

Chapter 2

Research Methodology

Abstract This chapter presents the research methodology followed in the study to assess the impact of mergers and acquisitions on financial performance. It also enumerates the research objectives, hypotheses, sources of primary data (based on questionnaire survey, personal interviews, emails and telephonic calls) and secondary data (drawn from Bombay Stock exchange, SEBI, Prowess database Centre for Monitoring Indian Economy, Thomson Security Data Corporation (SDC) Platinum M&A database), data analysis (primarily in terms of abnormal returns, major financial ratios), event study methodology, statistical techniques used in the study and research model.

Keywords Event methodology • Financial performance • Financial ratios • Abnormal return • Parametric test • Nonparametric test • Acquisitions • Mergers • Cross-border acquisitions

2.1 Introduction

This chapter contains the research objectives and hypotheses to be tested in the study. It explains the detailed research methodology that has been proposed in order to address these research objectives. It presents the data used to test these hypotheses. There are virtually no comprehensive studies that examine the short-term as well as long-term performance of M&A with a focus on corporate governance, management opinion and motives of M&A. Therefore, this study aims to capture the managerial views on motives of M&A; impact of mergers and acquisitions on stock returns as well as financial performance of acquirers with a focus on corporate governance in Indian context. The present research study uses both primary data (representing the managerial views on motives of M&A and corporate governance survey) and secondary data (related to stock market comprising of stock prices data and financial performance).

This chapter is organized into six sections. Section 2.2 (divided into Sects. 2.2.1 and 2.2.2) presents research objectives and hypotheses to be tested. Section 2.3 is

divided into three subsections. Section 2.3.1 provides a brief on the proposed research methodology used to address the objectives of the study. Section 2.3.2 delineates the scope of the study. Section 2.4 describes the event study methodology in detail. The data used, for empirically examining the objectives for the present study, is summarized in Sect. 2.5. An equally important aspect of this research study is sample selection criteria; it is provided in Sect. 2.6. The concluding observations are listed in the last Sect. 2.7.

2.2 Research Objectives and Hypotheses

2.2.1 Research Objectives

The present study has specifically identified the following objectives:

Objective 1: To measure the effect of the announcement of mergers and acquisitions on stock returns of acquiring firms by

- 1.1 Ascertaining the magnitude and the direction of the abnormal returns for entire sample.
- 1.2 Conducting analysis of the abnormal returns for subsamples on the basis of
 - (i) Domestic and cross-border M&A.
 - (ii) Method of payment (cash, stock).
 - (iii) Form of target firm acquired (listed, unlisted).
 - (iv) Status of target firm (remains wholly owned subsidiary, absorbed with the operations of the acquirer).
 - (v) Stake of acquisitions (partial/majority control, complete control).
 - (vi) Origin of target firm (developed market, emerging market).

Objective 2: To gain insight into managerial views about motives and sources of synergies of M&A.

Objective 3: To measure the magnitude and the direction of change in the financial performance of the acquiring firms post-M&A.

Objective 4: To gain insight into corporate governance practices of acquirers by developing a corporate governance index.

Objective 5: To ascertain the impact of corporate governance on stock returns due to the announcement of mergers and acquisitions and financial performance.

2.2.2 Hypotheses

To achieve the above-stated objectives, the following hypotheses have been formulated in this study:

2.2.2.1 Hypotheses Related to the Short-Term Performance of M&A

Hypothesis I: There is significant average abnormal return (AAR) during the event window due to announcement of mergers and acquisitions.

Hypothesis II: There is significant cumulative average abnormal return (CAAR) during the event window due to announcement of mergers and acquisitions.

2.2.2.2 Hypotheses Related to Financial Performance of M&A

Hypothesis III: The mean level of profitability ratio (based on investments, sales, expenses) for the post-merger and acquisition period is significantly different from mean level of profitability ratio (based on investments, sales, and expenses) from pre-merger and acquisition period.

Hypothesis IV: The mean level of efficiency ratio for the post-merger and acquisition period is significantly different from mean level of efficiency ratio from pre-merger and acquisition period.

Hypothesis V: The mean level of liquidity ratio for the post-merger and acquisition period is significantly different from mean level of liquidity ratio from pre-merger and acquisition period.

Hypothesis VI: The mean level of leverage ratio for the post-merger and acquisition period is significantly different from mean level of leverage ratio from pre-merger and acquisition period.

2.2.2.3 Hypotheses Related to Corporate Governance Index

Hypothesis VII: Acquiring firms with better corporate governance (as reflected in high corporate governance index) have better abnormal returns in short term.

Hypothesis VIII: Acquiring firms with better corporate governance (as reflected in high corporate governance index) have better firm performance.

Hypothesis IX: Acquiring firms with better corporate governance (as reflected in high corporate governance index) have higher firm value post-M&A.

2.3 Research Methodology and Scope

2.3.1 Research Methodology

The objectives of the study have been addressed using a comprehensive approach; it has been demonstrated in Fig. 2.1. From the figure, it may be deciphered that the objectives 1, 3, and 5 have been addressed using secondary data and objectives 2 and 4 have been responded to using primary data.

