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A Study on Cross-Sectional Dependence and Independence Approach in an Event Study- A Case with SENSEX

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Abstract

Purpose:
The objective of the study is to make a comparative analysis of the result of an event study on the effect of quarterly earnings announcement on stock returns of firms constituting SENSEX. The comparative study is pursued by incorporating cross sectional dependence adjustment as well cross sectional independence adjustment, side-by-side, in the estimation of standard deviation of Average Abnormal Return (AAR).

Methodology:
Event study methodology using daily returns and market model has been used for the present study. The variance of AAR has been computed under cross sectional dependence as well cross-sectional independence approaches.

Findings:
The study reveals that the result of an event study analysis under cross sectional dependence adjustment and cross sectional independence adjustment, has largely been similar.

Research limitations:
The present study involves study of the firms listed in BSE SENSEX. The effect of the quarterly earnings announcement with reference to firms listed in other indices, if covered, may provide different sets of results.

Value:
The paper identifies the significance of cross sectional dependence adjustment as well as cross-sectional independence adjustment in the event study analysis of quarterly earnings announcement.

Keywords: Event Study, BSE-SENSEX, Quarterly Earnings Announcements, Cross Sectional Dependence Approach and Cross Sectional Independence Approach.

Introduction

The reaction of the stock market to various corporate announcements has been documented in a large number of empirical studies. One such significant corporate announcement, which has bearing on the stock price movement of the firm, is earnings announcements. Earnings announcement serves as an indicator of the financial performance of the firm as well as its future growth prospectus. And therefore, the information content of earnings announcement is a matter of great importance to the investors. The impact of the announcement on stock prices islargely assessed by analyzing the security prices over a relatively short time periodusing event study methods (MacKinlay, 1997). An event study typically tries to examine the stock return behaviour for a sample of firms experiencing common type of events like earnings announcements, stock split announcements or any other corporate announcements. Central to event study is the measurement of the sample securities abnormal stock return around the time of an event. The abnormal returns are aggregated over many event observations to arrive at average abnormal return (AAR) and finally the null hypothesis that the mean abnormal performance is zero, is being tested.

The basis of inferences, in an event study, is a test statistic which is a ratio of the AAR to its estimated standard deviation. The variance or standard deviation of AAR can be found by adopting either of the two approaches

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– (i) Cross-section Dependence Assumption and (ii) Cross-section Independence Assumption. However, the empirical studies have provided mixed prediction about the seriousness of bias that would arise when cross-sectional dependence in data is ignored in event study analysis on price effect of earnings announcements. Hence a comparative analysis of the results of event study of earnings announcements using both the approach could be an important empirical issue.

The objective of the present study is to make a comparative analysis of the result, of an event study on the effect of quarterly earnings announcement on stock returns of firms constituting SENSEX. The comparative study is pursued by incorporating cross-sectional dependence adjustment as well cross-sectional independence adjustment, side-by-side, in the estimation of standard deviation of AAR.

The rest of the paper is organised as follows. The second section reviews the available literature on the event study analysis of the impact of earnings announcement on stock return in national and international context, where either or both the approaches have been adopted. The next section discusses the objectives of the study and highlights the methodology adopted. The analysis of data and interpretation of results are undertaken in the subsequent section. The fifth and final section concludes the discussion.

Review of Related Literature on Event Study Analysis

In the Indian context, there are some empirical studies on the impact of earnings announcement on stock price movement. Although these research studies have focused on the price effect of earnings announcements but most of them have not address the issue of cross-sectional dependence adjustment and cross-sectional independence adjustment in event study methodology. Infact, the review of selected empirical studies on effect of earnings announcement on stock returns using event study methodology revealed that the researchers have frequently adopted an approach that ignores cross-sectional dependence (MacKinlay, 1997; Odabasi, 1998; Gupta, 2006; Iqbal *et al.*, 2007; Das *et al.*, 2007, 2008 (a), (b); Mlonzi *et al.*, 2011; Mahmoudi *et al.*, 2011; Saravanakumar *et al.*, 2012). Incorporation of cross-sectional dependence adjustment in event study methodology have been found to have direct bearing on the test statistic which is used to draw inferences in event study and this has amply been demonstrated in some of the studies on event study methods carried out in international arena.

Some of the prominent Indian studies on the impact of earnings announcement on stock price movement are as under.

Chaturvedi (2000) studied the stock price reaction to semi-annual earnings announcement and found abnormal returns both during the pre and post announcement dates. Mallikarjunappa and Iqbal (2003) and Mallikarjunappa (2004) found that the Indian stock market did not react immediately to the quarterly earnings announcements. The authors observed that the Indian market is not efficient in the semi strong form. Manickraj (2004) investigated the effect of the quarterly earnings announcements on share price movement and found that the information conveyed by quarterly announcements was quickly reflected in stock prices.

Gupta (2006) investigated the stock market reaction associated with earnings announcements made in a single quarter (March 2004), of companies constituting CNX Nifty Index. The author concluded that there exists a scope to earn abnormal returns by formulating appropriate trading strategy by the investor during the period surrounding earnings announcement.

Das *et al.* (2007) studied the effect of quarterly earnings announcements made by companies constituting SENSEX for a quarter. Contrary to most of the research studies on earning releases, they found that the quarterly earning announcement releases by the sample companies did not have substantial impact on stock return. However, this study was limited to a single quarter earning releases comprising thirty announcements only.

Iqbal and Mallikarjunappa (2007) examined the stock market reaction to quarterly earnings announcements made by all those companies that had 20% or above foreign holdings and were traded on Bombay Stock Exchange (BSE) for more than 40% of the trading days of the year during September 2001 quarter. The author observed that the abnormal returns were positive but statistically not significant for the majority of days for full sample, 'good news' sub-sample and 'bad news' sub-sample.

Das *et al.*, (2008, a) investigated the effect of quarterly earnings announcements on security returns of the firm constituting SENSEX over the period of one year from June 1, 2006 and May 1, 2007. The authors did not find evidence of significant abnormal returns for all the three portfolios i.e. full sample, 'good news' sub-sample and 'bad news' sub-sample. Further the study could not establish drifting up of share price in case of 'good news' announcements and drift down in case of 'bad news' announcements. Das *et al.*, (2008, b) further examined the impact of quarterly earnings releases on the security returns of the firm constituting SENSEX. The significance of clustering of dates of the earnings announcements in the design of the testing framework of abnormal return was incorporated in the study. The authors did not find evidence of significant abnormal returns for all the three portfolios. Further the study could not establish drifting up of share price in case of positive earnings surprises and drift down in case of negative earnings surprises.

