2015
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SUMMARY

1. INTRODUCTION AND GENESIS OF THE RESEARCH IDEA

Corporate finance focuses on decisions aimed at maximization of shareholders wealth. In the long term perspective, the decisions related to investment, financing as well as dividends are expected to create value. One of the measures of value being market capitalization is influenced by share price value attached by the market. The performance, growth prospects, strategic direction and potential for long term sustainable results affects the share prices. The returns to shareholders simply depend upon capital appreciation in the holdings as well as dividends over the period. The changes in market prices reflect the perceived changes in the value of the shares of the company amidst changing environment and in response to make-up of the company including relations with shareholders in terms of dividends as well as additions to market value of shares as an outcome of company’s quality of decisions.

The market reaction to changes in share prices is affected not only by company’s performance and growth potential but also by the nature of market. Markets tend to be driven by the informational content of events in the external environment as well as information communicated by the company through its various decisions. One of the such decisions is the dividend related decision which has been a subject matter of interest for researchers all over the world as to its signalling effect. Existence of differences in signalling effect of dividend related events in different economies of the world characterised by respective nature and level of market efficiency have been observed.

Indian stock market has evolved over a period of time to emerge as one of the most prominent ones. India being a prominent emerging economy with a highest number of transactions amongst all the stock exchanges of the world (World Federation of Exchanges, 2013) thus provides a good example to examine if signalling theory holds and comment upon relative efficiency of the market.

2. AIM AND RESEARCH OBJECTIVES

This research primarily aims to study the signalling effect of dividend decisions on the market price of companies listed on stock market in India. Incidental to the study it is necessary to understand whether the efficiency level of the Indian stock market has any role
in affecting the changes in share prices due to dividend related events. The companies listed on the stock market are diverse in terms of the industry, market capitalization and performance. They also exhibit different types of dividend decisions viz. cash or stock and indirectly repurchase of shares. The dividend change decisions can be grouped in to various event categories such as dividend omission, initiation, increase or decrease. Accordingly, the following objectives of the study have been formulated:

i) To identify and analyze the different types of dividend related events and their signalling effect if any on the share price of listed companies in India.

ii) To analyze whether the signalling effect is consistent for all the events or it varies with market capitalization or industry representation of the company.

iii) To test the market efficiency of the Indian Stock Market in relation to dividend related announcements.

3. LITERATURE REVIEW

Miller and Modigliani’s (1961), asserted that dividend policy is not important because it has no effect on the value of the firm and thus does not affect a firm owner’s wealth. This school assumes that companies follow a residual dividend policy which is based on reinvestment of profits to avail investment opportunities with a positive net present value (Saxena 1999, Baker 2009, Chen and Dhiensiri 2009) and after that the firms distribute the surplus as a cash dividend to the shareholders. Partington (1985) claimed that in real practice companies do not follow the residual dividend policy as dividend decisions are taken independently from the investment policy.

Bhattacharya (1979), John and Williams (1985) and Miller and Rock (1985) have gone through all the dividend related school of thoughts and found a gap in practicing of dividend related policies and its impact on the shareholders. This gap they attribute to asymmetric information and the resulting impact on the shares prices and ultimately on the wealth of shareholders. Thus there seems to be consensus that dividend provide financial signal. The signaling effect of dividend decision depends on many factors of which prominently one is the level of perfection of the market. As markets in different countries are at varying levels of perfection and efficiency, the effect of dividend decision accordingly must be viewed in the context of the specific market. India being in transitory
state of financial market and is gradually evolving and getting integrated with global markets, the study of signaling effect on dividend decisions thus assumes importance considering the size of the equity market in India.

The summary of the views based on literature review of various researches on signalling theory are mentioned below:

- Under signaling equilibrium model, firms expecting larger future cash flows pay higher dividends, anticipating share prices to increase in future;
- The smooth dividends associated with optimal dividend policy require operational cash flows to occur in such way that dividend changes have a lagged relation with cash flow changes;
- Firms which pay dividend have clientele effect and therefore need liquidity to meet expectations of regular dividend; and
- Higher dividends change are associated, ceteris paribus, with higher changes in share prices while smaller dividends changes are associated with smaller changes in share prices.

Some of the empirical tests, organized in agreement with the implications of the dividend information content referred to above are discussed in following heads.

- Information Asymmetry and Dividend Policy
- Dividend Announcement and Future earnings:
- Dividend Announcement and Share Price:
- Dividend and Stock Price in Emerging Markets:

Part one of the literature reviewed, examined studies related to information asymmetry among stakeholders. The managers (insiders) are using dividend and other important information to signal outsider about the potential of the companies to enhance the value of the firm and by this way they try to safeguard managerial interest in the companies.

The second part of the literature review related to dividend announcement and future earnings. The results are mixed with some of the studies support dividends to convey future prospects. Most of the studies support the viewpoint only if there are potential real earnings in the long run then dividend announcement really acts as signal otherwise not. At the same time some of the studies do not find support that dividend conveys future potential earnings.
In third part of the literature review, the impact of dividend on share price reaction has been covered. Studies suggest that dividend and share prices are positively correlated. While some of the studies found signaling effect and inverse relationship between dividend announcement and share prices, others did not find any relationship at all. The literature is also abound with studies showing mixed results depending upon dividend related events and the event periods chosen for the respective studies.

Studies on dividend signaling in the context of emerging economies by and large do not show clear evidence of signaling effect. The reason for this has been attributed to low level of market efficiency.

