EFFECT OF MERGERS ON TECHNICAL AND SCALE EFICIENY OF BANKS: TWO CASES OF PAKISTAN BANK MERGERS

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ABSTRACT

This paper investigated the effect of mergers on the technical, pure technical and scale efficiency of banks. Hardly any literature was available on accessing the efficiency effects of mergers by using non-parametric approach. So this paper used Data envelopment analysis and studied two cases of mergers in Pakistani banking sector in last 10 years. Both CRS and VRS specifications were used under input-orientation. The results showed both overall technical efficiency and scale efficient reduced, however pure technical efficiency ascended after merger.

Key words: Efficiency Effects, Mergers, DEA, Pakistan Banks

INTRODUCTION

The Asian financial crisis in 1997 led many Asian countries to go through massive reforms in their financial sectors .Mergers of domestic banks was an indispensable concomitant of this strategy. In the case of Pakistan, the projected major restructuring plan for the banking sector was started since 2000. The aim of this shake-up was to

foster the financial stability of the financial sector enabling fewer but stronger banks to exploit economies of scale and hence to endure economic dip. This consolidation through mergers and acquisitions was curbed to banking sector only, rather it was slotting in the whole financial sector of Pakistan.

State bank of Pakistan is encouraging the mergers and acquisitions in the banking sector to endorse healthy competition. Since the uptick in minimum capital requirement by state bank of Pakistan small and medium sized banks have been looking towards redeemer. To survive in the current competitive environment, small and medium sized banks have two picks; issue right shares or to be gulped by other bank. In the last 10 years state bank of Pakistan has processed number of acquisitions and mergers transactions. Most of these transactions were mergers of banks with other banks and investment banks with commercial banks while some transactions entailed mergers of DFIs/ leasing companies with commercial banks. This exercise is involving mix color of both local and foreign banks. In order to ease the process of consolidation, number of revisions have been made in the legal structure as well e.g. allowing the mergers of NBFCs with banks, declaring foreign banks operating in branch mode as banking companies . These steps adopted by state bank of Pakistan have reduced the number of banks, in spite of the fact that a number of licenses to both Islamic and foreign banks have been issued in the past 10 years.

This stream of mergers has added to the development of vigorous competitive environment among financial institutions, predominantly among the banks. However this approach of state bank has reduced place for small banks in the future banking. The logic put forward to support this approach is that the banks with the prescribed capital

will only be able to operate and serve their customers efficiently and the risk of financial failure will be diminished. However one point of view is that shrinking the space for small banks will terminate in oligarchy leading to fair competition in the banking sector. This atmosphere may prefer inclinations over the socio-economic exigency.

Thus these opposite but logical facts about the steps taken by state banks of Pakistan have made the study of efficiency effects of mergers in Pakistan banking industry very interesting and research worthy. This study will help to picture the future impact of mergers and the efficiency changes taking place due to these restructurings and hence to answer the question:

What is the impact of merger on the efficiency of the banks involved?

To do so we calculated the technical, pure technical and scale efficiency of the banks for both periods (pre-merger and post-merger) using parametric approach DEA.

REVIEW OF LITERATURE

For measuring efficiency of banks two approaches are commonly used, parametric approach and non-parametric approach. Among parametric approaches are; Stochastic Frontier Approach (SFA), Distribution Free Approach (DFA) and the Thick Frontier Approach. (TFA) however non-parametric approaches include Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH).

Data envelopment analysis has been extensively used worldwide for the empirical assessment of banks, healthcare, and education sector‘s efficiency. And the technique

has been preferred in number of studies for studying the effect of bank mergers and acquisitions on efficiency, primarily when there is small sample size.

Peristiani (1996) inspected the efficiency of banks that played part in mergers during the period of 1980 to 1990. The results suggested no increase in x-efficiency of merging banks however the scale and profitability efficiency showed reasonable raise, the ability of bank to enhance performance was dependent on asset quality strength. He found no support from the study that efficiency improvement resulted from in-market merger.

Akhavein et al. (1997) applied the frontier profit function and studied the effects of mergers on price and efficiency and found a 16% increase in profit efficiency in merged banks. The banks with lower efficiency before merger showed greater progress as compared to others with high efficiency before merger. However they found slight changes in profit due to merger- related changes in prices.