Saravanakumar *et al.*, (2012) examined the abnormal returns of earnings announcements during the pre-announcement and post-announcement period, of 50 Nifty companies listed on National Stock Exchange (NSE) for a single quarter. The research study concluded that announcement of quarterly earnings did not convey any useful information to the investors and investors did not gain from earnings announcements.

There are numerous studies on the price effect of earnings announcements using event study in international context. The empirical studies on event study methods, in international context, which have documented evidences that the non-incorporation of cross sectional dependence adjustment in the estimation of variance may lead to incorrect inferences are as under.

Bernard (1987) observed that the assumption of independence of abnormal returns yields biased estimates of standard errors and therefore can lead to incorrect inferences. The author further observed that the previous literature on event study analysis provides mixed prediction about the seriousness of bias that would arise when cross-sectional dependence in data is ignored in typical accounting and finance context.

Christie (1986) found no evidence that cross-sectional dependence in data cause serious bias in standard error. Brown and Warner (1980, 1985) draw similar conclusion with regard to event study in simulated environment. They argue that adjustment for cross-sectional dependence is not always necessary for reasonable test statistic specification. If the degree of dependence is small, as is in studies where event dates are not clustered, ignoring the dependence induces little bias in variance estimates. They further reported that procedures assuming independence can apply even when there is clustering, and all securities of a given sample have the same event date. On the other hand, Beaver (1981) and Dent and Collins (1981) reported that when there is positive cross-sectional dependence, failure to make such an adjustment result in a systematic underestimation of the variance of the mean excess return, implying too many rejection of the null hypothesis, both when it is true and when abnormal performance is present.

Sefcik and Thompson (1986) described hypothetical situation where, when cross-sectional dependence is ignored, true standard errors would exceed reported standard error by several order of magnitude (Bernard, 1987).

Identification of Research Gap and Rationale for Proposed Study

From the brief review of related literature produced, following research gaps in Indian context can be identified with respect to the incorporation of cross-sectional dependence adjustment in an event study analysis of earnings announcements:

Event studies conducted on earnings announcement, in Indian context, are based on cross-sectional independence assumptions and does not incorporate cross-sectional dependence adjustment factor in the design of the testing framework of abnormal return. However, empirical studies in international context,provides mixed prediction about the seriousness of bias that would arise when cross-sectional dependence in data is ignored in typical accounting and finance context. Hence, it remains inconclusive to understand the effect of the incorporation of cross sectional dependence adjustment in an event study analysis of earnings announcements.

Objective of the Study

The objective of the study is to make a comparative analysis of the result, of an event study on the effect of quarterly earnings announcement on stock returns of firms constituting SENSEX. The comparative study is pursued

by incorporating cross-sectional dependence adjustment as well cross sectional independence adjustment, side-by-side, in the estimation of standard deviation of AAR.To achieve this objective, event study analysis of quarterly earnings announcements of companies constituting SENSEX for two different periods i.e. FY 2001-02 to 2005-06 and FY 2006-07 to FY 2010-11, have been undertaken.

Database and Research Methodology

Data and their Source

The data, used for comparative analysis of the result of an event study on the effect of quarterly earnings announcement on stock returns of firms constituting SENSEX, by adopting both the approaches, are obtained from the corporate database of the Capital Line.

The quarterly earnings announcements corresponding to the quarterly earnings for the first quarter of the financial year 2001-02 through the last quarter of the financial year 2010-11, have been taken up for the study. On May 22, 2006, the SENSEX plunged by 1100 points during intra-day trading, leading to the suspension of trading for the first time since May 17, 2004. It caused investors to lose Rupees Six Lakh Crore (US$131 billion) within seven trading sessions of May, 2006. When trading was suspended during that period, the then Finance Minister of India, Mr. P. Chidambaram, made an unscheduled press statement to assure investors that nothing was wrong with the fundamentals of the economy, and advised retail investors to stay invested. This event in Indian stock market is used as a base for the present study. Moreover, the period i.e. FY 2001-02 to FY 2005-06 and the period FY 2005-06 to FY 2010-11 represent two different market condition of Indian economy – boom followed by recession. Hence, analysis of quarterly earnings announcements on stock price movement during the five year period prior to trading suspension (FY 2001-02 to FY 2005-06), and similar analysis during the five year period following the trading suspension (FY 2005-06 to FY 2010-11) have been carried out separately in this study.

The ten year data for thirty firms provide a total sample of 773 quarterly earnings announcements. Out of the total 773, 379 quarterly earnings announcements correspond to the period ranging from first quarter of the financial year 2001-02 to fourth quarter of financial year 2005-06 while 394 quarterly earnings announcements correspond to the period from first quarter of the financial year 2006-07 to fourth quarter of the financial year 2010-11. All those quarterly earnings announcements of the firms are excluded from the sample:

(i) where the earnings announcement on a given date is coupled with other announcements like dividend announcements, stock splits, merger and acquisition and amalgamation. When multiple announcements are made on a given day, it becomes difficult to segregate the effect of quarterly earnings released from other announcements. Hence such quarterly earnings releases have not been considered in the study.

(ii) where there is lack of availability of quarterly announcement date data.

Methodology Adopted

The general framework for conducting an event study, to analyze the effect of quarterly earnings announcement on stock prices has been outlined in the following steps. The framework is based on the discussion of event studies by Brown and Warner(1980, 1985); MacKinlay (1997); Campbell *et al.*(1997); Kothari and Warner (2006). The present study is also largely based on it.

(i) Defining the event of interest

The initial task of conducting an event study is to define the event of interest. An event study typically tries to examine return behaviour for a sample of firms experiencing a common type of event. For example, in the context of quarterly earnings announcement studies, the quarterly earnings announcement is considered as the event.

(ii) Defining the selection criteria for the inclusion of firms

After identifying the event, it is necessary to determine the selection criteria for the inclusion of a given firm in the study. The criteria may involve restrictions imposed by data availability or may involve restrictions such as membership in a specific industry.

