COST, REVENUE, AND PROFIT EFFICIENCY OF ISLAMIC VERSUS CONVENTIONAL BANKS: INTERNATIONAL EVIDENCE USING DATA ENVELOPMENT ANALYSIS

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This paper measures and compares the cost, revenue and profit efficiency of 43 Islamic and 37 conventional banks over the period 1990-2005 in 21 countries using Data Envelopment Analysis. It assesses the average and overtime efficiency of those banks based on their size, age, and region using static and dynamic panels. The findings suggest that there are no significant differences between the overall efficiency results of conventional versus Islamic banks. Overall, the results in this paper are favorable with the 'new' banking system.

1 INTRODUCTION

The conventional banking theories assume that banks earn profits by purchasing transactions deposits from the depositors at a low interest rate, then reselling those funds to the borrowers at higher interest rate, based on its competitive advantage at gathering information and underwriting risk (Santos, 2000). In other words, conventional banks make profits from the spread between the interest rate received from borrowers and the interest rate paid to depositors.

Islamic banking performs the same intermediary function but does not receive a pre-determined interest from borrowers and does not pay a predetermined interest to the depositors; the amount of profits is based on the profit sharing agreements with the depositors and also with the borrowers. In addition, there are fee-based

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banking services that are similar to the conventional banks as long as there is no pre-determined interest payment/receipt in the transaction. Thus, Islamic banking considered as a *different* banking stream as it prohibits interest and replaces with (a) profit share and (b) the profit share depends on the extent of the risk participation of the parties. The absence of pre-determined rewards is based on Qurʾānic commands and as interpreted using sharīʿah principles (Ariff, 2006).

Academic research on Islamic banking and finance ahs increased considerably, thus leading to a better understanding of the new form of banking. This is, perhaps, due to the rapid growth of Islamic banking industry as these institutions have grown worldwide at a remarkable pace during the last three decades. According to a study by the International Monetary Fund (2005), the number of institutions rose from 75 in 1975 to over 300 in 2005, in more than 75 countries. Total assets are estimated to be US$ 250 billion, which is growing at about 15 percent per year; three times the rate for conventional banks. The total size of Islamic banking assets of US$ 250-300 billion should be considered in perspective. However, the three top conventional banking groups in 2005 had much larger assets: UBS of Switzerland (US$ 1,533 billion); Citigroup of the USA (US$ 1,484 billion); and Mizuho Financial Group of Japan (US$ 1,296 billion). Further, Bank of America, ranked as the tenth, has assets of US$ 1,110 billion, which is 4 times greater than the assets of all Islamic financial institutions.

Berger, Hunter, and Timme (1993) noted that if banks are efficient, then we might expect improved profitability, greater amounts of funds intermediated, better prices and service quality for consumers, and greater safety and soundness if some of the efficiency savings are applied towards improving capital buffers that absorb risk. However, the converse applies to inefficient intermediaries, with the additional danger of taxpayer-financed industry bailouts if substantial losses are sustained. Consequently, efficiency of banks improves the overall economy which affects the welfare of the society as a whole. The efficiency of banks is influenced by different factors in the environment in which production takes place *e.g*. size, age, region, competition, input and output quality, network characteristics, ownership form, regulations and changes in regulation, and management characteristics.

Carvallo and Kasman (2005) noted that the liberalization of financial markets at a global scale, the increasing use of advanced technology, and the information revolution have put competitive pressure on banking firms both domestically and internationally. This competitive pressure is particularly important for banks in the emerging markets as they constitute the main financial intermediaries to channel savings and investment. In this content, the competitive advantage is enhanced if banks can function efficiently.

In this regard, conventional banks enjoy several advantages over Islamic banks. For example, conventional banks have very long history and experience, accept interest which is a major source of bank revenues, do not share loss with clients

and ask for guaranteed collaterals in most transactions, enjoy very huge capital, spread very widely, have much more developed technologies, can enter Islamic banking market (e.g. Citibank, Bank of America, Deutche Bank, ABN Amro, UBS, HSBC, and Standard Chartered) and proved to benefit from theoretical and empirical research. In light of the above advantages, it is interesting to examine efficiency of both banking streams. Further, some important, both positive and negative, changes had taken place in the recent years. For example, many large international conventional banks have started to compete by offering Islamic banking services, and the number of Islamic banks has increased causing competition among Islamic banks themselves. Knowledge and practice of Islamic banking is spreading quickly and as more Islamic banking entities are established, new regulations, policies, and accounting standards are designed to accommodate these changes.

Despite the above discussed advantages and changes, the literature (Hassan and Bashir, 2003; Sarker, 1999; Bashir, 1999; Samad and Hassan, 1999; Yudistira, 2004; and Hussien, 2004) suggests that Islamic banks are more efficient than conventional banks. However, there is no conclusive evidence in this regard. To further substantiate on this controversial issue, this study uses a new set of international data over the period 1990-2005 and applies Data Envelopment analysis (DEA) to test the comparative cost, revenue, and profit efficiency of the conventional and Islamic banking.