The literature also points out that the methodology adopted and models used to analyse signaling effect also affect the outcome of the results. The theoretical and empirical works reviewed in the literature show various type of results for different markets. The different results from large number of empirical studies and the evidence of a significant percentage of cases where the market reaction to dividend change announcements is opposite to the expected reaction leads us to draw that the debate over the empirical validity of the dividend-signaling hypothesis remains inconclusive. However, different results in different markets also prompt one to explore the cause and effect relationship with the characteristics of the dividend related events as well as the nature of market.

Taking the clues from literature review carried out in the preceding sections, the following salient points emerge which provide a basis for formulating the aims and objectives of the study as under:

i) The relationship between dividend changes announcements and subsequent changes in share prices of the firms are not always consistent with the signaling theory and the information meant to be conveyed to the market through dividend decision is not always related to future earnings, growth or cash flow;

ii) The empirical evidence in developed countries predominately support the positive relationship between dividend change announcements and the subsequent change in share prices while in developing counties the same is not supported either due imperfections or inefficiencies in the market. The evidence of negative relationship between dividend change announcements and changes
in share prices may also be attributed to investors’ perceived behavior for future earnings and growth.

4. RESEARCH METHODOLOGY

4.1 PROCEDURE FOR SAMPLE SELECTION

There are twenty five stock exchanges operating in India. Out of these twenty one operate at regional level and only four are working at national level. Only Bombay Stock Exchange (BSE), National Stock Exchange (NSE), Over the Counter Stock Exchange (OTC) and Multiple Commodity Index (MCX) are operational at national level. The MCX is trading in commodities and falls within the regulatory purview of Forward Market Commission of India; while OTC is the market for non-listed medium size companies, only BSE (Bombay Stock Exchange) and NSE (National Stock Exchange) deal in majority of the companies listed on the Indian Stock Market. Due to their size in terms of number of listings as well as turnover, BSE and NSE have been considered as representative of Indian Stock Market for identification of companies and selection of events.

The selections of companies in the sample are based on non-probability purposive sampling (Stepwise sampling). Time span of 10 year from financial year 2001-02 to financial year 2010-11 has been taken for the study.

The final selection of companies is based on the criteria of regular announcement of dividend and active trading in the stated stock exchanges (e.g. BSE and NSE) during the span of time taken for the study. Listed companies on NSE and BSE exchanges were scanned for such companies which are common to both the exchanges. Amongst the ones which were found to be common, those companies which had at least ten dividend events including interim and final dividend over the ten-year period from Financial year 2001-02 to 2010-11 were identified and categorized into into Large Cap, Mid Cap and Small Cap companies based on their respective market capitalization bases to constitute the sample for event study analysis. The sample constitutes 103 companies and 725 events related to them over a span of 10 year period from FY 2001 to FY 2011.

4.2 Categorization of Events

As the study focusses on signaling effect of dividend decisions in the Indian Stock listed companies, the dividends related decisions have been categorized into following broad groups:
1. Dividend alone
2. Dividend along with financial results
3. Dividend along with other events except financial results
4. Dividend along with financial results and other events

In order to perform event study analysis it is necessary to exclude such cases where other events are announced during the window period. The number of isolated dividend related events falling in the window period of 61 days is arrived to be 725 with break-up different types of isolated dividend events such as 152 dividend alone events, 522 dividend along with financial results, 16 dividend and other events except of financial results and 29 of dividend along with financial results and other events.

4.3 Hypotheses:

The following hypotheses have been formulated to study the effect of change in dividend on the respective share prices of the selected companies:

i. \( H_0 \): There is no relationship between dividend change announcement (both increase or decrease) on the share prices of the Indian Stock market listed companies when dividend announcement is made along with declaration of financial results.

ii. \( H_0 \): There is no relationship between standalone dividend change announcements on the share prices of the Indian Stock Market listed companies.

iii. \( H_0 \): There is no relationship between dividend initiation announcements on the share prices of the Indian Stock Market listed companies.

iv. \( H_0 \): There is no relationship between dividend omission announcements on the share prices of the Indian Stock Market listed companies.

4.4 Data Collection:

This study used CMIE data base for the collection of data with the help of software called PROWESS. As claimed by organization itself “Prowess is a database of the financial performance of Indian companies. Annual Reports of individual companies are the principal source of this database. The database covers listed and unlisted companies. For listed companies, the database includes data sourced from the stock exchanges. Prowess contains time-series data from 1989-90 onwards. It is updated continuously. Therefore
Prowess database has been used for the collection of data for the period of 10 years from FY 2001-02 to FY 2010-11. Data collected from Prowess 3.1 includes dividend rate, dividend announcement date, closing prices of the selected companies for sampled companies.

4.5 Analytical tools For Event Study : GARCH Model

To examine the impact of any dividend related event on share price, abnormal returns have been calculated using GARCH (p, q) model as given by Bollerslev (1987). The decision to apply GARCH (p, q) model for the estimation of abnormal return over simple OLS model is based on resolution of concerns regarding autocorrelation and heteroskedasticity in residuals as advocated by Serra (May 2002) and Pynnonen (2005).

The current daily return $R_{i,t}$ is given by

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \quad (1)$$

Where $P_{i,t}$ and $P_{i,t-1}$ represent closing prices of the current date and previous date respectively.

The daily returns of individual scripts and of the market accordingly have been calculated using closing BSE share prices for each of the 20 companies and BSE’s closing index for the BSE’s index return respectively.

The data has been checked for stationarity using Augmented Dickey Fuller and Phillips-Perron test statistics popularly known as Unit Root test.