Liu and Tripe (2001) worked on six banks mergers that happened between 1989 to1998 and analyzed the impact of efficiency using both accounting ratios and Data Envelopment Analysis. The study supported the literature that merged banks were mostly small; also the analysis showed increase in efficiency after merger, but the study failed to depict any public gain as a result of merger.

Vennet (2002) studied the relationship between bank efficiency and cross boarder mergers and acquisitions in European banking in 1990s. With the sample of 62 cross boarder banks M & As and applying different methodologies, they concluded that there is a significant difference in cost and profit efficiency of the banks after merger and acquisition.

Shih (2003) said that when a weaker bank merged into a stronger bank the resulting banks failed than both of the precursor banks. However he found the merger between two healthier banks successful, and had less chances of failure.

Krishnasamy et al. (2004) studies the post merger productivity changes in Malaysian banks using two inputs (labor, total assets) and two outputs (loans and advances, total deposits). The results showed that post-merger Malaysian banks have total factor productivity growth of 5.1%, during 2000-2001. During that period, eight banks were found with positive total productivity growth, one bank with total factor productivity regress of 13.3% and one bank was inactive. They also found swift technological revolution of post merger Malaysian banks.

Sufian and Fadzlan (2004) determined the technical and scale efficiency of domestic Malaysian banks during .before and after merger, using data envelopment analysis. The results showed a 95.9% of overall efficiency level of Malaysian banks during the period 1998 to 2003. They found mergers flourishing chiefly for small and medium banks, and for large banks they suggested that in order to have scale advantage, they should reduce in size.

Turchynska (2005) used DEA to determine the efficiency effects of mergers for Ukrainian banks. Furthermore, the relationship between factors such as risk, size, and involvement into merger, ownership specialization and efficiency was measured using truncated regression. The analysis showed a negative Relationship between merger and the efficiency of banks. He also concluded that mergers made indirect changes in bank's efficiency by effecting specialization, size and ownership.

Radam et al. (2009).studied the pre-merger and post merger efficiency of Malaysian banks for the period of 1993to 2004. Both DEA and Malmqusit index approach was used to determine the technical efficiency, efficiency change, technical change and productivity of merchant bank, finance companies and commercial banks. The results showed 5.8% of increase in average productivity in banking institutions and this that growth was found due to technical change. The results also proved improvement in productivity of Malaysian banking sector.

Said et al. (2008) studied the Malaysian domestic banking sector using CAMEL-type variables and determined the financial performance and efficiency before and after three years of merger. The results showed that there was no significant boost in efficiency of banks after mergers and the banks were more focused on generating high net interest income.

Berger and Humphrey (1993) worked on cost and profit functions of US banks and background for expected inferences of European financial integration. They said that the effects of mergers on efficiency was not predictable as it might lead to increase or decrease in efficiency. They also found that scope and scale economies were not vital in banking sector.

Sufian and Habibullah (2009) calculated the technical, pure technical and scale efficiency of Malaysian banks during the period of 1997 to 2003 using non- parametric approach Data Envelopment Analysis. Also the changes in efficiency due to mergers and acquisitions were studied using various parametric and non-parametric Univariate

tests. He found that economic reasons were the main drivers of mergers among Malaysian domestic banks

Gjirja (2004) used an unbalanced panel of savings banks of Sweden for the period 1984 to 2002. He studied the effects of mergers on efficiency using frontier cost function and came to point that there was no notable augment in the technical efficiency of banks after merger. Also the analysis failed to verify that there was more chance of acquisition of inefficient banks by the efficiency ones.

Ismail and Rahim (2009) studied the impact of merger on the efficiency and productivity of Malaysian commercial banks for the period 1995 to 2005. Data Envelopment Analysis and Malmquist productivity index were used for analysis; the banks showed higher efficiency scores after merger and also the productivity showed improvement in both periods.

METHODOLOGY

Following Berg et al. (1992), Fare et al. (1994) and Bhattacharya et al. (1997), Data envelopment analysis (DEA) technique is employed with variable return to scale (VRS) assumption to determine input-oriented technical efficiency of Pakistani banks before and after merger. DEA is a linear programming technique which constructs a non-parametric frontier to determine the efficiency of each DMU (Decision Making Units) relative to the constructed frontier.