This paper assumes that both conventional and Islamic banks are cost minimisers, and revenue and profit maximisers. Hence, both conventional and Islamic banks try to maximize profits by raising revenues and reducing costs. On this basis, this paper investigates the differences in mean and overtime cost, revenue, and profit efficiency scores of conventional versus Islamic banks. The effect of size, age, and region on cost, revenue, and profit efficiency of those banks is examined.

2. LITERATURE REVIEW

Existing studies in this area are classified into two groups. The first group includes studies that assess the performance of Islamic banks using traditional financial ratios (Samad, 1999; Bashir, 1999; Hassan and Bashir, 2003; Bader, Ariff, and Shamsher, 2007). Some of those studies compared their results with conventional banks. The second group of studies focuses on banks' efficiency and utilizes frontier analysis approaches rather than traditional financial ratios. Studies in this group can be divided into three folds: i) studies that evaluate efficiency of Islamic banks (Yudistira, 2004; Brown and Skully, 2005; Hassan, 2005; Bader, Ariff, and Taufiq, 2007), ii) studies that assess conventional banks' efficiency (Weill, 2004; Bos and Kool, 2006; and Bader, 2007), and iii) studies that compare the efficiency of Islamic with conventional banks (Al-jarrah and Molyneux, 2003, Al-Shammari, 2003; Hussein, 2004; Bader, Shamsher, and Taufiq, 2007).

Iqbal and Molyneux (2005) find that frontier approaches are considered to be superior to standard financial ratios analysis because they use programming or statistical techniques that remove the effects of differences in input and output prices and other exogenous market factors affecting the standard performance of firms. This provides more accurate estimates of the underlying performance of firms and their managers. Therefore, frontier efficiency has been used extensively in the extant banking literature to measure the effects of mergers and acquisitions, capital regulation, deregulation of deposit rates, removal of geographic restrictions on branching and holding company acquisitions, and on financial institution performance in general.

Overall, the use of frontier efficiency techniques yields useful comparative and benchmarking information that can provide impetus for significant improvements and can alert institutions to new business practices. Simple ratio-based analysis that is used for benchmarking can provide important insights but may be limited in scope because they take a one-dimensional view of a service, product, or process and ignore any interactions, substitutions, or trade-offs between key variables. Thus, a more inclusive multiple-input, multiple-output framework for evaluating productive efficiency, that provides benchmarking information on how to become a well-managed bank, seems essential to improve decision making processes (Iqbal and Molyneux, 2005).

In this regard, *cost efficiency*[1] gives a measure of how close a bank's cost is to what a best-practice bank's cost would be for producing the same bundle of output under the same conditions. *Revenue efficiency* indicates how well a bank is predicted to perform in terms of profit relative to other banks in the same period for producing the same set of outputs. *Profit efficiency* indicates how well a bank is predicted to perform in terms of profit relative to other banks in the same period for producing the same set of outputs.

Most of the studies over the 1990s have concentrated mainly on estimates of cost efficiency (Berger, Hunter and Timme, 1993; Resti, 1997). Subsequently, bank efficiency studies have been criticized for ignoring the revenue and profit side of banks' operations. Indeed, banks that show the highest inefficiencies and incur the highest costs might be able to generate greater profits than more cost efficient banks (Berger and Humphrey, 1997; Berger and Mester, 1997). The few available studies that estimate revenue and profit frontier functions report efficiency levels that are much lower than cost efficiency levels, implying that the most important inefficiencies are on the revenue side (Maudos *et al.,* 2002).

Whereas Islamic banking literature represents studies from emerging markets and less developed countries, conventional banking literature includes studies from both developed and less developed countries. However, few studies cover the

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[1] Sources for definitions of efficiency concepts include: Coelli *et al.* (1998), and Thanassoulis (2001).

whole international banking industry perhaps due to the limitations that are associated with comprehensive studies.

In conventional banking literature, researchers had linked efficiency to different factors. Even though many researchers focus on two or more of these factors, literature can be reviewed from different aspects based on the following criteria: First, some studies focus on cross-country comparisons of conventional banks efficiency (Bonin *et al*., 2005), other studies consider country-specific environmental conditions (Bos and Kool, 2006). Second, some studies have compared efficiency scores of foreign-owned banks with domestic-owned banks (Isik and Hassan, 2002b). Third, other studies have focused on the efficiency of conventional banks based on their nature (kind) whether is large or small, specialized or diversified, retail or wholesale banks (Kwan, 2006). Fourth, other studies focused their efficiency analysis on the government ownership versus private ownership (Cornett *et al*., 2000). Fifth, some studies focused on the concept of new bank versus old bank efficiency (Fries and Taci, 2005). Sixth, a number of studies tackled banks' performance after merger and acquisition as (Hughes *et al*., 1999). Seventh, many researchers were interested to examine the performance and efficiency of banking industry post financial crisis like Asian 1997 crisis (Chen, 2004). Eighth, the last classification, are studies that assess the effect of deregulation and liberalization on banks' efficiency (Chen *et al*. 2005).