(iii) Defining the Event Window and Event Date

Event window refers to the period over which security prices of the firms associated with the event that shall

be examined. It is customary to expand the event window to multiple days. This permits examination of the period surrounding the event. Generally the event window comprises of pre-announcement period, the day of announcement and post-announcement period. The periods prior to the announcement is taken in order to explore the possibility that the market may acquire information about the earnings prior to actual announcement and one can investigate this possibility by examining the pre-event returns of the securities. While the post-event period permits examination of the price effects of announcements for days subsequent to the announcement day and provide information on market efficiency i.e. the speed of adjustment to the information revealed at the time of event into security prices (Kothari and Warner, 2006).

The day of the announcement is considered to be the event date. If return be indexed in event time using 't' then t = 0 is defined as announcement date.

(iv) Determination of the length of observation interval

It is necessary to specify the length of observation interval for the event study analysis. The length of observation interval may be monthly interval, daily interval and intraday period etc. However, the review of available literature identifies the daily return as the most common form of interval used in studies in relation to impact assessment of announcements on stock returns.

(v) Computation of Returns of the Firms and Returns of the Market Index

Depending upon the length of observation interval – daily, monthly etc., the stock returns are to be computed. For example, in case of event study using daily returns, the daily returns of the firms (R_{it}) and the corresponding market index (R_{mt}) can be calculated using the following formula:

Current daily return = (Current closing price – previous closing price) / previous day closing price.

(vi) Measure of Normal Return using Market Model

The normal return is defined as the expected return without conditioning on the event taking place. The Market Model for any security iis given by

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

where, R_{it} is the return on security i on day t,

R_{mt} is the return on the market index on day t,

α_i , β_i , and $\varepsilon_{it}$are called the parameters of the market model.

Ordinary least squares (OLS) method to determine the Market Model parameter: If $t = T_0 + 1$ to $t = T_1$ represent the estimation window of length L_1 such that $L_1 = T_1 - T_0$. Then for i^{th}firm in event time, the OLS estimators of the market model parameters for an estimation window of observations are given as under:

$$\beta_i = \frac{\sum_{T_0+1}^{T_1} (R_{it} - \mu_i)(R_{mt} - \mu_m)}{\sum_{T_0+1}^{T_1} (R_{mt} - \mu_m)^2} \quad \text{(ii)}$$

$$\alpha_i = \mu_i - \beta_i * \mu_m \quad \text{(iii)}$$

$$\sigma^2_{\varepsilon_i} = \frac{\sum_{T_0+1}^{T_1} (R_{it} - \alpha_i - \beta_i R_{mt})^2}{L_1 - 2} \quad \text{(iv)}$$

where,

$$\mu_i = \frac{\sum_{T_0+1}^{T_1} R_{it}}{L_1}$$

and,

$$\mu_m = \frac{\sum_{T_0+1}^{T_1} R_{mt}}{L_1}$$

(vii) Determination of Estimation Window

Estimation window refers to the period during which the security returns of the firms are used to estimate the parameters of normal performance model. The most common choice is using the period prior to the event window for the estimation window. Generally the event period is not included in the estimation period to prevent the event from influencing the normal performance model parameter estimates.

(viii) A Measure of Abnormal Return

Event study methodology is build around the assumption that the event impact is captured by abnormal returns. Abnormal return is the part of the movement in stock return of a firm that is not correlated with overall movement in stock prices and therefore may reflect unexpected firm-specific factors. Appraisal of the effect of announcement (event) requires a measure of the abnormal return. Abnormal return is the actual ex-post return of the security over the event window, minus the normal return of the firm over the event window. In other words, abnormal return is the difference between the return conditional on the event and the expected return unconditional on the event.

Thus the abnormal return (AR_{it}) for security i on event day t is calculated as under:

$$AR_{it} = R_{it} - \alpha_i - \beta_i R_{mt}$$

The abnormal return is the disturbance term of the market model calculated on an out of sample basis. The abnormal returns will be jointly normally distributed with a zero conditional mean and conditional variance $\sigma^2(AR_{it})$. The variance is given by

$$\sigma^2(AR_{it}) = \sigma_{\varepsilon_i}^2 \text{ (for large estimation window)}$$

(ix) Computation of Abnormal Return

Corresponding to each quarterly earnings announcements of the respective firms associated with the event under study, the abnormal returns (AR_{it}) are calculated for each period of the event window. If $t = T_1 + 1$ to $t = T_2$ represent the event window then the abnormal return for each event period $t = T_1 + 1, T_1 + 2, T_1 + 3, T_1 + 4, \ldots\ldots\ldots\ldots T_2$

(x) Assignment of Quarterly Earnings Announcements to 'Good News' Sub-Sample and 'Bad News' Sub-Sample

To facilitate the examination of the impact of the quarterly earnings announcement on stock price movement, it is essential to hypothesize the relation between quarterly earnings announcement and change in the value of equity. If the actual announced quarterly earnings exceed market expectation, there should be a positive impact on share prices i.e. increase in the value of equity and the announcement may be assigned to 'good news' sub-sample. On the other hand, if the announced quarterly earnings fall short of market expectation, then there should be a decrease in the value of equity and the announcement may be assigned to 'bad news' sub-sample. In an event study, the effect of the announcement on stock prices is studied with reference to full sample basis, considering all the announcements, 'good news' sub-sample and 'bad news' sub-sample.

(xi) Aggregation of abnormal returns

The abnormal return observations must be aggregated in order to draw overall inferences for the event of interest i.e. quarterly earnings announcements. This aggregation is along two dimensions – across securities and through time (event window). The concept of average abnormal return (AAR) and cumulative average abnormal return (CAAR) is necessary to accommodate the aggregation along two dimensions. For a sample of N securities, the cross-sectional average abnormal return at any time t in the event window is defined as:

$$AAR_t = \frac{\sum_{i=1}^{N} AR_{it}}{N}$$

The cumulative effect of average abnormal return on days surrounding the event i.e. for event days t_1 through t_2 is defined as

$$CAAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AAR_t$$

The aggregation is done for each of the three portfolios i.e. the full sample consisting of all announcements, 'good news' sub-sample as well as 'bad news' sub-sample so that the effect of announcement can be analyzed separately on each of the portfolio.