The notion of efficiency measurement instigates with Farrell (1957) who defined a single measure of firm efficiency which could account for multiple inputs. The term DEA was brought in by Charnes et al. (1978) to gauge the efficiency of each decision making unit

that is obtained as a maximum of a ratio of weighed output to weighted input. This indicates that the more the output produced from given inputs, the more efficient is the production. The weights for the ratio are determined by a restriction that the similar ratios for every DMU have to be less than or equal to unity. This definition of efficiency measure allows multiple outputs and multiple inputs without requiring pre-assigned weights. Multiple inputs and outputs are reduced to single 'virtual' input and single 'virtual' output by optimal weights. The efficiency measure is than a function of multipliers of the 'virtual' input-output combination. DEA involves the formation of efficient frontier using linear programming (collie et al., 1998). This frontier determines the relative performance of DMU and weigh against the best practice DMU in the sample without requiring any prior assumption (Al-Faraj et al., 1993).

Charnes et al. (1978) proposed CCR model of DEA. The model assumes no significant relationship between efficiency and scale of operations by assuming Constant Returns to Scale (CRS). This model gives the overall technical efficiency of the DMU.

The objective function to maximize h^0.

$$\text{Max } h^0 = \sum_{j=1}^{J} u_j^0 y_j^0$$

Subject to

$$\sum_{i=1}^{I} v_i^0 x_i^0 = 1, \qquad \sum_{j=1}^{j} u_j^0 y_j^n - \sum_{i=1}^{I} v_i^0 x_i^n \leq 0;$$

n=1,… N, $v_i^0 \geq \varepsilon$, $u_j^0 \geq \varepsilon$, i=1

j=1, …. , j

The variable defined in both the problems i.e. 4 & 5 are same .The arbitrary sign introduced in the problem 5 is small positive number i.e. ε to make sure that all the inputs and outputs are having positive weights. The condition *h* makes certain that the base decision making unit (DMU^0) is efficient; or else it is DEA inefficient as compared to all other decision making units in the sample. The above model assumes constant return to scale (CRS) proposed by the Charnes, cooper and Rhodes (1978) also called CCR model

Banker et al. (1984) added to the CRS assumption and introduced BCC model. The BBC model is characterized by variable returns to scale. This model provides the pure technical efficiency (devoid of scale efficiency effects) measurement of the DMU.

. The BCC model is given as follows;

$$\text{Max } h_0 = \sum_{r=1}^{s} u_r y_{rjo} + z_{j0}$$

Subject to

$$\sum_{i=1}^{m} v_i x_{ijo} + z_{jo} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} + z_{jo} \leq 0 \qquad j = 1, \ldots, n \qquad Ur, v_i \geq 0$$

Both the models i.e. the CCR and BCC models are thus applied in this study to calculate the technical, pure technical and scale efficiency.

DATA AND SELECTION OF VARIABLES

We used annual bank level data of NIB and KASAB bank covering the period of 2005-2010. The variables for analysis were collected from balance sheet information in published annual report of each bank. Although there were a number of other mergers during the period 2005 to 2010 but data was not enough to observe the efficiency impact of merger for these banks, so we selected only two banks to conduct the study. Our study includes mergers registered by State Bank of Pakistan.

We can compute efficiency of the bank either by using intermediation approach or operating approach. The intermediation approach deems bank as an entity, which converts and transfer the financial assets among surplus and deficient units thus acting as an intermediary (Sealey and Lindley, 1997). However in production approach, bank is supposed to be producer of services for its account holders (Benston 1965). The study uses the intermediation approach as it enables the banks to be prescribed as manufacturing units, transferring inputs into the outputs e.g. deposits into advances and investments.

Inputs used in the study are deposits (D) and Assets (A) while the outputs are investments (I) and advances (L). The selection of inputs and outputs was based on on hand literature on DEA application in banking sector, availability of data and theoretical consideration. The two mergers that fit into our sample are:

Case 1: Merger of PICIC & PCBL into NIB

Case 2: Merger of KASB Bank, KASB Capital and Atlas Bank to form KASB-Atlas.

