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Efficiency of Indian Commercial Banks: The Post-Reform Experience from Mergers & Acquisitions

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&

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Abstract

In recent times, Indian banks have resorted to mergers and acquisitions (M&A) in the expectation to reap efficiency gains brought in by such strategies. This paper explores the impact of M&A on technical efficiency of Indian commercial banks during the second decade (2000-2010) of reforms. We use DEA to compute the relative technical efficiency of banks that participated in M&A activities. The technical efficiency is computed under both *common* and *separate* frontier with the assumption of *constant* as well as *variable* returns to scale. We also compare the post-amalgamation efficiency scores of the participating banks with that of a control group comprising of such banks that did not undergo any consolidation since 1991. Our results indicate evidence of efficiency gains for the merging and/or acquiring banks. At the same time there are banks that have experienced deterioration in their post-M&A average efficiency levels. It would be wise for the banks to carefully consider the potential gains as well as threats posed by M&A before venturing into such activities.

Key words: Commercial Banking; DEA; Technical Efficiency; Control Group

JEL Classification: C61, G21

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1. Introduction

Mergers and acquisitions (M&A) as a means of modern corporate restructuring strategies have been increasingly resorted to in recent times to reap different forms of strategic benefits (*viz.* cost efficiencies, maximization of shareholders' value, synergies, etc.). Financial innovations have also fuelled consolidation activities. Commercial banks across the world have resorted to M&A in expectation to enhance efficiency gains through such consolidation strategies. In recent past, just after the massive sub-prime crisis when the world had witnessed a global financial meltdown that engulfed some of the giant advanced economies, there has been much emphasis on the efficiency of the commercial banks.

We focus on M&A that had taken place in the Indian commercial banking sector and the gamut of challenges and opportunities that such shake outs and restructuring brought in to the banks. In this context, a central issue has been *whether M&A enhanced efficiency of the Indian commercial banks*. The post-liberalization era of banking sector reforms had opened up fierce competition among *inter* and *intra*-bank groups in India. The cutthroat competition has resulted in new challenges especially for the public sector banks to hold back their market share, retention of the consumer base and creation of a new customer base.

The objective here is to explore the pre and post-M&A performance of Indian banks when there had been number of measures (e.g., interest rate deregulation, operational autonomy, etc.) that were taken towards the financial market reforms. The itinerary of the paper is as follows. Section 2 evaluates recent performance of the banks with respect to certain parameters. Section 3 discusses amalgamation among commercial banks and issues related to concentration in the banking sector. Section 4 mentions the extant empirical literature followed by discussion on research methodology, data and variables in Section 5. Empirical results are reported in Section 6. Finally, concluding remarks are given in Section 7.

2. Performance of Scheduled Commercial Banks

The banking sector in India is largely dominated by the public sector banks (PSBs) that account for nearly 70 percent of the banking assets.¹ In particular, the commercial banks account for majority of the total assets of India's financial landscape which in turn is largely dominated by the scheduled commercial banks (SCBs). The fast pace of deposits growth can be viewed from the fact that over a year time (2009 to 2010) total bank deposits increased by 48.6 percent. Not only that, the total advances and investments made by the SCBs grew at an impressive rate of 16.5 percent and 18.6 percent respectively, during the same period. Latest available statistics reveal that the new private sector banks have registered the highest growth rate at 20.8 percent in the

branch network during 2009-10 while SCBs as a whole marked 7 percent expansion in their total branch network during the same period. All commercial banks have migrated to Basel II framework for maintaining their regulatory capital. During the year 2010, the capital base of all SCBs increased by 16.9 percent over the previous year. ROA has been higher than the benchmark (1 percent) in 12 public sector and 14 private sector banks.ⁱⁱ These figures portray that since the initiation of financial sector reforms in early 1990s, private and foreign banks have carved a niche for themselves in the Indian financial system. These banks also started setting new standard for the entire banking sector in terms of capital adequacy, return on capital and profit per employee, etc.ⁱⁱⁱ The World Economic Forum in its Financial Development Index (2008) credits the gradual reforms and prudential regulations for the reasonable stability of the Indian banking system.

Table 1 quickly assess the performance of the different commercial bank groups at three different years — 1991, representing the initiation of the reform process, 2002 after a decade of reform process and 2010 for the recent performance.^{iv} The table reveals the dismal performance of all the different bank groups on the eve of the reforms; however, the private banks had an edge over others. Since 1991, profit per employee has consistently increased and cost-income ratio has shown a secular fall across all the bank groups.

Table 1: Profitability and Cost Based Indicators of Efficiency

Bank Groups	Net Profit per Employee (Rs. '000)			Cost-Income Ratio (<i>in percent</i>)		
	1991	2002	2010	1991	2002	2010
SBI & Associates	5.04	121.43	465.06	94.46	52.11	50.27
Nationalized Banks	4.76	102.58	566.82	93.89	56.65	44.14
Private Banks	7.42	170.94	719.28	92.63	51.46	43.73
<i>Average</i>	<i>5.74</i>	<i>131.65</i>	<i>583.72</i>	<i>93.66</i>	<i>53.40</i>	<i>46.04</i>

Source: Authors' calculation based on Database on Indian Banking 1987-98, IBA (1999) and Performance Highlights of Public Sector Banks, IBA (various issues).

Note: The cost-income ratio is ratio of operating cost (non-interest expense) to net total income (total income minus interest expense).

Table 1.1 reveals that on the eve of liberalization programs, the ratio of unsecured advances to total advances (a proxy for loan quality) increased substantially for SBI (by 47.3 percent) and private sector banks (74.6 percent) while the associates of SBI and other nationalized banks reported a marginal decline. This highlights the increased level of risk faced by the Indian banks.

Table 1.1: Loan Quality of Commercial Banks

Bank/Bank Groups	Unsecured Advances/ Total Advances (<i>in percent</i>)			
	1988	1989	1990	1991
SBI	16.50	19.80	20.96	24.31
Associates of SBI	5.34	4.90	5.41	4.64
Nationalized Banks	11.90	11.52	10.99	9.39
Private Banks	5.41	5.70	7.86	9.45

Source: Authors' calculation based on Performance Highlights of Public Sector Banks, IBA (1987-98).

Financial repression best describes the state of banking sector until the dawn of the era of liberal economic policies in India. The banking sector had remained shielded from foreign competition consequent of the various restrictive policies in place. An imminent need for improvement in efficiency of Indian banks was recognized and subsequently RBI started focusing its policies in pursuit of capital adequacy and profitability of the banks. The banking sector reforms were aimed at ushering efficiency and stability in Indian banking sector.

Table 2.1 and 2.2 represent the ratio of net profit to total assets of the public and private sector banks respectively, for the last decade.^v There is an overall improvement in terms of profitability for both the bank groups as indicated by their average values. However, the PSBs have experienced a better improvement; 13 of the 21 PSBs (including the SBI group) ended with a higher net profit to assets ratio in 2010. Amongst the private sector banks, there are few whose performances have deteriorated. Most of such banks were either acquired or merged primarily due to their dismal performance. In total, 23 banks (public and private) participated in M&A of which 4 PSBs [Bank of Baroda, IDBI, PNB and SBI] and 3 private banks [Federal bank, ICICI bank and HDFC] have improved their profitability in the post-merger period.

Table 2.1: Net Profit/Total Assets (*in percent*) of Public Sector Banks

Banks	2002	2003	2004	2005	2006	2007	2008	2009	2010
Allahabad Bank	0.32	0.59	1.34	1.20	1.28	1.11	1.18	0.79	0.99
Andhra Bank	0.97	1.63	1.72	1.59	1.19	1.13	1.02	0.95	1.16
Bank of Baroda	0.77	1.01	1.14	0.71	0.73	0.72	0.8	0.98	1.1
Bank of India	0.72	1.12	1.19	0.36	0.62	0.79	1.12	1.33	0.63
Bank of Maharashtra	0.68	0.89	0.95	0.54	0.16	0.70	0.68	0.64	0.62
Canara Bank	1.03	1.24	1.34	1.01	1.01	0.86	0.87	0.94	1.14
Central Bank of India	0.31	0.54	0.98	0.52	0.34	0.54	0.44	0.39	0.58
Corporation Bank	1.31	1.58	1.73	1.19	1.10	1.02	1.1	1.03	1.05
Dena Bank	0.06	0.57	1.04	0.25	0.27	0.64	0.93	0.87	0.89
Indian Bank	0.11	0.53	1.04	0.93	1.06	1.35	1.43	1.48	1.53
Indian Overseas Bank	0.65	1.01	1.08	1.28	1.32	1.23	1.18	1.1	0.54
Oriental Bank of Commerce	0.99	1.34	1.67	1.34	0.95	0.79	0.93	0.79	0.83
Punjab & Sind Bank	0.17	0.03	0.06	- 0.45	0.57	0.99	1.24	1.04	0.90
Punjab National Bank	0.77	0.98	1.08	1.12	0.99	0.95	1.03	1.25	1.32
Syndicate Bank	0.79	1	0.92	0.77	0.88	0.80	0.79	0.7	0.58
UCO Bank	0.52	0.59	0.99	0.63	0.32	0.42	0.46	0.5	0.74
Union Bank of India	0.71	1.08	1.22	0.99	0.76	0.82	1.12	1.07	1.06
United Bank of India	0.52	1.26	1.22	1.03	0.62	0.63	0.59	0.3	0.42
Vijaya Bank	0.81	1.03	1.71	1.30	0.40	0.78	0.64	0.42	0.72
SBI & Its Associates	0.77	0.91	1.02	0.91	0.86	0.82	0.89	0.93	0.88
IDBI Bank	...	...	...	0.38	0.63	0.61	0.56	0.5	0.44
Average	0.65	0.94	1.17	0.84	0.76	0.84	0.90	0.86	0.86

Source: Performance Highlight of Public Sector Banks, IBA (Various Issues).

