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Consolidation as a Determinant of Profitability and Efficiency of Indian Commercial Banks

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ABSTRACT

The study examines the relationship among consolidation, profitability and efficiency of commercial banks in India using input-oriented efficiency scores of banks which is measured by data envelopment analysis (DEA) in 2013. We used simultaneous equation method to measure the relationship among these variables. The main finding of the study reveals that profit of banks was determined by its efficiency but efficiency of banks was found insignificant with profitability and also found that efficiency was not determined by other control variables as well. As far as pure technical efficiency is concerned, there is a positive relationship between banks profitability and efficiency that is found from the analysis. Another finding indicates that consolidation impacts efficiency but that is observed only on the term of pure technical efficiency. Here, we found that efficiency is improved because of increased assets and proper management of inputs and outputs by consolidation. Further, it is also observed that except these variables others also contributed more in determining banks efficiency. As far as Scale Efficiency and Overall Technical Efficiency are concerned, increased assets size by consolidation and profit from consolidation are found to be insignificant and it reveals that these efficiency measures are not determined by profit and increased assets by consolidation.

Keywords: Consolidation, Profitability and Efficiency, Simultaneous Equation Method, Indian Commercial Banks, DEA.
JEL Classification: G21, G34, C3

INTRODUCTION:

Consolidation of banks means that two banks merge as a single bank. Further, 'mergers' and 'acquisitions' are the two vital role of the consolidation in India and global as well. A merger refers synergy between economics of scale of banks and it reduces the number of merged banks branches working in a particular region. Thus, leads to raise economies of scale and scope of production of merged banks. An acquisition means that large bank takes weak bank. An acquisition takes place when a larger bank offers to purchase a target bank due to declining performance of target bank. Apart from that, government may interfere and force a larger bank to take over the weaker one through acquisition.

In India after liberalization, commercial banks have witnessed more than 25 consolidation deals. It can be noted that only 1 such deal (the deal between Punjab National Bank (PNB) and New Bank of India (NBI)) is a merger deal, while the other deals were acquisition. In recent time, rapid changes in the banking sector have necessitated to investigate the issue of consolidation. RBI (2013) states that, consolidation between or among the smaller and the healthier banks has encouraged economies of scale of production and improved profit. At the same time, merger deals between same asset sized banks make the business stronger. The strengthening of the business leads to improvement in performance.

The reforms of Narasimhan committee 1991-I and 1998-II suggested that the consolidation process is essential for domestic banks to meet the competition of foreign banks in the wake of liberalization. Further, the consolidation helps for strong banks to create healthy position on intermediation.

The main objective is to focus on whether consolidation has been beneficial for impacting banks efficiency and profitability. In the Indian context, many studies have examined the determinants of banks profitability and efficiency in general. However, no studies have focused on consolidation. The study includes many literature related profitability and efficiency in general. The findings of the study are more useful for future research and consolidation in India.

In this paper, we attempt to study the relationship among consolidation, profitability and efficiency on Indian commercial banks. Thus two specific research questions that we attempt to investigate in the study. First, we address the issue whether the consolidation and increased asset size due to consolidation are important factor for profitability and efficiency in the banking sector. Second, we investigate whether banks profitability and efficiency determines each other or not that could be addressed. Further, we examine two hypotheses based on the research questions. The first one is that consolidation has an impact on profitability and efficiency. The second hypothesis is that there is a relationship among consolidation, profitability and efficiency. One of the main variable for analysis here are efficiency scores, calculated by using Data Envelopment Analysis (DEA).[1]

This paper is prearranged into six sections: Section 2 shows review of literature to the study. In Section 3 we present the methodology and data sources for the study. Section 4 shows a profile of consolidation in India. Section 5 provides results. Section 6 gives conclusion of the study.

REVIEW OF LITERATURE:

This section shows the reviews on determinants of efficiency and profitability. The reviews related to consolidation and its determinants on profitability and efficiency is scarce. So we have mentioned the reviews related to determinants of profitability and efficiency in general.

Determinants of Profitability:

In this section, we have presented the determinants of profitability by using interior exterior factors of banks. Generally, bank profitability has used as a measure of interior and exterior one. The interior one explains about the bank-specific measures. The exterior one considers the measure of banks profitability which is not belonged to management but creates impact on business operation at economic level. A few studies have examined the interior and exterior measure of profitability (Short, 1979; Bourke, 1989 Berger et al., 1987; Barajas et al., 1999). The interior factor such as size of assets, capital, risk, cost management and expenses have used for determinant of banks profitability. Bank asset size is direct relationship between banks' profitability. A few studies have substituted to these results (Smirlock, 1985; Ram Mohan, 2005). On the contrary, a few studies have found that bank assets size is not a determine factor of bank profitability (Mehta and Kakani, 2006; Jayaraman and Srinivasan, 2014; Kumar, 2008; Sanjeev, 2007). Small to medium-sized banks earns more profitability by turning its capital into profit. Large banks reduced operating cost that lead to more profit for banks. Berger et.al (1987) pointed out that cost saving of banks improved their profit performance. The credit risk and management have driven profit of banks. Further, there is an inverse position between banks liquidity and profitability. Further, expenses and cost per business have a considerable improvement in attaining higher profitability. Molyneux and Thornton (1992) found that profitability and better management of businesses have registered with positive correlation.

Under exterior determinants of banks profitability, other indicators such factor as, interest, inflation and production, market forces, market concentration, ownership have used in the study. Molyneux and Thornton (1992) have used correlation analysis to measure the relationship between banks' profitability and other control variables. The results of correlation analysis found that bank concentration and profitability have found to be correlated each other. Further, increasing gap between competitive market structure improved profit of banks but increased concentration is resulted in negative managerial efficiency (Molyneux and Thornton, 1992). Further, Short (1979) found that private-owned institutions get higher profits. In contrast, Molyneux and Thornton (1992) found that profitability is not controlled by ownership. A few studies have witnessed that inflation and interest rate have found to be correlated with profitability (Molyneux and Thornton, 1992; Bourke, 1989; Athanasoglou, et al., 2008). Further, some macro economics variables such as cyclical output and inflation improved banks performance. The overall results indicate that banks profitability is driven by bank-specific factors. Thus, impacted on management but macro variables have found no relationship with banks management.

[1]We have used DEA from Ray (2004) to calculate efficiency scores for the study.

Determinants of bank efficiency:

In this section, we have presented the determinants of efficiency by using the internal factors of banks. Generally, There are a few empirical studies that explained the determinants of efficiency. A study by Casu and Molynenx (2003) have used DEA and Tobit regression function to analyze the production efficiency of European banking systems for the period of 1993-1997. The results showed that the profitability of banks is directly affecting bank's efficiency; at the same time, it found that there is no relationship between a degree of capitalization and efficiency. Another study from Europe and Central Asia for the period of 1995-1998 has been conducted by Crigorian and Menole (2006). Crigorian and Menole (2006) found that foreign ownership and management improved banks' efficiency. They also found by using same methodology that well-capitalized banking services, wider market share, positively determined the bank efficiency and some macro economic variables GDP and per capita income also positively impacted banks' efficiency. Moreover, they found that non-bank financial institutions and market security had no impact on bank efficiency. A few empirical studies from Europe have also substantiated to the results (Deles and Papanikolaou, 2009; Garcia, 2011; Hassan and Sachez, 2007; Naceur et al. 2009).