(xii) Estimation of Variance of the Average Abnormal Returns (AAR)

The variance of the average abnormal return (AAR) can be estimated under either of the two following assumptions:

***Cross-sectional Independence Assumption*:** Under cross-sectional independence assumption, it is assumed that, the event windows of the securities included in the event study analysis do not overlap in calendar time and, therefore, the co-variance between the abnormal returns

across securities is zero. Under such assumption, the variance of the AAR for the period 't' is given as under (MacKinlay, 1997).

$$\text{Var}(\text{AAR}_t) = \frac{\sum_{i=1}^{N} \sigma_{\varepsilon_i}^2}{N^2}$$

$$\text{where, } \sigma_{\varepsilon_i}^2 = \frac{\sum_{T_0+1}^{T_1} (\text{R}_{\text{it}} - \alpha_{\text{i}} - \beta_i R_{mt})^2}{L_1 - 2}$$

***Cross-sectional Dependence Assumption*:** Under cross-sectional dependence assumption, the event windows of the securities included in the event study analyses do overlap and the co-variance between the abnormal returns across securities will not be zero. To account for the dependence across firms' average residuals, in event time, Brown and Warner (1980) suggested that the standard deviation of average residuals should be estimated from the time series of the AARs over the estimation period, using formula given below (Serra, 2002).

If $t = T_0 + 1$ to $t = T_1$ represent the estimation window of length L_1 such that $L_1 = T_1 - T_0$, then for N events, the variance measure is given as under:

$$\text{Var}(\text{AAR}_t) = \frac{\sum_{T_0+1}^{T_1} \left[\frac{\sum_{i=1}^{N} AR_{it}}{N} - AR^* \right]^2}{L_1 - 2}$$

where,

$$\text{AR}^* = \frac{\sum_{i=1}^{N} \left(\frac{\sum_{T_0+1}^{T_1} AR_{it}}{L_1} \right)}{N}$$

(xiii) Design of the Testing Framework for Average Abnormal Return

The basis of inference in event study is a test statistic which is a ratio of the AAR to its estimated standard deviation (MacKinlay, 1997; Kothari and Warner, 2006).

For a given performance measure, such as AAR, the test statistic is compared to its assumed distribution under the null hypothesis that average abnormal performance equals zero. The null hypothesis is rejected if the test statistic exceeds a critical value typically corresponding to a given level of significance (usually 5 %).

If $\boldsymbol{\Omega}$ be the test statistic for AAR, then $\boldsymbol{\Omega}_{\text{AAR}}$ is defined as under.

$$\boldsymbol{\Omega}_{\text{AAR}} = \frac{AAR_t}{\sqrt{Var(AAR_t)}}$$

For the present study, an event window of 41 days (t= -20 to t= 20) has been taken up for investigation.

For each announcement, the 250 trading days prior to the event window (technically called 'estimation window') is used to determine the parameters for the market model. Ordinary least squares (OLS) method has been applied to determine the Market Model parameter. A simple expectation model is used in order to tap market expectations of quarterly earnings. The model compares the adjusted EPS for the current quarter with that of previous quarter. Based on the model, the earnings announcements of each of the firm are assigned to any one of the two categories – 'good news' announcement and 'bad news' announcement. 'Good news' announcements refer those announcements, in which the adjusted EPS of the current quarter exceed previous quarter earnings. While bad news announcement refers all those announcements, in which the adjusted EPS of the current quarter is less than earnings of the previous quarter.

The abnormal returns, corresponding to all 'good news' announcements of all the firms, are aggregated and averaged for each event day, across the cross-section. For the sake of simplicity, the sample is called *'aggregated good news'* sample.

Similarly, the abnormal returns, corresponding to all 'bad news' announcements of all the firms, are aggregated and averaged for each event day, across the cross-section, and named *'aggregated bad news'* sample. While, the abnormal returns, corresponding to all the 'good news' and all the 'bad news' announcements of all the firms, are aggregated and averaged for each event day, across the cross-section, and named *'aggregated full'* sample.

In order to analyze the effect of quarterly earnings announcements on stock prices for the period before and after the trading suspension, the aggregation of abnormal return for each of the three portfolios i.e. 'aggregated good news' sample, 'aggregated bad news' sample and 'aggregated full' sample has been carried out with respect to the following sets.

(a) the quarterly earnings announcements of all the companies constituting SENSEX during the period from first quarter of the financial year 2006-07 to last quarter of the financial year 2010-11. For ease of reference, the set is termed as **'set A'.**

(b) the quarterly earnings announcements of all the companies constituting SENSEX during the period from first quarter of the financial year 2001-02 to last quarter of the financial year 2005-06. This set has been termed as **'set B'.**

Table 1A: Results of 'Aggregated Full' Sample during the Period Following the Temporary Suspension of Trading

Event Days	*AAR*	*Cross-sectional Dependence: Z(AAR)*	*Cross-sectional Independence: Z(AAR)*
-20	-0.0078	-0.0757	-0.0763
-19	0.0586	0.5719	0.5763
-18	0.0969	0.9454	0.9527
-17	0.0096	0.0940	0.0947
-16	0.0289	0.2819	0.2841
-15	0.0013	0.0129	0.0130
-14	0.0870	0.8494	0.8560
-13	-0.0170	-0.1660	-0.1673
-12	0.1416	1.3820	1.3927
-11	-0.0034	-0.0336	-0.0339
-10	-0.0601	-0.5864	-0.5910
-9	-0.0078	-0.0764	-0.0770
-8	-0.2341	-2.2844	-2.3021
-7	-0.1735	-1.6932	-1.7063
-6	-0.0071	-0.0697	-0.0702
-5	-0.2781	-2.7148	-2.7358
-4	-0.0989	-0.9651	-0.9726
-3	-0.2026	-1.9771	-1.9924
-2	0.1500	1.4640	1.4753
-1	0.1678	1.6378	1.6504
0	-0.2548	-2.4866	-2.5058
1	-0.2540	-2.4790	-2.4982
2	0.1095	1.0692	1.0775
3	-0.0539	-0.5262	-0.5303
4	-0.0744	-0.7259	-0.7316
5	0.1302	1.2713	1.2811
6	0.0371	0.3622	0.3650
7	-0.0566	-0.5524	-0.5567
8	-0.0525	-0.5126	-0.5166
9	-0.0330	-0.3221	-0.3246
10	0.0125	0.1225	0.1234
11	0.0860	0.8393	0.8458
12	-0.1114	-1.0874	-1.0958
13	0.0456	0.4455	0.4490
14	-0.1377	-1.3438	-1.3542
15	0.0190	0.1855	0.1869
16	0.0364	0.3557	0.3585
17	-0.0169	-0.1653	-0.1666
18	-0.1289	-1.2581	-1.2679
19	-0.0524	-0.5114	-0.5154
20	0.1408	1.3740	1.3846

Source: Compiled from *Capital Line Database*.

