Comparing the efficiency of Islamic versus conventional banking: through data envelopment analysis (DEA) model

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The purpose of this study is to compare the efficiency of Islamic banks and conventional banks under loan base approach and income base approach. Also, it aims to investigate the economies of scales for both banking streams. Further, we investigated the effect of banks specific factors on efficiency, like size of banks, total liabilities of banks, total profit of banks, total markup revenue, total non-markup revenue, total markup expenses and total non-markup expenses. The data for this study was taken from banking statistics of Pakistan for the year 2001 to 2008. For the measurement of efficiency, data envelopment analysis (DEA) was used. For the effect of banks specific factors on efficiency Tobit regression model was used. The finding suggested that, the Islamic banks overall technical efficiency was better than conventional banks under loan base approach. Further, the result showed that Islamic banks had pure technical inefficiency than conventional banks but Islamic banks has high scale efficiency than conventional banks. Under income base approach conventional banks are efficient than Islamic banks. Islamic banks inefficiency was due to pure technical inefficiency. On the other hand only total markup expenses, total liability and ownership has significant impact on overall technical efficiency score under loan base approach. And total liability, total profit and ownership have significant impact on the overall technical efficiency under income base approach. This study is different from other studies in respect that it compares the efficiency of Islamic banks with conventional banks with these variables and under these two different approaches.

Key words: Efficiency, Islamic banks, conventional banks, Pakistan, data envelopment analysis.

INTRODUCTION

Efficiency of commercial banks is one of core issues for the economists all over the world due to its strong association with economic growth of the country (Zaidi, 2005). Economic growth would be achieved by utilizing the existing resources of the banks in an appropriate and efficient way (Saeed, 2005). Efficiency of commercial banks has an importance for evaluation of its performance. Banking efficiency provides signal for the economic development of a country (Sathy, 2005). Efficiency of commercial banks is actually the relationship of different combinations of outputs and inputs of the banks to achieve optimum level. The optimum level can be achieved under the objective of inputs minimization, while producing the same level of outputs and outputs maximization with same level of inputs.

Actually banks provide links from surplus unit to deficit unit of the economy. In the last fifty years, financial sectors, especially banking sector has been expanded a lot in both developed and underdeveloped countries (Hassan, 2004). Efficiency of the banks and different controversial issues, like competition and economies of scales are linked together. Competition between different banks and banking systems forces these banks to...
operate efficiently. Lacking of different banking systems and relatively small number of banks, in economy, might encourage monopoly by restricting their output or colluding between different banks. Efficiency of the banks normally depends on different banking systems and number of banks in the market, along with their ability to achieve economies of scales (Qayyum and Khan, 2006). Different banking systems force banks to operate efficiently. In Pakistan there are two massive banking systems: Islamic banking and conventional banking.

Conventional banks have very long history in Pakistan and have been existing since the independence of Pakistan. While on the other hand, Islamic banks are based on Quran and Sunah, which strictly forbid Ribah (Roy, 1991; Ariff, 2006). Islamic banks normally perform the same functions like conventional banks, but Islamic banks do not receive and pay any interest. Islamic banks are based on profit and loss sharing principal and based on profit sharing agreement between the provider of the funds and the borrower of the funds, but do not receive and lend profit in advance. Islamic banks take fee, commission in transactions but do not accept or give any predetermined interest. Profit is distributed normally on the basis of risk (Hassan et al., 2009).

Islamic banking is operating in many countries of the world. Initially it was established to fulfill the Muslim’s need of halal income. But now a day it is spreading even in non Muslim world Islamic banking is considered as fast growing banking system (Sufian and Noor, 2009). The first bank was established in 1963 in Egypt. And the total number of Islamic financial institutions all over the world is round about 300, and the total assets of Islamic banks all over the world are about $250 billion (Sufian and Noor, 2009).

Efficiency of banks might result in high profits, good customer service or use for risk diversion (Berger et al., 1993a, b). Efficiency of banks might be affected by different factors like size, interest expense, total profits etc. (Hassan et al., 2009).

As in Pakistan the conventional banking has long history as compared to Islamic banking, so conventional banking has more advantages, like high spread of interest and good will etc. over the Islamic banks. In Pakistan, conventional banks on the basis of ownership structure are categorized as local conventional banks and foreign conventional banks.

Various researchers (Hassan and Bashir, 2003; Sarker, 1999; Bashir, 1999; Samad and Hassan, 1999; Yudistira, 2003; Hussein, 2004) suggested that Islamic banks are more efficient than conventional banks but none of them tested it empirically, and other researchers (Hassan and Bashir, 2003; Sarker, 1999; Bashir, 1999; Samad and Hassan, 1999; Yudistira, 2003; Hussein, 2004) suggested that Islamic banks are more efficient than conventional banks but none of them tested it empirically. So the aim of this paper is to solve empirically this controversial issue and compare the efficiency between Islamic banks and conventional banks in Pakistani context. To show more insight and deep information, the efficiency of Islamic banks has been compared with conventional local banks and foreign conventional banks and determined the impact of various micro economic factors, like size of banks, total liabilities, interest expenses, noninterest expenses, interest markup revenue, non interest markup revenue, total profit and on qualitative side ownership structure on the efficiency of banks.