In the Indian context, Mehta and Kakani (2006) pointed out that the higher banks assets size is not alone a factor of banks profitability and efficiency. Jayaraman and Srinivasan (2014) has also substantiated this point that the assets are not a significant factor in increasing profit and efficiency of banks and others factor are more likely contributed in generating profitability and efficiency. Hence, many works from the areas of studies have revealed that banks assets size have no impacts on efficiency (Kumar 2008, Sanjeev 2007). Sometimes, the choice of variables might affect the results of efficiency. Further, many studies are not focusing the issue of consolidation and its impacts on bank efficiency and profitability. In India, we do not find similar literature for the study. An empirical study by Kalluru and Bhat (2009) examined the efficiency score and determinants of Indian commercial banks for the period of 1992-2006. They used stochastic frontier analysis (SFA) and Tobit regression function to calculate the efficiency scores. They found that the first analyses found that the cost efficiency of banks has declined in the period of 1992-2006. And the second stage on Tobit regression found that the bank's earning is the main variable of impacting efficiency. Thus, it is followed by wider spread of business and higher earnings from other income sources.

A study by Sanjeev (2007) has examined overall performance and technical efficiency of Indian commercial banks during 1997 to 2001. This study has used DEA and used different variables of banks such as interest and non-interest expenses as measured as an input variables and interest income, commission and transaction income as considered as output variables. The results found that there was no considerable and strong relationship between efficiency and banks assets size. The finding of the study says that increasing assets of banks could not improve the efficiency of banks. Another study from India by Majid (2012) is measured the banks' efficiency. The results suggest that ICICI bank and Bank of India (BOI) are more efficient than other banks for the period of 2000-2010. The advancement in innovation technology and consolidation will create a positive effect on bank's performance. The technological innovation will distress on non- performing assets to create efficient loans for customers. The results also suggest that there is a positive trend on bank's performance for the period of 2000-01 to 2010-11 and it was achieved through consolidation.

In our existing literature on determinants of banks profitability and efficiency has given low priority for consolidation and we need to address the problem. Obviously, simultaneous equation method will help us to address the determinants of efficiency and profitability because both the variables correlated each other. This method will be more reliable to find and conclude our hypotheses.

RESEARCH METHODOLOGY:

The empirical study includes 66 commercial banks from 2013. These selected banks include public, private and foreign sector banks and not included cooperative and regional rural banks. For our analysis, we have considered 26 public sector banks, 20 private sector banks and 20 foreign sector banks. The study takes which banks assets and capital came less than the acquirer banks that banks have considered as a weak bank. If we see that target banks have low assets compared to their respective acquirers, we take that bank is weak bank in terms of assets (millions). All variables are converted to ratios for our analysis. In the study, we have considered that the banks which have more than 50 million capitals in the banking sector and omitted which have less than 50 million capital and assets.

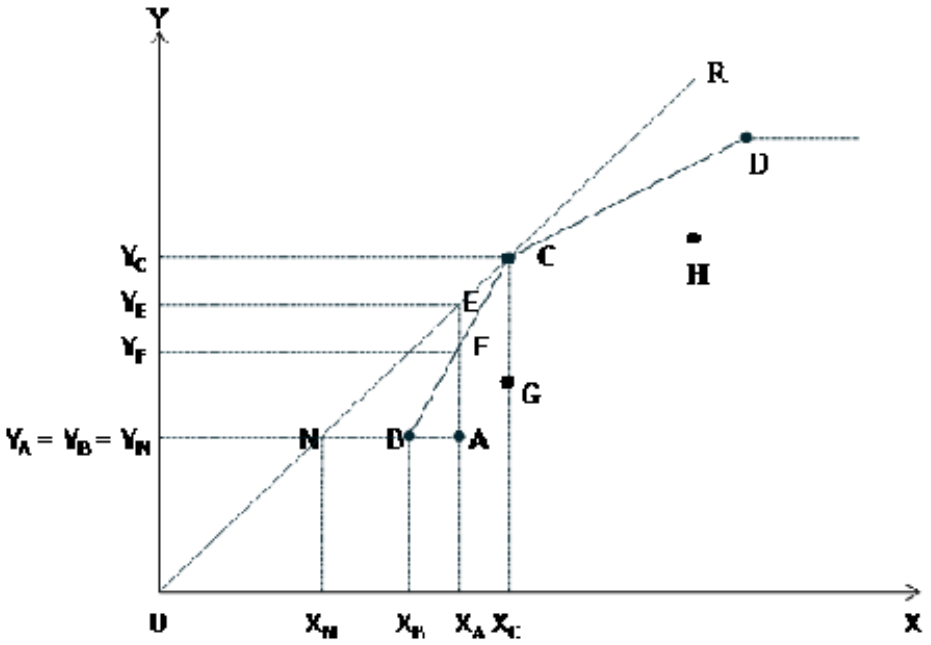
The study is an empirical one to address that consolidation is an impact on profitability and efficiency of banks. So, to investigate the relationship among consolidation, banks' profitability and efficiency, we use Simultaneous Equation Method (SEM). For this, we have taken a set of banks in 2013, consisting of all banks

which has gone through consolidation and has not gone through consolidation in the last 10 years. The following sub-sections explain the details of methodology of the study. The table 1 shows the details of consolidation from 1993 to 2013 but in the study; we take last 10 year consolidation deals for our analysis.

Theoretical Background: Overall, Technical and Scale Efficiency[2]:

In this section, we have presented three types of efficiency measures which are used in the study- overall, pure technical and scale efficiency. These concepts are introduced by Farrell (1957) and later these concepts are briefly explained by Fare et al., (1985) and Fernandez et al.,(2001). Further, these models are extended and reused by Charnes et al., (1978).

Figure 1: Overall, Technical and scale efficiencies



In the study, we have presented the input oriented measure of efficiency scores. It indicates that how much a bank can reduce inputs relative to other banks, to produce a same level of output. A bank is considered to as a "decision-making unit (DMU)". For example, consider the case of a single output produced by using single input.[3]

In diagram 1, X-axis shows input of firms and Y-axis shows output by firms. Let A, B, C, D, H and G are six DMUs (banks). The bank A produces Y_A amount of output and uses X_A level of input. The bank B is also attained same level of output by using $X_B < X_A$ level of input. Since bank B uses low input to produce the fixed output compared with bank A, thus, we can conclude that bank A is inefficient compared with bank B.