The abnormal return of security in time period t can be calculated with the help of formula given below:

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \quad (2)$$

where $E(R_{i,t})$ corresponds to expected return of security i in time period t and is given by

$$E(R_{i,t}) = \alpha_i + \beta_i R_{m,t} \quad (3)$$

The expected return using market model (GARCH (p, q)) is given by
\[ E(R_{it}) = \alpha_{i,t} + \beta_{i,t} R_{m,t} + \varepsilon_{i,t} \quad (4) \]

Subject to condition of error term \( \varepsilon_{i,t} \sim N(0, \sigma^2_{i,t}) \) where variance in the error term is given by

\[ \sigma^2_{i,t} = \gamma_{i,0} + \gamma_{1} \varepsilon^2_{i,t-1} + \cdots + \gamma_{p} \varepsilon^2_{i,t-p} + \theta_{i,1} \sigma^2_{i,t-1} + \cdots + \theta_{i,p} \sigma^2_{i,t-p} \quad (5) \]

Equation (4) is simple ordinary least squares (OLS) model which puts the condition for mean of error term as zero and constant variance. Equation (5) includes volatility measured by the term error square lagged and lags of volatility itself to calculate variance of error.

We have relied upon the use of Breusch-Godfrey Serial Correlation LM test and Heteroskedasticity: ARCH test on the residuals calculated by using simple OLS model. To ensure residuals are free from autocorrelation and heteroskedasticity, residual diagnostic tests are further performed on the residuals obtained by using GARCH (p, q) model.

The cumulative average abnormal return (CAAR) over the window period for n number of events being considered is given by

\[ \text{CAAR} = \sum_t \text{AAR}_t \quad (6) \]

Where \( \text{AAR}_t = \frac{1}{n} \sum_{i=1}^{n} \text{AR}_{it} \quad (7) \)

The hypothesis testing has been carried out using t-test as favoured by Serra A. P. (May 2002) to determine whether abnormal return realized during event window is significant or happened by chance.

**4.5.1. Hypothesis Testing Tool:**

For the testing of hypothesis that abnormal return realized due to particular event announcement is significant or not, t –test is employed.

\[ t = \frac{\text{AAR}_i}{\sigma/\sqrt{n}} \]

\( \text{AAR}_i = \text{Average abnormal return for security ith} \)

\( \sigma = \text{standard deviation of abnormal return for security i}. \)
n= number of observations, or time period.

5. EVENT STUDY ANALYSIS OF DIVIDEND DECISIONS

In Chapter IV of the thesis, Event Analysis of dividend related decisions of the selected sample of companies has been performed.

The events selected for the analysis fall into three broad categories as under:

i) Dividend announcement along with declaration of financial results

ii) Standalone dividend increase or decrease decision

iii) Dividend initiation or omission decision

Each of the above three categories of dividend decisions has been analyzed for range of dividend announcement levels from increase or decrease of 10%, 15%, 20%, 25%, and 50% and above. The total number of events analyzed number 872 covering a period of 10 ten years from FY 2001-02 to 2010-11 in respect of 103 companies constituting the sample.

The details of events to study signaling effect through event analysis appears in Table 5.1

Table 5.1: Details of dividend events analyzed

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Dividend Change Announcement</th>
<th>Large Cap</th>
<th>Mid Cap</th>
<th>Small Cap</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Increase of minimum 10%</td>
<td>15</td>
<td>10</td>
<td>26</td>
<td>51</td>
</tr>
<tr>
<td>2</td>
<td>Decrease of minimum 10%</td>
<td>09</td>
<td>00</td>
<td>07</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>Increase of minimum 15%</td>
<td>19</td>
<td>12</td>
<td>30</td>
<td>61</td>
</tr>
<tr>
<td>4</td>
<td>Decrease of minimum 15%</td>
<td>08</td>
<td>01</td>
<td>06</td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td>Increase of minimum 20%</td>
<td>07</td>
<td>14</td>
<td>22</td>
<td>43</td>
</tr>
<tr>
<td>6</td>
<td>Decrease of minimum 20%</td>
<td>07</td>
<td>01</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>7</td>
<td>Increase of minimum 25%</td>
<td>30</td>
<td>21</td>
<td>47</td>
<td>98</td>
</tr>
<tr>
<td>8</td>
<td>Decrease of minimum 25%</td>
<td>20</td>
<td>11</td>
<td>41</td>
<td>72</td>
</tr>
<tr>
<td>9</td>
<td>Increase of minimum 50% or above</td>
<td>40</td>
<td>19</td>
<td>80</td>
<td>139</td>
</tr>
<tr>
<td>10</td>
<td>Decrease of minimum 50% or above</td>
<td>27</td>
<td>06</td>
<td>30</td>
<td>63</td>
</tr>
<tr>
<td>Sub-total</td>
<td>182</td>
<td>102</td>
<td>299</td>
<td>583</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td></td>
</tr>
</tbody>
</table>

**Standalone dividend increase or decrease decision**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Dividend Change Announcement</th>
<th>Large Cap</th>
<th>Mid Cap</th>
<th>Small Cap</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Increase of minimum 10%</td>
<td>01</td>
<td>01</td>
<td>06</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Decrease of minimum 10%</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Increase of minimum 15%</td>
<td>01</td>
<td>08</td>
<td>09</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>Decrease of minimum 15%</td>
<td>00</td>
<td>00</td>
<td>05</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Increase of minimum 20%</td>
<td>04</td>
<td>00</td>
<td>07</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>Decrease of minimum 20%</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Increase of minimum 25%</td>
<td>09</td>
<td>00</td>
<td>25</td>
<td>34</td>
</tr>
<tr>
<td>8</td>
<td>Decrease of minimum 25%</td>
<td>07</td>
<td>00</td>
<td>25</td>
<td>32</td>
</tr>
<tr>
<td>9</td>
<td>Increase of minimum 50% or above</td>
<td>17</td>
<td>06</td>
<td>35</td>
<td>58</td>
</tr>
<tr>
<td>10</td>
<td>Decrease of minimum 50% or above</td>
<td>01</td>
<td>00</td>
<td>08</td>
<td>9</td>
</tr>
<tr>
<td>Sub- Total</td>
<td></td>
<td>40</td>
<td>15</td>
<td>121</td>
<td>176</td>
</tr>
</tbody>
</table>