Significance of study

Both banking streams have importance in the economy of a country; the efficiency evaluation of both streams has an importance at micro and macro level. At micro level, this study provides information to different stake holders, like depositors, investors, creditors. Its measurement provides help to depositors in their decision making about their savings. At macro level, this study will provide help the government in decision making regarding banking sector because government implements various macro policies through banks (Hartman, 2004). Islamic banking particularly in Pakistan is growing interest for academia; this study provides the information to academia on banking system efficiency. This study will fill the gap in literature because little evidence is available in the prior literature about the comparison of Islamic and conventional banks. So this study will contribute to the literature.

LITERATURE REVIEW

Financial service industry is playing a very imperative role in today dynamic environment, and banks take a very important part in the financial intermediation (Akhtar, 2002). The various studies that are done for the evolution of efficiency in the financial service industries and especially in banking sector are different with respect to the methodology, variables and sample size (Ahmad and Gill, 2007a). Various economists empirically examined deep and positive association between financial growth and economic development in their studies (levine et al., 1999; Khan and Senhandji, 2000).

There has been general literature in the banking sector that examined the efficiency of conventional commercial banks in the developed countries, especially U.S and European banking sector, over recent years. The work, especially on empirical side, Islamic banking has not been much investigated (Sufian, 2006). Islamic banks are based on equity base relationship instead of loan base relationship between provider of fund and borrower of fund. Equity base relationship is encouraged by Islamic banking between equity provider and entrepreneur (Roy, 1991).
Several studies that have been keen to measure the performance of Islamic banks have commonly investigated the association between profitability and banking characteristics using financial ratios (Samad, 1999; Bashir, 1999; Hassan and Bashir, 2003; Bashir, 2001; Sarker, 1999).

Sarker (1999) used a banking efficiency model to investigate Islamic banks efficiency in Bangladesh. He argued that, Islamic banks could stay alive still within a conventional banking design in which profit and loss modes of financing were less dominated. He further claimed that due to difference in Islamic banking system and conventional banking system, Islamic banks have different products and different risk characteristic, so different rules and regulation should be implemented over Islamic banks.

The other group of researchers conducted their studies on the efficiency of Islamic banking sector by considering the frontier approach instead of financial ratios (Yudistira, 2003; Brown and Skully, 2005; Hassan, 2005; Shamsher et al., 2007; Badar et al., 2007a; Sufian, 2006).

Batchelor and Wadud (2004) found the efficiency of Islamic banks in Malaysia by applying DEA model and using technical and scale efficiency; their result revealed that full- fledged Islamic banks are generally inefficient due to scale inefficiency and not due to pure technical inefficiency. Technical efficiency means the ability of firm (bank in this case) to produce more output with a given level of input, this is called technical efficiency by output side. Technical efficiency input side means to produce the same level of output with less input (Farrell, 1957). More theoretically, if a firm produces one unit of output with the same level of input or it can produce the same level of output by marginally decreasing in input, and can be called technically efficient firm.

Income efficiency shows how particular firms obtain their financial and non financial revenues while utilizing the same level of financial and non financial expenditure. It is actually the earning side of the banks (Ahmad and Gill, 2007b). In the same way Pasiouras (2006) took the revenue side of the banks for income efficiency and found how much a particular bank increases its revenue while utilizing the same level of financial and non financial expenses. Atuallah et al. (2004) found technical and scale efficiency of Pakistan and Indian commercial banks under two models; loan base model and income base model.

There are two widely accepted concepts used in banking literature about the functions of banks; production approach and intermediation approach (Sealey and Lindley, 1977). In production approach banks are considered as firms that use factors of production (that is, land, labor and capital) to produce a deposits and loans account. Outputs are measured by the number of accounts and numbers of transactions done in each type of product mean, in terms of physical accounts, deposits are taken as output under this approach (Colwell and Davis, 1992; Rizvi, 2001). This approach is used in various studies (Swank, 1997; Bikker, 2001; Resti, 1997). While on the other hand, intermediation approach treated bank as intermediary of financial services rather than producer of loans and deposits, which takes funds from surplus unit and provides it to deficit unit of the economy. Deposits are taken as input under this approach (Colwell and Davis, 1992; Rizvi, 2001; Akhtar, 2001).

Using financial ratios is a good indicator for measuring the performance of banks, but it loses, advantages and effectiveness when a DMU's operates in different environmental structures and practices like different capital structures and accounting practices (Ikhaid, 2000). Further, financial ratios deal for short term performances of the company and that’s why it misleads the analysts (Oberhoffer and Westuizen, 2004). The method used by the State Bank of Pakistan is CAMELS approach (that is, capital adequacy ratio, asset quality, management soundness, earning and profitability, sensitivity to market risk) (SBP, 2003). For measurement, the efficiency of banks various models and techniques are available. Among these available models and techniques the parametric and non parametric models are frequently used. Parametric model takes the residual value and also a need to develop in functional form. While non parametric model has minimum constrain on its structure form. DEA has an advantage over regression analysis because single regression analysis captures the average performance of banks and it’s also affected by high values. In contrast the DEA analyzes the efficiency of various DMU’s on yearly bases, and constructs a separate frontier on the yearly basis. It might be possible that the bank efficiency varies over the years that a particular DMU in this case the bank may be efficient in one year while inefficient in other year (Sufian, 2006).