The overall technical efficiency (OTE) of banks is ONCR in Figure 1. This is the most efficient production frontier under CRS. This CRS frontier represents potential to actual input and output usage, while holding input and output proportions constant. This overall efficiency can be decomposed to pure technical and scale efficiencies when we consider Variable Returns to Scale (VRS) production technology. Scale efficiency is,

$$Overall\ Technical\ \ Efficiency\ (OTE)^{crs}_{input} = Pure\ Technical\ \ Efficiency\ (PTE)^{vrs}_{input}.Scale\ \ Efficiency\ _{input}$$

$$TE^{crs}_{input-orinted} = TE^{vrs}_{input-orinted} \cdot SE_{input-oriented}$$

This will not be the same as in the output-oriented efficiency measure except for the constant returns to scale technology. In an analogous manner, it can be seen that the factor $\frac{OY_C}{OY_A}$ is a measure of the pure technical (output-oriented) efficiency of firm A. Although a firm may be technically inefficient in an overall sense, while

[2]I thank Anushree Paul for her help in writing this section.

[3] In general, firms use a bundle of different inputs to produce their bundle of outputs. In figure 1, we consider a single input and a single output for simplicity.

experiencing scale inefficiencies, it can be purely technically efficient (Fernandez et al., 2001). This is evident in Figure 1 that firms B and D are purely technically efficient but exhibit scale inefficiencies. Firm G is neither scale efficient nor purely technical efficient as it lies below the frontier. Firm H is scale efficient as it produces at input level X_C, but (pure) technically inefficient as it is lying outside the frontier.

Simultaneous Equation Method

For SEM estimation, we consider the data of 66 selected Indian commercial banks including foreign banks. The data of dependent and independent variables for the SEM analysis is collected from `Profile of the Banks, RBI'. Our study includes the variable of consolidation dummy and interaction term (between consolidation dummy and assets of banks) for analyzing the relationship between consolidation and other endogenous variables. Here, banks selected variables are converted to ratios. Further, efficiency scores are converted to logistic transformation by using,

$$E_{OTE} = \ln (OTE /1- OTE)$$

Where, E_{OTE}= logistic transformation scores of Overall Technical Efficiency

As same as all the efficiency scores PTE and SE scores of input and output-oriented are converted by using same formula. These efficiency scores (OTE, PTE and SE), ROA and ROE variables have used as an endogenous variable in SEM. We used Three-Stage Least Squares estimation (3SLS) for the analysis of relationship among consolidation, profitability and efficiency. The 3SLS is more generalized format of system of equation. The 3SLS method is used for solving simultaneity bias which comes from ordinary least squares (OLS) method. Mathematically, profitability and efficiency can be followed as:

Profitability: π = f (Efficiency scores, Consolidation dummy (CD), Interaction variable (CD*lnTA), Total assets (lnTA), Capital, Reserves, Borrowings, Investment, Net interest income, Operating cost, Operating profit, Profit per employee, Office per employee, CRAR and Net NPA)

Efficiency scores: E = h (Profitability, consolidation dummy (CD), interaction variable (CD*Total assets), Total assets (lnTA), Capital, Reserves, Borrowings, Investment, Net interest income, Operating profit, Profit per employee, Office per employee, CRAR and Net NPA)

Where π = Profitability indicators (ROA and ROE); E = Efficiency scores (OTE, PTE and SE)

We analyze six SEM equations in the study based on the above endogenous variables, viz., the relationship between OTE and ROA, relationship between PTE and ROA, relationship between SE and ROA, relationship between OTE and ROE, relationship between PTE and ROE, relationship between SE and ROE.[4] As mentioned above, efficiency is divided into three components: OTE, PTE and SE as measured as endogenous variable in structural equation 1 of SEM. Further, profitability indicators: ROA and ROE as taken as endogenous variables in structural equation 2 of SEM. Further, we use consolidation, total assets and interaction term for analyzing its impacts and determinants on profitability and efficiency. We explain 2SLS estimation method for analyzing the problem of simultaneity bias.[5] The 3SLS estimation is calculated from 2SLS but 3SLS additionally includes one more step.

Two-Stage Least Squares (2SLS):

In OLS, we face `simultaneity bias'. By solving this bias, we take Two-Stage Least Squares (2SLS) method in a system of equation framework. The 2SLS includes two stages, viz., the first Stage contains that the OLS is valid and useful for consistent measurement of the reduced equations parameters when the reduced equation has no endogenous variables. This 2SLS is consistent and it does not suffer by simultaneous bias. In 3SLS, we use additional stage that Re-estimating the structural equations with estimated error term included as explanatory variables. For example, we have explained efficiency and profitability equation for understanding.

Efficiency and profitability:

$$\text{Efficiency: } E_i = \alpha + \beta \Pi_i + \varepsilon$$
$$\text{Profitability: } \Pi_i = \lambda + \theta E_i + \mu$$
$$\text{Endogenous: } E_i, \Pi_i$$

[4] CRAR: it is calculated by dividing with risk weighted assets which includes operational risk, market risk and credit risk. Further, higher CRAR refers to bank that the bank is well capitalized. Net NPA = Gross NPA - Bank adjustment, Balance in Interest Suspense account, Total provisions, Part payment accepted and remained in suspense account. **ROA** = (Net Profit /Average Total assets)*100. **ROE** = {Net Profit / (Total equity + Total equity of previous year) /2}*100.

[5] These concepts (2SLS and 3SLS) are taken from Wooldridge (2009).

There is a relation between the reduced-form parameters and the structural form equations. The parameters of reduced equations and structural equations come equal that the equation is identified. We can solve this equation by using 2SLS and OLS. Reduced-form equations are estimated in first step of 2SLS. Structural equations are measured in second step of 2SLS. 2SLS provides unbiased estimator but it is not efficient because it ignores to find the correlation between errors. 3SLS gives unbiased as well as an Efficient Estimator. The 3SLS estimation is calculated by following three stages. In the beginning stage, we estimate $\hat{E}_i$ and $\hat{\Pi}_i$ from reduced form equations. In the second stage, we estimate structural equations by using $\hat{E}_i$ and $\hat{\Pi}_i$ calculated from reduced form equations. Further, we take the residuals $\hat{\varepsilon}$ and $\hat{\mu}$ from these equations and use it as an independent variable in 3 stage. In the third stage, we finally re-estimate the structural equations with $\hat{\varepsilon}$ and $\hat{\mu}$ included as explanatory variables. Because ε and μ are correlated, $\hat{\mu}$ provides information for explaining E_i and $\hat{\varepsilon}$ provides information for explaining Π_i. Including this information makes the estimates better.

REGULATION OF BANK CONSOLIDATION IN INDIA[6]:

The consolidation is mechanised by Indian Banking Regulation Act (BR Act), 1949. RBI has the main power to regulate the consolidation and BR act is providing additional power to it. Consolidation includes two types, viz., voluntary consolidations and compulsory consolidations and each consolidation includes mergers and acquisitions. BR act under section 44(a) gives special references and regulation for voluntary consolidation. Further, BR act under section 45 provides special criteria and regulation for Compulsory consolidation. This section states that voluntary deal requires the approval of board of directors of banks and also requires the approval of two-third shareholders of both the banks. Finally, this voluntary proposal has to be submitted to RBI for approval. Apart from that, this act is not providing any references for Public sector banks (PSBs) in India. The State Bank of India (SBI) Act, 1955 mechanizes SBI and its group Banks. Consolidation of Public sector banks is regulated by Commercial Act 1970 and 1980.