Note: IDBI Bank was established in the year 2004.

Table 2.2: Net Profit/Total Assets (in percent) of Private Sector Banks

Banks	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Bharat Overseas Bank	0.80	0.90	1.17	1.25	0.62	0.14	...	...	...	...
City Union Bank	1.13	1.25	1.23	1.79	1.33	1.36	1.34	1.38	1.32	1.32
Dev. Credit Bank	0.71	0.72	0.58	0.32	-3.50	-2.27	0.14	0.51	-1.48	-1.28
Karnataka Bank	0.64	1.12	1.19	1.26	1.17	1.17	1.09	1.25	1.17	0.62
Lord Krishna Bank	0.34	1.12	1.24	1.01	-0.97	0.14	-0.61	...	...	...
Nainital Bank	0.52	0.86	0.98	1.43	1.08	0.92	1.04	1.32	1.48	1.51
SBI Commercial & International Bank	-6.32	0.44	-1.45	3.67	-2.10	1.08	1.13	1.93	1.52	0.49
Tamilnad Mercantile Bank of Rajasthan	1.29	1.22	1.35	1.59	1.47	1.65	1.49	1.43	1.34	1.36
Bank of Rajasthan	0.69	0.78	1.12	0.82	0.38	0.15	0.91	0.73	0.68	-0.59
Catholic Syrian Bank	0.36	1.03	1.17	1.31	0.24	0.12	0.36	0.61	0.53	0.02
Dhanalakshmi Bank	0.39	0.52	0.71	0.71	-0.82	0.33	0.47	0.71	1.02	0.29
Federal Bank	0.66	0.78	0.86	0.90	0.54	1.09	1.17	1.13	1.29	1.06
Ganesh Bank of Kurundwad	0.21	0.50	0.66	0.61	-2.56	...	...	...	...	...
Jammu & Kashmir Bank	1.29	1.73	2.01	1.92	0.47	0.66	0.96	1.12	1.09	1.20
Karur Vysya Bank	1.62	2.03	2.02	2.27	1.34	1.50	1.44	1.41	1.38	1.53
Lakshmi Vilas Bank	0.97	1.01	1.06	1.07	0.08	0.45	0.30	0.39	0.61	0.29
Nedungadi Bank	-3.40	0.07	...	...	...	...	...	...	...	...
Ratnakar Bank	0.66	0.99	1.30	1.04	-1.09	0.06	0.26	1.14	1.79	0.92
Sangli Bank	0.32	0.50	0.64	0.61	...	-1.36	-18.8	...	...	...
South Indian Bank	0.77	0.93	0.94	0.91	0.09	0.47	0.76	0.89	0.96	0.92
United Western Bank	-0.24	0.45	0.46	0.43	-1.39	-1.48	...	...	...	...
Vysya Bank	0.33	0.58	...	...	...	...	...	...	...	...
ING Vysya Bank	...	...	0.75	0.45	-0.25	0.05	0.46	0.61	0.59	0.71
Bank of Punjab	0.92	0.91	0.74	0.76	-1.25	...	...	...	...	...
Centurion Bank	0.19	-3.80	-0.74	-2.96	0.54	...	...	...	...	...
Centurion Bank of Punjab	...	...	...	...	...	0.77	0.66	0.44	...	...
Global Trust Bank	0.78	0.47	-3.55	-11.2	...	...	...	...	...	...
HDFC Bank	1.25	1.19	1.27	1.20	1.29	1.18	1.25	1.19	1.22	1.33
ICICI Bank	0.79	0.24	1.12	1.31	1.20	1.01	0.90	1.04	0.99	1.11
IDBI Bank	0.35	0.72	0.89	1.02	...	...	...	...	...	...
IndusInd Bank	0.43	0.46	0.91	1.74	1.35	0.20	0.33	0.32	0.54	0.99
UTI Bank	0.75	0.89	0.98	1.15	0.89	0.97	0.90	0.98	1.23	1.39
Kotak Mahindra Bank	...	...	2.08	1.35	1.30	1.16	0.71	1.04	0.96	1.50
Yes Bank	...	...	...	...	-0.29	1.32	0.85	1.18	1.33	1.31
Average	0.67	0.61	0.99	0.95	0.84	0.87	0.86	1.01	1.05	1.13

Source: Performance Highlights of Private Sector Banks, IBA (Various Issues).

In the pre-reform days, interest rate regulation had been a major hindrance to the development and efficient functioning of the banking sector. Competition among banks was virtually absent and the nationalized banks were to perform many 'social duties'. All these were at the cost of profitability of the banks and eventually led to cumulative rise in non-performing assets (NPA). In spite of a rapid increase in the bank deposits, the profitability was extremely low — the average ROA in the second half of 1980s was only about 0.15 percent. In 1992-93, the NPA of public sector banks stood at 24 percent of the total loan portfolio. By 1991, the Indian banking sector had become

unprofitable, inefficient, and financially weak; Joshi *et al.* (2003). Following the nationalization of banks in 1969, the primary objective was *not* of attaining efficiency but an increase in deposits and loans by way of branch expansion. The banking sector in the recent past has shown stability and resilience.^{vi} Amidst the global financial conundrum, Indian banking system was able to withstand the shocks of the meltdown mainly due to its strengths, prudential regulations and timely interventions by the RBI.

Table 3 shows that banks have been successful in cutting down their operational expenses since the initiation of the reform process. Both the bank groups experience a decrease in the cost of intermediation by around 38 percent vis-à-vis their 1991 position. While the PSBs took some time to adjust to the regulatory changes, the private banks were able to adapt quickly to the new business environment. In the recent past, the PSBs had maintained a lower intermediation cost than their private sector counterparts implying their relative cost advantage with respect to the domestic private banks.

Table 3: Intermediation Cost (as percent of total assets) of SCBs

Year	Public Sector Banks	(Domestic) Private Banks
1991	2.36	3.14
1992	2.47	2.74
1993	2.51	2.55
1994	2.51	2.32
1995	2.69	2.11
1996	2.84	2.32
1997	2.69	2.18
1998	2.52	1.98
1999	2.65	2.04
2000	2.52	1.85
2001	2.59	1.75
2002	2.28	1.39
2003	2.24	1.99
2004	2.21	2.01
2005	2.05	2.02
2006	2.05	2.10
2007	1.77	2.05
2008	1.54	2.15
2009	1.47	1.73
2010	1.46	1.89

Source: Authors' calculation based on Performance Highlights of Public and Private Sector Banks, IBA (various issues).

Table 3.1 portrays the improvement in the financial health of the public and private sector banks.^{vii} We chose three discrete years [2002, 2006 and 2010] with equal intervals to have a representative assessment of the financial performance of the banks over the last decade. In comparison to the Basel II norms, we find only the (domestic) private banks to perform above the benchmark in 2002.^{viii} In the later period, though SBI group have witnessed a fall in the average ROA, it has subsequently improved its performance along with the other nationalized banks in 2010. In contrast, the private banks as a whole experienced an initial decline in their ROA before improving it in 2010. Operating profit declined by 29.34 and 21.67 percent respectively, for the SBI group and the private sector banks. However, the nationalized banks recorded an impressive growth of 176.47 percent.