For the present study, the estimation of variance of average abnormal returns using cross-section dependence approach as well as cross-section independence approach have been adopted side-by-side. With regard to each portfolio i.e. 'aggregated good news' sample, 'aggregated bad news' sample and 'aggregated full' sample corresponding to the 'Set A' and 'Set B' following hypotheses are tested:

1. the AAR of the sample of firms announcing quarterly earnings is zero on the announcement date;
2. the AARs of the sample of firms announcing quarterly earnings is zero on days surrounding the announcement in the event window;

In this paper, Z (AAR) represent the values of test statistic for AAR. The test has been carried out at 5% level of significance.

Results and Analysis

Analysis of AAR of 'Aggregated Full' Sample during the Period Following Trading Suspension

Event study of 'aggregated full' sample of 'set A' consisting of 394 quarterly earnings announcements has been undertaken. The event study is performed under cross-sectional independence assumption, and under cross-sectional dependence assumption. The results of 'aggregated full' sample are presented in Table 1 A.

Analysis of AAR under Cross-section Independence Approach

It is observed that on the day of announcement i.e. when t = 0, AAR = -0.2548, is significant at 5% level of significance. This implies that the quarterly earnings

announcements have effect on the stock prices on the day of announcement; hence, the null hypothesis that AAR is zero on the day of announcement is rejected. AARs are found to be significant for 12.20 % of days of the event window. This rejects the existence of abnormal returns for the majority of days in the event window.

Analysis of AAR under Cross-section Dependence Approach

Under cross-sectional dependence approach, it is observed that on the day of the announcement i.e. when t = 0, the AARis significant at 5% level of significance. The average abnormal return was found to be significant on event days, t = 1; t = -3; t = -5 and t = -8. The AARs, on rest of the event days in the event window, are not significant. The results of the analysis of the test statistic, under cross-sectional dependence approach and cross-sectional independence approach has been quite similar for the 'aggregated full' sample. The results are consistent with the findings of Brown and Warner (1985).

Analysis of AAR of 'Aggregated Full' Sample During the Period Prior to Trading Suspension

Event study of 'aggregated full' sample of 'set B' consisting of 379 quarterly earnings announcements has been undertaken, the event study is performed under cross-sectional independence assumption, and under cross-sectional dependence assumption.

Table 1B: Results of 'Aggregated Full' Sample during the Period Prior to Temporary Suspension of Trading

Event Days	*AAR*	*Cross-sectional Dependence: Z(AAR)*	*Cross-sectional Independence: Z(AAR)*
-20	0.0481	0.3737	0.4382
-19	0.0510	0.3965	0.4650
-18	-0.0131	-0.1017	-0.1192
-17	0.0698	0.5427	0.6364
-16	0.1370	1.0650	1.2490
-15	0.0241	0.1870	0.2193
-14	-0.1011	-0.7858	-0.9215
-13	-0.1606	-1.2483	-1.4639
-12	0.0273	0.2126	0.2493
-11	-0.0270	-0.2096	-0.2458
-10	-0.0514	-0.3994	-0.4684
-9	-0.0353	-0.2745	-0.3219
-8	-0.0056	-0.0433	-0.0508
-7	0.0643	0.5000	0.5863
-6	-0.0533	-0.4143	-0.4859
-5	-0.1172	-0.9112	-1.0686
-4	0.0266	0.2071	0.2429
-3	0.0010	0.0075	0.0088
-2	0.0516	0.4008	0.4700
-1	-0.1630	-1.2676	-1.4866
0	-0.1751	-1.3610	-1.5961
1	0.0581	0.4516	0.5296
2	-0.1102	-0.8567	-1.0047
3	-0.0019	-0.0149	-0.0175
4	0.2371	1.8437	2.1622
5	0.3232	2.5127	2.9467
6	0.0242	0.1878	0.2202
7	0.0346	0.2687	0.3151
8	0.0779	0.6060	0.7107
9	-0.1415	-1.0998	-1.2897
10	0.0738	0.5740	0.6732
11	0.0887	0.6895	0.8086
12	-0.1981	-1.5403	-1.8063
13	-0.1571	-1.2211	-1.4320
14	-0.0606	-0.4709	-0.5523
15	0.1115	0.8672	1.0170
16	0.0840	0.6534	0.7663
17	-0.1004	-0.7808	-0.9157
18	0.0106	0.0823	0.0965
19	0.0073	0.0568	0.0666
20	-0.1514	-1.1773	-1.3806

Source: Compiled from *Capital Line Database*.

Analysis of AAR under Cross-section Independence Approach

It is observed that on the day of announcement i.e. when t = 0, AAR = -0.1751, is not significant at 5% level of significance. This implies that the quarterly earnings announcements do not have effect on the stock prices on the day of announcement; hence, the null hypothesis that AAR is zero on the day of announcement is accepted. Further, it is observed that during the pre-announcement period, the AARs are not statistically significant. This means that the market had not reacted to earnings

information prior to actual announcement. During the post event window, AAR is significant only at t = 4 (AAR = 0.2371) and t = 5 (AAR = 0.3232). The AARs on rest of the days in the post event window period are not statistically significant at 5% level of significance. Thus, the existence of abnormal returns for the majority of days in the event window is rejected.

Analysis of AAR under Cross-section Dependence Approach

Under cross-sectional dependence approach, it is observed that on the day of announcement i.e. when t = 0, AAR = -0.1751, is not significant at 5% level of significance. This implies that the quarterly earnings announcements do not have effect on the stock prices on the day of announcement; hence, the null hypothesis that AAR is zero on the day of announcement is accepted. Further, it is observed that during the pre-announcement period, the AARs are not statistically significant. This means that the market had not reacted to earnings information prior to actual announcement. Throughout the event window, AAR is significant only at t = 5 (AAR = 0.3232). The AARs on rest of the days in the pre-event window period and post-event window period are not statistically significant at 5% level of significance. This rejects the existence of abnormal returns for the majority of days in the event window. The results of the analysis of the test statistic, under cross-sectional dependence approach and cross-sectional independence approach has been similar for the 'aggregated full' sample. The results are consistent with the findings of Brown and Warner (1985).