Table 1: List of selected consolidation in India for the period of 1993-2013.

Sl.No	Target	Acquirer	Year	Reason
1	New Bank of India (G)	Punjab National Bank (G)	1993	weak bank (in terms of assets and capital)
2	Bank of Karad Ltd (P)	Bank of India (G)	1994	weak bank
3	Kashi Nath Seth Bank Ltd (P)	State Bank of India (G)	1996	weak bank
4	Bari Doab Bank Ltd (P)	Oriental Bank of Commerce (G)	1997	weak bank
5	Punjab Co-operative Bank	Oriental Bank of Commerce (G)	1997	weak bank
6	Bareilly Corporation Bank (P)	Bank of Baroda (G)	1999	Expansion of scale
7	Sikkim Bank Ltd (P)	Union Bank of India (G)	1999	weak bank
8	Times Bank Ltd. (P)	HDFC Bank Ltd	2000	Expansion of scale
9	Bank of Madura Ltd. (P)	ICICI Bank Ltd.	2001	Expansion of scale
10	ICICI Ltd (P)	ICICI Bank Ltd	2002	Expansion of size
11	Benares State Bank Ltd (P)	Bank of Baroda (G)	2002	weak bank
12	Nedungadi Bank Ltd. (P)	Punjab National Bank(G)	2003	weak bank
13	South Gujarat Local Bank (P)	Bank of Baroda (G)	2004	weak bank
14	Global Trust Bank Ltd. (P)	Oriental Bank of Commerce (G)	2004	weak bank
15	IDBI Bank Ltd (P)	IDBI Ltd (P)	2005	Expansion of size
16	Bank of Punjab Ltd. (P)	Centurion Bank Ltd (P)	2005	Expansion of scale
17	Ganesh Bank of Kurundwad (P)	Federal Bank Ltd(P)	2006	weak bank
18	United Western Bank Ltd (P)	IDBI Ltd. (P)	2006	weak bank
19	Bharat Overseas Bank Ltd. (P)	Indian Overseas Bank (G)	2007	weak bank
20	Sangli Bank Ltd. (P)	ICICI Bank Ltd. (P)	2007	Expansion of scale
21	Lord Krishna Bank Ltd. (P)	Centurion Bank of Punjab(P)	2007	Expansion of scale
22	Centurion Bank of Punjab (P)	HDFC Bank Ltd. (P)	2008	Expansion of scale
23	The Bank of Rajasthan (P)	ICICI Bank Ltd (P)	2010	weak bank
24	State Bank of Indore(G)	State Bank of India(G)	2010	Expansion of scale
25	ING (P)	Kodak Mahindra Bank (P)	2013	weak bank

Source: Report on Currency and Finance, RBI, Various Issues. G = Public Banks; P = Private Banks

[6] This part has taken from Kollapuri (2017).

Table 1 shows 25 consolidation deals. These deals generally happened for reforming the distressed banks based on their size, scale and scope. Table 1 shows that 11 deals were under the category of voluntary amalgamation and 14 deals were compulsory consolidation. It is also noted that private sector banks have triggered more consolidation in India than Public Sector Banks (PSBs). Apart from that, it is important to note that up to 1999, mergers and acquisitions have been driven by weak and low-performance of target banks. Further, consolidation is witnessed for expanding businesses and improving economics of scale from 1999 to 2005. Afterwards, bank consolidation in India has been driven by market forces such forces as deregulation, technology, competition, etc. It is observed that out of these 25 consolidation deals, private sector banks are more vulnerable than government banks. Many deals are encouraged by the market forces especially declining prices and performance of banks. As far as public sector banks are concerned, they need support from the government if they face any financial distress. Further, if these banks are not able to fulfill the requirement of RBI and GOI, by using BR ACT, consolidation term came to support these banks to solve their financial distress. This financial distress may be generated by Non-performing assets and it is the crucial factors for bank bailouts.

EMPIRICAL RESULTS:

In the Indian context, the literatures related to the hypothesis that bank consolidation has an impact on profitability and efficiency is scarce. This paper tries to examine if consolidation is a significant determinant of banks' profitability and efficiency. Additionally, most of the Indian literatures have explained the determinants of banks profitability and efficiency in general. In Indian context, this study is first to address the relationship among consolidation, profitability and efficiency including other control variables of 66 banks in 2013. Further, we try to find if increased assets size due to consolidation is important factor for banks profitability and efficiency.

Descriptive statistics:

The descriptive statistics of the variables for the SEM analysis is given in Table 2. This table includes maximum, minimum and mean values of 66 commercial banks in India. In this table, Banks Capital, Consolidation Dummy (CD), Interaction Term, Reserves, Borrowings, Investments, Operating cost, Operating profit, Return on Equity, Return on Assets, CRAR, Net NPA, Office per Employee, Profit per Employee and Net Interest Income have taken as in ratios. Further, total assets have taken as lnTA. More importantly, banks input-based scores of efficiency (OTE_I, PTE_I and SE_I) and output-based scores of efficiency (OTE_O, PTE_O and SE_O) have converted to logistic transformation values (log $OTE_{I \text{ or } O}$, $PTE_{I \text{ or } O}$ and $SE_{I \text{ or } O}$). The $OTE_{I \text{ or } O}$, $PTE_{I \text{ or } O}$ and $SE_{I \text{ or } O}$ refer that Overall Technical Efficiency, Pure Technical Efficiency and Scale efficiency are calculated by using input and output-oriented Data envelopment analysis (DEA). Input-oriented Model of DEA considers that output is fixed one and input is the only factor of banks can change. Output model refers that input is fixed one and output is flexible.[7] Table 2 includes 66 banks commercial of India in 2013. Most of the banking parameters are converted to ratios by dividing with total assets of the banks. These variables are used to measure the determinants of profitability and efficiency to fulfill our main objective of the study. Apart from that, the study included only interior factors of banks and is not included the exterior factors and macro economic factors which are mentioned in review of literature. DEA scores of banks help to indicate the efficiency performance of banks with respect their input and output combinations.

Table 2: The descriptive statistics of selected banks variables in 2013 for SEM analysis (ratios)

Variables	Capital	Reserves	Borrowings	Investment	Operating cost	Operating Profit	CD	CD* lnTA
Banks	66	66	66	66	66	66	66	66
Maximum	39.938	19.624	49.890	161.4061	22.053	5.916	1	16.566
Minimum	0.001	-0.092	0.171	4.707	0.604	-1.236	0	0
Mean	5.453	6.889	13.416	31.235	2.040	2.250	0.196	2.923

[7] Input and output DEA concepts of Indian commercial banks efficiency are explained in (Kollapuri, 2017). Pure technical efficiency refers that banks ability to avoid its input waste by producing as much outputs as input usage follows. Scale efficiency shows that the bank's ability to produce its optimal scale.