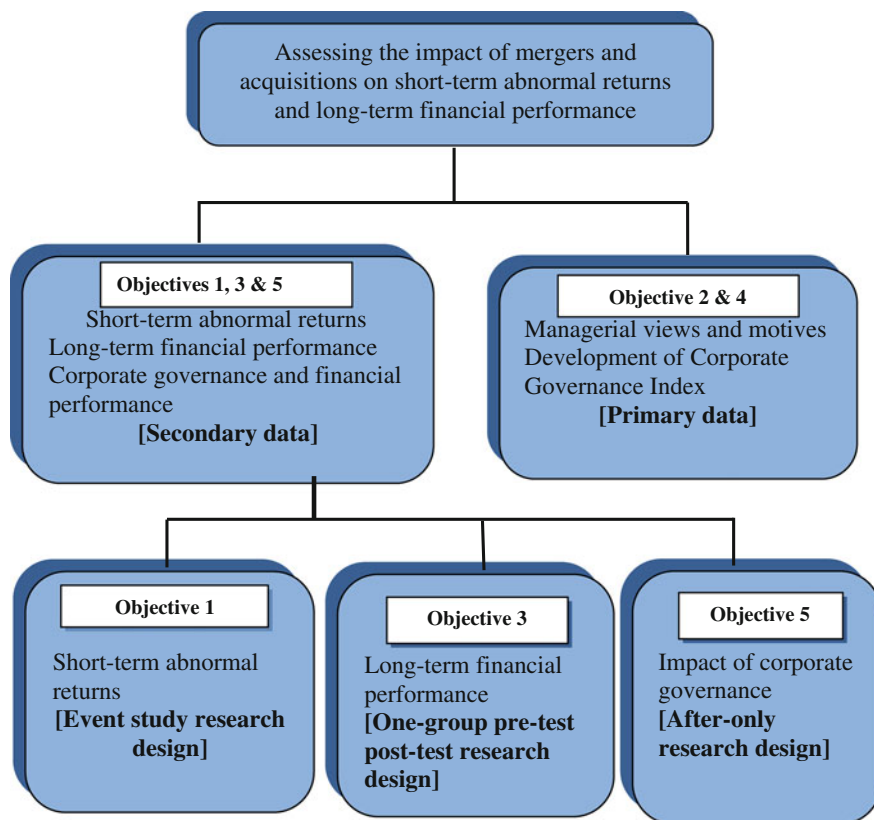


Fig. 2.1 Outline of research methodology

Objective 1 evaluates the impact of mergers and acquisitions on short-term abnormal returns. The objective has been achieved using event study methodology. Event study methodology is one of the most popular statistical research designs in the area of finance (Brown and Warner 1980; Bowman 1983; Brown and Warner 1985; Henderson 1990; Peterson 1989; McWilliams and Siegel 1997; MacKinlay 1997; McWilliams and McWilliams 2000; Serra 2004; Wells 2004; Weston et al. 2004; Kothari and Warner 2007; Tabak 2010; Konchitchki and O’Leary 2011). It is used to examine the market’s response to a well-defined event by examining the security prices around such event. The secondary data (stock prices of the companies that announced mergers and acquisitions) has been examined using event study methodology. This enables a researcher to assess if there are any abnormal returns earned by the investors due to these events. The abnormal return is the differences between the observed return and the expected return on a particular day, calculated by a return model (chosen by the researcher).

For objectives 2 and 4, survey research methodology has been used to collect primary data. Survey research, as a mode of enquiry, enables the researcher to know

the views and opinions of the respondents of the questionnaire. The present work conducted two questionnaire-based surveys to gauge the managerial perception about these decisions.

Objective 3 has been dealt with using one-group pre test, post test research design and ratio analysis. In one-group pre test, post test research design, the changes in financial performance (due to mergers and acquisitions decisions) have been measured 5 years prior to and after the M&A.

Objective 5 evaluates the impact of corporate governance on short-term abnormal returns due to mergers and acquisitions and financial performance. 'After-only research design' has been used to address the objective.

2.3.2 Scope of the Study

1. The study is confined to the analysis of companies (listed on BSE) that have undertaken mergers and acquisitions. The scope of the study is limited to analyze the performance of acquiring firms.
2. It covers a time span of more than 13 years starting from January 1, 2003 to December 31, 2015. January 1, 2003 has been chosen as it precedes the effective dates of relevant provisions of SEBI Clause 49 enacted by Stock Exchanges in India. The reference period for the study includes the 5 years before and 5 years after the M&A.
3. The management survey has been carried out for companies that completed mergers and acquisitions during the specified time period; these companies are located all over India.

2.4 Event Study Methodology

Event study methodology in the finance literature has become a standard methodology in evaluating the stock price reaction to a specific event (McWilliams and Siegel 1997). The event study methodology is used to investigate the market's response to a well-defined event by examining the security prices around such event. The methodology assesses whether specific events create abnormal stock returns as stock returns move in response to market-specific factors or several firm specific factors such as announcements of earnings, mergers and acquisitions, etc. The information about the event is released through the financial press, corporate releases or directly providing it to the stock exchanges where the security is listed. The investigation enables a researcher to assess if there are any abnormal returns earned by the security holders due to these events.

The methodology is based on the fundamental idea that stock prices represent the discounted value of firms' future stream of profits. Hence, the change in the

equity value of firm observed due to stock market's response to the announcement of mergers and acquisitions may be considered as a measure of the (discounted) additional profits that they are expected to accrue as a consequence of mergers and acquisitions (Duso et al. 2010). The event study methodology uses average abnormal stock market reaction as a gauge of value creation or value destruction. Based on the announcement-period stock market response, it may be concluded whether mergers and acquisitions create value for shareholders of acquiring firms or not.

2.4.1 Mechanics of Event Study

The following steps comprise the mechanics of event study:

2.4.1.1 Event Definition and Date of Announcement

The *event* is the action that the researcher would like to study. The event is expected to convey some information that potentially influences the stock prices. The events defined for this research study are the announcements of mergers and acquisitions.

The first step in the event study methodology is to define the event as the date on which the acquisition is first announced to the public. Day 0 is defined as the day the announcement first appears in any newspaper. For this purpose of the study, the announcement day has been defined as the day when the Stock Exchange is informed about the board approval of the merger and acquisition deal. These dates are verified (manually) from the archives of corporate announcements of stock exchange.