**Dividend initiation or omission decision**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Dividend Change Announcement</th>
<th>Large Cap</th>
<th>Mid Cap</th>
<th>Small Cap</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dividend initiation</td>
<td>11</td>
<td>09</td>
<td>44</td>
<td>64</td>
</tr>
<tr>
<td>2</td>
<td>Dividend omissions</td>
<td>09</td>
<td>07</td>
<td>33</td>
<td>49</td>
</tr>
<tr>
<td>Sub- Total</td>
<td></td>
<td>20</td>
<td>16</td>
<td>77</td>
<td>113</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>242</td>
<td>133</td>
<td>497</td>
<td>872</td>
</tr>
</tbody>
</table>

The analysis carried out provides an understanding of the behavior of the Indian Stock market in response to dividend related decisions by large-cap, mid-cap and small-cap companies respectively. The findings based on the analysis of isolated dividend decisions of 103 sampled companies and 865 events covering a ten-year period from FY 2001 to FY 2010 appear in next section.
6. FINDINGS AND DISCUSSIONS

6.1 Findings

Chapter V has been organized by presenting the findings of the analysis of events categorized into following three categories:

iv) Dividend announcement along with declaration of financial results
v) Standalone dividend increase or decrease decision
vi) Dividend initiation or omission decision

The trends associated in daily AAR and CAAR for respective categories of events to cover the event window of 61 days have been analyzed in the previous chapter. The inferences about the signaling effect of the respective category of events on share price movement as well as the relative efficiency of the stock market in response to price reaction are discussed below:

6.1.1 Event dividend Increase/decrease along with announcement of financial results

The analysis of different rates of dividend changes made simultaneously with declaration of financial results by large –cap, mid-cap and small cap companies respectively in the sample based on daily ARR and CAAR movements as well as 10-day mean CAAR trends have been summarized in Table 6.1 below:

Table 6.1: Summary of AAR and CAAR movement and pronounced periods

<table>
<thead>
<tr>
<th>Category of companies</th>
<th>Events</th>
<th>Trend in AAR on event day</th>
<th>Trend in Daily CAAR</th>
<th>Pronounced Period based on 10 day mean CAAR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trend</td>
<td>t-test result</td>
<td>Pre Event</td>
<td>Post Event</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(-)Pre Event/ (+)Post Event</td>
<td></td>
</tr>
<tr>
<td>Large Cap</td>
<td>+10%</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Secular negative</td>
</tr>
<tr>
<td></td>
<td>+15%</td>
<td>Negative</td>
<td>Significant</td>
<td>Cyclical</td>
</tr>
<tr>
<td></td>
<td>+20%</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Cyclical</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------</td>
<td>----------</td>
<td>---------------</td>
<td>----------</td>
</tr>
<tr>
<td></td>
<td>+25%</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Cyclical positive</td>
</tr>
<tr>
<td></td>
<td>+50% or more</td>
<td>Positive</td>
<td>Significant</td>
<td>C cyclical positive</td>
</tr>
<tr>
<td></td>
<td>-10%</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Secular Positive</td>
</tr>
<tr>
<td></td>
<td>-15%</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Cyclical</td>
</tr>
<tr>
<td></td>
<td>-20%</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>-25%</td>
<td>Positive</td>
<td>Insignificant</td>
<td>No trend</td>
</tr>
<tr>
<td></td>
<td>-50% or more</td>
<td>Positive</td>
<td>Insignificant</td>
<td>C cyclical negative</td>
</tr>
</tbody>
</table>

Mid-Cap

<table>
<thead>
<tr>
<th></th>
<th>+10%</th>
<th>Positive</th>
<th>Insignificant</th>
<th>C cyclical negative</th>
<th>C cyclical negative</th>
<th>+21 to +31 day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+15%</td>
<td>Positive</td>
<td>Insignificant</td>
<td>C cyclical positive</td>
<td>C cyclical negative</td>
<td>-10 to -01 day</td>
</tr>
<tr>
<td></td>
<td>+20%</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Positive</td>
<td>Negative</td>
<td>+01 to +10 day</td>
</tr>
<tr>
<td></td>
<td>+25%</td>
<td>Positive</td>
<td>Insignificant</td>
<td>Secular positive</td>
<td>Secular positive</td>
<td>+21 to +30 days</td>
</tr>
<tr>
<td></td>
<td>+50% or more</td>
<td>Positive</td>
<td>Insignificant</td>
<td>Secular positive</td>
<td>Secular Negative</td>
<td>-10 to -01 day</td>
</tr>
<tr>
<td>-10%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-15%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-20%</td>
<td>No event observed in the sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-25%</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Secular positive</td>
<td>Secular positive</td>
<td>+21 to +30 days</td>
</tr>
<tr>
<td></td>
<td>-50% or more</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Cyclical positive</td>
<td>Secular negative</td>
<td>-20 to -11 day</td>
</tr>
</tbody>
</table>