As majority of efficiency studies on financial institution have been done in USA. Berger and Humphrey (1997) investigated 130 different studies that applied frontier analysis that are conducted in different 20 countries. They reported that, majority of the studies concluded that, the overall USA banking industry is inefficient, although small banks are more efficient than large banks, these results are supported in the by other studies (Ferrier and Lovell, 1990; Elyasiani and Mehdian, 1995; Noulas, 1997, and Daniels and Tirtiroglu., 1998). Jemric and Vujic (2002) conducted a study in coardian banks that small banks are on average more efficient than large banks under constant return to scale. But large banks are on average efficient under variable return to scale. Constant returns to scale (CRS) means that the proportionate increase in inputs would result in proportionate increase in outputs. While variable return to scale (VRS) means it is not necessary that output would be increased in proportionate percentage. Further, under VRS banks are operating either on increasing return to scale (IRS) or decreasing return to scale (DRS). IRS means proportionate increase inputs will result higher proportionate...
increase in outputs. On the other hand DRS means proportionate increase in inputs will result in less proportionate increase in outputs (Sufian and Noor, 2009). If a firm has at IRS, it would achieve cost efficiency or income efficiency either through acquisition or elimination scale inefficiency. Banks that are operating at DRS should be conscious when increasing their operations (Sufian and Noor, 2009; Evanoff and Israelevich, 1991).

Some researchers compared the efficiency of Islamic banks and conventional banks but some of them just compare the performance of both banking system (Hassan, 1999; Iqbal, 2001; Bader et al., 2007b). Some researchers compared the efficiency of Islamic banks and conventional banks by utilizing frontier approach, instead of using financial ratios (Hassan et al., 2009; Hussain, 2004; Al-Jarrah and Molyneux, 2003; Bader et al., 2007c; Shamsher et al., 2007).

MATERIALS AND METHODS
Data and sources
The data was taken from annual balance sheets, published by State Bank of Pakistan from period 2001 to 2008. The data comprised of unbalanced panel data of 35, 33, 34, 32, 35, 34, and 34 banks from year 2001 to 2008, respectively.

For measuring the efficiency of financial and non-financial sectors, various methods are available to measure the efficiency of financial and non-financial sectors, especially commercial banks, but unfortunately the researchers do not agree on one specific method. The available methods for measuring the efficiency of commercial banks are classified in three ways financial ratios, parametric test and non parametric test. In this study we used DEA that is non parametric test.

Data envelopment analysis (DEA)
DEA is a linear programming model used for evaluating the efficiency of particular Decision making units (DMUs) in this case the banks regarding to construct frontier by DEA over the data. It was first developed by Charnes et al. (1978) on the sample of nonprofit organization and later it was extended to the banking sector by Sherman and Gold (1985). On the foundation of coelli (1996), under input oriented model, suppose there are N DMU’s producing L outputs by utilizing P inputs. Suppose xi and yi are the representing the vectors of i-th bank. For this, X is the input matrix for P*N and Y is output matrix for L*N. DEA measures the maximum ratio observed weighted of outputs to observed weighted inputs subject to constraint. The ratios of all other banks are less or equal to 1 representing DEA in ratio form. It is actually the ratio of output and input \( \omega \) in the equation and \( \hat{\omega} \) is the output and input weights. But for the optimal weights we used the linear programming technique, that is:

\[
\max_{\omega, \hat{\omega}} \left( \omega y_i / \omega x_i \right) \quad \text{subject to} \quad \omega, \hat{\omega} \geq 0
\]

This equation is used for the purpose to find the value of output and input weights of particular i-th DMU. This means that to maximize the efficiency of a particular DMU under certain constraint, the value of efficiency for the particular DMU is not greater than 1 and the weights must be greater or equal to 0. Despite its strength, it has a limitation that it gives infinite solution for the problem. To solve this problem Coelli et al. (1998) suggested another restriction that

\[
\hat{\omega} X_i = 1
\]

\[
\max_{u, \hat{u}} \left( \hat{u} y_i / \hat{u} x_i \right) \quad \text{subject to} \quad \hat{u}, \hat{u} \geq 0
\]

Where the notation for \( \hat{\omega}, \hat{u} \) is changed to \( u, \hat{u} \) respectively and shows transformation. This is named as the multiplier form of linear programming as suggested by coelli et al. (1998).

Coelli (1996) suggested the duality in linear programming based on Farrell (1957). The duality form for this problem is as follows:

\[
\min_{\theta, \lambda} \left( \theta y_i / \lambda x_i \right) \quad \text{subject to} \quad \lambda \geq 0, \lambda \geq 0
\]

Where \( \theta \) is Scalar and \( \lambda \) is vector for constants. This form had fewer constraints than previous one. Where the value of \( \theta \) is efficiency score and it is necessary for to satisfy the condition of \( \theta \leq 1 \). The value of \( \theta \) indicates score of efficiency for individual banks multiplier form has more hurdles and constraints than this form.

