CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Design

Research design is the framework that is used to collect and analyse data. The type of research, time period of study, sampling design and research tools are determined during the design phase. Since this study seeks to investigate the effect of bank mergers on the performance of banks and their stock returns, it could be categorised as ‘descriptive research’.

3.2 Time period of the study

India went through large scale economic reforms in the year 1991, and consequently the existent private sector banks expanded their business operations and a few other new banks also came into existence. Tough competition ensued among the banks owing to free-market conditions and many private and public sector banks sought rapid growth through both organic and inorganic means. As a result, India witnessed the first market-driven bank merger in the year 1999, about eight years after the economic reforms were initiated. Hence, the year 1999 has been considered as the beginning year for this study after providing for the gestation period typically associated with large scale economic reforms.

Whereas, the upper limit was fixed as 2010 since a time window of (-3, +3) years is considered ideal for DEA analysis by many researchers. For example, Rhoades (1998) observed that there is unanimous agreement among the experts that about half of any efficiency gains would be apparent
after one-year and all gains would be realised within three years after merger. Kaur & Kaur (2010) and Sufian et al (2007) have also expressed the same viewpoint about the choice of time window for DEA analysis.

3.3 Sampling design

In the post liberalisation era during 1991 to 2010 there were 25 bank mergers in India. Out of these mergers 18 bank mergers had happened during the study period from 1999 to 2010. Among the 18 mergers only 16 mergers were bank-to-bank mergers. The merger of ICICI Ltd. with ICICI Bank and IDBI Ltd. with IDBI Bank was excluded from the study since both ICICI Ltd. and IDBI Ltd. were not commercial banks. Moreover, both mergers were reverse mergers where the parent company was acquired by the subsidiary company. The remaining 16 bank-to-bank mergers were considered for this study. Therefore, this study followed a purposive sampling technique. Since the market-driven mergers and the mergers based on government directives happen on the notion of perceived benefits to stakeholders, both types of mergers have been considered for this study (Table 3.1).
Table 3.1 List of bank-to-bank mergers in India from 1999 to 2010

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Acquiring Bank</th>
<th>Acquired Bank</th>
<th>Date of merger announcement</th>
<th>Date of actual merger</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HDFC Bank</td>
<td>Times Bank</td>
<td>26 Nov 1999</td>
<td>26 Feb 2000</td>
</tr>
<tr>
<td>2</td>
<td>ICICI Bank</td>
<td>Bank of Madura</td>
<td>08 Dec 2000</td>
<td>10 Mar 2001</td>
</tr>
<tr>
<td>4</td>
<td>Punjab National Bank</td>
<td>Nedungadi Bank</td>
<td>20 May 2002</td>
<td>01 Feb 2003</td>
</tr>
<tr>
<td>5</td>
<td>Bank of Baroda</td>
<td>South Gujarat Local Area Bank</td>
<td>18 Jun 2004</td>
<td>25 Jun 2004</td>
</tr>
<tr>
<td>7</td>
<td>Centurion Bank</td>
<td>Bank of Punjab</td>
<td>20 Jun 2005</td>
<td>01 Oct 2005</td>
</tr>
<tr>
<td>8</td>
<td>Federal Bank</td>
<td>Ganesh Bank of Kurundwad</td>
<td>06 Jan 2006</td>
<td>02 Sep 2006</td>
</tr>
<tr>
<td>9</td>
<td>IDBI Bank</td>
<td>United Western Bank</td>
<td>04 Sep 2006</td>
<td>03 Oct 2006</td>
</tr>
<tr>
<td>10</td>
<td>Indian Overseas Bank</td>
<td>Bharat Overseas Bank</td>
<td>15 Feb 2006</td>
<td>31 Mar 2007</td>
</tr>
<tr>
<td>16</td>
<td>ICICI Bank</td>
<td>The Bank of Rajasthan</td>
<td>19 May 2010</td>
<td>13 Aug 2010</td>
</tr>
</tbody>
</table>
3.4 Sources of data

This study has used secondary data collected from various sources. For event study analysis the dates of public announcement of mergers were collected from the Prowess database of Centre for Monitoring Indian Economy. The date of actual merger was obtained from the RBI website. Stock price data were collected from the online database Capitaline. BSE-500 index numbers were obtained from Capitaline.