Variables	ROE	ROA	CRAR	Net NPA	Office per employee	Profit per Employee	lnTA	Net Interest Income
Banks	66	66	66	66	66	66	66	66
Maximum	24.81	4.26	71.45	9.71	324	27.68	16.566	6.013
Minimum	-10.5	-3.26	11.02	0	6.990	-3.1	8.036	-1.129
Mean	11.905	1.157	18.352	1.412	32.573	2.339	13.099	2.904
Variables	**logOTE$_I$**	**logPTE$_I$**	**logSE$_I$**	**logOTE$_O$**	**logPTE$_O$**	**logSE$_O$**		
Banks	66	66	66	66	66	66		
Maximum	20.723	20.723	20.723	20.723	20.723	20.723		
Minimum	-1.516	-1.009	-1.516	-1.516	-1.020	-1.516		
Mean	-0.641	4.715	-0.079	-0.641	4.820	0.162		

Sources: Profile of the Banks, RBI, 2013.

Results from 3SLS regression:

The OLS produces inconsistent estimates, so we will use 3SLS estimation for analyzing the determinants of banks profitability and efficiency including other control variables. In the system of equations, we have taken and converted most of the variables in ratios with the values ranging $-\infty \; to + \infty$. Further, all the input and output-based scores of efficiency used in the study is a monotonic logarithmic transformation. All the equation related to efficiency scores in SEM analysis has divided into two SEM results based on input-oriented ($_{log}OTE_I$, $_{log}PTE_I$ and $_{log}SE_I$) scores and output-oriented ($_{log}OTE_O$, $_{log}PTE_O$ and $_{log}SE_O$) scores. The equations and results based on the sample of 66 commercial banks of India are presented in following sections.

Case 1: Relationship between OTE and ROA:

Our results and conclusions are very similar with respect to input-oriented or output-oriented efficiency scores (OTE, PTE and SE) technique. Hence, we are only showing and using the results of input- oriented efficiency scores for brevity. The results of 3SLS estimation for overall technical efficiency and ROA are presented in Table 3 by using input-oriented overall efficiency scores of 66's banks.

The results show that ROA has significant impact on logOTE while logOTE is found to be insignificantly associated with ROA. This indicates that banks' ROA is positively associated with banks' efficiency at 10 percent significant level. Further, in the simultaneous equation method, logOTE is associated with ROA negatively and ROA is positively associated with logOTE. These results indicate that profitability is determined banks efficiency.

Apart from that, looking at other control variables, we find that banks' capital and capital adequacy ratio are significant with logOTE at 1 per cent and 5 percent level respectively but CRAR has found to be negative coefficient with logOTE. However, the rest of the explanatory variables are insignificant with logOTE and ROA which is observed in Table 3. Further, these results are clearly indicating that consolidation dummy and interaction term are insignificant with logOTE and ROA.

Among these variables, increased capital and return on assets by consolidation encourages the efficiency.

Table 3: Simultaneous Equation results of OTE and ROA
(Three Regression Analysis- Input-oriented efficiency scores 66's banks)

Equation 1	RMSE	"R-sq"	F-Stat	P	Equation 2	RMSE	"R-sq"	F-	P
LogOTE	**1.817**	**0.538**	**60.830**	**0.000**	**ROA**	**16.931**	**-217.320**	**0.290**	**1.000**
LogOTE	**Coef.**	**Std. Err.**	**T**	**P>|t|**	**ROA**	**Coef.**	**Std. Err.**	**T**	**P>|t|**
Capital	0.264	0.070	3.750	0.000***	Capital	2.681	85.399	0.030	0.975
Reserves	-0.134	0.144	-0.930	0.351	Reserves	0.384	9.787	0.040	0.969
Borrowings	0.009	0.026	0.350	0.730	Borrowings	-0.072	2.005	-0.040	0.971
Investment	-0.012	0.013	-0.970	0.332	Investment	-0.152	4.768	-0.030	0.975
Operating Profit	-0.721	0.868	-0.830	0.406	Operating Cost	-3.765	113.772	-0.030	0.974

Equation 1	RMSE	"R-sq"	F-Stat	P	Equation 2	RMSE	"R-sq"	F-	P
LogOTE	**1.817**	**0.538**	**60.830**	**0.000**	**ROA**	**16.931**	**-217.320**	**0.290**	**1.000**
LogOTE	**Coef.**	**Std. Err.**	**T**	**P>|t|**	**ROA**	**Coef.**	**Std. Err.**	**T**	**P>|t|**
Net in Income	0.067	0.557	0.120	0.904	Operating Profit	-0.057	16.897	0.000	0.997
Profit Per employee	0.013	0.131	0.100	0.918	Profit Per Employee	-0.172	5.064	-0.030	0.973
ROE	-0.040	0.072	-0.560	0.577	Net in Income	-1.432	42.121	-0.030	0.973
ROA	1.915	1.131	1.690	0.090*	CRAR	-0.620	19.933	-0.030	0.975
CRAR	-0.075	0.040	-1.850	0.065*	Net NPA	-2.313	63.525	-0.040	0.971
Net NPA	0.334	0.409	0.820	0.413	Office per Employee	0.071	2.141	0.030	0.974
Office per employee	-0.001	0.009	-0.100	0.922	CD	89.375	2843.259	0.030	0.975
CD	8.935	9.221	0.970	0.333	CD* lnTA	-6.295	200.016	-0.030	0.975
CD* lnTA	-0.618	0.633	-0.980	0.329	lnTA	5.054	160.039	0.030	0.975
LnTA	0.490	0.331	1.480	0.139	logOTE	-8.271	265.778	-0.030	0.975
_cons	-6.653	4.703	-1.410	0.157	_cons	-56.400	1813.740	-0.030	0.975

Notes: Author's own calculation. p-values in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent levels, respectively.

Case 2: Relationship between logPTE and ROA:

The results of 3SLS estimation for simultaneity between Pure Technical Efficiency and ROA are presented in Table 4 by using input-oriented scores of PTE. As far as pure technical efficiency is concerned in equation 1, the simultaneous estimation of logPTE and ROA from Table 4 shows that ROA has positive coefficient in determining banks' logPTE at 5 per cent significant level. Further, more interestingly, banks' interaction variable (consolidation dummy and lnTA), lnTotal assets, Capital and Net interest income have found to be positive coefficient and statistically significant at 5 per cent level in determining logPTE.

These results indicate that these variables have found to be increased assets size as a positive coefficient in improving logPTE. Apart from that, banks' Borrowings and Office per employee have found to be statically significant at 1 per cent level and found to be positive coefficient in impacting logPTE. However, Consolidation dummy has found negative coefficient in affecting logPTE and found to be statistically significant at 5 per cent level. As far as ROA is concerned in equation 2, only Operating profit has found to be statistically significant at 10 per cent level and positive coefficient by affecting ROA. Therefore, rests of the variables are found to be insignificant both in Equation 1 and 2.