Table2A: Results of 'Aggregated Good News' Sample during the Period Following Trading Suspension

Event Days	*AAR*	*Cross-sectional Dependence: Z(AAR)*	*Cross-sectional Independence: Z(AAR)*
-20	-0.0494	-0.40	-0.38
-19	-0.0714	-0.58	-0.54
-18	0.1288	1.04	0.98
-17	0.0650	0.53	0.49
-16	0.0444	0.36	0.34
-15	-0.0267	-0.22	-0.20
-14	-0.0824	-0.67	-0.63
-13	-0.0116	-0.09	-0.09
-12	0.1837	1.49	1.40
-11	0.0240	0.19	0.18
-10	0.0837	0.68	0.64
-9	-0.0845	-0.69	-0.64
-8	-0.1129	-0.91	-0.86
-7	-0.0605	-0.49	-0.46
-6	-0.0222	-0.18	-0.17
-5	-0.2652	-2.15	-2.02
-4	-0.0664	-0.54	-0.51
-3	-0.1723	-1.40	-1.31
-2	0.1597	1.29	1.22
-1	0.4256	3.45	3.24
0	0.1054	0.85	0.80
1	-0.1869	-1.51	-1.42
2	-0.0810	-0.66	-0.62
3	0.0382	0.31	0.29
4	-0.2513	-2.04	-1.91
5	0.2005	1.62	1.53
6	-0.0187	-0.15	-0.14
7	-0.0763	-0.62	-0.58
8	-0.2341	-1.90	-1.78
9	-0.0082	-0.07	-0.06
10	-0.0272	-0.22	-0.21
11	-0.0653	-0.53	-0.50
12	-0.0498	-0.40	-0.38
13	0.1219	0.99	0.93
14	-0.1340	-1.09	-1.02
15	-0.0202	-0.16	-0.15
16	-0.0469	-0.38	-0.36
17	-0.1341	-1.09	-1.02
18	-0.1257	-1.02	-0.96
19	-0.0234	-0.19	-0.18
20	-0.0460	-0.37	-0.35

Source: Compiled from *Capital Line Database*.

Analysis of AAR of 'Aggregated Good News' Sample During the Period Following Trading Suspension

Event study of 'aggregated good news' sample of 'set A', consisting of 221 quarterly earnings announcements, has been undertaken. The event study was performed under cross-sectional independence assumption as well as by incorporating cross-sectional dependence adjustment.

Analysis of AAR under Cross-section Independence Approach

On the day of announcement of quarterly earnings results i.e. when t = 0, the AAR is 0.1054, which is positive but statistically insignificant at 5 % level of significance. Hence, the null hypothesis that average abnormal return is zero on the announcement day is not rejected. It is observed that all the AARs in the pre-event window period (t = -20 to t = -1) are not significant except on event days, t = -1 and t = -5. Further, all the AARs during the post-event window (t = 1 to t = 20) are also not significant. Thus only 4.9 % of AARs during the event window were found to be significant at 5 % level of significance. This rejects the existence of abnormal returns for the majority of days in the event window.

Analysis of AAR under Cross-Section Dependence Approach

Under cross-sectional dependence assumption, it is observed that AAR on the day of announcement of event is insignificant, and, therefore the null hypothesis that average abnormal return is zero is accepted. The AAR on event date t = -5; t = -1; and t = 4 is found to be significant at 5 % level of significance. For rest of the days in the pre-event period and post-event period of the event window, AARs are not significant. This rejects the existence of significant abnormal returns for majority of days in the event window. AAR is found to be significant on t = 4 under cross-sectional approach and this is not observed when cross-sectional independence approach is undertaken; barring this, both the approach of analyzing the test statistic has given similar results.

Analysis of AAR of 'Aggregated Good News' Sample During the Period Prior to Trading Suspension

Event study of 'aggregated good news' sample of 'set B', consisting of 209 quarterly earnings announcements, has been undertaken. The event study was performed under cross-sectional independence assumption as well as by incorporating cross-sectional dependence adjustment.

Table 2 B: Results of 'Aggregated Good News' Sampleduring the Period Prior to Trading Suspension

Event Days	*AAR*	*Cross-sectional Dependence: Z(AAR)*	*Cross-sectional Independence: Z(AAR)*
-20	0.0996	0.6744	0.7025
-19	0.1424	0.9645	1.0046
-18	0.0606	0.4105	0.4275
-17	0.1100	0.7450	0.7759
-16	0.1988	1.3464	1.4024
-15	0.1184	0.8022	0.8355
-14	-0.0287	-0.1947	-0.2028
-13	-0.2313	-1.5665	-1.6317
-12	0.1358	0.9201	0.9583
-11	-0.0431	-0.2918	-0.3039
-10	-0.0869	-0.5884	-0.6128
-9	-0.1319	-0.8932	-0.9303
-8	0.1290	0.8740	0.9103
-7	0.2162	1.4641	1.5250
-6	-0.1932	-1.3086	-1.3630
-5	-0.0332	-0.2247	-0.2341
-4	0.1110	0.7519	0.7832
-3	0.0798	0.5402	0.5626
-2	0.0248	0.1681	0.1751
-1	-0.0834	-0.5648	-0.5882
0	-0.2029	-1.3739	-1.4310
1	0.3714	2.5152	2.6198
2	-0.1042	-0.7055	-0.7348
3	-0.1795	-1.2155	-1.2661
4	0.1465	0.9920	1.0333
5	0.4191	2.8383	2.9563
6	-0.0994	-0.6729	-0.7009
7	-0.0217	-0.1468	-0.1529
8	0.0471	0.3188	0.3320
9	-0.2080	-1.4088	-1.4673
10	-0.0291	-0.1974	-0.2056
11	0.1215	0.8229	0.8571
12	-0.2603	-1.7631	-1.8364
13	-0.0855	-0.5790	-0.6030
14	-0.0726	-0.4919	-0.5123
15	-0.0461	-0.3121	-0.3251
16	0.1776	1.2029	1.2529
17	-0.2292	-1.5523	-1.6168

Event Days	AAR	Cross-sectional Dependence: Z(AAR)	Cross-sectional Independence: Z(AAR)
18	0.0649	0.4394	0.4577
19	0.0615	0.4167	0.4340
20	-0.1708	-1.1569	-1.2050

Source: Compiled from *Capital Line Database*.