Table 3.1: Performance Indicators of Public and Private Sector Banks

Bank Group	2002		2006		2010	
	ROA	Operating Profit (Percent of AWF)	ROA	Operating Profit (Percent of AWF)	ROA	Operating Profit (Percent of AWF)
SBI Group	0.95	2.76	0.80	2.25	1.00	1.95
Nationalized Banks	0.68	1.90	0.85	1.98	0.98	1.88
Private Banks	1.18	2.63	0.59	1.71	0.94	2.06

Source: Performance Highlights of Public and Private Sector Banks, IBA (various issues).
 Note: AWF refers to average working funds defined as fortnightly average of total assets.

3. Mergers & Acquisitions Among Indian Banks

The M&A scenario in the last decade has been quite prominent as 15 bank mergers and/or acquisitions have taken place with at least one merger and/or acquisition every year.^{ix} HDFC, ICICI and SBI with two acquisitions each, are the banks that seem to be keen on taking advantages of M&A friendly environment witnessed by the banking sector. It is worth mentioning that prior to 1999, M&A were resorted to only by the weak banks. During the second decade of reforms the banking sector witnessed consolidation even between financially healthy banks; e.g., acquisition of State Bank of Indore by SBI.

A larger number of M&A have been voluntary and market driven based on strategic considerations. The share of the public and the private sector banks (as surviving entities) in the total number of M&A are 7 and 8, respectively. The private sector banks had a larger share in the number of participating banks (acquirer plus target bank) than the PSBs. The decade of 2000-10 actually saw the re-emergence of consolidation in the banking system in a more pronounced way wherein a total of 17 M&A took place. A noteworthy feature of the first phase of financial sector reforms (1991-94) is the increased importance of consolidation strategies; for instance, the merger of New Bank of India with Punjab National Bank in 1993. There from, the Indian banking sector has witnessed a new series of merger & acquisition activities involving both the public sector and Indian owned private sector banks. In the public sector, SBI acquired Kashinath Seth Bank in 1995; Oriental Bank of Commerce acquired Punjab Co-operative Bank Ltd. and Bari Doab Bank

Ltd. in 1997, and the Global Trust Bank in 2004. ICICI has been a prominent player among the Indian owned private sector banks as it has acquired four banks till date, namely, Bank of Madura (1997), ICICI Ltd. (1998), Sangli Bank (2007) and the recent one being Bank of Rajasthan (2010).

Table 4: M&A in the Indian Banking Sector

Period	Number of M&As
Pre-nationalization: 1961-1968	204
Pre-liberalization: 1969-1991	15
Post-liberalization: Phase I [1992-2000]	09
Phase II [2001-2010]	17
Total	245

Source: Report on Trend and Progress in Banking, RBI (*various issues*).

Note: The figure for 2001-2010 includes the merger of a foreign bank ING and Vysya Bank and the creation of ICICI Bank and IDBI Bank from ICICI and IDBI, respectively.

The prospects of M&A in the Indian banking sector can be seen from two perspectives. One is the legal or regulatory framework that have taken place since the herald of gradual liberalization during which the restrictions on such activities have been removed or moderated by the policy makers. The second perspective is to assess whether the merging banks have reaped any potential advantage from such consolidation strategies. To put it differently, there is an imperative to gauge the financial position of banks vis-à-vis M&A strategies.

3.1 Issues in Consolidation

During the first decade of reforms, Avkiran (1999) cautioned the policy makers against any haste in facilitating M&A activities as there are inconclusive international evidences of gains reaped either by the banks themselves or by their customers. The merging banks were expected to improve their financial performance so as to give healthy competition to the big foreign banks in near future. In cases where a strong bank is merged with a relatively weak bank, M&A should not result in post-merger dilution of the former bank's efficiency. The surviving banks should be able to transfer its managerial and other skills to the acquired units and maintain its pre-merger efficiency. Bagchi *et al.* (2005) argued that M&A should not be aimed at improving the balance sheet of the weak banks so as to make them attractive targets by foreign banks that are on acquisition spree. Consolidation should not have any adverse effect on credit access to the needy section and priority sectors of the society namely, agriculture and SMEs.

There are some differences in opinion about the prospect of consolidation in the Indian banking sector. On one hand, there is skepticism and doubts about the viability of M&A activities; and at the other end, there are potential gains to be reaped by resorting to M&A strategies. The extant literature reveals that the greater degree of stability achieved by the Indian commercial banks has

been at the cost of efficiency. See, Das (1997), Basu (2005), Sensarma (2005) and Zhao *et al.* (2010), among others.

Another important issue is the threat of concentration that such consolidation strategies bring along. We compute the Herfindahl-Hirschman Index (HHI) based on total assets of the public and private sector banks to see if the level of concentration has increased, decreased or remained stable following the spate of M&A in the last decade.

Table 5: The HHI Index for Indian Banks

Year	HHI
2001	0.0879
2002	0.0825
2003	0.0798
2004	0.0730
2005	0.0689
2006	0.0634
2007	0.0627
2008	0.0625
2009	0.0672
2010	0.0619

Note: Foreign banks have been excluded from the computation of HHI

It can be said that over the past decade the Indian banking system has been fairly competitive. The consolidation process has *not* adversely affected the level of competition in Indian banking sector as the HHI shows a decline in the concentration during the second decade of reforms. The advent of new private sector banks has increased competition among the public and (domestic) private sector banks as indicated by the fall in the HHI score from 2001 to 2010. The increased competitive pressure is likely to affect the profit margin and the cost of intermediation of the banks.

4. A Brief Review of Literature

Most of the studies on banking sector of developing economies had addressed the efficiency aspects rather than assessing the impact of M&A. In the Indian context, very few studies have appraised the impact of consolidation strategies in the banking sector, though there is considerable literature on efficiency aspects. The literature review is divided here into two parts. The first part focuses on the efficiency issues of the SCBs and the possible bottlenecks that act as hindrances to the performance of Indian banks; and the second part discusses the evidence on M&A and efficiency gains that the Indian banking sector has so far witnessed.

Way back in the 1970s, Khusro *et al.* (1971) indicated that the banks with higher efficiency were also the banks with the higher annual growth rate. In the post-reforms period Bhattacharyya *et al.*

(1997) found that while PSBs could attain higher (technical) efficiency, the private and foreign banks secured substantially low efficiency scores. Sathye (2003) found foreign banks to be relatively more efficient than their national counterparts in the usage of employees and deposits. The dismal performance of the private banks was referred to their expansionary phase with relatively higher amount of fixed assets employed. Rationalization of staff and branches were suggested to improve the efficiency of banks. Shanmugam *et al.* (2004) while analyzing the technical efficiency of SBI Groups, Nationalized Banks, Indian Private Banks and Foreign Banks during 1992 to 1999, indicated that significant difference between banks' potential and realized efficiency to stem from technical inefficiency. Chatterjee *et al.* (2006) while comparing the performance of commercial banks with respect to lending observed that the public sector commercial banks lagged behind the private sector commercial banks both in respect of technical efficiency and allocative efficiency. According to Mahesh *et al.* (2008) Indian banks in the wake of financial liberalization were more efficient in generating deposits than making investments. An inspection of the major determinants of in (efficiency) identified bank size and competition as the two important factors. The PSBs were found to be more efficient. They suggested mergers to happen among the small banks as the bigger banks were found to be scale efficient. Kumar *et al.* (2009) observed majority of PSBs to improve their efficiency during the post-reform phase. The banks that were classified as inefficient during the initial years showed higher level of improvement in their efficiency vis-à-vis the banks that were efficient at the onset of reforms. Zhao *et al.* (*ibid.*) found that (cost) efficiency of Indian banks experienced a fall till 1996 and increased thereafter. While foreign banks were found to be efficient in the initial years of study, later PSBs emerged to be relatively more efficient vis-à-vis their foreign counterparts. In another recent study by Ray *et al.* (2010), the high scores of cost efficiency indicated waste minimization and appropriate input mix chosen by the banks. The national banks were found to improve their profit efficiency over the years. SBI group consistently scored much higher relative to other groups by virtue of their exclusive access to most of the government businesses. The foreign banks however, had higher profit efficiency scores than the nationalized banks.

M&A in Banking Sector: Evidence from India Data

Here we briefly review the available studies that have examined the effect of consolidation activities on the Indian banks. We could find very few studies that have attempted to appraise the impact of M&A on the efficiency of the merged/acquired banks.