It is evident that consolidation improves and determines the banks efficiency with positive coefficient. Interestingly, banks consolidation and increased assets by consolidation impacts pure technical efficiency and also increased assets size have found to be 3.449 at 5 percent level of significant. It indicates that efficiency rose up to 3.449 digit when a percent increase in total assets by consolidation.

Table 4: Simultaneous Equation results of PTE and ROA
(Three Regression Analysis- Input-oriented efficiency scores of 66's banks)

Equation 1	RMSE	"R-sq"	F-Stat	P	Equation 2	RMSE	"R-sq"	F-Stat	P
LogPTE	**4.370**	**0.669**	**129.920**	**0.000**	**ROA**	**0.627**	**0.701**	**208.500**	**0.000**
LogPTE	**Coef.**	**Std. Err.**	**T**	**P>|t|**	**ROA**	**Coef.**	**Std. Err.**	**T**	**P>|t|**
Capital	0.336	0.169	1.990	0.047**	Capital	-0.042	0.081	-0.520	0.600
Reserves	0.272	0.347	0.780	0.434	Reserves	-0.022	0.130	-0.170	0.865
Borrowings	0.244	0.064	3.790	0.000***	Borrowings	-0.036	0.032	-1.140	0.256
Investment	0.021	0.032	0.670	0.505	Investment	-0.003	0.005	-0.770	0.441
Operating Profit	-2.503	2.088	-1.200	0.231	Operating Cost	-0.041	0.236	-0.180	0.861

Equation 1	RMSE	"R-sq"	F-Stat	P	Equation 2	RMSE	"R-sq"	F-Stat	P
LogPTE	**4.370**	**0.669**	**129.920**	**0.000**	**ROA**	**0.627**	**0.701**	**208.500**	**0.000**
LogPTE	**Coef.**	**Std. Err.**	**T**	**P>|t|**	**ROA**	**Coef.**	**Std. Err.**	**T**	**P>|t|**
Net in Income	2.779	1.341	2.070	0.038**	Operating Profit	0.420	0.247	1.700	0.089*
Profit Per Employee	-1.142	0.316	-3.620	0.000***	Net in Income	-0.416	0.389	-1.070	0.286
ROE	0.026	0.174	0.150	0.882	Profit Per Employ	0.159	0.218	0.730	0.466
ROA	5.754	2.719	2.120	0.034**	CRAR	0.008	0.017	0.470	0.637
CRAR	-0.057	0.098	-0.580	0.563	Net NPA	-0.221	0.158	-1.400	0.161
Net NPA	1.164	0.984	1.180	0.237	Office per Employ	-0.009	0.016	-0.530	0.597
Office per Employ	0.066	0.022	2.990	0.003***	CD	6.878	7.735	0.890	0.374
CD	-47.326	22.170	-2.130	0.033**	CD* lnTA	-0.502	0.553	-0.910	0.364
CD* lnTA	3.449	1.524	2.260	0.024**	lnTA	-0.254	0.403	-0.630	0.529
LnTA	1.868	0.797	2.340	0.019**	logPTE	0.142	0.169	0.840	0.400
_cons	-37.645	11.307	-3.330	0.001	_cons	5.321	6.493	0.820	0.412

Notes: Author's own calculation. P-values in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent levels, respectively.

Case 3: Relationship between logSE and ROA

The 3SLS estimation for simultaneity between Scale Efficiency and ROA are presented in Table 5 by using input-oriented scores of SE.

Table 5: Simultaneous Equation results of SE and ROA (Three Regression Analysis)

Input-oriented efficiency scores of 66's banks									
Equation 1	**RMSE**	**"R-sq"**	**F-Stat**	**P**	**Equation 2**	**RMSE**	**"R-sq"**	**F-Stat**	**P**
LnSE	**1.808**	**0.568**	**68.670**	**0.000**	**ROA**	**1.168**	**-0.038**	**60.080**	**0.000**
LogSE	**Coef.**	**Std. Err.**	**T**	**P>|t|**	**ROA**	**Coef.**	**Std. Err.**	**T**	**P>|t|**
Capital	0.229	0.070	3.270	0.001***	Capital	0.171	0.331	0.520	0.605
Reserves	-0.229	0.144	-1.590	0.112	Reserves	0.066	0.086	0.770	0.443
Borrowings	-0.002	0.027	-0.060	0.953	Borrowings	-0.018	0.024	-0.760	0.448
Investment	-0.014	0.013	-1.050	0.294	Investment	-0.012	0.022	-0.570	0.570
Operating Profit	-0.824	0.864	-0.950	0.340	Operating Cost	-0.447	0.518	-0.860	0.388
Net in Income	0.165	0.554	0.300	0.765	Operating Profit	0.297	0.541	0.550	0.584
Profit Per employee	0.030	0.131	0.230	0.817	Net in Income	-0.155	0.363	-0.430	0.670
ROE	-0.081	0.072	-1.120	0.263	Profit Per Employee	-0.019	0.091	-0.210	0.837
ROA	2.036	1.125	1.810	0.070*	CRAR	-0.037	0.086	-0.430	0.666
CRAR	-0.076	0.041	-1.880	0.060*	Net NPA	-0.563	0.520	-1.080	0.279
Net NPA	0.082	0.407	0.200	0.840	Office per Employee	0.008	0.012	0.690	0.489
Office per employee	-0.002	0.009	-0.240	0.809	CD	3.301	7.839	0.420	0.674
CD	2.979	9.170	0.320	0.745	CD* lnTA	-0.237	0.539	-0.440	0.660
CD* lnTA	-0.197	0.630	-0.310	0.754	LnTA	0.143	0.243	0.590	0.557

Input-oriented efficiency scores of 66's banks									
Equation 1	**RMSE**	**"R-sq"**	**F-Stat**	**P**	**Equation 2**	**RMSE**	**"R-sq"**	**F-Stat**	**P**
LnSE	**1.808**	**0.568**	**68.670**	**0.000**	**ROA**	**1.168**	**-0.038**	**60.080**	**0.000**
LogSE	**Coef.**	**Std. Err.**	**T**	**P>|t|**	**ROA**	**Coef.**	**Std. Err.**	**T**	**P>|t|**
LnTA	0.049	0.330	0.150	0.882	LnSE	-0.491	1.089	-0.450	0.652
_cons	1.305	4.677	0.280	0.780	Cons	0.479	3.143	0.150	0.879

Notes: Author's own calculation. P-values in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent levels, respectively.

These results shows as same as logOTE that profitability indicator (ROA) is determined banks scale efficiency. Further, banks' capital and capital adequacy ratio are significant with logSE at 1 per cent and 5 percent level respectively but CRAR found to be negative coefficient with logSE. However, the rest of the independent variables have found to be insignificant with logSE and ROA which is observed in Table 5. It is also evident from the results that consolidation dummy and interaction term are insignificant with endogenous variable (logSE and ROA).

Apart from that, it is also observed that increased assets size and the term of consolidation are found to be significant. According to scale efficiency, the objective of null hypothesis is found to be insignificant. These results are also reflected in determining OTE scores with other control variables of banks. As far as profitability is concerned, it is also witnessed that no independent variables are significant with profitability. Finally, we conclude that both the hypothesis 1 and 2 are accepted here.