Table 1.Inputs and outputs used in the study

Inputs	**Outputs**
Assets (A)	Investments (I)
Deposits (D)	Advances (L)

Empirical results

Using input oriented approach of DEA the efficiency scores for both CRS and VRS models are calculated for both cases under study. The period under study is divided into three sub-periods i.e. pre-merger, during merger and post merger For analyzing the difference between pre-merger and post merger efficiency, means of technical efficiency (TE), pure technical efficiency (PTE) and scale efficiency (SE) are calculated.

Table 2: Summary of Mean Efficiency Scores of Two Banks

Bank	**Pre-Merger***			**During Merger****			**Post-Merger*****		
	TE	**PTE**	**SE**	**TE**	**PTE**	**SE**	**TE**	**PTE**	**SE**
NIB	0.99	0.99	0.99	0.88	1.00	0.88	0.94	1.00	0.94
KASAB	0.95	0.98	0.98	1.00	1.00	1.00	0.99	0.99	1.00
MEAN	0.97	0.98	0.98	0.94	1.00	0.94	0.96	0.99	0.97

NOTE: Pre-Merger* = 2004-2006(NIB), 2005-2007(KASAB), During Merger= 2007(NIB), 2008(KASAB), Post- Merger = 2008-2010(NIB), 2009-2010(KASAB). TE= Technical efficiency, PTE= Pure Technical Efficiency. SE= Scale Efficiency.

Table 2 illustrates that before merger NIB bank was 99% efficient in overall efficiency, pure technical efficiency and in scale efficiency. only1% decrease in inputs could let the bank to produce the same level of output and perform at optimal level. However the KASAB bank overall efficiency was 95% and both pure technical efficiency and scale efficiency were 98%

The mean of pre-merger efficiency of both banks is 97%. The decomposition of technical efficiency into PTE and SE shows that both technical and scale inefficiency contributed in overall inefficiency.

During merger year in case if NIB both overall efficiency and scale efficiency was reduced by 11% but pure technical efficiency showed 1% increase. However in case of KASAB overall technical efficiency, pure technical efficiency and scale efficiency increased to the optimal level.

The merger resulted in reduction of both overall technical efficiency and scale efficiency in case of NIB .on the other hand KASAB bank showed increase in technical and scale efficiency.

When we analyze the mean of efficiencies after merger the findings suggest that merger has resulted in reduction of TE during post merger period. It is evident from table that the banks showed 96% of TE which is lower than pre-merger TE i.e. 97%. Thus the overall technical efficiency has reduced in the post merger period.

But if observe the decomposition of TE into PTE and SE the table shows that pure technical efficiency has shown increase from 98% to 99%. However the scale efficiency has reduced in post –merger period from 98% to 97%. The inefficiency in the post-

merger period is contributed by SE more than the PTE. So both NIB and KASAB banks were are relatively non-optimal scale of operations as compared to operating cost in which banks were marginally efficient.

The results of DEA show the merger has marginally reduced the TE and SE of the banks in the post merger period but PTE has increased. A reason for decrease in TE and SE could be the inefficient operation of large network which has resulted due to merger.

Thus examining the efficiency effects of merger by discussing two cases from the banking secretor of Pakistan, we found that mergers have not resulted in gigantic efficiency changes. The reason could be that none of the banks in Pakistan banking is going through this reform because of the encouragement of state bank of banks. So after merger, the banks have to face their competitors who went through the similar reform resulting in tough competition and consequently restricting noteworthy efficiency changes.

Conclusion

Applying non-parametric approach Data Envelopment Analysis, this paper aims to analyze the effects of merger to the efficiency of Pakistan banks by discussing two cases of mergers from the last ten years. The sample period is divided into three sub-periods to compare the efficiency changes before and after the merger.

The results suggest that the mean overall efficiency of two banks under study has reduced from 97% to 96% showing 1% input wastage. During merger, overall efficiency deteriorated significantly from 97% to 94%. However after merger the overall efficiency

again started increasing .The pure technically efficiency reached the optimal level during merger year but showed 1% increase after merger as compared to before merger efficiency level . Analyzing scale efficiency, we found that the mean reduced from 98% to 94% in the merger year however this figure again started increasing and reached 97%.

Though the mergers have resulted in increase of pure technically efficiency, the banks should restrain their network from becoming too large after merger to enjoy the scale efficiency. Conclusively, we can say that banks maintain their efficiency level even going through the process of merger in Pakistan banking sector.

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