Ram Mohan (2005) examined the rationale for consolidation in the Indian public sector banks. Among other factors that induced consolidation, deregulation and financial distress were recognized as the major drivers of M&A in the banking sector of the emerging economies. The author argued that it was essentially due to removal of interest rate ceilings on savings deposits that put pressure on bank spreads that forced banks to see M&A as a timely opportunity to offset the impact of declining margins on their profitability. Diversification rather than economies of scale or scope was suggested to benefit the banks from mergers. Bagchi *et al.* (*ibid.*) argued that

granting managements the autonomy to undertake domestic and foreign acquisitions would improve banks profitability but at the expense of small borrowers and economically backward regions of the country.^x The authors maintained that mergers among banks should be case based and ought to be judged by the business complementarities and synergies of the merging banks. M&A among the banks was intended to make the distressed banks financially sound so as to make them potential acquisition targets. Gourlay *et al.* (2006) argued that even if the merging banks could not realize the potential gains completely, they still might have got enough efficiency gains to have competitive advantage vis-à-vis the non-merging banks. The market driven mergers did not provide the merging banks with any competitive edge vis-à-vis the non-merging banks. RBI undertook a study in 2008. This study also involved seven select commercial bank mergers.^{xi} Although 21 cases of amalgamations had taken place since 1991, the central bank chose only those seven banks that were relatively larger in size to assess the impact of such consolidation activities on the efficiency of the banks. Out of the seven chosen banks, four were PSB while three were from the private sector. A significant improvement in the average ROA among the PSBs was observed. In terms of operational cost-assets ratio, three of the four PSBs reported a fall while private banks experienced an increase during the post-merger period. Kumar *et al.* (2010) found that the merging banks experienced a fall in their ROA in the post-merger period. Further, the ratio of fund-based income to cash flow also decreased in the aftermath of M&A. However, after the mergers, banks reported an increase in the ratios of loan to equity and deposit to equity. Kaur *et al.* (2010) analyzed eleven bank mergers of which in eight cases the surviving entity happened to be a PSB. The results indicated presence of significant difference between the pre and post-merger (cost) efficiency scores of the merged banks. The mergers in which the surviving banks happened to be PSBs were forced mergers. On the contrary, all the market driven mergers involved private banks as surviving entities. The mergers between strong and weak banks failed to translate efficiency gains for the surviving banks. The authors suggested mergers to be undertaken only between strong banks and not between strong and weak banks. Market driven mergers were found to be successful in improving the efficiency of the merging Indian banks.

Thus we find that some studies have reported efficiency gains in terms of technical, cost, scale or profit, for the merging banks. At the same time there are studies that have found no efficiency gains bestowed by M&A. There is no clear evidence in the literature of efficiency gains brought in by M&A. This motivated us to undertake this study.

5. Research Methodology

Traditionally finance ratios such as ROA, operating ratio and profitability have been used to measure the performance of commercial banks. However, often it is argued that gauging performance of the banks based on such ratios could be misleading as these ratios do not capture the long-term performance; see for instance Sherman *et al.* (1985). In recent times, there is a growing trend to explain the performance of the banks using frontier analysis methods, namely DEA, SFA, among others. Of late, the usual practice is to use the profitability ratios as

supplements to the efficiency scores to look for any significant disagreement in both the aforesaid approaches; Sathye (*ibid.*). Following the major studies in the existing literature, we use DEA to estimate efficiency of banks.

5.1 Data Envelopment Analysis

Data Envelopment Analysis is a non-parametric method to estimate various aspects of relative efficiency of homogenous decision making units (DMUs). The DEA method pioneered by Charnes, Cooper and Rhodes (CCR) in 1978 was initially applicable to units operating under CRS only.^{xii} The modified CCR model was developed by Banker, Charnes & Cooper (BCC) in 1984.^{xiii} The BCC (*ibid.*) model incorporates the assumption of VRS. The *input-oriented* and *output-oriented* measures of technical efficiency (TE) are alternatively called ‘input saving’ and ‘output augmenting’ measures of TE, respectively; see Farell (1957), Ray (2004). These alternative measures of TE give different results unless the DMU is operating under CRS.^{xiv}

DEA identifies the DMUs into two broad categories: one with none or least wastage of resources and the other with the maximum wastage. Once the best-practice banks are identified, DEA makes use of them to define a piece-wise linear surface called the *efficient frontier*. The efficiency of a representative DMU falling below the efficiency frontier is calculated relative to those DMUs located on the efficiency frontier. The particular DMU that lies below the efficiency frontier is then termed as technically *inefficient*. The best practice DMUs get an efficiency score of 1 whereas the scores of inefficient DMUs lie somewhere between 0 and 1.

Following Koopmans (1951) an input vector x is technically efficient for the production of an output quantity q if by reducing any component of x renders it unfeasible for producing q .^{xv} In other words, an input vector $x \in L(q)$ is said to be technically efficient for the production of q if there is no $x' \in L(q)$ with $x' \leq x$. The set of all input vectors that are technically efficient for the production of q are denoted by $L^*(q) : \{x \in L(q) \mid x \in \mathbb{R}^n : x' \leq x \Rightarrow x' \notin L(q)\}$

Let there be N DMUs, then the objective of maximizing the technical efficiency of j th DMU can be written as:

$$\max e^j = \frac{\sum_{m=1}^M u_m^j y_m^j}{\sum_{n=1}^K v_n^j x_n^j} \quad \text{subject to} \quad \frac{\sum_{m=1}^M u_m^j y_m^j}{\sum_{n=1}^K v_n^j x_n^j} \leq 1; j = 1, \dots, N$$

$$v_n^j, u_m^j \geq 0; n = 1, \dots, K; m = 1, \dots, M.$$

where y_m^j, x_n^j are (positive) known outputs and inputs of the j^{th} DMU, u_m^j, v_n^j are weights of the variables and subscripts m and n denote the number of outputs and inputs of DMU j . The aim is

to find the largest sum of weighted sum of j^{th} DMU while keeping the sum of its weighted inputs at the unit value which in turn requires the ratio of the weighted outputs to weighted inputs for any other DMU to be less than or equal or 1.

A difficulty with the above formulation is that it can have an infinite number of solutions. That is, if (u^*, v^*) is a solution then for any $\alpha > 0$, $(\alpha u^*, \alpha v^*)$ is another solution. To avoid this, we impose

the constraint $\sum_{n=1}^K v_n^j x_n^j = 1$.

Charnes *et al.* (*ibid.*) further transformed the non-linear programming problem into a linear one as:

$$\begin{aligned} \max E^j = \sum_{m=1}^M u_m^j y_m^j \quad \text{subject to} \quad \sum_{i=1}^K v_n^j x_n^j = 1, \\ \sum_{m=1}^M u_m^j y_m^j - \sum_{n=1}^K v_n^j x_n^j \leq 0; \\ j = 1, 2, \dots, N; \quad n = 1, 2, \dots, K; \quad \text{and} \quad m = 1, 2, \dots, M \end{aligned}$$

The above stated formulation yields *output-oriented* measure of technical efficiency.

We estimate output-oriented technical efficiency scores of the Indian commercial banks. The rationale for choosing this approach is that Indian commercial banks have moved on significantly from catering to the ‘social duties’ to profit maximizing corporate entities in the post-reform competitive world. This is worth mentioning here that in 1991 the SLR in India was 38.5% and CRR 15%. Presently, SLR is 24% and CRR below 5% (as of 1st week of June, 2012). With such measures from the RBI the commercial banks have sufficient funds at their disposal to be loaned out. As the survival of banks depends on their profit potential, commercial banks are on an aggressive loan and investment making spree. India being a fast growing economy and having a reasonably developed financial market, the commercial banks are faced with the challenge of providing the banking needs to the business houses and public in general. Efficiency of banks is reflected in the ability of the banks to transform its resources (mainly, deposits) to outputs (loans and advances). Thus, we feel that for Indian commercial banks output augmentation is of more importance than economizing on the usage of inputs.

5.2 Data and Variables

This study uses annual data available in various issues of Performance Highlights of Public and Private Sector Banks published by Indian Banking Association (IBA).^{xvi} Our study excludes foreign banks due to the following reasons. Firstly, foreign banks have relatively smaller share in total banking assets and are scarcely present in this vast country.^{xvii} Secondly, there have been

very few cases of M&A in this group.^{xviii} Moreover, foreign banks operate under different regulatory framework.

We consider the data period 2000-2010 for evaluating post-M&A efficiency of SCBs in India. In doing so, we consider the five-year average relative efficiency scores of commercial banks and compare the mean pre-M&A relative efficiency score with the post-M&A mean technical efficiency score. But unfortunately, we could not find relevant data for the year 2000.^{xix} Furthermore, we encounter that for a few banks the figures pertaining to our choice of variables were not available for the year 1995. Hence, in order to compute the pre-M&A average relative efficiency scores of certain banks we extend our data period backwards to 1994. Data were not available for all the banks for all the years due to non-reporting by some of the banks. Therefore, the number of banks in the study has varied over the years due to entry of some new banks in the private as well as public sector, M&A among the banks apart from non-availability of data for certain variables for some years. See Table 7.