In majority of cases, the stock exchanges are informed the same day on which the acquisition is first announced to the public. Intent date and the actual date have also been verified (manually). In a few cases, the intent of acquisition is announced before the approval date (almost 10 trading days), to capture the effect of this leakage event window of 20 days before the announcement has been observed. The day 0 has been defined as the board approval date as it facilitates the verification of a clean window from the archives of Bombay Stock Exchange. The most critical assumption of event study methodology is that there is no confounding event during the event window.

2.4.1.2 Estimation Period

An *estimation window* is the period used for estimating the expected returns. The *estimation period* is defined as the period prior to the occurrence of the event and the event window. The expected returns (also called normal returns) are calculated using a time period other than the event window. For the present study, the

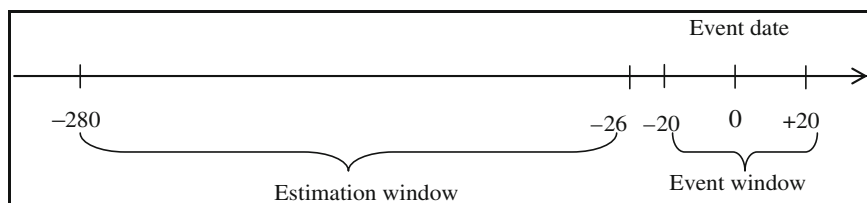


Fig. 2.2 Return analysis time line for event study research design

estimation window is from the day -280 to the day -26 (from 25 to 280 days prior to the event window), thus comprising of 255 trading days. This ensures that estimates of the normal return model are not influenced by the event-related returns.

Figure 2.2 depicts the event window and estimation window. It is imperative for the estimation window and event window not to overlap.

2.4.1.3 Event Window Period

An *event window* is the period in which an event occurs; during this period, the security prices of the relevant firms are examined. The event window for this study is chosen as -20, through 0, to +20. Here, 0 depicts the announcement date, -20 is the 20 days time period prior to announcement date and +20 is the 20 days time period after the announcement date. To conduct an in-depth analysis, the event window has been further broken into smaller windows. The event period surrounds the date of the announcement of acquisition during which the stock market's response to the announcement is investigated. In order to account for early share price reactions (induced by the anticipation of stock market of an upcoming announcement before and potentially slow information processing after the event), the cumulative abnormal returns over alternate windows are considered. Fama et al. (1969) suggest that event date may be uncertain. Therefore, it is desired to consider abnormal return which might appear before and after the defined date. This interval is known as event window.

The abnormal returns over varying windows, namely, (-20, -2), (-15, -2), (-10, -2), (-5, -2) (-5, 0) (-1, 0), (-1, +1), (-2, +2), (-5, +5) (-10, +10), (-20, +20), (+2, +5), (+2, +10), (+2, +15) and (+2, +20) have been observed to capture the leakage effect. The dates are verified (manually) from the archives of corporate announcements of Bombay Stock Exchange (BSE) to ascertain the clean period data. It has been checked (manually) that there is no contamination of information and confounding event during the event window.

Long-term event windows have not been examined in the study due to two reasons: first, using a long-event window severely reduces the power of the test statistic and leads to false inferences (Brown and Warner 1980, 1985; McWilliams

and Siegel 1997). Second problem is the difficulty of controlling for confounding events. Also, long-event windows increase the likelihood of contemporaneous and inter-temporal correlations of residuals resulting in significant underestimates of standard errors (Salinger 1992).

2.4.1.4 Estimation Model and Definition of Abnormal Return

The estimation model is the model used to estimate the expected returns. The traditional single factor market model has been considered to estimate the expected returns. It involves the regression of a stock's returns against a market index. For the present study, the value weighted market index—BSE SENSEX¹ has been used for regression.

The key issue in event studies is what portion of the price movement is actually caused by the event of interest. In other words, it is required to extract the impact of the one particular event on stock returns. This leads to the concept of abnormal returns. The abnormal return is the differences between the actual return and the expected return on a particular day.

The abnormal return of the j th stock (AR_{jt}) is obtained by subtracting the normal or expected returns in absence of the event $E(R_{jt})$, from the actual return in the event period, (R_{jt}) as per following Eq. (2.4.1):

$$AR_{jt} = R_{jt} - E(R_{jt}) \quad (2.4.1)$$

The market model approach relates the return of a security to the return of the market portfolio as per the market model Eq. (2.4.2):

$$R_{jt} = \alpha_j + \beta_{mj} + \varepsilon_{jt} \quad (2.4.2)$$

where $t = -280, \dots, -26$, α_j is a constant term for the j th stock, β_j is the beta of the j th stock, R_{mt} is the market returns, and ε_{jt} is an error term.

The parameters of the model are estimated by using the time-series data from the estimation period that precedes each individual announcement. The parameters estimated from the market model are then used in the calculation of abnormal returns for each day in the event window. The estimated parameters are then matched with the actual returns in the event period. The daily excess return, i.e., abnormal return of firm j for the day t (AR_{jt}) is estimated from actual returns during the event period and the estimated coefficients from the estimation period as per Eq. (2.4.3)

¹BSE SENSEX (Bombay Stock Exchange Sensitivity Index) is a 'Market Capitalisation—Weighted' Index of 30 component stocks representing a sample of large well established and financially sound companies. It is reckoned as a benchmark index of the Indian capital market.

$$AR_{jt} = R_{jt} - \left(\hat{\alpha} + \hat{\beta} R_{mt} \right) \quad (2.4.3)$$

where $t = -20, \dots, +20$.

The average abnormal return (AAR_t) for each day in the event window is calculated as per Eq. (2.4.4):

$$AAR_t = \frac{1}{N} \sum_{j=1}^N AR_{jt} \quad (2.4.4)$$

where N is the number of firms.