For DEA analysis the accounting data relating to the various inputs i.e. capital, interest expenses and operating expenses and various outputs i.e. annual increase in average assets, total income and profit after tax were obtained from Capitaline database. Apart from these key sources data were obtained from websites of National Stock Exchange, other research papers, business magazines and newspapers for verification and to ensure data consistency.

3.5 Data

Daily closing stock price data of acquiring and acquired banks and closing value of BSE-500 index were used for computing daily stock returns and market returns in event study analysis. Shares of many acquired banks were not traded in the market after weeks of merger announcement and their share price data was not available for long after the date of merger announcement i.e. ‘Day Zero’. Hence daily stock return calculations were restricted to a 30 day time period after ‘Day Zero’. Black & Khanna (2007) and Anand & Singh (2008) have used similar time windows.

S&P BSE Bankex, the index which tracks the banking stocks in India was launched only during June 2003 and many mergers in the current study had happened before 2003. Hence, BSE-500 index, which is a broader
index compared to Bankex and BSE-30 Sensex, was considered as reference index to compute market returns. For example, Anand & Singh (2008) have used S&P CNX-500 index data in their study on bank mergers in India.

Data pertaining to shareholders capital, interest expenses, operating expenses, annual increase in average assets, total income and profit after tax of merged banks have been used for DEA analysis.

### 3.6 Research tools

Mergers are typically conceived on the basis of several gains that could be realised by different stakeholders across various time frames. Among the many consequences of mergers, the impact on stockholders and the impact on firm’s performance and efficiency have been widely studied by many researchers. While event study technique has been commonly used to analyse the impact on stockholders, either ratio analysis or DEA technique has been frequently used to analyse the impact on firm’s performance. Zollo & Degenhard (2007) reviewed 87 research papers on acquisition performance from top Management and Finance Journals between 1970 and 2006, and found that 41% of the papers had used the short-term event study method and 16% of the papers had used the long term event study method.

However, gauging the performance of banks based on ratios could be misleading as these ratios do not capture the long-term performance (Sherman & Gold 1985). Hence, recent studies appear to prefer frontier analysis methods, such as Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis too explain the performance of banks (Bhattacharyya & Chatri 2012). Among the frontier approaches, DEA does not require any assumption to be made about the distribution of data (Talluri 2000) and is gaining popularity now-a-days (Sufian 2007) since it is suitable for small samples (Evanoff & Israilevich 1991 and Avkiran 1999).
Very few authors appear to have analysed the bank mergers by combining these different methodologies to provide a comprehensive picture about bank mergers. For example, Sufian et al (2007) have applied both financial ratio analysis and Data Envelopment Analysis, to study the pre-merger and post-merger bank performance in Singapore. Avkiran (1999) and Liu & Tripe (2002) used financial ratio analysis and DEA to analyse the mergers in Australia and New Zealand, respectively. In India, Kumar & Suhas (2010) have used event study technique and accounting ratios to analyse bank mergers.

In this study bank merger effects are analysed using event study methodology and DEA analysis. Results of event study analysis and DEA analysis are compared to understand whether stockholders reaction and efficiency effects were in the same direction. While bank managers have their own reasons for indulging in merger activities they may or may not be addressing the concerns of stockholders. If the assessment made by stockholders is same as that of managerial expectations the impact of merger announcement on stock returns and performance efficiency must be similar. Otherwise, it implies that the assessment made by stockholders at the time of merger announcement was not correct. It would give rise to four different scenarios as shown in Figure 3.1.

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
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<tbody>
<tr>
<td>Stockholders Reaction – Positive</td>
<td>Stockholders reaction – Positive</td>
</tr>
<tr>
<td>Efficiency Effects – Positive</td>
<td>Efficiency effects – Negative</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 3</th>
<th>Scenario 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stockholders Reaction – Negative</td>
<td>Stockholders reaction – Negative</td>
</tr>
<tr>
<td>Efficiency Effects – Positive</td>
<td>Efficiency effects – Negative</td>
</tr>
</tbody>
</table>

**Figure 3.1 Stockholders Reaction and Efficiency Effects**
While scenarios 1 and 4 indicate that the stockholders assessment was correct, scenarios 2 and 3 indicate that their assessment was wrong. Conceptually, shareholder wealth maximisation is the main objective of companies and market capitalisation is a major component of the wealth. Any action that would deplete the market value of stocks is considered detrimental by the stockholders. If consolidation does, in fact, lead to value gains, then shareholder wealth can be increased. Otherwise, it would lead to less profitable and valuable banking industry (Singh 2009).