Small-Cap

<table>
<thead>
<tr>
<th></th>
<th>+10%</th>
<th>Positive</th>
<th>Significant</th>
<th>Secular positive</th>
<th>Secular decreasing</th>
<th>+01 to +10 day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+15%</td>
<td>Positive</td>
<td>Significant</td>
<td>C cyclical negative</td>
<td>Secular negative</td>
<td>+11 to +20 day</td>
</tr>
<tr>
<td></td>
<td>+20%</td>
<td>Positive</td>
<td>Insignificant</td>
<td>No trend</td>
<td>C cyclical positive</td>
<td>+01 to +10 day</td>
</tr>
<tr>
<td></td>
<td>+25%</td>
<td>Positive</td>
<td>Insignificant</td>
<td>No trend</td>
<td>Secular positive</td>
<td>+21 to +30 days</td>
</tr>
</tbody>
</table>
The mixed results of our findings are similar to the findings of Aharony and Swary (1980), Asquith and Mullins (1983), Eades et al. (1985), Kalay and Loewenstein (1985, 1986), Bernheim and Wantz (1995), Benartzi et al. (1997), and Nissim and Jiv (2001). These studies outlined the factors causing disparity in share price behavior in response to dividend changes as under:

   i) Demand for Buy and sell
   ii) The differences in level of informed and non-informed traders in the market.
   iii) The dominance of promoter group (Shanti Suresh, 2011)
   iv) The dividend preferences of retail investors as influenced by behavioral lifecycle (Shefrin, 1988)
   v) Different types of traders viz. liquidity traders, discretionary traders, present and potential shareholders, market makers and speculators (Fuller, 2003)
   vi) The condition that markets are efficient only when large number of investors disbelieve its efficiency and there is less effort to accumulate, analyze and evaluate information resulting in market becoming less efficient. (Horne & Dhamija, 2012)

### 6.2 Event Dividend Increase/Decrease announcements:

The analysis of different rates of dividend changes made by large –cap, mid-cap and small cap companies in the sample based on daily ARR and CAAR movements as well as 10 day mean CAAR trends have been captured in Table 6.2 below:
## Table 6.2: Summary of AAR and CAAR movement and pronounced periods

<table>
<thead>
<tr>
<th>Category of companies</th>
<th>Events</th>
<th>Trend in AAR on event day</th>
<th>Trend in Daily CAAR</th>
<th>Pronounced Period based on 10 day mean CAAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dividend change %</td>
<td></td>
<td>Significant/Insignificant based on t-test</td>
<td>Pre Event</td>
<td>Post Event</td>
</tr>
<tr>
<td>Large Cap</td>
<td>+10%</td>
<td>Positive</td>
<td>Secular positive</td>
<td>Secular positive</td>
</tr>
<tr>
<td></td>
<td>+15%</td>
<td></td>
<td>No event observed in the sample</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+20%</td>
<td>Positive</td>
<td>Insignificant</td>
<td>Secular positive</td>
</tr>
<tr>
<td></td>
<td>+25%</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Cyclical</td>
</tr>
<tr>
<td></td>
<td>+50% or more</td>
<td>Positive</td>
<td>Insignificant</td>
<td>Secular positive</td>
</tr>
<tr>
<td></td>
<td>-10%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-15%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-20%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-25%</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Secular positive</td>
</tr>
<tr>
<td></td>
<td>-50% or more</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-Cap</td>
<td>+10%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+15%</td>
<td>Positive</td>
<td>Insignificant</td>
<td>Cyclical negative</td>
</tr>
<tr>
<td></td>
<td>+20%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+25%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+50% or more</td>
<td>Negative</td>
<td>Insignificant</td>
<td>No trend</td>
</tr>
<tr>
<td></td>
<td>-10%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-15%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-20%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-25%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>-50% or more</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small-Cap</td>
<td>+10%</td>
<td>Event are not sufficient to be included in final study</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+15%</td>
<td>Positive</td>
<td>Insignificant</td>
<td>Secular</td>
</tr>
</tbody>
</table>
The findings of reactions in share prices being insignificant and pronounced period being quite away from the event announcement date suggest inefficient nature of Indian Stock Market in-line with the findings for dividend changes made along with announcement of financial results events reported in 6.1 above.

### 6.3 Event Dividend Initiation/Omission Announcement

The analysis of different rates of initiation and omission made by large –cap, mid-cap and small cap companies in the sample based on daily ARR and CAAR movements as well as 10 day mean CAAR trends have been captured in Table 6.3 below:

<table>
<thead>
<tr>
<th>Category of companies</th>
<th>Events</th>
<th>Trend in AAR on event day</th>
<th>Trend in Daily CAAR</th>
<th>Pronounced Period based on 10 day mean CAAR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dividend change</td>
<td>Trend</td>
<td>Significant/Insignificant based on t-test</td>
<td>Pre Event</td>
</tr>
<tr>
<td>Large-Cap</td>
<td>Initiation</td>
<td>Negative</td>
<td>Insignificant</td>
<td>Secular positive</td>
</tr>
<tr>
<td>Mid-Cap</td>
<td>Initiation</td>
<td>Positive</td>
<td>Insignificant</td>
<td>Cyclical negative</td>
</tr>
<tr>
<td>----------</td>
<td>------------</td>
<td>------------------</td>
<td>---------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Small-Cap</td>
<td>Initiation</td>
<td>Positive</td>
<td>Insignificant</td>
<td>Secular positive</td>
</tr>
<tr>
<td>Large-Cap</td>
<td>Omission</td>
<td>Positive</td>
<td>Insignificant</td>
<td>No trend</td>
</tr>
<tr>
<td>Mid-Cap</td>
<td>Omission</td>
<td>Positive</td>
<td>Insignificant</td>
<td>Positive</td>
</tr>
<tr>
<td>Small-Cap</td>
<td>Omission</td>
<td>Positive</td>
<td>Insignificant</td>
<td>Positive</td>
</tr>
</tbody>
</table>

For both dividend initiation and dividend omission announcement events, the pronounced period is quite away from event day. The negative reaction in share prices for dividend initiation and positive reaction for dividend omission can be due to growing state of Indian economy as stated by the other studies related to various countries such as Rimbey and Officer (1992), Liang et. al. (2009), Jin (2000) for US market, Capstaff et.al. (2004), for Oslo Stock Exchange, Chen et.al. (2009) for Chinese market, Forner and Sanabria (2010) for Spanish market who found inverse relation between dividend initiation and omissions announcements and impact on share prices while concluding that there is partial effect of dividend related events on the market.