Case 4: Relationship between logOTE and ROE

The 3SLS estimation for overall technical efficiency and ROE are given in Table 6 using input-oriented scores of OTE.

Table 6: Simultaneous Equation results of OTE and ROE (Three Regression Analysis)

Input-oriented efficiency scores of 66's banks									
Equation 1	**RMSE**	**"R-sq"**	**F-**	**P**	**Equation 2**	**RMSE**	**"R-sq"**	**F-**	**P**
LogOTE	**3.133**	**-0.369**	**27.470**	**0.025**	**ROE**	**3.623**	**0.697**	**166.600**	**0.000**
LogOTE	**Coef.**	**Std. Err.**	**T**	**P>t**	**ROE**	**Coef.**	**Std. Err.**	**T**	**P>t**
Capital	0.526	0.369	1.430	0.154	Capital	-0.571	0.190	-3.010	0.003***
Reserves	0.167	0.526	0.320	0.750	Reserves	-0.386	0.241	-1.600	0.110
Borrowings	0.071	0.082	0.870	0.385	Borrowings	-0.078	0.052	-1.500	0.135
Investment	0.008	0.033	0.250	0.802	Investment	-0.015	0.027	-0.540	0.590
Operating Profit	-3.555	3.179	-1.120	0.263	Operating Cost	0.241	0.538	0.450	0.654
Net in Income	0.556	1.094	0.510	0.611	Operating Profit	3.839	1.426	2.690	0.007***
Profit Per Employ	0.113	0.300	0.380	0.706	Net in Income	-0.557	1.118	-0.500	0.618
ROE	0.738	0.988	0.750	0.455	Profit Per Employ	-0.121	0.284	-0.430	0.669
ROA	1.632	2.236	0.730	0.466	CRAR	0.040	0.087	0.460	0.643
CRAR	-0.063	0.075	-0.840	0.404	Net NPA	-1.606	0.447	-3.600	0.000***
Net NPA	1.630	1.249	1.310	0.192	Office per Employ	-0.015	0.027	-0.550	0.581
Office per Employ	0.007	0.014	0.530	0.599	CD	-7.624	18.636	-0.410	0.682
CD	8.854	15.874	0.560	0.577	CD* lnTA	0.416	1.277	0.330	0.745
CD* lnTA	-0.521	1.075	-0.480	0.628	LnTA	0.301	0.647	0.470	0.642
LnTA	-0.077	0.679	-0.110	0.910	LnOTE	0.754	0.438	1.720	0.085*
_cons	-11.040	11.352	-0.970	0.331	Cons	10.792	9.723	1.110	0.267

Notes: Author's own calculation. P-values in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent levels, respectively.

The results indicate that logOTE has insignificant impact on ROE but ROE is found insignificant with logOTE. The results show that banks' logOTE is significant with banks' ROE at 10 percent level. Apart from that, ROE is insignificantly associated with logOTE in equation 1. Further, logOTE has found to be positive coefficient on ROE in equation 2. These results reveal that banks' efficiency has a positive relationship on profitability. Looking at other exogenous variables, SEM equation 2 found that banks' capital and Net NPA are significant and positive coefficient with ROE at 1 per cent level. Moreover, operating profit has found negative coefficient on ROE but significant at 1 per cent level. However, the rest of the independent variables have found to be insignificant with logOTE and ROE which is presented in Table 6. These results have also found that consolidation dummy and interaction term are insignificant with dependent variable.

Case 5: Relationship between logPTE and ROE

The 3SLS estimation results are presented in Table 7 using input-oriented scores of PTE for the measurement of simultaneity between Pure Technical Efficiency and ROE. The Pure Technical Efficiency is taken as a dependent variable in equation 1, the estimation of relationship between logPTE and ROE shows that ROE has found to be insignificant in determining banks' logPTE.

Table 7: Simultaneous Equation results of PTE and ROE (Three Regression Analysis)

Input-oriented efficiency scores of 66's banks									
Equation 1	**RMSE**	**"R-sq"**	**F-Stat**	**P**	**Equation 2**	**RMSE**	**"R-sq"**	**F-Stat**	**P**
LogPTE	**4.894**	**0.585**	**106.740**	**0.000**	**ROE**	**4.198**	**0.593**	**124.140**	**0.000**
LogPTE	**Coef.**	**Std. Err.**	**T**	**P>|t|**	**ROE**	**Coef.**	**Std. Err.**	**t**	**P>|t|**
Capital	0.110	0.576	0.190	0.849	Capital	-0.633	0.252	-2.510	0.012**
Reserves	0.011	0.822	0.010	0.990	Reserves	-0.843	0.429	-1.960	0.050**
Borrowings	0.190	0.128	1.480	0.138	Borrowings	-0.204	0.101	-2.020	0.043**
Investment	0.003	0.052	0.060	0.956	Investment	-0.029	0.030	-0.960	0.337
Operating Profit	-0.056	4.968	-0.010	0.991	Operating Cost	0.776	0.821	0.950	0.344
Net in Income	2.357	1.709	1.380	0.168	Operating Profit	3.765	1.652	2.280	0.023**
Profit Per Em.	-1.228	0.469	-2.620	0.009***	Net in Income	-2.002	1.571	-1.270	0.203
ROE	-0.647	1.543	-0.420	0.675	Profit Per Em.	0.697	0.649	1.070	0.283
ROA	5.999	3.494	1.720	0.086*	CRAR	0.022	0.097	0.230	0.819
CRAR	-0.068	0.118	-0.570	0.566	Net NPA	-1.243	0.622	-2.000	0.046**
Net NPA	0.046	1.951	0.020	0.981	Office per Em.	-0.070	0.051	-1.360	0.174
Office per Em.	0.059	0.021	2.800	0.005***	CD	28.203	28.023	1.010	0.314
CD	-47.256	24.801	-1.910	0.057*	CD* lnTA	-2.152	1.963	-1.100	0.273
CD* lnTA	3.365	1.680	2.000	0.045**	LnTA	-0.776	1.236	-0.630	0.530
LnTA	2.357	1.060	2.220	0.026**	LnPTE	0.661	0.445	1.490	0.137
_cons	-33.857	17.737	-1.910	0.056	Cons	30.327	19.758	1.530	0.125

Notes: Author's own calculation. P-values in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent levels, respectively.

Apart from that, banks' interaction variable (consolidation dummy and lnTA) and lnTotal assets have found to be statistically significant at 5 per cent level and registered positive coefficient in determining logPTE. Further, ROA and Office per employee have also found positive coefficient and registered significant at 10 percent and 1 percent level respectively. Moreover, Profit per employee and Office per employee has registered at 1 per cent significant level but Profit per employee has found to be negative coefficient on logPTE. We have observed that

increased assets size and interaction term have found a positive coefficient on improving logPTE.
Further, Consolidation dummy has found to be statistically significant at 10 per cent level but registered negative coefficient on affecting logPTE. These results are accepted the null hypothesis that consolidation and assets size have a relationship with logPTE. The ROE has taken as an endogenous variable in equation 2. The results show that Capital, Reserves, Borrowing, Operating profit and Net NPA have found to be statistically significant at 5 per cent level but all variables have registered negative coefficient in determining ROE except Operating profit.