In the literature, three approaches have been mentioned with respect to modelling the behavior of banks. The first is the *production approach* that treats banks as any other production unit. The second is *intermediation approach* proposed by Sealey *et al.* (1977). The intermediation approach differs from the production approach as it allows deposits to be treated as an input. Berger *et al.* (1997) suggest that intermediation approach is most appropriate for assessing bank level efficiency while the production approach is best suited for analyzing branch level efficiency. The third one is *modern approach*; see Denizer *et al.* (2007) for more details. In the literature intermediation approach has been preferred to model bank behavior. It is essentially because it allows interest expenses that comprise a substantial part of banks' total costs to be used as an input. Moreover it is difficult to get data in terms of number of accounts serviced as required by the production approach. One more drawback of the production approach is that the number of accounts serviced by a bank does not truly reflect the average size of deposits and the associated costs of servicing those accounts; see Gilligan *et al.* (1984). Following Bhattacharyya *et al.* (1997), Avkiran (*ibid.*), Casu *et al.* (2002), Sathye (*ibid.*) and Kumar *et al.* (2009), among others we model the behavior of the Indian commercial banks with intermediation approach.

Advances and *interest income* are the two outputs considered while *total deposits* and *establishment expenses* are the two inputs used. In the context of Indian commercial banks, establishment expenses refer to the expenditure incurred on payments to and provisions for the employees.

Table 7 reports the total number of banks included in the computation of the efficiency frontier. The number of PSBs has remained stable over the years whereas the number of domestic private banks changed due to entry of new banks and also due to M&A activities.

Table 7: Number of Banks Included in the Efficiency Frontier

Year	Total No. of Banks	PSBs	(Domestic) Private Sector Banks
1994	50	27	23
1995	50	27	23
1996	59	27	32
1997	60	27	33
1998	60	27	33
1999	60	27	33
2001	57	27	30
2002	56	27	29
2003	57	27	30
2004	57	27	30
2005	56	28	28
2006	54	28	26
2007	53	28	25
2008	51	28	23
2009	49	27	22
2010	49	27	22

Note: Recall that we have data unavailable for the year 2000.

6. Empirical Results

In order to assess the impact of M&A on the surviving bank, we compare the five-year average relative efficiency scores before and after the merger and/or takeover. There were a total of 15 M&A among the public and domestic private sector banks in India during the period 2000-2010. Very recently there have been 2 M&A — one between ICICI Bank and Bank of Rajasthan and the other between SBI and State Bank of Indore both took place in the year 2010. Hence, we excluded them from our study as their post-amalgamation assessment is not possible. There are a few cases where one bank has engaged itself into M&A activity more than once in different time periods — for instance, HDFC Bank and ICICI Bank. Whether HDFC has taken over another bank or any bank has merged with HDFC we treat such a newly formed unit as a bank itself.

We compute the efficiency of the banks under both common and separate frontier. The common frontier refers to inclusion of both the PSBs and the private banks in estimation of the frontier and the relative efficiency of a bank is calculated relative to the common frontier. In the separate frontier banks of only one group are included at a time in the estimation of the frontier and the relative efficiency of a bank is calculated relative to the efficiency of the banks on the efficiency frontier.

Coelli *et al.* (2005) stated that the CRS assumption is appropriate if all the DMUs are operating at an optimal scale. If a DMU operates at sub-optimal scale then estimation of TE produces results that incorporate scale effects. Banker *et al.* (*ibid.*) suggested the assumption of VRS wherein the

efficiency of a DMU is compared to DMUs of similar sizes. A difference between TE scores obtained from CRS and VRS assumption indicates scale inefficiency of the DMUs. We have estimated efficiency of banks under both these assumptions to check for scale inefficiency of the banks.

We judge the success of an M&A based on the following criteria:

- (i) The merging and/or acquiring bank is able to improve its efficiency in the post-M&A period vis-à-vis the pre-merger period; and
- (ii) The concerned bank's post-M&A efficiency is higher than that of a defined control group.

Common Frontier with CRS

We begin with output-oriented relative TE of the commercial banks with respect to the common frontier. Initially we assume that the banks operate under CRS, though we relax this assumption later to explore for any inconsistency in the results also to examine for any possible scale inefficiency.

Table 8.1 reports the pre and post- amalgamation average relative TE of the 13 M&A cases. We find that in 8 of the 13 cases efficiency has improved after the consolidation. A close examination of the cases reveals that all the 5 cases where TE did not improve after M&A were before the year 2005. In the later part of the decade banks had become more efficient in their usage of mobilizing deposits towards advances.

Out of the 5 unsuccessful M&A, 3 involved acquisition of a private bank by a PSB suggesting that difference in the operational environment between the two bank groups could have affected the post-merger performance of the PSBs. Further, in 9 of the 13 cases, the acquiring banks were more technically efficient vis-à-vis the acquired banks. M&A helped two banks namely IDBI and ICICI Bank that were earlier close to the efficiency frontier in their pre-merger years to become frontier banks post-merger. Most of the banks are found to have average relative TE scores lie below 1 both in the pre and post-M&A years.

Table 8.1: Mean Technical Efficiency of Merged/Acquired Commercial Banks

Sr. No.	Name of the Bank	Year of Merger	Pre-Merger TE	Post-Merger TE	Summary Findings
1. {	HDFC Bank	2000	0.803	0.680	TE ↓
	Times Bank		0.778		
2. {	ICICI Bank	2001	0.801	0.904	TE ↑
	Bank of Madura		0.769		
3. {	Bank of Baroda	2002	0.745	0.466	TE ↓
	Benaras State Bank		0.638		
4. {	Punjab National Bank	2003	0.773	0.554	TE ↓
	Nedungadi Bank		0.838		
5. {	Oriental Bank of Commerce	2004	0.724	0.599	TE ↓
	Global Trust Bank		0.827		
6. {	Bank of Punjab	2005	0.878	0.587	TE ↓
	Centurion Bank		0.901		
7. {	IDBI Bank	2006	0.941	1.000	TE ↑
	United Western Bank		0.635		
8. {	Federal Bank	2006	0.703	0.722	TE ↑
	Ganesh Bank of Kurundwad		0.660		
9. {	Centurion Bank of Punjab	2006	0.363	0.674	TE ↑
	Lord Krishna Bank		0.618		
10. {	ICICI Bank	2007	0.904	1.000	TE ↑
	Sangli Bank		0.498		
11. {	Indian Overseas Bank	2007	0.553	0.760	TE ↑
	Bharat Overseas Bank		0.531		
12. {	HDFC Bank	2008	0.628	0.788	TE ↑
	Centurion Bank of Punjab		0.498		
13. {	SBI	2008	0.541	0.800	TE ↑
	State Bank of Saurashtra		0.520		

Note: The model estimated is output-oriented DEA.

Outputs: Advances and Interest Income. Inputs: Total Deposits, Establishment Expenses.

Common Frontier with VRS

We now report (Table 8.2) the output-oriented pre and post-M&A average relative TE with the relaxed assumption that all the banks may not be operating at their optimal scale. Only 6 banks (against 8 banks under CRS) benefitted from M&A; 2 banks, namely ICICI and HDFC maintained their pre-merger TE score in the post-merger period as well. All banks secure efficiency scores higher than those obtained under CRS. It is because under the VRS assumption, DEA compares a bank with an efficient bank of similar size. The difference in the TE score

suggests presence of *scale inefficiency* in the both acquiring and target banks. All 5 banks that experienced post-M&A fall in TE under CRS score similar results.

Table 8.2: Mean Technical Efficiency of Merged/Acquired Commercial Banks

Sr. No.	Name of the Bank	Year of Merger	Pre-Merger TE	Post-Merger TE	Summary Findings
1. {	HDFC Bank	2000	0.858	0.811	TE ↓
	Times Bank		0.818		
2. {	ICICI Bank	2001	0.874	1.000	TE ↑
	Bank of Madura		0.814		
3. {	Bank of Baroda	2002	1.000	0.676	TE ↓
	Benaras State Bank		0.678		
4. {	Punjab National Bank	2003	0.941	0.756	TE ↓
	Nedungadi Bank		0.845		
5. {	Oriental Bank of Commerce	2004	0.912	0.670	TE ↓
	Global Trust Bank		0.878		
6. {	Bank of Punjab	2005	0.900	0.592	TE ↓
	Centurion Bank		0.911		
7. {	IDBI Bank	2006	0.946	1.000	TE ↑
	United Western Bank		0.653		
8. {	Federal Bank	2006	0.725	0.726	TE ↑
	Ganesh Bank of Kurundwad		1.000		
9. {	Centurion Bank of Punjab	2006	0.371	0.678	TE ↑
	Lord Krishna Bank		0.634		
10. {	ICICI Bank	2007	1.000	1.000	\overline{TE}
	Sangli Bank		0.556		
11. {	Indian Overseas Bank	2007	0.689	0.762	TE ↑
	Bharat Overseas Bank		0.548		
12. {	HDFC Bank	2008	1.000	1.000	\overline{TE}
	Centurion Bank of Punjab		0.540		
13. {	SBI	2008	0.694	0.814	TE ↑
	State Bank of Saurashtra		0.504		

Note: The Model estimated is output-oriented DEA.