Banker et al. (1984) proposed a variable to scale model. The former is suitable in the case where all DMUs’ are operating on optimal scale, which means that banks have obtained the economies of scale. But normally DMU’s in this case, the banks are not normally operating on optimal scale due to imperfect market, constrain regarding generating finances, government policies (Casu and Molyneux, 2003). In Pakistan, particularly the macro economic factors, like ups and downs in economy of the country, political destabilization, suddenly changing policies are some of the constrains that make hurdles for the banks to achieve economies of scale. For Pakistani banks, it is necessary to evaluate their efficiency both under constant return to scale and variable return to scale (Miller and Noulas, 1996; Burki and Niazi, 2006; Akmal and Saleem, 2008; Pasiouras, 2006; Atuallah et al., 2004; Atuallah and Le, 2006). VRS is the extended part of CRS Dual model, which is modified and its mathematical form is as follows:

\[
\min_{\theta, \lambda} \left( \theta y_i / \lambda x_i \right) \quad \text{subject to} \quad \lambda \geq 0, \lambda \geq 0
\]

\[
\theta x_i - \lambda y_i \geq 0
\]

\[
\lambda \geq 0
\]

Where \( \theta \) is Scalar and \( \lambda \) is vector for constants. This form had fewer constraints than previous one. Where the value of \( \theta \) is efficiency score and it is necessary for to satisfy the condition of \( \theta \leq 1 \). The value of \( \theta \) indicates score of efficiency for individual banks multiplier form has more hurdles and constraints than this form.
ß shows the categorization of matrix having ones. It represents in the form of N*1 VRS tight the envelope more than CRS. This new constrain ensures that inefficient firms is only benchmarked with the firm of similar size.

Further, we are interested in scale efficiency. If TE under CRS is equal to TE under VRS than it means that there is no scale inefficiency and overall technical inefficiency is due to a pure technical inefficiency. Therefore:

\[ \text{Scale efficiency} = \frac{TE_{\text{under CRS}}}{TE_{\text{under VRS}}} \]

If the value of scale efficiency is one (1), it means that overall technical inefficiency is due to a pure technical inefficiency. In other to know if banks are operating at IRS or DRS, the mathematical formula proposed by Coelli (1996) was used.

\[ \min_{\lambda \geq 0} B \]

\[ s_t \cdot y_t, \quad \forall \lambda \geq 0 \]

\[ \theta_t \cdot x_t \geq 0 \]

\[ N_T \leq 1 \]

\[ \lambda \geq 0 \]

If the value of TE under CRS and TE VRS are equal, it means that bank is operating at constant return to scale. If both values are not same then compare the value from VRS with a value NA TE if both are unequal then banks are operating at IRS, and if both are equal than bank are operating at DRS (Fare et al., 1985b).

In the second stage we used the Tobit regression model to determine the impact various micro economic factors on the efficiency of banks.

**Tobit model**

Tobit model was developed by Tobin (1958), which is appropriate when the dependent variable is in proportion or in percentage form. This model is appropriate when the value is between the two limits, for example, 0 and 1. That's why it is the appropriate model for determinants of efficiency, because the value of efficiency lies between 0 and 1.

**Variable used for data envelopment analysis (DEA)**

According to our literature, various models of efficiency are measured by different researchers in their studies, Atallah et al. (2004) found technical efficiency under loan and income based approach. In the same way, we measured the efficiency of Islamic and conventional banks in Pakistan under loan base and income base approaches.

This specification technical efficiency is calculated under both constant return to scale and variable return to scale. In this study, investment and advances plus loans are regarded as output. Total loan were used as output in previous study (Hassan et al., 2009; Sufian, 2006; Yusidhra, 2003; Ayadi et al., 1998; Sathy, 2003), while loans and advances are taken as output by Sathy (2001). Investment are taken as output by researchers in their studies (Haung and Wang, 2002), while loan plus advances and investment are taken as output by others (Akitar, 2002). While the inputs for this study is number of employees, operating fixed asset and deposits plus borrowing from other financial institutions.

Pasiouras (2006) used fixed assets, customer deposits plus short term funding and number of employees as inputs. In the same way, Ahmad and Gill (2007a), and Ahmad and Ahmad (2007) used number of employees, operating fixed asset, bills payable and borrowing from financial institutions as input for this specification.

To determine the effect of various factors on the efficiency score various quantitative and qualitative variables are taken for this study. Quantitative factors are the size of banks for which the natural log of total assets are taken, total liabilities, total markup revenue that bank earned, total non markup revenue that banks earned, total markup expenses and total non markup expenses incurred by the banks. The qualitative variable is the ownership structure of the bank. For this Tobit regression model are used.

\[ Y_{it} = \beta_0 + \beta_1 \ln T A_{it} + \beta_2 T M R_{it} + \beta_3 T N M R_{it} + \beta_4 T M E_{it} + \beta_5 T N M E_{it} + \beta_6 D F o r e i g n_{it} + \beta_7 D L o c a l_{it} + \mu_{it} \]

Where:

- \( Y_{it} = \) Technical efficiency obtained by i-th bank in time t
- \( TA_{it} = \) Total Assets of i-th bank in time t
- \( TL_{it} = \) Total liabilities of i-th bank in time t
- \( TM R_{it} = \) Total markup Revenue of i-th bank in time t
- \( TN M R_{it} = \) Total Non markup revenue of i-th bank in time t
- \( T M E_{it} = \) Total markup expenses that i-th bank incurred in time t
- \( TN M E_{it} = \) Total non markup expenses that i-th bank incurred in time t
- \( D F o r e i g n_{it} = \) 1 if i-th bank in time t has foreign ownership otherwise 0
- \( D L o c a l_{it} = \) 1 if i-th bank in time t has local ownership otherwise 0

Where, Betas are slope or parameters in the Tobit regression model.