Berger & Humphrey (1992) found that acquiring banks were significantly more efficient than acquired banks, indicating that the acquirer might improve the efficiency of the acquired bank. Whereas, Akhavein et al (1997) argued acquiring banks use merger as an excuse to improve efficiency within the current organisation. Hence, firms that benefit most from mergers would be those that are least efficient at the outset. Based on the findings of Berger & Humphrey (1992), DeLong (2003) hypothesised that, mergers in which the acquirer was more efficient than the target had a higher potential for improving efficiency. It was argued that more the difference in efficiency ratios, higher should be the abnormal stock returns of the merging banks.

In this study most of the acquired banks were financially distressed at the time of merger. Hence, on the basis of DeLong’s (2003) argument, an attempt has been made to relate the stock returns of acquiring banks to the DEA results. When investors perceive a merger as beneficial the market reaction would be favourable and the stock returns would be positive. However, stockholders assessment of merger outcome may or may not be reflected in the long-term financial performance of banks. Therefore, DEA results computed from reported financial data of merged banks are
corroborated with the event study results. This rationale could be further strengthened by the fact that shareholders’ capital is used as an input to calculate profit and cost efficiencies (Chu & Lim 1998 and Singh 2009).

If the financial performance of merged banks had improved after merger their profit efficiency and cost efficiency would be higher than the pre-merger efficiency values. If the stock returns in such cases are also positive it would indicate that the stockholders assessment of the merger deal was indeed correct (Figure 3.1).

3.6.1. Event Study Methodology

This methodology is founded on the semi-strong form of market efficiency and assumes that all publicly available information is reflected in the stock prices. The impact of public announcement on stock prices is gauged by measuring the difference between actual and expected stock returns. This difference is ‘abnormal stock return’ and a positive value indicates that the public announcement was viewed favourably by the markets and vice versa. At the same time if abnormal stock returns are observed ahead of public announcement it implies the possibility of information leakage. Usually, data pertaining to such doubtful time period is excluded to avoid sampling bias.

3.6.1.1 Event definition

Any public announcement, such as merger, dividend, financial result, key research result, change in business strategy etc. which might affect the stock prices of a firm is considered as an event. Here, the public announcement of bank merger is considered as an event. Moreover, the term ‘merger’ has been used in a broad sense to denote all the corporate consolidation activities in Indian banking sector, such as acquisition, takeover, amalgamation etc.
3.6.1.2. Event day

In most cases there is considerable time delay between merger announcement of firms and actual merger of the firms due to legal, technical and accounting complexities. By the time the concerned firms commence their operations as a single entity the information shock that arose out of merger announcement would have been absorbed in the stock prices. Hence, it would be inappropriate to use the date of actual merger for analysing the impact of merger announcements on stock prices. Therefore, the first date of public announcement of merger was considered as the event day i.e. ‘day zero’.

3.6.1.3. Clean period and window period

Merger announcements are usually preceded by board meetings, where merger proposals are considered and evaluated before public announcement and, the possibility of information leakage cannot be ruled out. As discussed earlier, these leakages would lead to sampling bias and wrongly influence the results. Hence, a few researchers, Anand & Singh (1997) and Singh & Montgomery (1987) used an event window of 800 to -551 days before the event, to remove the effect of rumours. However, the typical estimation period is about -250 to -50 days before the event (Chatterjee 1986, Hayward 2002 and Kiymaz & Baker 2008).