2.4.1.5 Definition of Cumulative Abnormal Return (CAR)

The cumulative abnormal return for a given security is simply the sum of daily abnormal returns over the event window. Over an interval of two or more trading days beginning with day T_1 and ending with day T_2 , the cumulative average abnormal return (CAAR) is calculated as per Eq. (2.4.5)

$$CAAR_{T_1 T_2} = \frac{1}{N} \sum_{j=1}^N \sum_{t=T_1}^{T_2} AR_{jt} \quad (2.4.5)$$

2.4.1.6 Definition of Precision-Weighted Cumulative Abnormal Return

The study also reports precision-weighted cumulative average abnormal return (PWCAAR). The precision-weighted average is constructed using the relative weights of each stock (Cowan 2007). The precision-weighted return weight each stock in inverse proportion to its standard deviation. The precision-weighted CAAR (as a weighted average of the original CARs) preserves the sample interpretation of CAAR (Cowan 2007). The precision-weighted cumulative average abnormal return (PWCAAR) is a better measure than CAAR and average standardized cumulative abnormal return. The precision-weighted cumulative average is calculated as specified in Eq. (2.4.6)

$$PWCAAR_{T_1 T_2} = \sum_{J=1}^N \sum_{t=T_2}^{T_2} \omega_j AR_{jT} \quad (2.4.6)$$

where,

$$\omega_j = \frac{\left(\sum_{t=T_1}^{T_2} \delta_{AR_{jt}}^2 \right)^{-\frac{1}{2}}}{\sum_{i=1}^N \left(\sum_{t=T_1}^{T_2} \delta_{AR_{it}}^2 \right)^{-\frac{1}{2}}}$$

where,

$$\delta_{AR_{jt}}^2 = \frac{\sum_{k=T_{D_b}}^{T_{D_e}} (AR_{jk})^2}{D_j - 2} \left[1 + \frac{1}{D_j} + \frac{(R_{mt} - \bar{R}_m)^2}{\sum_{k=T_{D_b}}^{T_{D_e}} (R_{mk} - \bar{R}_m)^2} \right]$$

D_j is the number of non-missing estimation period returns for firm j . R_{mt} is the return on the market index on day t in the event window, R_{mk} is the return on the market index on day k in the estimation window. $\bar{R}_m$ is the mean market return over estimation period. k represents the trading day in estimation period.

2.4.1.7 Hypotheses for Announcement Effects

The null hypotheses being tested are

H_{01} : The average abnormal return to the shareholders of acquiring company on the announcement of acquisition is zero.

H_{02} : The cumulative average abnormal return to the shareholders of acquiring company for the event window period around the announcements of acquisition is zero.

2.4.2 Statistical Significance of Abnormal Returns

There are numerous tests for evaluating the statistical significance of abnormal returns. Several studies have developed tests to control for specific problems that occur with event studies. Each of them tests the null hypothesis that abnormal returns are zero, but they differ in the necessary assumptions about the statistical properties of (abnormal) returns. The parametric tests implicitly assume that the residuals follow normal distribution. When the assumption of normality of abnormal returns is violated, parametric tests are not well specified. In addition to parametric statistics, event studies typically use a nonparametric test. A nonparametric test is normally used in conjunction with parametric test (in event study) to verify that the results are not driven by outliers. Nonparametric statistics do not require as stringent assumptions about return distributions as parametric tests. Kang and Stulz (1996) documented specific robustness issues in event studies using Asia-Pacific financial market data. In order to obtain robust results, a wide

variety of statistical tests have been applied. These tests are well specified and more powerful in random samples of Asia-Pacific financial market data (Corrado and Truong 2008; Corrado and Zivney 1992; Campbell et al. 2010). We use the following four widely used parametric and three nonparametric test statistics commonly used in event studies to test for the significance of average abnormal returns and cumulative abnormal returns over the event period:

2.4.2.1 Parametric Tests

Four parametric test statistics, namely, Crude dependence adjustment test (Brown and Warner 1980), Cross-sectional standard deviation test (Brown and Warner, 1985), Patell's test (1976) corrected by Mikkelson and Partch (1988) and Standardized cross-sectional test (Boehmer et al. 1991) have been conducted to test for the significance of average abnormal returns and cumulative abnormal returns over the event period.

The Crude Dependence Adjustment Test (CDA)

The test incorporates the sample time-series standard deviation. Brown and Warner describe the test as featuring a 'crude dependence adjustment.' That is, the test compensates for potential dependence of returns across security events by estimating the standard deviation using the time series of sample mean returns from the estimation period. Crude dependence adjustment test uses a single variance estimate for the entire sample. Therefore, the time-series standard test does not take account of the unequal return variances across securities. This test avoids the potential problem of cross-sectional correlation of security return. To account for the dependence across firms' average residuals, in event time, Brown and Warner (1985) suggest that the standard deviation of average residuals should be estimated from the time series of the average abnormal returns over the estimation period. The estimated variance of AAR_t is given as per Eq. (2.4.2.1):

$$\hat{\sigma}_{AAR}^2 = \frac{\sum_{t=-280}^{-26} (AAR_t - \overline{AAR})^2}{254} \quad (2.4.2.1)$$

where the market model parameters are estimated over the estimation period of 255 days and

$$\overline{AAR} = \frac{\sum_{t=-280}^{-26} AAR_t}{255}$$

The test statistics for day t in event time is given as per Eq. (2.4.2.2)

$$t = \frac{AAR_t}{\hat{\sigma}_{AAR}} \quad (2.4.2.2)$$

The test statistics for $CAAR_{T_1, T_2}$ is given as per Eq. (2.4.2.3):

$$t = \frac{CAAR_t}{(T_2 - T_1 + 1)^{\frac{1}{2}} \hat{\sigma}_{AAR}} \quad (2.4.2.3)$$

Cross-Sectional Standard Deviation Test (CSS)