Technical efficiency input oriented under VRS and micro economic factors is obtained by replacing the technical efficiency score under CRS by VRS score in model 5. In the same way, we obtained the determinants of scale efficiency once again replacing the dependent variable by scale efficiency score under input oriented.

**RESULTS AND DISCUSSION**

Table 1 shows technical efficiency score of Islamic and conventional banks under loan base approach and income base approach. Islamic banks overall technical efficiency score under CRS was 0.808. While overall conventional banks efficiency under CRS was 0.759. These results depicts that Islamic banks were technically more efficient than conventional banks. Mean efficiency score of Islamic banks, under VRS assumption was less efficient with efficiency score 0.874 than from conventional banks efficiency score at 0.883. Under scale efficiency specification, Islamic banks were more efficient with efficiency score of 0.928 than conventional banks scale efficiency score of 0.863.

The result shows that under loan base approach, Islamic banks overall technical inefficiency was mainly due to pure technical inefficiency as compare to scale inefficiency. On the other hand, in Conventional banks the overall technical inefficiency was due to both pure technical inefficiency and scale inefficiency. Islamic banks in comparison of Conventional banks achieved the optimum level. Islamic banks could achieve better efficiency score in comparison of Conventional banks if it properly utilized its inputs.
Table 1. Comparing efficiency of Islamic and conventional banks under income and loan base approach.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Technical efficiency</th>
<th>Pure technical efficiency</th>
<th>Scale efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Conventional banks under loan base approach</td>
<td>0.759</td>
<td>0.2</td>
<td>0.884</td>
</tr>
<tr>
<td>Islamic banks under loan base approach</td>
<td>0.808</td>
<td>0.136</td>
<td>0.874</td>
</tr>
<tr>
<td>Conventional banks under income base approach</td>
<td>0.868</td>
<td>0.174</td>
<td>0.928</td>
</tr>
<tr>
<td>Islamic banks under income base approach</td>
<td>0.691</td>
<td>0.173</td>
<td>0.74</td>
</tr>
</tbody>
</table>

Under income base approach Islamic banks with average calculated efficiency score of 0.691 were less efficient than overall conventional average efficiency score of 0.728 using CRS assumption. This means that Islamic banks had not achieved high financial and non financial revenue with existing level of financial and non financial expenditures. Under VRS specification, Table 1 indicates that Islamic banks with mean efficiency score of 0.740 were less efficient than conventional banks with average efficiency score of 0.788. Further, under scale efficiency specification shows that the Islamic banks had obtained higher efficiency with a mean efficiency score of 0.944 than conventional banks with a mean efficiency score of 0.929. Thus, we infer that Islamic banks income inefficiency as compared conventional banks was due to pure technical income inefficiency.

Table 2 compare the efficiency of Islamic banks, local conventional banks and foreign conventional banks under loan base approach and income base approach. The result of conventional banks by parts shows that foreign banks were more efficient than local conventional banks. Our finding corresponds with the findings of Akmal and Saleem (2008), and Burki and Niazi (2003). On the other hand, Islamic banks were more efficient than conventional local banks but were less efficient than conventional foreign banks. Table 2 further indicates mean efficiency score under VRS on the basis of ownership.

Result of Table 2 show that foreign banks were more efficient with calculated mean efficiency score of 0.928 than conventional local banks with estimated efficiency score of 0.867, which was also reported by Burki and Niazi (2003), and from Islamic banks. Islamic banks were technically more efficient under VRS than conventional local banks. Local conventional banks is huge in operations and in large size so it efficiency increased under VRS.

The result further shows that Islamic banks were more scale efficient than local conventional banks but less efficient than foreign conventional banks. So foreign conventional banks were more scale efficient than local conventional banks, this also corresponds to the findings of Qayyum and Khan (2006).

This shows that Islamic bank’s inefficiency as compared to conventional banks was due to pure technical inefficiency and not on scale inefficiency. The local conventional banks, inefficiency were mainly due to both technical and scale inefficiency but scale inefficiency contributed more.

Under Income base approach, Table 2 reveal that Islamic banks had inefficient from both local and foreign conventional banks under CRS assumption. Under VRS assumption foreign conventional banks were more efficient than Islamic banks but were less efficient than local conventional banks. Under scale efficiency concept, there is no big difference in the efficiency scores between the three types of banks. This shows that that main difference between the overall technical inefficiency of the three types of banks were mainly due to pure technical inefficiency. All three types of banks have less efficiency score under income base approach than under loan base approach.

Returns to scales under loan base approach specification-1

As earlier mentioned in the literature that if all banks are not operating on optimal level then for that Banker et al. (1988) proposed VRS (Variable return to scale) model beside of CRS. CRS (Constant return to scale) model means that proportionate increase in inputs will result in proportionate increase in outputs, while VRS means increase in inputs will results in disproportionate increase in outputs. If banks operate at VRS, it may also operate at IRS or DRS. IRS (Increasing return to scale) means that proportionate increase in inputs will results in higher proportionate increase in outputs, while DRS (Decreasing return to scale) means proportionate decrease in inputs will result in less proportionate increase in outputs.
Table 2. Comparing efficiency of Islamic, local and foreign conventional banks.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Technical efficiency</th>
<th>Pure technical efficiency</th>
<th>Scale efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Local conventional banks under loan base approach</td>
<td>0.719</td>
<td>0.194</td>
<td>0.867</td>
</tr>
<tr>
<td>Islamic banks under loan base approach</td>
<td>0.808</td>
<td>0.136</td>
<td>0.874</td>
</tr>
<tr>
<td>Foreign conventional banks under loan base approach</td>
<td>0.868</td>
<td>0.174</td>
<td>0.928</td>
</tr>
<tr>
<td>Local conventional banks under income base approach</td>
<td>0.729</td>
<td>0.205</td>
<td>0.797</td>
</tr>
<tr>
<td>Islamic banks under income base approach</td>
<td>0.691</td>
<td>0.173</td>
<td>0.74</td>
</tr>
<tr>
<td>Foreign conventional banks under income base approach</td>
<td>0.727</td>
<td>0.245</td>
<td>0.762</td>
</tr>
</tbody>
</table>