Yet, in the context of bank mergers in India, Kumar & Panneerselvam (2009) have argued that if the reference period was too long or far removed from the event, the risk characteristics of the sample firm might have changed. Hence, the clean period was chosen as 120 days. Kelm et al (1995), Black & Khanna (2007) and Anand & Singh (2008) have also used similar clean period windows.
While Mathur et al (1997) used ±2 days event window, Nayyar (1993) used an even shorter event window of ± 1 day. However, Kumar & Panneerselvam (2009) had cautioned that if the reference period was too short, it might not serve as a valid benchmark. At the same time stocks of acquired banks were not traded for long after merger announcements. Hence, the event window was chosen as ±30 days. Black & Khanna (2007) and Anand & Singh (2008) have used a similar time window.

3.6.1.4. Actual return

Actual return is the real gain or loss made in terms of capital gain/loss and stock price gain/loss. Here, the daily actual returns are computed by finding the difference between stock prices on two consecutive trading days. The actual stock return in percentage terms is obtained by dividing this difference by the closing price of stocks on the previous trading day. This method has been used in many event study analyses done by researchers such as Pandey (2001), Amihud & Lev (1981) and Bradley et al (1988).

3.6.1.5. Expected return

Expected return is the potential gain or loss sans the event and is computed by constructing a model with the clean period data of stock returns and market returns. This approach helps to exclude the shock effect resulting out of any event on the model and indicates the likely price in the absence of the event. Daily stock returns are estimated using clean period data of bank stock returns and BSE-500 index (Equation 3.1)

In the Indian context Anand & Singh (2008) have used both single-factor and two-factor models to compute expected returns. They had used CNX Bank Index and S&P CNX 500 indices for model construction. However, McKinlay (1997) has supported the usage of standard event study
model and argued against usage of multi-factor models owing to their limited benefits. Moreover, S&P BSE Bankex and CNX Bank Index, potential secondary indices cannot be used in this context. These indices were launched in 2003 and 2000, respectively, whereas some of the mergers in this study have happened before 2000. Hence, single-factor model has been used in this study.

In the US context, Cornett & De (1991), and Toyne & Trip (1998) have used the standard event study method as described by Dodd & Warner (1983). This market model has also been used by Chehab (2002) and Neely (1987) for analysing bank mergers.

3.6.1.6. Average return

Average return is obtained by dividing the sum of daily percentage returns in a given time period by the number of days.

3.6.1.7. Cumulative average return

Cumulative average return in a given time period is the sum of average returns in the given time period (Hayward 2003, Masulis et al 2007 and Uddin & Boetang 2009).

3.6.1.8. Abnormal return (AR)

The difference between observed/actual returns and estimated returns is the abnormal stock return, and many researchers appear to have used the market model for computing the estimated returns. For example, Brown & Warner (1980), Pruitt & Peterson (1986) and Etebari et al (1987) have used this model to analyse the impact of public announcements on corporate stock prices. Pandey (2001) and, Kumar & Rajib (2007). have used this model to study the corporate mergers in India. Depending on the potential
positive or negative impact, or perception of impact, the abnormal returns could be either positive or negative. If abnormal positive returns are observed after an event i.e. public announcement, it may be assumed that the impact was favourable and vice versa.

Typical canonical form of the model is given below:

$$r_{jt} = R_{jt} - (\alpha + \beta R_{mt} + \varepsilon_{jt})$$ \hspace{1cm} \ldots (3.1)

Where,

- $r_{jt}$ = Abnormal return for bank stock $j$ at time $t$
- $R_{jt}$ = Actual return of bank stock $j$ at time $t$
- $\alpha$ = Ordinary Least Squares (OLS) estimate of the intercept of the market model regression
- $\beta$ = OLS estimate of the coefficient in the market model regression
- $R_{mt}$ = Return of market index BSE-500 on day ‘t’
- $\varepsilon_{jt}$ = Error term / unsystematic component of firm j’s return

The Average Abnormal Return was calculated as follows:

$$AR_{p} = \frac{\sum_{t=1}^{n} r_{jt}}{n}$$ \hspace{1cm} \ldots (3.2)

Where,

- $n$ = Number of events in the event study

The cumulative average abnormal return (CAAR) was calculated as follows:

$$CAAR = \sum_{t=0}^{n} AR_{t}$$ \hspace{1cm} \ldots (3.3)

The statistical significance of CAAR was computed as follows:

$$t = \frac{CAAR}{S.E.}$$ \hspace{1cm} \ldots (3.4)
Where,

\[ t = \text{Student’s t statistic value} \]
\[ \text{S.E.} = \text{Standard Error of the average returns} \]