7. CONCLUSIONS, POLICY IMPLICATIONS AND FUTURE RESEARCH DIRECTIONS.

7.1 Conclusions

The analysis of twenty six dividend related events for three categories of companies i.e. Large cap, mid cap and small cap companies reveals insignificant effect of dividend decision in share prices on the event day with following five exceptions:

i) Dividend increase of 15% and 50% or more declared along with financial results announcement by large cap companies,

ii) Dividend increase of 10% and 15% declared along with financial results announcement by small cap companies

iii) Dividend increase of 10% by large cap companies

Thus insignificant effect predominately witnessed in share prices provides enough evidence of no signaling effect of dividend decisions in the Indian stock market. The above five
exceptions to the results need to be viewed in the context of previous studies which also found certain exceptions not consistent with predominant findings due to information asymmetry and investor motivated behavior to capitalize on possessed information or uninformed investment decision.

The inefficiency in the Indian Stock market has also been supported through the extension of the analysis with the help of 10–day mean CAAR values to examine pronounced periods of reaction in share prices as shown in Table 5.1, 5.2 and 5.3 wherein in majority of the cases examined, the pronounced period of CAAR is observed to be quite away from the event day. However, in few cases as mentioned below, the pronounced period of CAAR is observed to be close to the event day:

i. Dividend decrease of 50% or more with announcement of financial result event by large cap companies where the pronounced period of CAAR is -10 to -01 days.

ii. Dividend increase of 15% and 50% or more along with financial results event by midcap companies where pronounced period of CAAR is -10 to -01 days.

iii. Dividend increase of 20% along with financial results event by mid cap companies where the pronounced period of CAAR is +01 to +10 days.

iv. Dividend increase of 10%, 20% and 50% or more along with financial results event by small cap companies with pronounced period of CAAR being +01 to +10 days.

v. Dividend decrease of 20% and 25% along with financial results by small cap companies in which pronounced period of CAAR is +01 to +10 days.

vi. Dividend increase of 15% event and increase of 50% or more event by mid cap companies with pronounced period of CAAR being from +01 to +10 and -10 to -01 days respectively.

With the identification of events of listed companies, use of Garch model with removal of heterodasticity in the data, choice of model, sufficient precautions have been taken to ensure reliability of the results.

However, presences of few exceptions to the general results need to be explained. The mixed results point out that other factor such as transparency issues, behavioral aspect of investors due to information asymmetry, ownership patterns could be the possible reasons for above exceptions. The deviations are more in case of small cap and mid cap companies
suggesting more information asymmetry as regards dividend decisions of mid-cap and small companies due to large promoter group holdings. Same can be the case of large cap companies as well where promoter group could be dominant and have all the motives to influence share prices with their actions.

7.1.1 Signaling effect

From this empirical study on Signaling effect of dividend decisions in the Indian Stock Market, the following conclusions can be drawn:

a. In case of Large cap companies with market capitalization of more than Rs.10,000 Crores no signaling effect has been observed for following types of events:

   i) Dividend increase of 10%, 20%, 25% along with financial results announcement.
   ii) Dividend decrease of 10% up to 50 % or more along with financial results announcement.
   iii) Dividend initiation/omission for any change in rate
   iv) Dividend increase/decrease for any change in dividend
   v) Dividend increase of 15%, 20%, 25% and 50% or more
   vi) Dividend decrease of 10% up to 50 % or more

   The notable exceptions to results have been observed in case of 15% and 50 % or more increase in dividend along with financial results announcement and 10% of dividend increase. These exceptions can be explained with the support of pronounced period of CAAR analysis performed in order to comment on inefficiency in the market.

b. In case of Mid cap companies with market capitalization between Rs. 5,000 Crores to Rs.10, 000 Crores, no signaling effect has been observed for the following types of events:

   i) Dividend increase of 10% up to 50% or more along with financial results announcement.
   ii) Dividend decrease of 10% up to 50% or more along with financial results announcement.
   iii) Dividend initiation/ omission for any change in rate.
   iv) Dividend increase/decrease for any change in dividend.
c. In case of Small cap companies with market capitalization of less than Rs. 5,000 Crores, no signaling effect has been observed for the following types of events:

i) Dividend increase of 20%, 25% and 50% or more along with financial results announcement.

ii) Dividend decrease of 10% up to 50% or more along with financial results announcement.

iii) Dividend initiation/omission for any change in rate

iv) Dividend increase/decrease for any change in dividend

The notable exceptions to results have been observed in case of 10% and 15% increase in dividend along with financial results announcement which can be attributed due to chance/inefficiency in the market.

Taking into account all the events for large cap, mid cap and small cap companies covering a period of 10 years spanning FY 2001 to FY 2011 based on an event window of 61 days, the predominance of results pointing to no signaling effect in terms of number of events analyzed leads to draw the conclusion that there is no signaling effect of dividend decisions in the Indian Stock market. The exceptions to the results can be commented upon through pronounced periods of CAAR reflecting inefficiency in the market as explained in next section.