This test uses a daily cross-sectional standard deviation instead of sample time-series standard deviation. The test statistics for the day t in event time is given as per Eq. (2.4.2.4)

$$t = \frac{AAR_t}{\hat{\sigma}_{AAR_t} / \sqrt{N}} \quad (2.4.2.4)$$

where,

$$\hat{\sigma}_{AAR_t}^2 = \frac{1}{N-1} \sum_{i=1}^N \left(AR_{it} - \frac{1}{N} \sum_{j=1}^N AR_{jt} \right)^2$$

The test statistics for $CAAR_{T_1, T_2}$ is given as per Eq. (2.4.2.5):

$$t_{CAAR} = \frac{CAAR_{T_1, T_2}}{\hat{\sigma}_{CAAR_{T_1, T_2}} / \sqrt{N}} \quad (2.4.2.5)$$

where the estimated variance of $CAAR_{T_1, T_2}$ is

$$\hat{\sigma}_{CAAR_{T_1, T_2}}^2 = \frac{1}{N-1} \sum_{i=1}^N \left(CAR_{i, T_1, T_2} - \frac{1}{N} \sum_{j=1}^N CAR_{j, T_1, T_2} \right)^2$$

Patell's Test

Patell (1976) proposes a test statistic where the event period abnormal returns are standardized by the standard deviation of the estimation period abnormal returns. The Patell Z test is an example of a standardized abnormal return approach, which estimates a separate standard error for each security event and assumes cross-sectional independence. This standardization reduces the effect of stocks with

large returns standard deviation on the test. Patell test statistics assumes cross-sectional independence in abnormal returns; it also assumes that there is no event-induced change in the variance of event period abnormal returns. The standardized abnormal return (SAR) for each security is calculated as per Eq. (2.4.2.6):

$$\text{SAR}_{jt} = \frac{\text{AR}_{jt}}{\delta_{\text{AR}_{jt}}} \quad (2.4.2.6)$$

where,

$$\delta_{\text{AR}_{jt}}^2 = \frac{\sum_{k=T_{D_b}}^{T_{D_e}} (\text{AR}_{jk})^2}{D_j - 2} \left[1 + \frac{1}{D_j} + \frac{(R_{mt} - \bar{R}_m)^2}{\sum_{k=T_{D_b}}^{T_{D_e}} (R_{mk} - \bar{R}_m)^2} \right]$$

Under the null hypothesis, each SAR_{jt} follows a Student's t distribution with $D_j - 2$ degrees of freedom. Total standardized abnormal return (TSAR) across the sample is given as per Eq. (2.4.2.7):

$$\text{TSAR}_{jt} = \sum_{j=1}^N \text{SAR}_{jt} \quad (2.4.2.7)$$

The expected value of TSAR_t is zero. The variance of TSAR_t is given as per Eq. (2.4.2.8):

$$Q_t = \sum_{j=1}^N \frac{D_j - 2}{D_j - 4} \quad (2.4.2.8)$$

The test statistic for the null hypothesis that $\text{CAAR}_{T_1, T_2} = 0$ is given as per Eq. (2.4.2.9):

$$Z_{T_1 T_2} = \frac{1}{\sqrt{N}} \sum_{j=1}^N Z_{T_1 T_2}^j \quad (2.4.2.9)$$

where,

$$Z_{T_1 T_2}^j = \frac{1}{\sqrt{Q_{T_1 T_2}^j}} \sum_{t=T_1}^{T_2} \text{SAR}_{jt}$$

and

$$Q_{T_1 T_2}^j = (T_2 - T_1 + 1) \frac{D_j - 2}{D_j - 4}$$

under cross-sectional independence of the Z_{T_1, T_2}^j and other assumptions, Z_{T_1, T_2} follows the standard normal distribution under the null hypothesis.

The Patell test statistics for cumulative abnormal return for event window is not adjusted for serial dependence. Mikkelsen and Partch (1988) corrected the Patell test for the possible serial correlation of abnormal returns of each security within the window. The serial correlation occurs as all the abnormal returns are functions of the same market model intercept and slope estimators.

The corrected test statistic for the null hypothesis that $CAAR = 0$ is given as per Eq. (2.4.2.10)

$$Z_{CAAR} = N^{-\frac{1}{2}} \sum_{j=1}^N \frac{CAR_{T_{lj}, T_2}}{\delta_{CAR_{T_{lj}, T_2}}} \quad (2.4.2.10)$$

where

$$\delta_{CAR_{T_1, T_2}}^2 = \frac{\sum_{k=T_{D_b}}^{T_{D_e}} AR_{jk}^2}{D_j - 2} \left\{ L \left[1 + \frac{L}{D_j} + \frac{\left(\sum_{t=T_1}^{T_2} R_{mt} - L\bar{R}_m \right)^2}{\sum_{k=1}^{D_j} (R_{mk} - \bar{R}_m)^2} \right] \right\}$$

where L is the length of the event period in trading days, $L = T_2 - T_1 + 1$. D_j is the number of non-missing trading day returns in the D -day interval T_{D_b} through T_{D_e} used to estimate the parameter of the firm j .

Standardized Cross-Sectional Test (SCS)

Standardized cross-sectional test developed by Boehmer et al. (1991) incorporates the information from both estimation and the event period. The event period abnormal returns are first standardized by estimation period standard deviation. The cross-sectional technique is then applied to the standardized abnormal returns. The test is same as Patell test except that there is a final adjustment in the place of analytical variance of the total standardized abnormal return.