Analysis of AAR under Cross-section Independence Approach

On the day of announcement of quarterly earnings results i.e. when t = 0, the AAR is -0.2029, which is statistically insignificant at 5 % level of significance. Hence, the null hypothesis that average abnormal return is zero on the announcement day is not rejected. It is observed that, all the AARs in the pre-event window period are not significant. Further, the AARs during the post event window are also not significant except at t = 1 (AAR = 0.3714) and at t = 5 (AAR = 0.4191). Thus only 4.9 % of AARs during the event window were found to be significant at 5 % level of significance. This rejects the existence of abnormal returns for the majority of days in the event window.

Analysis of AAR under Cross-section Dependence Approach

Under cross-sectional dependence assumption, it is observed that AAR on the day of announcement of event is insignificant, and, therefore the null hypothesis that average abnormal return is zero is not rejected. It is observed that, throughout the event window AARs not significant except at t = 1 (AAR = 0.3714) and at t = 5 (AAR = 0.4191). This rejects the existence of significant abnormal returns for majority of days in the event window. The test of significance under both the approach of analyzing the test statistic has given similar results.

Analysis of AAR of 'Aggregated Bad News' Sample During the Period Following Trading Suspension

The 'aggregated bad news' sample of 'set A', consist of 173 quarterly earnings announcements under cross-sectional independence assumption as well as cross-sectional dependence assumption. The result of 'aggregated bad news' sample is presented in Table 3A.

Table3A: Results of 'Aggregated Bad News' Sample during the period following trading suspension

Event Days	AAR	Cross-sectional Dependence: Z(AAR)	Cross-sectional Independence: Z(AAR)
-20	0.0455	0.2833	0.2850
-19	0.2246	1.3994	1.4074
-18	0.0561	0.3495	0.3515
-17	-0.0611	-0.3805	-0.3826
-16	0.0091	0.0566	0.0570
-15	0.0372	0.2315	0.2329
-14	0.3034	1.8899	1.9007
-13	-0.0240	-0.1492	-0.1501
-12	0.0878	0.5470	0.5501
-11	-0.0385	-0.2397	-0.2411
-10	-0.2437	-1.5183	-1.5269
-9	0.0902	0.5617	0.5649
-8	-0.3889	-2.4224	-2.4363
-7	-0.3178	-1.9796	-1.9909
-6	0.0121	0.0753	0.0757
-5	-0.2947	-1.8355	-1.8460
-4	-0.1403	-0.8742	-0.8792
-3	-0.2412	-1.5028	-1.5114
-2	0.1376	0.8571	0.8620
-1	-0.1615	-1.0063	-1.0120
0	-0.7149	-4.4533	-4.4788
1	-0.3397	-2.1161	-2.1282
2	0.3529	2.1986	2.2112
3	-0.1716	-1.0690	-1.0751
4	0.1517	0.9449	0.9503
5	0.0406	0.2527	0.2541
6	0.1085	0.6756	0.6795
7	-0.0315	-0.1961	-0.1972
8	0.1795	1.1179	1.1243
9	-0.0646	-0.4025	-0.4048
10	0.0634	0.3946	0.3969
11	0.2793	1.7399	1.7499
12	-0.1901	-1.1840	-1.1908
13	-0.0518	-0.3225	-0.3244
14	-0.1424	-0.8871	-0.8922

Event Days	*AAR*	*Cross-sectional Dependence: Z(AAR)*	*Cross-sectional Independence: Z(AAR)*
15	0.0691	0.4306	0.4331
16	0.1429	0.8899	0.8950
17	0.1327	0.8265	0.8313
18	-0.1330	-0.8287	-0.8334
19	-0.0894	-0.5569	-0.5601
20	0.3794	2.3634	2.3770

Source: Compiled from *Capital Line Database*.

Analysis of AAR under Cross-section Independence Approach

It is found that on the day of announcement (t = 0), AAR = -0.7149 is statistically significant at 5% level of significance. The average abnormal return on the announcement date has the largest negative value among all the values of AAR in the event window. This reflects the effect of bad announcement on the security prices on the announcement date. Hence, the null hypothesis that the average abnormal return on the announcement date is zero is rejected. Further it is observed that on the day of announcement, magnitude of abnormal return (ignoring the sign) of 'aggregated bad news' firms is much higher than the magnitude of abnormal return of 'aggregated good news' firm. Hence, it can be concluded that the share price reaction in case of 'bad news' is much larger than price reaction in case of 'good news'. The result is consistent with other empirical studies carried out on the effect of earnings announcements on stock prices in South African market (Bhana, 1995) and in NIFTY representing Indian market (Gupta, 2006). The AAR on event days t = 1 is also negative and statistically significant. It appears that the effect of bad news announcement persist for two consecutive days, including the day of announcement.

Significant and negative average abnormal returns are also found on event days t = -8; t = -7. This shows that the market has reacted to the bad news earnings information prior to actual announcement while significant and positive AAR sare found on event days t = 2 and t = 20. However, during the entire event window, only 14.63 % of event days have significant abnormal return. This rejects the existence of abnormal return for majority of days in the event window.

Analysis of AAR under Cross-section Dependence Approach

Event analysis of 'aggregated bad news' sample of 'set A', under cross-section dependence approach, has yielded result quite similar to cross-sectional independence approach.

Analysis of AAR of 'Aggregated Bad News' Sample During the Period Prior to Trading Suspension

The 'aggregated bad news' sample of 'set B' consists of 170 quarterly earnings announcements. The 'aggregated bad news' sample has been analyzed using event study method. The test of significance of AARs has been carried out under cross-sectional independence assumption as well as cross-sectional dependence assumption. The result of 'aggregated bad news' sample is presented in Table 3B.

Analysis of AAR under Cross-section Independence Approach

It is found that on the day of announcement (t = 0), AAR = -0.1409 is statistically insignificant at 5% level of significance. Hence, the null hypothesis that the average abnormal return on the announcement date is zero is not rejected.