Outputs: Advances and Interest Income. Inputs: Total Deposits, Establishment Expenses.

Separate Frontier with CRS

The business environment of the PSBs and private banks is arguably different due to difference in technology, operational flexibility among other factors. This prompted us to compute the efficiency scores of the banks under separate frontiers. The efficiency frontier of the former includes only the public sector banks while that of the latter includes only the private banks. It

helps us to check for any significant discrepancy in the results obtained from that under the common frontier CRS assumption.

Table 8.3: Mean Technical Efficiency of Merged/Acquired Commercial Banks

Sr. No.	Name of the Bank	Year of Merger	Pre-Merger TE	Post-Merger TE	Summary Findings
1. {	HDFC Bank	2000	0.803	0.736	TE ↓
	Times Bank		0.778		
2. {	ICICI Bank	2001	0.801	1.000	TE ↑
	Bank of Madura		0.773		
3. {	Bank of Baroda	2002	0.950	0.642	TE ↓
	Benaras State Bank		0.663		
4. {	Punjab National Bank	2003	0.877	0.615	TE ↓
	Nedungadi Bank		0.800		
5. {	Oriental Bank of Commerce	2004	1.000	0.642	TE ↓
	Global Trust Bank		0.827		
6. {	Bank of Punjab	2005	0.878	0.827	TE ↓
	Centurion Bank		0.901		
7. {	IDBI Bank	2006	0.941	1.000	TE ↑
	United Western Bank		0.703		
8. {	Federal Bank	2006	0.771	0.783	TE ↑
	Ganesh Bank of Kurundwad		0.724		
9. {	Centurion Bank of Punjab	2006	0.853	0.815	TE ↓
	Lord Krishna Bank		0.694		
10. {	ICICI Bank	2007	1.000	1.000	\overline{TE}
	Sangli Bank		0.542		
11. {	Indian Overseas Bank	2007	0.712	0.930	TE ↑
	Bharat Overseas Bank		0.683		
12. {	HDFC Bank	2008	0.800	0.788	TE ↓
	Centurion Bank of Punjab		0.837		
13. {	SBI	2008	0.692	0.899	TE ↑
	State Bank of Saurashtra		0.669		

Note: The Model estimated is output-oriented DEA.

Outputs: Advances and Interest Income. Inputs: Total Deposits, Establishment Expenses.

We find that the scores of most of the banks increased under the separate frontier relative to those obtained under the common frontier. Only 6 banks witnessed improvement in post-amalgamation efficiency scores compared to 8 under the common frontier. IDBI, Federal Bank (FB), ICICI and IOB witnessed post-M&A increase whereas HDFC and PNB witnessed fall in TE. ICICI is the only common bank to report post-amalgamation increase in efficiency scores. Similarly HDFC and PNB are the ones to experience decline in their relative mean efficiency scores.

Separate Frontier with VRS

We find that ICICI, IDBI, and SBI witness an increase in their post-M&A efficiency level whereas HDFC, PNB and FB report a decline in both the efficiency aspects. FB, CBP and HDFC that had experienced improvement in TE (post-M&A under the common frontier), now witness decline in their efficiency level. We find that for HDFC and PNB, post-amalgamation efficiency decline under both common frontier with both CRS and VRS assumptions.

Table 8.4: Mean Technical Efficiency of Merged/Acquired Commercial Banks

Sr. No.	Name of the Bank	Year of Merger	Pre-Merger TE	Post-Merger TE	Summary Findings
1. {	HDFC Bank	2000	0.844	0.838	<i>TE</i> ↓
	Times Bank		0.796		
2. {	ICICI Bank	2001	0.834	1.000	<i>TE</i> ↑
	Bank of Madura		0.818		
3. {	Bank of Baroda	2002	1.000	0.713	<i>TE</i> ↓
	Benaras State Bank		0.684		
4. {	Punjab National Bank	2003	0.927	0.810	<i>TE</i> ↓
	Nedungadi Bank		0.814		
5. {	Oriental Bank of Commerce	2004	1.000	0.745	<i>TE</i> ↓
	Global Trust Bank		0.873		
6. {	Bank of Punjab	2005	0.905	0.831	<i>TE</i> ↓
	Centurion Bank		0.914		
7. {	IDBI Bank	2006	0.947	1.000	<i>TE</i> ↑
	United Western Bank		0.729		
8. {	Federal Bank	2006	0.789	0.787	<i>TE</i> ↓
	Ganesh Bank of Kurundwad		1.000		
9. {	Centurion Bank of Punjab	2006	0.856	0.819	<i>TE</i> ↓
	Lord Krishna Bank		0.721		
10. {	ICICI Bank	2007	1.000	1.000	\overline{TE}
	Sangli Bank		0.564		
11. {	Indian Overseas Bank	2007	0.775	0.931	<i>TE</i> ↑
	Bharat Overseas Bank		0.708		
12. {	HDFC Bank	2008	0.816	0.809	<i>TE</i> ↓
	Centurion Bank of Punjab		0.844		
13. {	SBI	2008	1.000	1.000	\overline{TE}
	State Bank of Saurashtra		1.000		

Note: The Model estimated is output-oriented DEA.

Outputs: Advances and Interest Income. Inputs: Total Deposits, Establishment Expenses.

Comparison with the Control Group

In this section we assess the extent to which M&A were able to benefit the merging banks relative to their non-merging counterparts. It is possible that M&A might not have benefitted banks in terms of efficiency enhancement in the post-M&A vis-à-vis their pre-M&A efficiency levels but still it could have enabled the bank to gain competitive advantage relative to those banks that did not opt to expand via the inorganic routes. To perform the analysis we construct a control group consisting of such banks that did not participate in any M&A activity for fifteen years before the year of post-M&A comparison. The post-M&A average efficiency (five years after the M&A) of a merged bank was compared to the average efficiency of the control group (CG). For example, the first M&A took place in 2000 — we compare the average efficiency of the bank five years after its M&A with the average efficiency of the control group in 2005. The control group constructed for the year 2005 consists of such banks that did not participate in any M&A since 1990. Similarly, the control group constructed for the year 2006 comprises of such banks that did not participate in any M&A since 1991 and so on. The composition of the control group varied over the years due to two reasons; one because of entry and exit of banks in the banking system; second due to imposition/lapse of the constraint on the banks pertaining to participation in M&A activity.

It may be recalled that success of a M&A is measured subject to two criteria — bank’s post-M&A TE is greater than its pre-M&A TE; bank’s post-M&A TE exceeds that of a defined control group. If a surviving bank fulfills both the criteria, we term the M&A as successful one, if it fulfills any one of the two criteria we call it as partial successful and if it fails in both, we call it as an unsuccessful M&A.

The M&A Matrix

Quadrant IV Post-M&A < Control Group but Post-M&A > Pre-M&A <i>(Partially Successful)</i>	Quadrant I Post-M&A > Control Group and Post-M&A > Pre-M&A <i>(Successful)</i>
Quadrant III Post-M&A < Control Group and Post-M&A < Pre-M&A <i>(Unsuccessful)</i>	Quadrant II Post-M&A > Control Group but Post-M&A < Pre-M&A <i>(Partially Successful)</i>

In the above matrix, Quadrant I denotes M&A that achieve the dual success of improving the post-M&A TE of the surviving banks and also gives it competitive advantage over its non-merging counterparts. Those M&As that fail to improve the post-M&A efficiency of the surviving banks but increase the banks efficiency relative to the non-merging banks lie in the Quadrant II. Such M&As that failed to improve the post-M&A efficiency relative to both the pre-M&A

efficiency level and the efficiency level of the control group fall in Quadrant III. Lastly, the Quadrant IV contains such M&A that helped the surviving banks to increase their post-M&A efficiency vis-à-vis their pre-M&A efficiency scores but failed to provide an edge over the non-merging banks. The average efficiency scores of the control group were calculated from efficiency scores obtained under both CRS and VRS respectively.