For day t in the event period, the test statistics is given in Eq. (2.4.2.11)

$$Z_t = \frac{TSAR_t}{N^{\frac{1}{2}}(\delta_{SAR_t})} \quad (2.4.2.11)$$

where

$$\delta_{SAR_t}^2 = \frac{1}{N-1} \sum_{i=1}^N \left(SAR_{it} - \frac{1}{N} \sum_{j=1}^N SAR_{jt} \right)^2$$

Define the standardized cumulative abnormal return for stock j as in Eq. (2.4.2.12)

$$SCAR_{T_{1j}, T_{2j}} = \left(\frac{CAR_{T_{1j}, T_{2j}}}{\delta_{CAR_{T_{1j}, T_{2j}}}} \right) \quad (2.4.2.12)$$

Then the standardized cross-sectional test for the null hypothesis that $CAAR = 0$ is given in Eq. (2.4.2.13)

$$Z_t = \frac{\sum_{i=1}^N SCAR_{T_{1j}, T_{2j}}}{N^{\frac{1}{2}} \left(\delta_{SCAR_{(T_{1j}, T_{2j})}} \right)} \quad (2.4.2.13)$$

where

$$\delta_{\delta_{SCAR_{(T_{1j}, T_{2j})}}}^2 = \frac{1}{N-1} \sum_{i=1}^N \left(SCAR_{T_{1j}, T_{2j}} - \frac{1}{N} \sum_{j=1}^N SCAR_{T_{1j}, T_{2j}} \right)^2$$

2.4.2.2 Nonparametric Tests

Three nonparametric test statistics, namely, generalized sign test (Cowan 1992), rank test (Corrado 1989) and jackknife test (Giaccotto and Sfridis 1996) have been conducted to test for the significance of average abnormal returns and cumulative abnormal returns over the event period.

Generalized Sign Test (Gsign Z)

The generalized sign test is a refined version of the sign test by allowing the null hypothesis having positive abnormal residuals to be different from 0.5 (Cowan, 1992). The sign test is a simple binomial test to ascertain whether the frequency of positive abnormal residuals equals 50 % or not. The generalized sign test adjusts for the fraction of positive abnormal returns in the estimation period instead of assuming 0.5. The generalized sign test compares the proportion of positive abnormal returns around an event to the proportion from a period unaffected by the event.

In this way, the generalized sign test takes account of a possible asymmetric return distribution under the null hypothesis. The generalized sign test does not require symmetry of the cross-sectional abnormal return distribution and becomes relatively more powerful as the length of the event window increases. The generalized sign test is correctly specified when the variance of the stock return increases during the event window.

The generalized sign test examines whether the number of stocks with positive cumulative abnormal returns in the event window exceeds the number expected in the absence of abnormal performance or not. The number expected is based on the proportion of positive abnormal returns in the 255 day estimation period as calculated in Eq. (2.4.2.14)

$$\hat{p} = \frac{1}{n} \sum_{j=1}^n \frac{1}{255} \sum_{t=1}^{255} S_{jt} \quad (2.4.2.14)$$

where

$$S_{jt} = \begin{cases} 1 & \text{if } AR_{jt} > 0 \\ 0 & \text{otherwise} \end{cases}$$

The following statistic has an approximate unit normal distribution with parameter $\hat{p}$:

$$Z_G = \frac{w - n\hat{p}}{\sqrt{n\hat{p}(1 - \hat{p})}} \quad (2.4.2.15)$$

where w is the number of stocks in the event window for which the cumulative abnormal return is positive.

The null and alternative hypotheses of interest are:

The null hypothesis for generalized sign test is that there is no difference between the proportion of positive returns in the event window and its proportion of positive returns in the estimation period.

The alternative hypothesis, for any level of abnormal performance, is that the proportion of positive returns in the event window is different from proportion of positive returns in the estimation period.

Rank Test

The rank test (Corrado 1989) procedure considers the combined estimation period and event period as a single set of returns, and assigns a rank based on return to each daily for each firm. The rank statistic has been denoted as T_R . For day zero, the test statistics is specified in Eq. (2.4.2.16)

$$Z_{\text{rank}} = \left[\left(\frac{1}{N} \sum_{j=1}^N k_{j0} \right) - \tilde{k} \right] / S_k \quad (2.4.2.16)$$

where k_{j0} is the rank of security event j 's day zero abnormal return in security event j 's combined 255 day estimation period and 19-day event period (in the case of

(+2, +20)) time series, k is the expected rank defined below, and sk is the time series standard deviation of the sample mean abnormal return ranks.

Each security event's non-missing returns have been ranked with the lowest rank being one. E_j represents the number of non-missing returns of security j in the event period; if there is no missing return, $E_j = E = \text{post} - \text{pre} + 1$ and $D = \text{length of estimation window}$. The mean rank across the combined estimation and event period is

$$\tilde{k} = \frac{D + E + 1}{2}$$

The rank test statistic for the null hypothesis relating to the event window (T1, T2) is given in Eq. (2.4.2.17)

$$Z_{\text{rank}} = (T_2 - T_1 + 1)^{\frac{1}{2}} \left\{ \frac{\overline{K_{T_1 T_2}} - \tilde{K}}{\left[\sum_{t=1}^{D+E} (\overline{K}_t - \tilde{K})^2 / D + E \right]^{\frac{1}{2}}} \right\} \quad (2.4.2.17)$$

where,

$\overline{K_{T_1 T_2}} = \frac{1}{T_2 - T_1 + 1} \sum_{t=T_1}^{T_2} \frac{1}{n} \sum_{j=1}^n K_{jt}$ is the average rank across the n securities and $T_2 - T_1 + 1$ days of the event window and $\overline{K}_t = (1/n) \sum_{j=1}^n K_{jt}$ is the average rank across n securities on day t of the $D + E$ day combined estimation and event period.