Table 3B: Results of 'Aggregated Bad News' Sample during the Period Prior to Trading Suspension

Event Days	*AAR*	*Cross-sectional Dependence: Z(AAR)*	*Cross-sectional Independence: Z(AAR)*
-20	-0.0153	-0.0804	-0.0891
-19	-0.0614	-0.3230	-0.3579
-18	-0.1037	-0.5455	-0.6044
-17	0.0204	0.1073	0.1189
-16	0.0610	0.3209	0.3556
-15	-0.0920	-0.4841	-0.5364
-14	-0.1900	-0.9998	-1.1078
-13	-0.0736	-0.3872	-0.4290
-12	-0.1061	-0.5581	-0.6184
-11	-0.0071	-0.0375	-0.0416
-10	-0.0077	-0.0407	-0.0451

Event Days	AAR	Cross-sectional Dependence: Z(AAR)	Cross-sectional Independence: Z(AAR)
-9	0.0834	0.4390	0.4865
-8	-0.1711	-0.9002	-0.9974
-7	-0.1224	-0.6441	-0.7137
-6	0.1187	0.6247	0.6922
-5	-0.2205	-1.1603	-1.2856
-4	-0.0771	-0.4057	-0.4496
-3	-0.0959	-0.5047	-0.5592
-2	0.0844	0.4442	0.4922
-1	-0.2610	-1.3733	-1.5216
0	-0.1409	-0.7413	-0.8214
1	-0.3271	-1.7211	-1.9071
2	-0.1176	-0.6188	-0.6857
3	0.2164	1.1386	1.2616
4	0.3486	1.8344	2.0326
5	0.2053	1.0802	1.1969
6	0.1760	0.9261	1.0262
7	0.1037	0.5457	0.6046
8	0.1159	0.6099	0.6758
9	-0.0596	-0.3138	-0.3477
10	0.2004	1.0547	1.1687
11	0.0483	0.2544	0.2819
12	-0.1216	-0.6400	-0.7092
13	-0.2450	-1.2895	-1.4288
14	-0.0457	-0.2407	-0.2667
15	0.3053	1.6067	1.7802
16	-0.0310	-0.1631	-0.1807
17	0.0579	0.3045	0.3374
18	-0.0562	-0.2956	-0.3276
19	-0.0594	-0.3123	-0.3461
20	-0.1276	-0.6713	-0.7438

Source: Compiled from *Capital Line Database*.

However it is observed for the 'set B' that the on the day following the announcement date (t = 1), AAR attains the most negative value during the entire event window. Although the value is statistically insignificant at 5% level of significance, but it reflects the negative effect of 'bad news announcements' on the day after the announcement. The AARs during the pre-announcement and post announcement window are statistically insignificant except the AAR at t = 4 (AAR = 0.3486). Hence reaction of the market prior to bad earnings announcement is not observed for the sample of companies of 'set B'. Moreover, during the entire event window, only 2.4 % of the event days have significant abnormal return. This rejects the existence of abnormal return for majority of days in the event window.

Analysis of AAR under Cross-section Dependence Approach

Event analysis of 'aggregated bad news' sample of 'set B', under cross-section dependence approach, has yielded result quite similar to cross-sectional independence approach. The AARs are insignificant at 5% level of significance through out the event window.

Conclusions

The inferences about the average abnormal return for 'set A', under both the approaches, have been similar with regard to 'aggregated full' sample and 'aggregated bad news' sample while in 'aggregated good news' sample, both the approaches yielded similar result, with the exception of one event day observation (t = 4) where the results differed. For the 'set B', the inferences about the average abnormal return, under both the approaches, have been similar with regard to 'aggregated good news' sample while in 'aggregated full' sample and 'aggregated bad news' sample, but for one event day observation (t = 4) both the approaches yielded similar result.

This study implies that the event study analysis of the price effect of quarterly earnings announcements of the companies constituting SENSEX, under cross sectional dependence adjustment and cross sectional independence adjustment, has yielded results that have largely been similar. This finding is consistent with the findings of Brown and Warner (1985). In their study titled 'Using daily stock returns -the case of event studies', they examined event study methodologies using daily returns and found that the distribution of test statistic (using market model) for both independence and dependence adjustments were similar.

The study has demonstrated that the event study analysis of earnings announcements ignoring cross-sectional dependence adjustments in the research design, may not be biased so far as BSE-SENSEX is concerned. This observation is expected to address the question of biased results of the event studies on earnings announcements

which have ignored the cross-sectional dependence adjustment and have been pursued earlier using companies constituting SENSEX.

Limitations of the Study

The specific limitations of the present study are outlined as under:

1. The study has been undertaken using only 30 most actively traded firms listed in BSE SENSEX on the basis of market capitalization. The effect of the quarterly earnings announcement with reference to firms listed in BSE-100, BSE-200, BSE-500, DOLLEX-200, BSE-PSU Index etc.,if covered, may provide different sets of results.
2. The number of quarterly earnings announcements taken up for analyzing its effect on stock returns, is not uniform in the sample with regard to each company.
3. The length of observation interval is set to one day.

Scope for Further Research

The limitations outlined above provide the genesis for undertaking further research in this area.

The present study examined the effect of quarterly earnings announcements in the context of the companies constituting SENSEX. Future studies may be carried out to study the effect of quarterly earnings announcement with respect to companies listed in different indices viz. BSE-100, BSE-200, BSE-500, DOLLEX-200, BSE-PSU Index etc.

The study may further be extended to observe the quarterly effect of announcement on different indices, using shorter observation interval i.e. intraday analysis of quarterly earnings announcement.

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APPENDIX – I

List of Companies included in the given study
ACC Ltd.
Ambuja Cements Ltd.
BHEL
Bajaj Holdings Ltd.
Bharti Airtel Ltd.
Cipla Ltd.
DLF Ltd.
Dr. Reddys' Labs Ltd.
Grasim Industries Ltd.
HDFC Ltd.
HDFC Bank Ltd.
Hero Honda Motors Ltd.
HUL Ltd.
Hindalco Industries Ltd.
ICICI Bank Ltd.
ITC Ltd.
Infosys Ltd.
JP Associates Ltd.
Jindal Steel & Power Ltd.
L & T Ltd.
M & M Ltd.
Maruti Suzuki India Ltd.
NTPC Ltd.
ONGC Ltd.
Reliance Infra Ltd.
Ranbaxy Labs Ltd.
Reliance Comm Ltd.
Reliance Iindustries Ltd.
Satyam Computers Ltd.
SBI
Sterlite Industries(I) Ltd.
Sun Pharmaceuticals Industries Ltd.
Tata Motors Ltd.
Tata Power Co. Ltd.
Tata Steel Ltd.
Wipro Ltd.