Table 3. Economies of scales between Islamic banks versus conventional banks.

<table>
<thead>
<tr>
<th>Variable</th>
<th>IRS</th>
<th>CRS</th>
<th>DRS</th>
<th>Number of banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional banks TE under loan base approach</td>
<td>41</td>
<td>61</td>
<td>205</td>
<td>249</td>
</tr>
<tr>
<td></td>
<td>16.46%</td>
<td>24.49%</td>
<td>82.32%</td>
<td></td>
</tr>
<tr>
<td>Islamic banks TE under loan base approach</td>
<td>14</td>
<td>2</td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>56%</td>
<td>8%</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>Conventional banks TE under income base approach</td>
<td>78</td>
<td>60</td>
<td>108</td>
<td>246</td>
</tr>
<tr>
<td></td>
<td>31.45%</td>
<td>24.19%</td>
<td>43.54%</td>
<td></td>
</tr>
<tr>
<td>Islamic banks TE under income base approach</td>
<td>14</td>
<td>7</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>56%</td>
<td>28%</td>
<td>16%</td>
<td></td>
</tr>
</tbody>
</table>

1IRS, increasing return to scale; CRS, constant return to scale; and DRS, decreasing return to scale.

Table 3 shows the economies of scales on the basis of banks types. The result reveals that 41 conventional banks out of 249 banks were on IRS, which was almost 16.46% of the sample. On the other side, 14 Islamic banks out of 25 Islamic banks were on IRS, which was 56% of the Islamic banks sample. This means that most Islamic banks were on IRS as compared to conventional banks.

This result also shows that these banks have an advantage to increase their size because they operate at downside slope of frontier. Large numbers of conventional banks operated at DRS. Conventional banks are large in operations, so they normally operated at CRS or IRS, similar with the study of McAllister and McManus (1993). As many as 205 (82.32%) conventional banks, out of 249 operate at DRS. On the other hand, 9 Islamic banks out of 25 were at DRS, which is almost 36% of whole sample.

These banks have not appropriate to increase their operations because output would increase at less proportion than input would increase. At CRS, 62 conventional banks operated which was 24.49% of the sample. On the other hand, only 2 banks were operated at CRS which was 8% of sample.

Hence, it is better for majority of both Islamic and foreign conventional banks to increase their operations, because it will increase their outputs more than their inputs.

Returns to scales under income base approach specification 2

Under income base model, Table 2 shows that conventional banks were better economies of scales as compared to loan base approach. Under this approach, 78 conventional banks out of 246 had operated at increasing return to scale which was 31.45% of
conventional banks sample.

On the other hand, 14 Islamic banks which were 56% of sample had operated at IRS. These banks increase their financial operations because they can achieve a high proportionate increase in financial and non financial revenues in relation to proportionate increase in financial and non financial expenses.

Sixty conventional banks had operated at CRS, that is, 24.13% of the sample, while 7 Islamic banks operated at CRS, that is, 28% of sample. Conventional banks were better under this model because lesser banks were operating at DRS as compared to loan base approach. 108 conventional banks had operated at DRS, that is, 43.54% of the sample.

On the other hand, 4 Islamic banks operated on DRS, that is, 16% of the sample. This means that these banks have to take care regarding increasing their financial and non financial expenses because these banks would not achieve high proportion of revenue as compared to proportionate increase in financial expenses.

Determinants of technical efficiency under loan base approach

Technical efficiency under constant return to scale (CRS) and its determinants

Table 3 depicts that total liabilities, interest expense, total profit and ownership had significant impact on technical efficiency score under CRS at 95% confidence interval. Total liabilities, ownership and interest expense had significant relationship with efficiency score. Total liabilities had negative significant relationship with technical efficiency. This result is in line with the findings of Ahmad and Gill (2007a, b). Total asset and total profit had insignificant relationship with technical efficiency score, this result is in line with the findings of Sathye (2001), and Hassan (2005). Interest expenses had significant positive relationship with technical efficiency under CRS; this result is in line with the study of Staub et al. (2009). On qualitative side, ownership had positive significant relationship with technical efficiency score and this result is in line with the study of Isik and Hassan (2002), and Burki and Niazi (2006). While the other variables, that is, total non markup expenses, total markup revenue and total non markup revenue had insignificant relationship with technical efficiency score under CRS and this result is in line with the study of Ahmad and Gill (2007a).

Technical efficiency under variable return to scale (VRS) and its determinants

To determine the effect of different variables on technical efficiency score under VRS. Table 3 depicts that, the total markup revenue had positive significant relationship with technical efficiency score under VRS. Size of the banks had insignificant and negative relationship with technical efficiency score, this result is in line with the study of Darrat et al. (2002).