Case 6: Relationship between logSE and ROE

The 3SLS estimation is given in Table 8 using input-oriented scores of SE for the measurement of simultaneity between Pure Technical Efficiency and ROE. The results found in equation 1 that ROE has insignificant on logSE. In equation 2, logSE is found to be significant on ROE.
It is evident in Table 8 on equation 2 that logSE is positively associated with banks' ROE at 10 percent significant level. However, in equation 1, we found that ROE is insignificant with logSE. It indicates that there is no relation between ROE and logSE including consolidation and its effects. These results are similar to logOTE and profitability indicator ROE. Further, banks' capital, Operating cost and net NPA are significant with ROE at 1 per cent level but Capital and net NPA have found to be negative coefficient on ROE.
In equation 1 and 2, the rest of the exogenous variables have found to be insignificant with logSE and ROE which is evident in Table 8. It is also evident from the results that consolidation dummy and interaction term are insignificant with endogenous variable (logSE and ROE). These results are accepted the alternative hypothesis that there is no relationship among consolidation, profitability and efficiency.

Table 8: Simultaneous Equation results of SE and ROE (Three Regression Analysis)

Input-oriented efficiency scores of 66's banks									
Equation 1	**RMSE**	**"R-sq"**	**F-tat**	**P**	**Equation 2**	**RMSE**	**"R-sq"**	**F-Stat**	**P**
LogSE	**3.141**	**-0.305**	**29.660**	**0.013**	**ROE**	**3.707**	**0.683**	**159.220**	**0.000**
LogSE	**Coef.**	**Std. Err.**	**T**	**P>|t|**	**ROE**	**Coef.**	**Std. Err.**	**T**	**P>t**
Capital	0.493	0.370	1.330	0.183	Capital	-0.555	0.187	-2.960	0.003***
Reserves	0.076	0.528	0.140	0.886	Reserves	-0.333	0.247	-1.350	0.177
Borrowings	0.061	0.082	0.740	0.459	Borrowings	-0.072	0.054	-1.330	0.183
Investment	0.007	0.033	0.230	0.822	Investment	-0.015	0.028	-0.520	0.601
Operating Profit	-3.677	3.188	-1.150	0.249	Operating Cost	0.257	0.553	0.460	0.643
Net in Income	0.658	1.097	0.600	0.549	Operating Profit	3.992	1.463	2.730	0.006***
Profit Per employee	0.131	0.301	0.430	0.664	Net in Income	-0.640	1.142	-0.560	0.575
ROE	0.703	0.990	0.710	0.478	Profit Per employee	-0.136	0.290	-0.470	0.639
ROA	1.750	2.242	0.780	0.435	CRAR	0.040	0.089	0.450	0.653
CRAR	-0.064	0.075	-0.840	0.400	Net NPA	-1.441	0.489	-2.950	0.003***
Net NPA	1.386	1.252	1.110	0.268	Office per Em.	-0.014	0.027	-0.530	0.598
Office per Em.	0.006	0.014	0.430	0.666	CD	-3.181	18.580	-0.170	0.864
CD	2.897	15.915	0.180	0.856	CD* lnTA	0.099	1.271	0.080	0.938
CD* lnTA	-0.099	1.078	-0.090	0.927	LnTA	0.650	0.607	1.070	0.284
LnTA	-0.522	0.681	-0.770	0.443	LnSE	0.750	0.445	1.680	0.092*
_cons	-3.111	11.382	-0.270	0.785	Cons	4.961	9.475	0.520	0.601

Notes: Author's own calculation. P-values in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent levels, respectively.

Overall results reveals that that Capital, ROA and CRAR are found to be significant but CRAR only has negative coefficient on Overall Technical efficiency which is observed in the case of 1 and 3. In Return on assets, there are no exogenous variables found to be significant. Thus, it reveals that Return on assets impacts Overall Technical efficiency but Overall Technical efficiency has no impact on Return on assets. Further, it found that consolidation

and total assets has no impact on profitability and efficiency. In case 2, the input-oriented SEM results show that Capital, Borrowings, Net interest income, Profit per employee, Return on assets, Office per employee, Consolidation dummy, Interaction term and Total assets are found to be significant on determining Pure Technical Efficiency but Consolidation dummy and Profit per employee are found to be negative coefficient. As far as Return on assets is concerned, except operating profit all the variables are found to be insignificant. The overall results indicate that Pure Technical Efficiency and Return on assets are not interrelated each other but Return on assets determines Pure Technical Efficiency. Apart from that, it found that consolidation and total assets including interaction term have found an impact on efficiency but not on profitability.

In case 4 and 6, we found that there are no independent variables found to be significant on Overall Technical efficiency and SE. We found that Overall Technical efficiency and SE impact Return on equity but Return on equity has no impact on Overall Technical efficiency and SE. It is also observed that consolidation and total assets has no impact on profitability and efficiency. In case 5, As far as Return on equity is concerned, Capital, Reserves, Borrowings, operating profit and Net NPA are found to be significant and rest of the variables are insignificant. The overall results found that there is no relationship between Pure Technical Efficiency and Return on equity. Further, it found that consolidation and total assets including interaction term are found an impact on efficiency but not on profitability. The overall results reveal that consolidation has an impact on pure technical efficiency and it found insignificant on other efficiency scores. But, consolidation has no effect on profitability that has found in all results of Return on assets and Return on equity in case 1, 2, 3, 4, 5 and 6.

CONCLUSION:

The overall results reveal that banks profitability and efficiency are interrelated. The results indicated that consolidation makes an impact on banks efficiency. As far as pure technical efficiency is concerned, it is evident that pure technical efficiency is determined by consolidation. Here, we found that increased assets by consolidation and consolidation term are found to be significant on determining efficiency but consolidation has negative co-efficient. As far as Scale Efficiency is concerned, these variables are found to be insignificant. It indicates that consolidation has no impact on Scale Efficiency. As far as Overall Technical efficiency is concerned, most of the exogenous variables are found to be insignificant. The scores of Overall Technical efficiency are decomposed by pure technical efficiency and Scale Efficiency scores. The results of Overall Technical inefficiency are more likely the reflection of the results of Scale inefficiency. Further, the study found that consolidation has no effects on Scale Efficiency and Overall Technical Efficiency.

Among these consolidation deals, we found that overall efficiency and profitability are not improved by consolidation. Further, we conclude that only pure technical efficiency witnessed with improvement and other are not. In India, different government policies are encouraged and supported for consolidation to improve their respective objectives. Whether that objectives are successful or not, maintained and regulated by RBI. Merely seeing the process of these deals, we must go in-depth to find the issues and problems behind the mergers and acquisitions. The suggestion from paper is that before we encourage any deals, we must thing about the problems pertaining and related to the banking sector and rules and regulation from that respective government.

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