Jackknife Test

The jackknife test by Giaccotto and Sfiridis (1996) computes the standardized abnormal return for each stock j , computed using the event period sample standard deviation. The standardized abnormal return for day t is given in Eq. (2.4.2.18)

$$\hat{\theta} = \frac{\text{AR}_{jt}}{\tilde{\sigma} \text{AR}_{jt}} \quad (2.4.2.18)$$

where

$$\tilde{\sigma}_{\text{AR}_{jt}} = \left\{ \sum_{t=T_b}^{T_e} \frac{(\text{AR}_{jt} - \text{AAR}_j^2)}{E_j} \right\}^{\frac{1}{2}}$$

and AAR_j is the average abnormal return of stock j during the event period of $E = T_e - T_b + 1$ days. If there is an event-induced variance on day t , then $\tilde{\sigma}_{\text{AR}_{jt}}$ is a

biased estimator of $\sigma_{AR_{jt}}$ and $\hat{\theta}$ is a biased statistic. Giaccotto and Sfridis (1996) propose reducing the bias by jackknifing the $\hat{\theta}$ values.

The first step of the jackknife is to sequentially delete one abnormal return AR_{jt_s} from $\tilde{\sigma}_{AR_{jt}}$ and recompute $\tilde{\sigma}_{AR_{jt}}$, using the new value in turn to recompute $\hat{\theta}$ using Eq. (2.4.2.18). This latter value is named as $\hat{\theta}_{(-d)}$ and pseudo-values are formed using $\hat{\theta}_{(-d)}$ in the next step as per Eq. (2.4.2.19)

$$\theta_{(-d)} = (E_j)\hat{\theta} - (E_j - 1)\hat{\theta}_{(-d)} \quad (2.4.2.19)$$

The jackknife estimator for stock j on day t is the mean of the pseudo-values as per Eq. (2.4.2.20):

$$\theta_{jt} = \frac{1}{E_j} \sum_{t=T_b}^{T_e} \theta(-s) \quad (2.4.2.20)$$

To gain efficiency, the estimates are averaged across the sample of stocks as in Eq. (2.4.2.21).

$$\bar{\theta}_t = \frac{1}{N} \sum_{j=1}^N \theta_{jt} \quad (2.4.2.21)$$

Finally, the jackknife test statistic for the sample of stock on day t is given in Eq. (2.4.2.22)

$$t_{\text{jackknife}} = \frac{\bar{\theta}_t}{S_{\text{jackknife}}/\sqrt{N}} \quad (2.4.2.22)$$

where,

$$S_{\text{jackknife}} = \left[\frac{1}{N-1} \sum_{i=1}^N (\theta_{jt} - \bar{\theta}_t)^2 \right]^{\frac{1}{2}}$$

To test the significance of the cumulative average abnormal returns over the window from day T_1 through day T_2 define as given in Eq. (2.4.2.23)

$$\hat{\theta}_{T_1 T_2} = \frac{\sum_{t=T_1}^{T_2} AR_{jt}}{(T_2 - T_1 + 1)^{\frac{1}{2}} \tilde{\sigma}_{AR_{jt}}} \quad (2.4.2.23)$$

Sequentially delete one abnormal return AR_{jt_s} from equation $\tilde{\sigma}_{AR_{jt}}$ and recompute $\tilde{\sigma}_{AR_{jt}}$, using the new value in turn to recompute $\hat{\theta}$ using Eq. (2.4.2.23). Name this latter value as in Eq. (2.4.2.24)

$$\theta_{(-d),T_1T_2} = (E_j)\hat{\theta}_{T_1T_2} - (E_j - 1)\hat{\theta}_{(-d),T_1T_2} \quad (2.4.2.24)$$

The jackknife estimator for stock j in window (T_1, T_2) is the mean of the pseudo-values given in Eq. (2.4.2.25)

$$\theta_{j,T_1T_2} = \frac{1}{E_j} \sum_{t=E_b}^{E_e} \theta_{(-d)} \quad (2.4.2.25)$$

The estimates are averaged across the sample of stocks as per Eq. (2.4.2.26):

$$\bar{\theta}_{T_1T_2} = \frac{1}{N} \sum_{j=1}^N \theta_{j,T_1T_2} \quad (2.4.2.26)$$

The jackknife test statistic for CAAR for the sample of stocks in window (T_1, T_2) is given in Eq. (2.4.2.27)

$$t_{\text{jackknife}} = \frac{\bar{\theta}_{T_1T_2}}{S_{\text{jackknife},T_1T_2}/\sqrt{N}} \quad (2.4.2.27)$$

where

$$S_{\text{jackknife},T_1T_2} = \left[\frac{1}{N-1} \sum_{i=1}^N (\theta_{j,T_1T_2} - \bar{\theta}_{T_1T_2})^2 \right]^{\frac{1}{2}}$$

The distribution of $t_{\text{jackknife}}$ under the null hypothesis is approximately normal with mean zero and unit variance.

2.5 Data Description

The present study covers a period of 13 years from January 1, 2003 to December 31, 2015. There were 11,683 mergers and acquisitions announcements during this period.

Table 2.1 provides the year-wise sample distribution of mergers and acquisitions. It has been observed that the maximum announcements happened in the year 2006 (9.9 %) followed by 2010 (9.73 %) and 2007 (9.72 %). However, the maximum number of completed mergers and acquisitions happened in the year 2007 (10.5 %) followed by 2008 (10.2 %) and 2006 (9.1 %). The relevant data in the Table also reveal that a substantial number (37.4 %) of acquisitions announcements are either still pending or withdrawn subsequently.