Table 9: Average Post-M&A Efficiency of the Control Group

Efficiency	2005	2006	2007	2008	2009	2010
TE _{CRS}	0.502	0.437	0.575	0.710	0.711	0.788
TE _{VRS}	0.591	0.490	0.626	0.731	0.728	0.811

We compare the technical efficiency scores (both under CRS and VRS) obtained under the common frontier only. Matrix 1 shows that 4 cases of M&A involving ICICI*, IDBI, ICICI** and SBI were fully successful with an equal number of unsuccessful M&A involving BoB, PNB, OBC and CBP*. In 4 cases involving FB, CBP**, IOB and HDFC**, consolidation increased the post-M&A average relative efficiency from the pre-M&A level but the banks fared below the average efficiency level of the control group. In only 1 case pertaining to HDFC*, the post-M&A efficiency increased relative to the control group but not to its pre-M&A level. Overall M&A have been successful for the surviving banks as 9 banks (successful plus partially successful) witnessed efficiency gains in the aftermath of M&A.

Table 10: List of DMUs

DMU No.	DMUs	Year of Merger
1.	HDFC*	2000
2.	ICICI*	2001
3.	Bank of Baroda (BoB)	2002
4.	Punjab National Bank (PNB)	2003
5.	Oriental Bank of Commerce (OBC)	2004
6.	Centurion Bank of Punjab (CBP)*	2005
7.	IDBI	2006
8.	Federal Bank (FB)	2006
9.	Centurion Bank of Punjab (CBP)**	2007
10.	ICICI**	2007
11.	Indian Overseas Bank (IOB)	2007
12.	HDFC**	2008
13.	State Bank of India (SBI)	2008

Note: * indicates the 1st M&A by the DMU. ** indicates the 2nd M&A by the same DMU.

M&A Matrix 1: Technical Efficiency of DMUs under CRS

<p align="center">Quadrant IV FB, CBP**, IOB, HDFC** <i>(Partially Successful)</i></p>	<p align="center">Quadrant I ICICI*, IDBI, ICICI**, SBI <i>(Successful)</i></p>
<p align="center">Quadrant III BoB, PNB, OBC, CBP* <i>(Unsuccessful)</i></p>	<p align="center">Quadrant II HDFC* <i>(Partially Successful)</i></p>

M&A Matrix 2 displays no change in the positions of the respective DMUs even after the change in the returns to scale assumption.

M&A Matrix 2: Technical Efficiency of DMUs under VRS

<p align="center">Quadrant IV FB, CBP**, IOB, HDFC** <i>(Partially Successful)</i></p>	<p align="center">Quadrant I ICICI*, IDBI, ICICI**, SBI <i>(Successful)</i></p>
<p align="center">Quadrant III BoB, PNB, OBC, CBP* <i>(Unsuccessful)</i></p>	<p align="center">Quadrant II HDFC* <i>(Partially Successful)</i></p>

Therefore, M&A have bestowed more or less success to many of the merging and/or acquiring banks; however, all the banks have not been able to reap efficiency gains from their consolidation strategies. While IDBI, ICICI and SBI witnessed most successful amalgamation, Bank of Baroda, Punjab National Bank, Oriental Bank of Commerce and Centurion Bank of Punjab are the four banks that experienced unsuccessful M&A.

7. Summing Up

One of the outcomes of the financial sector reforms process in India is the resurgence of M&A in the banking sector. In the initial years of reforms, M&A mostly took place between weak and relatively strong banks; e.g., merger of New Bank of India with Punjab National Bank. Since 2000 the banking sector has witnessed consolidation among the financially healthy banks as well, e.g., amalgamation of Bharat Overseas Bank with Indian Overseas Bank.

We compared the pre and post-amalgamation technical efficiency of 13 commercial banks that participated in M&A activities in the first decade of the 21st Century. The mean technical efficiency of the banks when computed with respect to the *common* frontier under the assumption

of CRS, we found that 8 banks witnessed post-M&A mean efficiency improvement. However, most of the surviving banks are found to be relatively inefficient! While the pre-M&A five-year average relative TE of 9 banks lie between 0.363 to 0.803; the post-M&A average relative TE of 10 banks lie between 0.466 and 0.8. Further, in 9 out of 13 M&A cases the acquiring banks were more technically efficient vis-à-vis the acquired banks. A close examination reveals that all the 5 banks where mean TE did not improve after consolidation were before the year 2005. In the later part of the decade banks have gained efficiency in their usage of mobilizing deposits towards advances.

When the assumption of CRS was changed to VRS, we found 7 banks to improve their post-M&A mean technical efficiency. Under the *separate* frontier with CRS, 6 banks witnessed improvement in post-M&A TE; whereas under the relaxed assumption of VRS, 5 banks improved their post-M&A technical efficiency.

We also judged the success of an amalgamation also with respect to a defined dynamic control group consisting of non-merging banks. We found 4 banks to be successful and 8 to be partially successful. Bank of Baroda, Oriental Bank of Commerce and Centurion Bank of Punjab are the three banks that had unsuccessful amalgamation whereas IDBI, ICICI and SBI witnessed success mostly.

However, not all banks are able to benefit from consolidation. M&A among the banks should be case specific and based on the potential synergy gains and the associated threats for the merging banks. It is yet to be ascertained a priori if M&A are the best ways to consolidate before preferring it over other ways of restructuring. In addition, the M&A environment in the Indian commercial banking sector should not culminate in market concentration. The evidence till now does not indicate an increase in market concentration as along with the exit of several banks due to consolidation, 12 new banks were set up in the past two decades.

Availability of data pertaining to our choice of variables for the banks that underwent consolidation during the period 1991-1999 would have enabled us to enlarge the sample size and hence a more conclusive set of results could have been obtained. Also, we could not segregate the impact of successive M&A activities on efficiency of a bank. For instance, ICICI Bank acquired Bank of Madura in 2001 and Sangli Bank in 2007. The post-M&A efficiency scores of ICICI after it acquired Sangli Bank can confound the impact of acquiring the Bank of Madura as well. With DEA we could not segregate such impacts.

Endnotes

ⁱ See, India's Financial Sector: An Assessment, Overview Report, Vol. II, RBI (2009).

ⁱⁱ See, Performance Highlights of Public and Private Sector Banks for 2009-2010, IBA.

ⁱⁱⁱ The 7 new private sector banks had an average ROA of 1.09 percent compared to 0.84 percent earned by the PSBs in 2010. The ratio of interest expenses to total expenses was 60.53 percent and 68.8 percent for the private and public sector banks, respectively; the Capital Adequacy Ratio was 17.32 percent and 13.72 percent, respectively for the same year. See, Performance Highlights of Public and Private Sector Banks, IBA (2010).

^{iv} The data for the year 2001 was not available for net profit so we extended the 2nd assessment point by a year.

^v Bharat Overseas Bank was acquired by Indian Overseas Bank in 2007, Lord Krishna by Centurion Bank in 2008, Ganesh Bank of Kurundwad by Federal Bank in 2006, Nedungadi Bank by Punjab National Bank in 2003, Sangli Bank by ICICI in 2007, United Western Bank by IDBI in 2006, Vysya Bank was acquired by ING in 2002, Bank of Punjab and Centurion Bank merged to form Centurion Bank of Punjab in 2005 and Global Trust Bank by Oriental Bank of Commerce in 2004. Hence figures for these banks are not available for the post-merger years. IDBI became a PSB in 2004.

^{vi} The Banking Stability Index points to a healthy improvement in the stability of the banking sector over the past few years. See, the Financial Stability report, RBI (2010).

^{vii} Return on Assets (ROA) is considered to be the best measure of a bank's overall performance; Sinkey (1983).

^{viii} As per BASEL II norms ROA of banks should exceed 1 percent; Ghosh *et al.* (2004).

^{ix} It excludes the M&A between foreign banks and Indian owned banks (e.g., merger of ING with Vysya Bank in 2002) and also the M&A involving only the foreign banks.

^x Dymski (1999) stated that megamergers of banks in USA succeeded in improving banks' profitability by marginalizing 20 percent of the population from banking services.

^{xi} The study is contained in Report on Currency and Finance, RBI (2008).

^{xii} Banker *et al.* (1984) extended the original CCR model to make it applicable to technologies characterized by variable returns to scale.

^{xiii} There is another variant of the DEA model developed by Bogetoft *et al.* (2005).

^{xiv} If a firm is operating under CRS, then the average productivity of the firm at two different points on the production frontier would be the same.