7.1.2 Pronounced period of CAAR reflecting inefficiency in the Indian Stock market.

The study has been able to bring out inefficiencies in the market on account of following results:

a. In case of Large cap companies pronounced period of CAAR has been observed for following types of events:

i) Pronounced period of CAAR from +21 to +30 days in events of dividend increase from 10%, up to 50% or more along with announcement of financial results.

ii) Pronounced period of CAAR from +21 to +30 days in events dividend decrease from 10%, 15%, 20% and 25% along with announcement of financial results.

iii) Pronounced period of CAAR from +21 to +30 days in events of dividend increase of 10% and dividend decrease of 25%.
iv) Pronounced period of CAAR from +11 to +20 days in event of dividend increase of 20% & 25%.

v) Pronounced period of CAAR from +11 to +30 days in event of dividend increase of 50% or more.

vi) Pronounced period of CAAR from +21 to +30 days in event dividend omission.

b. In case of Mid cap companies pronounced period of CAAR has been observed for following types of events:

i) Pronounced period of CAAR from +21 to +30 days in events dividend increase of 21% & 25% and dividend decrease of 25% along with announcement of financial results.

ii) Pronounced period of CAAR from -20 to -11 days in event dividend decrease of 50% or more.

iii) Pronounced period of CAAR in event from +21 to +30 days in event dividend initiation.

c. In case of Small cap companies, pronounced period of CAAR has been observed for following types of events:

i) Pronounced period of CAAR from +11 to +20 days in event dividend increase of 15% and dividend decrease of 50% or more along with financial results announcement.

ii) Pronounced period of CAAR from +21 to +30 days in event dividend increase of 25% and dividend decrease of 10% and 15% along with financial results announcement.

iii) Pronounced period of CAAR from +11 to +20 days in event dividend increase of 15% & 50% or more and dividend decrease of 25%, 50% or more.

iv) Pronounced period of CAAR from +21 to +30 days in event dividend increase of 20% and 25%.

v) Pronounced period of CAAR from -20 to -11 days in event dividend decrease of 15%.

vi) Pronounced period of CAAR from +21 to +30 days for event dividend initiation/omission.

The pronounced periods of CAAR being quite distant from the event day reflect lag in adjustments of prices due to inefficiencies in the market arising out of information asymmetry.
The notable exceptions to results have been observed for following cases which can be attributed due to following reasons:

vii. Dividend decrease of 50% or more with announcement of financial result event by large cap companies where the pronounced period of CAAR is -10 to -01 days.

viii. Dividend increase of 15% and 50% or more along with financial results event by midcap companies where pronounced period of CAAR is -10 to -01 days.

ix. Dividend increase of 20% along with financial results event by mid cap companies where the pronounced period of CAAR is +01 to +10 days.

x. Dividend increase of 10%, 20% and 50% or more along with financial results event by small cap companies with pronounced period of CAAR being +01 to +10 days.

xi. Dividend decrease of 20% and 25% along with financial results by small cap companies in which pronounced period of CAAR is +01 to +10 days.

xii. Dividend increase of 15% event and increase of 50% or more event by mid cap companies with pronounced period of CAAR being from +01 to +10 and -10 to -01 days respectively.

The exceptions point out to random behavior in the market explainable due to chance or motivated investor behavior driven by privy information or unprocessed information expecting market to be efficient which in reality is inefficient. The results need to be viewed in the context of nature of Indian Stock Market and India as a transient emerging economy in which regulatory set up governing listing and market transactions are still evolving to make the market efficient.

7.2 Empirical support to findings from other studies

The conclusion regarding no signaling effect of dividend decisions in the Indian stock market as well as inefficient nature of the market is well supported by other works. The findings of this research are consistent with research for various markets such as Benartzi, Michaely and Thaler (1997), Daniels, Shain and Lee (1997) and Grullon, Michaely, Benartzi and Thaler (2005), Iqbal and Rahman (2002) and Amihud and Li (2006) for US market, Vieira and Raposo (2007) for UK, French and Portuguese markets, Salameh and Albahsh (2011) for Palestine market, Chen, Firth and Gao (2002) for Chinese market, Abdullah, Rashid and Ibrahim (2004) for Malaysian market, Akbar and Baig

7.3. Level of Corporate Governance and market efficiency in emerging economies

The low level of transparency also undermines efficiency of the market. In this respect following views substantiate the above statement:

i) Beekes & Brown (2006) in their study of the informational content of earnings and its impact on share prices observe that price discovery is based on the level of transparency in the market where private information gets incorporated in the market prices of listed shares.

ii) Abdelsalam & Street, 2007; Ajinkya et al., 2005, Borokhovich, Parrino, & Trapani, 1996; Fama & Jensen, 1983; Weisbach, 1988 on researches in this direction are of the view that timely release of information in the market, level of transparency and the role of independent directors also impact the level of the efficiency of the market.

iii) The timely release of information in the market influences the price discovery of share prices depending upon the mandated corporate governance practices in any country as indicated by Hab, Vergauwe and Zhang (2014).

iv) In addition, Georgakopoulos (1996) observed that informed investors tend to reap abnormal profits at the cost of others bringing distortions in share prices simultaneously affecting efficiency of the market and recommended that effective disclosure rules avert frauds, eliminates privileged shareholders collective actions and assist the market in reflecting the true value of the shares.

v) Emerging market economies including India are characterized by predominance of family business houses. Millar, Eldomiaty, Choi and Hilton (2005) found that a concentrated ownership and control on corporation by families enable them to determine the appointment of executives as well as independent directors who take decisions in sake of their interest. Nama et., al (1999), extend the argument that all key decisions are in the hands of families.

vi) The conflict of interest between dominant shareholders and minority shareholders (Aoki and Kim, 1995 and Phan 2001) widely observed in these countries is not new to India.
vii) Eroding faith in the corporate India due to accounting and financial shenanigans has been pointed out by Gupta (1998) where slow regulatory enactments have not yet contributed in soliciting the faith of retail investors. Amongst the reasons given for eroding faith include undue advantage taken by corporate managers at the cost of retail investors, existence of crony capitalism in the market, price manipulation and high volatility.

viii) The study by Sharma and Sachdeva (2011) in ‘Global Initiative towards Corporate Governance in India: Investors’ Prospective found investors dissatisfaction with regulatory norms and authorities in India and presence of widespread insider trading.

ix) Some of the major frauds related to Indian Stock Market are being mentioned in Appendix 6.1 to get an idea of the levels how corporates and individuals have taken shaken investors confidence in the past.

x) The regulatory bodies initiated many measures to restore confidence, transparency in the direction of efficiency. Appendix 6.2 captures these measures as they are relevant to the context.