Table 2.1 Year-wise distribution of mergers and acquisitions announcements, 2003–2015

S. No.		Year													Grand total	Percentage
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		
1	Total announcements of M&A	507	570	1003	1157	1136	1131	1058	1137	790	810	705	800	902	11,683	100
2	Rumors, news of acquisitions withdrawn subsequently and pending	198	228	411	501	395	392	398	488	273	303	276	272	321	4365	37.4
3	M&A completed	310	349	602	668	770	748	660	649	517	507	429	528	581	7318	62.6
	Total announcements of M&A	507	570	1003	1157	1136	1131	1058	1137	790	810	705	800	902		
	Percentage of total announcements	4.34	4.88	8.59	9.90	9.72	9.68	9.06	9.73	6.76	6.93	6.03	6.85	7.72		
	Percentage of total M&A completed	4.2	4.8	8.2	9.1	10.5	10.2	9.0	8.9	7.1	6.9	5.9	7.2	7.9		

Source Thomson SDC Platinum Database

Table 2.2 summarizes the stake-wise sample distribution of mergers and acquisitions; it is evident from the Table that almost half (49.2 %) of acquisitions are acquisitions of minor stake as where nearly two-fifth (39.1 %) are acquisitions of complete stake and more than one-tenth (11.7 %) acquisitions are of partial/majority control.

The study has attempted to analyze the primary as well as secondary data related to mergers and acquisitions. The primary data has been collected using a questionnaire sent to Director (Finance) of companies that were engaged in merger and acquisition activities during a specified time period. The companies are located all over India. The questionnaire captures the opinion on the three major aspects, namely, management view on motives for M&A, management views on sources of synergy from M&A and motives of merger of wholly owned subsidiary.

The secondary data has been collected from various sources; these include the Thomson SDC database on mergers and acquisitions, Prowess databases of Centre for Monitoring Indian Economy (CMIE), websites of Bombay Stock Exchange, National Stock Exchange, Securities and Exchange Board of India (SEBI), Electronic Data Information Filing and Retrieval System (EDIFAR) website of SEBI, Economic Times, Business Standard and Moneycontrol. Besides, relevant data were also extracted from the annual reports and websites of the companies. As per the research methodology, these two types of data have been further used for analysis.

2.6 Sample Selection Criteria

To ascertain that the present research study captures the impact of merger and acquisition announcements and provides valid estimates of the measures, certain sample selection criteria (McWilliams and Siegel 1997) have been considered. As per the criteria, certain announcements other than M&A should not have taken place during the chosen event window of 41 days (20 days prior to announcement, 1 day for the announcement and 20 days after the announcement). This ensures that event window is not contaminated with any other type of announcement, thereby capturing the exclusive effect of the M&A announcements. The firm is included in the sample only when criteria as stated below are fulfilled.

The shares are ordinary common shares.

- (i) There are no announcements or ex-dates of cash dividend within the event window.
- (ii) There are no announcements or ex-dates of stock splits and stock dividends/bonus issues during the event window.
- (iii) There is no announcement of capital investment in a new project, credit rating and financial results during the event window.
- (iv) As a part of normal course of business, a company receives orders from various customers. It has been observed that if the order is of a substantial

Table 2.2 Stake-wise distribution of mergers and acquisitions announcements, 2003–2015

S. No.		Year												Grand total	Percentage
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	Acquisitions of minor stake	186	195	290	314	397	341	352	294	251	228	216	262	275	49.2
2	Acquisitions of major/partial control stake	21	37	69	69	83	91	72	94	84	69	51	66	47	11.7
3	Acquisitions of complete stake	103	117	243	285	290	316	236	261	182	210	162	200	259	39.1
	Total	310	349	602	668	770	748	660	649	517	507	429	528	581	100
	Percentage	3.6	4.1	8.5	10.0	10.1	11.0	8.2	9.1	6.4	7.3	5.7	7.0	9.0	

Source Thomson SDC Platinum Database

value and from prestigious customers, some companies provide this information to Bombay Stock Exchange expecting a positive change in the stock prices of the company. To make our sample free from this issue, the companies that made such announcement during the event window are eliminated.

- (v) There are no announcement of issuance of new shares by way of domestic or international offering in the form of Public Offer, Preferential Issue, Foreign Currency Convertible Bonds (FCCB), American Depository Receipts (ADR) and Global Depository Receipts (GDR).
- (vi) The firms must have daily price information available from the Prowess database, Bombay Stock Exchange or the Capitaline database. The firms having non-synchronous trading have been eliminated from the sample.
- (vii) The firms must have financial information available in 'Prowess' database.

Therefore, in this study while the universe for the M&A announcements is 11,683, the sample for short-term abnormal returns (event study) is 800. The unit of analysis for this study is acquiring firms in India.

The long-term performance of only those firms have been analyzed whose data is available before and after M&A. Extreme values have been excluded from the data to deal with the influence of outliers. After analyzing data for outliers, the values beyond three standard deviations have been dropped from the analysis. Due to unavailability of some data and inconsistency in some data collected, the number of firms utilized for long-term analysis of financial performance (ratio analysis) varied: 402 firms for 1 year before and after M&A, 401 firms for 1 year before and 2 year mean after M&A (-1, 2), 391 firms for 1 year before and 3 year mean after M&A (-1, 3), 361 firms for 1 year before and 4 year mean after M&A (-1, 4), 351 firms for 1 year before and 5 year mean after M&A (-1, 5), the mean of 2 years before and after M&A (-2, 2) of 401 firms, the mean of 3 years before and after M&A (-3, 3) of 398 firms, the mean of 4 years before and after M&A (-4, 4) of 387 firms, the mean of 5 years before and after M&A (-5, 5) of 360 firms have been analyzed.

2.7 Concluding Observations

This chapter discusses the objectives of the study, hypotheses to be tested and provides a description of the research methodology being used for the present work. The chapter also delineates the basis of the sample selection criteria. The proposed sample selection criterion differentiates this research work from the earlier works as it attempts to provide the non-contaminated (mergers and acquisitions) sample by manually verifying rigorous sample selection criterion. This enables the researchers

to determine the true impact of these decisions without contamination of data (McWilliams and Siegel 1997). The mechanics of the event study methodology, hypotheses and various tests used to check the robustness of the results have been explained in the chapter.

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