Scale efficiency and its determinants:

Table 3 also shows the determinants of scale efficiency. The result depicts that, interest expense, total liabilities, total profit and ownership had significant relationship with scale efficiency at 95% confidence interval. Total profit had positive and significant relationship with scale efficiency. This result is in line with the previous studies conducted by Sufian (2007), Hassan (2005), Sufian et al. (2007), and Darat et al. (2002). Total asset had insignificant relationship with scale efficiency score (Sufian et al., 2007; Darat et al., 2002). Total liabilities had negative and significant relationship with scale efficiency this is in line with the finding of Miller and Noulas (1996). The directions of expenses were related to the study of Atuallah et al. (2004). On the qualitative side, ownership had significant and positive relationship with scale efficiency; this study is in line with the findings of Burki and Niazi (2006), and Isik and Hassan (2002b).

Technical efficiency under constant return to scale (CRS) and its determinants

Table 4 depicts that, the total liabilities had negative and significant impact at 5% on income efficiency under CRS. Total profit had significant relationship with income efficiency and the relationship was positive between technical efficiency and total profit. Size of the banks and ownership had insignificant relationship with technical efficiency score under CRS.

Technical efficiency under variable return to scale (VRS) and its determinants

Table 4 reveals the determinants of technical efficiency under VRS. Result reveals that total liabilities had significant negative relationship with income efficiency under VRS, this result is in line with the study of Ahmad and Gill (2007a), while Total profit had significant and positive relationship with technical efficiency, under VRS; this result is in line with the study of Atuallah and le (2006), Pasiouras (2006), and Ahmad and Gill (2007). Size of the bank had insignificant and negative relationship with technical efficiency under VRS. This result is contract with the studies of Atuallah and le (2006), and Pasiouras (2006), who reported a significant and positive relationship between size of banks and technical efficiency under VRS. On the qualitative side ownership had insignificant
Table 4. Determinants of technical efficiency.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>TE CRS t-value</th>
<th>P-value</th>
<th>TE VRS t-value</th>
<th>P-value</th>
<th>SE t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TME</td>
<td>0.0000185</td>
<td>2.54</td>
<td>0.012</td>
<td>-5.39E-06</td>
<td>0.055</td>
<td>0.582</td>
</tr>
<tr>
<td>TL</td>
<td>-1.58E-06</td>
<td>-3.83</td>
<td>0.000</td>
<td>7.26E-07</td>
<td>1.20</td>
<td>0.233</td>
</tr>
<tr>
<td>lnTA</td>
<td>0.0266536</td>
<td>1.65</td>
<td>0.1</td>
<td>0.000139</td>
<td>1.82</td>
<td>0.069</td>
</tr>
<tr>
<td>TMR</td>
<td>5.76E-06</td>
<td>1.08</td>
<td>0.282</td>
<td>0.0000201</td>
<td>0.690</td>
<td>0.490</td>
</tr>
<tr>
<td>TNMR</td>
<td>0.000012</td>
<td>0.62</td>
<td>0.536</td>
<td>0.0000187</td>
<td>0.690</td>
<td>0.490</td>
</tr>
<tr>
<td>TNME</td>
<td>-0.000102</td>
<td>-0.84</td>
<td>0.403</td>
<td>-0.000187</td>
<td>-1.01</td>
<td>0.312</td>
</tr>
<tr>
<td>Ownership</td>
<td>0.1965581</td>
<td>5.49</td>
<td>0.000</td>
<td>0.1954263</td>
<td>4.4</td>
<td>0.000</td>
</tr>
<tr>
<td>Constant</td>
<td>0.4903758</td>
<td>3.02</td>
<td>0.000</td>
<td>1.031722</td>
<td>4.44</td>
<td>0.000</td>
</tr>
<tr>
<td>log liklehood</td>
<td>-30.942372</td>
<td>-82.277371</td>
<td>49.689254</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| No. observation    | 274            | 274     |

TME: total markup expenses; TL: total liabilities; lnTA: log total assets; TNMR: total non markup revenue; TNME: total non markup expenses; Tprofit, total profit.

relationship with income efficiency score under VRS. This result is in line with the study of Ahmad and Gill (2007).

Scale efficiency and its determinants:

Table 4 further reveals the relationship between different variables and scale efficiency score under income base approach. The result indicates that size of the banks had significant and positive relationship with scale efficiency score. This result was consistent with previous studies (Atuallah and le, 2006; Pasiouras, 2006). Similarly, total profit had significant and positive relationship with scale efficiency; this result is in line with the study of Atuallah and le (2006), and Pasiouras (2006). Total liabilities had significant and negative relationship with scale efficiency. On the qualitative side, ownership had insignificant relationship with scale efficiency under income specification.