The reforms and changes mentioned in Appendix 6.2 are primarily to ensure proper disclosures, good governance, transparency to help investors make rational decisions and improving the overall efficiency in the market more specifically the stock market. However, new encounters, issues and imperatives to integrate the Indian financial markets with rest of the world in terms of standards and efficiency requires continuous improvements. The recommendations in next sections are therefore being made to remove imperfections and streamline the Indian Stock market for improving its efficiency.

8. POLICY IMPLICATIONS

The findings and conclusions drawn from the study have important policy implications for corporates, regulators, investors and market intermediaries. These implications have been discussed below:

8.1 Implications for corporates

i. The signaling effect of divided decision is influenced and impacted both by the dividend rationality as well as by the efficiency level of the stock market. The optimism bias due to estimates of earnings or management of earnings to convey
unrealistic future earnings and growth potential can undermine corporate dividend rationality affecting value of the firm. Asymmetric information leads to profit making in the market and contributes to market inefficiency.

ii. The managerial implications are that dividend decision should not be made with a view to affect share price behavior but for long term sustainable growth and value.

iii. Corporate managers are expected to contribute to good governance practices through ethical conduct of actions related to material information having a bearing on the share prices of their company and not fuel inefficiency in the market through irresponsible behavior. There are evidences of unethical practices in the Indian stock Market which need to be eliminated for healthy business environment and safeguarding the interest of all the stakeholders.

iv. The transparency of disclosures by the company and dissemination of timely information to public contributes to information symmetry, improved market efficiency and improves credibility of the company in the market and its value. The signaling effect of rational dividend decisions can thus get incorporated in its market price.

v. Dividend decisions of the companies must be supported by the financial strength of the companies not by the decisions of the peer groups in the industry or market. A signal supported by the financial fundamentals of any company is a good signal while any decision or event without fundamental support must be avoided. The decision to change in dividend must be long term in nature and supported by the financial results and future prospect of the company.

vi. The degree of comprehensiveness of firms’ financial statement is also important for bringing the market transparent and efficient. In this respect comprehensive income statement as prescribed under US GAAP and instrumental in full disclosure can be considered for adoption in practice.

vii. Efficiency measures by regulation are warranted to provide protection to retail and minority shareholders devoid of full information by way of representation to Board. Voluntary action on the part of companies in this direction would speak of good governance and add credibility to board functioning in the interest of the company for it long term value creation.
8.2 Regulatory Bodies

i. Regulatory bodies such as Ministry of Corporate Affairs, SEBI and Stock Exchanges are expected to exercise more stringent measures to ensure investor protection and transparency in the market for improved efficiency through punitive and penal actions.

ii. In order to intergrate the Indian financial system internationally, mandatory movement to IFRS by all listed companies may become necessary for ensuring more disclosure, transparency and efficiency in the market.

iii. To make the disclosure prescribed disclosure norms more effective in practice, the stock exchanges are expected to ensure compliances from the listed companies through surveillance investigation, and punitive actions to deter market players companies in endulging in trading based on inside information.

8.3 Investors

Institutional investors are expected to exercise prudence and sound judgement in their stock market behavior. Due to their position and expertise, they have better understanding of the market dynamics. They are expected to make their portfolio decisions for long term capital gains instead of short term profit booking thereby giving stability to the market and preventing undue volatility which may drive herd behavior.

Retail investors must be conversant with the understanding required for making rational investment decisions rather than engage in speculative behavior. They must exercise their decisions based on analysis as irrational behavior on their part adds to inefficiency of the market. Investor education would facilitate more responsible behavior and protection of interests of the retail investors and would simultaneously spread the equity culture in the country. This would force companies to incorporate improved information characteristics to help investors make rational investment decisions based on quality of information.

9. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

i) This study covers only cash dividend related events of Large cap, mid cap and small cap companies numbering 103 common to NSE and BSE Indices as representing Indian Stock market. Larger sample of companies would be able to give more substantive results.
ii) Buyback of shares and bonus shares have not been included in the study. The study can also be extended to examine signaling of the events pertaining to non-cash dividends such as buyback of shares and issue of bonus shares.

iii) In the selection of events we have considered minimum 10% change in dividend for the inclusion of event in the study. It is also possible to examine the expected dividend and dividend surprise to see the effect on the share prices.

iv) Though the GARCH model used in this study is regarded as advanced market model for event analysis, other statistical models such as Arma, WLS etc can also be used to compare the results of this study.

v) This study considered only one factor for analysis i.e dividend change. Owner structure is supposed to play a vital role in dividend decision and therefore correlating dividend change decision with ownership structure can provide interesting insights about dividend decisions of business houses which control almost 50% of the big businesses in India.

vi) This study examined events over a span of 10 years from FY 2001 to FY 2011. A structural break analysis can be performed by dividing the period under study to compare relative effects of signaling as well as levels of efficiency.
References