### 3.6.2. Data Envelopment Analysis (DEA)

Data Envelopment Analysis, also termed as frontier analysis, is a non-parametric method based on microeconomic production theory and is used to measure the relative efficiency of decision making units (DMUs) on the basis of a frontier or the maximum possible outputs with the given set of inputs. The term DMU is conventionally used to emphasise that the focus is on decision making entities and not essentially profit making firms. However, DEA came to be applied to private sector too later on (Gattoufi et al 2014). In DEA it is endeavoured to construct a frontier which envelops all the inputs and outputs and hence the name ‘data envelopment analysis’. DMUs which are on the frontier are deemed to have unit efficiency and other DMUs which are inside the frontier are considered to be less efficient. DMUs with lesser efficiency strive to reach maximum efficiency by either reducing the input requirements or by increasing the outputs.

The term *data envelopment analysis* was coined by Charnes et al (1978) who furthered the ideas of Farrell (1957) and used linear programme technique to create a frontier based on actual data. The original idea was based on constant returns to scale idea i.e. increase in inputs would result in a proportionate increase in the output levels. This meant that in perfect market conditions a firm which is less efficient than other homogenous players would
not be able to survive in the long run i.e. all the firms had to operate at an optimal level. This limiting assumption is not applicable over a wide range of practical situations where the market conditions are far from being perfect and the existence of firms with lower efficiencies is commonly observed.

This framework is easier understood as a ratio which is given below:

\[
\text{Efficiency} = \frac{\text{Weighted sum of outputs}}{\text{Weighted sum of inputs}} \ldots (3.5)
\]

The goal is to maximise the efficiency of a DMU with the given set of inputs and outputs. The fundamental question of many post-merger studies is to identify whether or not, the acquiring firms’ performance improved after the merger. If the efficiency of acquiring banks increase after merger performance improvement could be implied as a consequence of merger and vice versa. Typically, cost efficiency, profit/revenue efficiency and market power are compared. Mergers could increase profits through the exercise of additional market power or a superior combination of inputs and outputs could improve the profit efficiency. Overall, profit efficiency appears to be a more inclusive concept since it considers cost and revenue effects of the output (Berger 1998).

Equation (3.5), used to calculate such efficiencies could be restated (Charnes et al 1978) for \( n \) DMUs, each with \( m \) inputs and \( s \) outputs, as follows:

\[
\begin{align*}
\max & \quad \frac{\sum_{k=1}^{n} v_k y_{k} u}{\sum_{j=1}^{m} u_j x_{j}} \\
\text{s.t.} & \quad \frac{\sum_{k=1}^{n} v_k y_{k} u}{\sum_{j=1}^{m} u_j x_{j}} \leq 1 \quad v_k, u_j \geq 0
\end{align*}
\]

\ldots (3.6)
Where,
\[ k = 1 \text{ to } s \]
\[ j = 1 \text{ to } m \]
\[ i = 1 \text{ to } n \]
\[ y_{ki} = \text{amount of output } k \text{ produced by DMU } i \]
\[ x_{ji} = \text{amount of input } j \text{ utilised by DMU } i \]
\[ v_k = \text{weight given to output } k \]
\[ u_j = \text{weight given to input } j \]

Equation (3.6) could be converted to a linear programme model as given below:

\[
\begin{align*}
\text{Max} & \quad \sum_{k=1}^{s} v_k y_{ki} \\
\text{s.t.} & \quad \sum_{j=1}^{m} u_j x_{ji} = 1 \\
& \quad \sum_{k=1}^{s} v_k y_{ki} - \sum_{j=1}^{m} u_j x_{ji} \leq 0 \\
& \quad v_k, u_j \geq 0
\end{align*}
\]

As stated earlier, a score of 1 denotes that a DMU is efficient and lesser score denotes that a DMU is inefficient. Later, Banker et al (1984) extended the constant returns to scale (CRS) model to permit variable returns to scale (VRS). This approach is based on the notion that an increase in inputs does not result in a proportional change in outputs and is more relevant in various scenarios. This was achieved by adding another constraint to the original CRS model developed by Charnes et al (1978). The constraint, in simple terms, is that the sum of weights must add up to unity.