Conclusion

Pakistan is a transition economy, and banks play a very important role in the economic development. Pakistan has two massive banking systems; Islamic banking and conventional banking. In this study, we compared efficiency of Islamic banks and conventional banks from year 2001 to 2008 using DEA model under loan and income base model. We also compared the efficiency of Islamic banks and conventional banks on the basis of ownership structure, that is, foreign conventional banks and local conventional banks. We examined the efficiency of two models under CRS and VRS assumptions. Under VRS we compared Islamic banks and conventional banks on the basis of economies of scales that they performed on IRS or DRS. The empirical results recommend that under CRS, the Islamic banks were technically more efficient than its conventional counterparts. Further on the basis of ownership structure results suggest that Islamic banks were less efficient than foreign conventional banks but were more efficient than local conventional banks. Under VRS assumption the results show that Islamic banks and conventional banks have almost same technical efficiency score. The result also suggest that Islamic banks were efficient than local conventional banks but were less efficient than foreign conventional banks. Islamic banks were more scale efficient than conventional banks which means that conventional banks technical inefficiency was due to scale inefficiency.

Table 5, the empirical results further show Income efficiency under CRS and VRS. The result indicate that Islamic banks were less income efficient than conventional banks under CRS. Moreover, local and foreign conventional banks had same efficiency scores and both were more efficient than Islamic banks. This means that Islamic banks obtained less financial and non financial revenue by using same level of financial and non financial expenses as compared to conventional banks. Under VRS, Islamic banks were less income efficient than conventional banks but Islamic banks were more efficient than conventional banks. This means Islamic banks income inefficiency was due to income efficiency of VRS or pure technical inefficiency.

Further we examined the economies of scales and compare the Islamic banks and conventional banks. The result suggests that 56% of Islamic banks were at IRS as compared to 16.46% of conventional banks under specification 1. Thus means that large number of Islamic banks has a chance to increase their operations to eliminate scale inefficiency as compare to conventional banks. It is also established that 82.32% conventional banks were at DRS as compared to 36% Islamic banks. Thus majority of conventional banks should be conscious while increasing their operations.
Table 5. Determinants of TE under Income base approach.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>TE CRS t-value p-value</th>
<th>TE VRS t-value p-value</th>
<th>SE t-value p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL</td>
<td>-5.45E-07 -2.19 0.029</td>
<td>7.49E-07 2.36 0.019</td>
<td>-8.46E-07 -7.05 0.000</td>
</tr>
<tr>
<td>ln TA</td>
<td>0.025428 1.42 0.157</td>
<td>-0.0239392 -1.11 0.267</td>
<td>0.0271446 3.11 0.002</td>
</tr>
<tr>
<td>Tprofit</td>
<td>0.0000266 3.33 0.001</td>
<td>0.0000243 2.26 0.025</td>
<td>0.000036 3.58 0.000</td>
</tr>
<tr>
<td>Ownership</td>
<td>0.0332275 0.88 0.379</td>
<td>0.0194275 0.45 0.653</td>
<td>0.0092247 0.5 0.618</td>
</tr>
<tr>
<td>Constant</td>
<td>0.4869648 2.7 0.007</td>
<td>0.9980365 4.63 0.000</td>
<td>0.7206458 8.19 0.000</td>
</tr>
<tr>
<td>log likelihood</td>
<td>-48.70948</td>
<td>-91.051023</td>
<td></td>
</tr>
</tbody>
</table>

The empirical result further suggests that 56% Islamic banks were at IRS as compared to 31.45% conventional banks. Thus Islamic banks have better chance as compared to conventional banks to increase their operations in respect of financial and non financial matters. On the other hand 43.54% conventional banks were at DRS as compared to Islamic banks which were 16% at DRS. This show that more conventional banks were at IRS under income base approach as compare to loan base approach.

In the second stage we regressed bank specific factors to bank efficiency score, under three basic specifications and under two basic assumptions. Our findings reveal that interest expenses, total profit and ownership had positive significant relationship while total liabilities had significant negative relationship with technical efficiency score under CRS, with scale efficiency score and cost efficiency score under CRS. The other factors like non markup revenue, non markup expenses and size of bank had insignificant relationship with technical efficiency and scale efficiency score. Only interest expenses, non markup expenses are excluded from cost efficiency regression because these variables are used for its efficiency model. On the other hand only total markup revenue had significant relationship with technical efficiency score under VRS. The all bank specific factors are insignificant in relationship with cost efficiency score under VRS.

The result further suggests that total liabilities had significant relationship with income efficiency score under CRS, VRS and scale efficiency. Total profit had significant relationship with income efficiency score under CRS, VRS and scale efficiency, while size and ownership had insignificant relationship with income efficiency scores under CRS, VRS and scale efficiency.

LIMITATION OF STUDY

This study has some limitations that a lot merger and acquisition occurred in banking sector but this study did not give any idea regarding merger and acquisition. In this study, we studied the impact of aggregate level variables, for example, asset but specific type of assets like (Cash with other banks, demand deposits, consumer deposits etc) were not studied. Technology progress is one of important part in the progress of banks but this study did not give any idea about it. Further, this study also did not give any idea about the macro economic factors, such as, GDP, Political condition, Regulations on banks etc.

FUTURE RESEARCH

Future research could compare conventional and Islamic bank efficiencies across countries, for example, Malaysia, Sudan, Iran should establish the impact of different regions (owing to different levels of economic, financial and market micro-structure development in each region) on the level of different efficiencies in both banking streams. Also, further insights could be ascertained on the level of technical, cost and income efficiency of both banking streams using the SFA also called econometric frontier approach, as in Koetter (2005). Incorporate variables like age, GDP, consumer satisfaction, political structure etc. to see their effect on the efficiency of banks.

REFERENCES


Resli A (1997). Evaluating the cost-efficiency of the Italian banking system: what can be learned from the joint application of parametric