^{xv} Conventionally, efficiency of a firm is reflected by its success in producing maximum possible output from a given vector of inputs; see Farrell (1957), Ray (2004), among others. Alternatively, Ramanathan (2003) defines technical efficiency of a firm as the ratio of output to input.

^{xvi} IBA annually publishes various reports on the Indian Banking sector that contain useful information on a wide range of variables such capital adequacy, advances, deposits, etc. Some other reports are, Indian Banking at a Glance, Consolidation in the Indian Banking Sector among others.

^{xvii} Foreign banks as a whole had just 310 offices in the country during 2009-10 compared to 43,187 and 10,387 offices of nationalized and Indian owned private sector banks respectively. Their share in the total deposits, total advances and total investments during 2009-10 stood at 5 percent, 4.6 percent and 9.26 percent respectively; see A Profile of Banks, RBI (2009-10).

^{xviii} Standard Chartered acquired Grindlays Bank in 2000, ING Bank of Netherlands and Vysya bank of India merged in 2002 and recently HSBC acquired RBS's retail and commercial units in 2010.

^{xix} We also looked in to 'Report on Trend and Progress of Banking in India,' (various issues) by RBI, but could not find the required data in it as well.

References

- Avkiran, N.K., 1999. The evidence on efficiency gains: the role of mergers and the benefits to the public. *Journal of Banking and Finance*, 23(7), pp.991-1013.
- Bagchi, A.K., and Banerjee S., 2005. How strong are the arguments for bank mergers? *Economic and Political Weekly*, 40(12), pp.1181-1189.
- Banker, R.D., Charnes, A., and Cooper, W.W., 1984. Some models for estimating technical and scale inefficiencies in Data Envelopment Analysis. *Management Science*, 30(9), pp.1078-1092.
- Basu, P., 2005. *Introduction to India's financial sector: Recent reforms, future challenges*. New Delhi: Macmillan.
- Berger, A.N., and Humphrey, D.B., 1997. Efficiency of financial Institutions: International survey and direction for future research. *European Journal of Operations Research*, 98(2), pp.175-212.
- Bhattacharyya, A., Lovell, C.A.K., and Sahay, P., 1997. The impact of liberalization on the productive efficiency of Indian commercial banks. *European Journal of Operational Research*, 98, pp.332-345.
- Bogetoft, P. and Wang, D., 2005. Estimating the potential gains from mergers. *Journal of Productivity Analysis*, 23(2), pp.147-171.
- Casu, B., and Girardone, C., 2002. A comparative study of the cost efficiency of Italian conglomerates. *Managerial Finance*, 23, pp.3-23.
- Charnes, A., Cooper, W.W., and Rhodes, E., 1978. Measuring efficiency of decision making unit. *European Journal of Operations Research*, 2, pp.429-444.
- Coelli, T.J., Rao, D.S.P., O'Donnell, C.J., and Battese, G.E., 2005. *An introduction to efficiency and productivity analysis*. 2nd ed. New York: Springer.
- Chatterjee, B., and Sinha R.P., 2006. Cost Efficiency and Commercial Bank Lending: Some Empirical Results." *Indian Economic Journal*, 54(1). pp. 145-163.
- Das, A. 1997. Technical, allocative and scale efficiency of public sector banks in India. Reserve Bank of India, *Occasional Papers*, 18(2, 3), pp.279-297.
- Denizer, C.A., Dinc, M., and Tarimciilar, M., 2007. Financial liberalization and banking efficiency: Evidence from Turkey. *Journal of Productivity Analysis*, 27, pp.177-195.
- Dymski, G., 1999. *The bank merger wave*. New York: M E Sharpe, Armonk.
- Farell, M.J., 1957. The measurement of productive efficiency. *Journal of the Royal Statistical Society*, Series A, 120/3, pp.253-281.
- Gilligan, T., Smirlock, M., and Marshall W., 1984, Scale and scope economies in the multi-product banking firm. *Journal of Monetary Economics*, 13, pp.393-405.
- Ghosh, S, Nachane, D. M, and Ray, P, 2004. Behavior of bank capital: Issues and evidences from India. *Economic and Political Weekly*, 39(12), pp.1291-1298.

-
- Gourlay, A, Ravishankar G., Weyman-Jones, T., 2006, Non-parametric analysis of efficiency gains from bank mergers in India. Department of Economics, Loughborough University, Working Paper No. 17. Leicestershire: University of Loughborough.
- Indian Banks' Association, 1999. *Database on Indian Banking 1987-98*. Mumbai: Indian Banks' Association.
- Indian Banks' Association, Various Issues. *Performance Highlights of Private Sector Banks*. Mumbai: Indian Banks' Association.
- Indian Banks' Association, Various Issues. *Performance Highlights of Public Sector Banks*. Mumbai: Indian Banks' Association.
- Joshi, V., and Little, I.M.D., 2003. *India's economic reforms 1991-2001*. New Delhi: Oxford University Press.
- Kaur, P., and Kaur, G., 2010. Impact of mergers on the cost efficiency of Indian commercial banks. *European Journal of Business and Economics*, 3(5), pp.27-50.
- Khusro, A.M., Raghavan, S.N., Ram, K., and Siddhartan, N.S., 1971. Banking efficiency and banking growth. *Economic and Political Weekly*, 6(23), pp.1150-1152.
- Koopmans, T.C., 1951. An analysis of production as an efficient combination of activities. In: T.C. Koopmans ed. 1951. *Activity analysis of production and allocation*, Cowles Commission for Research in Economics, Monograph No. 13. New York: Wiley.
- Kumar, S., Gulati, R., 2008. Evaluation of technical efficiency and ranking of public sector banks in India. *International Journal of Productivity & Performance Management*, 57(7), pp. 540-568.
- Kumar, S. and Gulati R., 2009. Did efficiency of Indian public sector banks converge with banking reforms? *International Review of Economics*, 56, pp.47-84.
- Kumar, B.R., and Suhas, K.M., 2010. An analytical study on value creation in Indian bank mergers. *Afro-Asian Journal of Finance and Accounting*, 2(2), pp.107-134.
- Mahesh, H.P., and Rajeev, M., 2008. Producing financial services: An efficiency analysis of Indian commercial banks. *Journal of Services Research*, 8(2), pp.7-24.
- Ram Mohan, T.T., 2005. Bank consolidation: Issues and evidences. *Economic and Political Weekly*, 40(12), pp.1151-1161.
- Ramanathan R., 2003. *Introduction to Data Envelopment Analysis: A tool for performance measurement*. 1st ed. New Delhi: Sage Publication.
- Ray, S.C., 2004. *Data Envelopment Analysis: Theory and techniques for economics and operations research*. Cambridge: Cambridge University Press.
- Ray, S.C., and Das, A., 2010. *Distribution of cost and profit efficiency: Evidence from Indian banking*. *European Journal of Operational Research*, 201, pp.297-307.
- Reserve Bank of India, 2010. *A Profile of Banks*. Mumbai: Reserve Bank of India.
- Reserve Bank of India, 2010. *Financial Stability Report*. Mumbai: Reserve Bank of India.

-
- Reserve Bank of India, 2008. *Report on Currency and Finance*. Mumbai: Reserve Bank of India.
- Reserve Bank of India, 2008. *Report on Trend and Progress in Banking in India 2007-08*. Mumbai: Reserve Bank of India.
- Reserve Bank of India, 2009. *India's Financial Sector: An Assessment*, Overview Report, Vol. II. Mumbai: Reserve Bank of India.
- Sathye, M., 2003. Efficiency of banks in a developing country: the case of India. *European Journal of Operations Research*, 148, pp.662-671.
- Sealey, C., and Lindley, J.T., 1977. Inputs, output and a theory of production and cost at depository financial institution. *Journal of Finance*, 32, pp.1251-66.
- Sensarma, R., 2005. Cost and profit efficiency of Indian banks during 1986-2003: A stochastic frontier analysis. *Economic and Political Weekly*, 40(12), pp.1198-1209.
- Shanmugam, K.R., and Das, A., 2004. Efficiency of Indian commercial banks during the reform period. *Applied Financial Economics*, 14, pp.681-686.
- Sherman, H.D., and Gold, F., 1985. Bank branch operation efficiency: Evaluation with data envelopment analysis. *Journal of Banking and Finance*, 9, pp.297-316.
- Sinkey Jr., J.F., 1983. *Commercial bank financial management*. New York: MacMillan.
- World Economic Forum, 2009. *Financial Development Report*. Geneva: World Economic Forum USA Inc.
- Zhao T., B. Casu and Ferrari, A., 2010. The impact of regulatory reforms on cost structure, ownership and competition in Indian banking. *Journal of Banking and Finance*, 34, pp.246-254.