Another deduction is that efficiency maximisation is possible either by maximising the outputs or by minimising the inputs or both. The first scenario is generally termed as output oriented model and the second scenario as input oriented model. In this study, variable returns to scale model
with an output orientation is being used. This approach would help to check whether bank performance, measured in terms of growth, has increased after merger.

3.6.2.1. Choice of variables

While there is no consensus on the choice of variables (Rammohan 2004 and Aly et al 1990) many researchers appear to have either followed the production approach or intermediation approach (Berger et al 1992). Production approach is based on the original micro economic production theory and the banks are considered to use labour and capital as inputs to generate deposits and loans as outputs. Intermediation approach was proposed by Sealey and Lindley (1977) where, deposits are considered to be converted into loans (Mester 1987). This method usually takes into account interest expense, which is a major cost for any bank (Berger & Humphrey 1993) and appears to be more popular in the banking context. For example, Sathye (2003), Cook et al (2001) and, Leong & Drollery (2002) have considered interest expense in their analyses. However, other researchers like Das & Ghosh (2006), and Kumar & Verma (2003) have not considered interest expense in their studies.

Yet, the argument that interest expense is a major cost to banks appears to be valid and hence it was decided to apply the intermediation approach. For example, Singh (2009) and Yeh (1996) have used interest expense as an input variable in their study. Sharma (2002) too argued that bank intermediate deposits into loans and hence interest expenses must be considered as independent variable. It was also noted that banks operated with a profit motive in the liberalised environment and hence Profit After Tax must be included as a dependent variable for calculation of profit efficiency. In case of
cost efficiency calculation it was observed that loans were more important than real assets (fixed assets) and hence annual increase in assets was considered as dependent variable.

Apart from interest expenses, banks also incur huge outflows in the form of salaries, rentals etc. which were considered as the second input variable under the head operational expense. The third input variable considered is the shareholders’ capital, since considerable expenditure is incurred under this head (Hughes 1993 and Mester 1996). Moreover, this was chosen to provide a link to the first objective, where shareholder wealth maximisation notion is implicitly evaluated using event study model.

Total income, which is a sum of interest and non-interest income, was considered as one output variable. Profit after tax, was considered as the second output variable since profit efficiency is more inclusive in nature. Increase in assets, was considered as the third variable, since loans form a major portfolio of the banks’ assets. Singh (2009) and, Chu & Lim (1998) have used similar variables in their analyses.

Various combinations of these inputs and outputs could be used to calculate different efficiencies like cost efficiency, profit efficiency and total efficiency. Cost efficiency is calculated from the annual increase in average assets and total income (Equation 3.8). Profit efficiency (Equation 3.9) is calculated from the annual increase in average assets and profit (Refer Figure 3.2).

1. Shareholders capital
2. Interest expenses
3. Operating expenses

Bank transforms input into output

1. Annual increase in assets
2. Total income (CE)
3. Profit after tax (PE)

Figure 3.2 Inputs and Outputs of DEA model
Cost Efficiency = \( \frac{(v_1 \times \text{Annual Increase in Assets} + v_2 \times \text{Total Income})}{(u_1 \times \text{Shareholders capital} + u_2 \times \text{Interest Expenses} + u_3 \times \text{Operating Expenses})} \)  (3.8)

Profit Efficiency = \( \frac{(v_1 \times \text{Annual Increase in Assets} + v_2 \times \text{Profit After Tax})}{(u_1 \times \text{Shareholders capital} + u_2 \times \text{Interest Expenses} + u_3 \times \text{Operating Expenses})} \)  (3.9)

Where, \( v_1, v_2, u_1, u_2 \) and \( u_3 \) are weights computed by solving the Equation 3.7. Overall, any corporate activity must be aimed at increasing the stockholders' wealth and at times the expectation of stockholders and managers may not be similar. It would lead to situations where either of them benefits, leaving the other stakeholder out. If the merger expectations of stockholders and managers are similar the estimated benefits would positively impact the stock prices. Hence, an attempt has been made to compare the stock returns and efficiency gains of bank mergers in India.