So far, there is a fair number of researches that studied banking efficiency in less developed countries. For example: Malaysia (Sufian and Ibrahim, 2005), Pakistan (Limi, 2004), Bangladesh (Sarker, 1999), Turkey (Isik and Hassan, 2002a and 2002b), Jordan (Isik *et al*., 2005), Bahrain (Hassan *et al.,* 2003), Saudi (Al-Faraj *et al*., 1993), Kuwait (Limam, 2002), and U.A.E. (Rao, 2005).

There are some documented studies that compare the performance of Islamic banks with their conventional counterparts. However, the focus of the majority of those studies is on comparing performance, especially profitability, with the help of financial ratios and constrained by the time span and the number of Islamic banks (Samad and Hassan, 1999; Iqbal 2001). Despite the significant importance of this area, documented studies that address the cost, revenue, and profit efficiency of Islamic banks are very few (Yudistria, 2003; Hassan, 2005; Brown and Skully, 2005; and Bader, Ariff, and Taufiq, 2007).

Yudistira (2003) was the first study that used frontier non-parametric approach (DEA) to assess Islamic banks' efficiency. He provides new evidence on the performance of 18 Islamic banks over the period 1997-2000. He selected the intermediation approach as it is in line with the principle of Islamic financial system. Overall, his results suggest that Islamic banks suffer slight inefficiencies during the global crisis 1998-9. Efficiency differences across the sample data appear to be mainly determined by country specific factors. He also found that Islamic banking industry experienced slight inefficiencies in 1998 and 1999 (87 and 89.7 percent, respectively) compared to 1997 and 2000 (90.2 and 90.9 percent,

respectively). Indeed, 1998 and 1999 were the period of turmoil that hit the global economy. The level of inefficiency in 1998 is more attributable to pure technical inefficiency rather than scale inefficiency.

Brown and Skully (2005) examined the efficiency of Islamic banks on a cross country basis using DEA methodology on International Accounting Standards (IAS) and Islamic Financial Reporting (IFR) styled reports data. The overall sample consisted of 36 banks from 19 different countries. They found that average cost efficiencies based on (IAS) were 46.3, 80.8, and 89.7 percent in Africa, Asia, and the Middle East, respectively. However, based on (IFR) the results were 45.9, 66.5, and 66.5 percent in the same sequence.

Their results also show that where Iran has the largest banking market, Saudi Arabia has highest bank equity ratio. The highest net interest margin and the highest Returns on Adjusted Assets (ROAA) were in Bahrain and the highest Return on Adjusted Equity (ROAE) wan in Gambia. The Bahamas posses the most bank liquidity and the UAE enjoy the highest bank Islamic asset ratio. On a country basis, Iran was the most efficient as well as having large Islamic banks. At the regional level, Islamic banks from the Middle East were the most efficient, followed by Asia and Africa.

3. DATA AND METHODOLOGY

The study evaluates a cross-country level data compiled from the financial statements of 80 banks in 21 of Organization of Islamic Conference (OIC) countries as follows: 37 conventional banks, and 43 Islamic banks.[2] The countries are: (i) Africa (Algeria, Egypt, Gambia, Senegal, Sudan, and Tunisia); (ii) Asia (Bangladesh, Brunei, Indonesia, Malaysia, and Pakistan); and (iii) the Middle East and Turkey (Bahrain, Iran, Jordan, Kuwait, Lebanon, Qatar, Saudi Arabia, Turkey, UAE, and Yemen).

The data collected for each year are available in the *BankScope* database over the period 1990-2005.[3] The choice of this sample period reflects three factors: First, to cover the longest available history of Islamic banks. Second, the study is interested in assessments that are affected by the instability generated by the deterioration of banks' financial strength during the 1990s; to include the periods associated with financial crisis. Third, the use of a relatively long observation period provides us with estimates that are more representative of the present

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[2] In each selected country, there are more banks than what is selected in this study; however, the scope of the study does not allow for more number of banks as the sample includes 21 countries and the investigation includes type of banks, size, age, and region. In addition, the study employs three approaches. Therefore, it would be difficult and impractical to analyze all the banks within this scope.

[3] Not all banks have 16-years history, especially the new banks category. Please refer to appendices for the details of the selected banks.

situation and of future trends. A disadvantage in this efficiency estimates, however, is that random fluctuations play a more important role. Over a long time period, however, any good or bad "luck" should not be the main driver of the efficiency estimates (Rime and Stiroh, 2003).

For each bank in each country in the sample and for *each year* available over the period 1990-2005, the following data were needed to select the group of banks and to run the proposed analysis: the financial statements and annual reports, total assets (size), date of establishment (age), and inflation rates. The primary source for data used in this research is the banks' balance sheets and income statements in the *BankScope* database produced by the Bureau van Dijk. *BankScope* reports the data in the original currencies of the respected countries and provide a choice to convert the data to any other currency including the US Dollars. This paper uses the US Dollars-based reports in the selected sample. Accordingly, all figures have been adjusted for inflation rates.

Data Envelopment Analysis (DEA)

There are five different approaches that have been reported in the literature as methods to evaluate bank efficiency.[4]

I.   Data Envelopment Analysis (DEA) as in Sathye (2001).
II. Free Disposal Hull (FDH) as Chang (1999).
III. Stochastic Frontier Approach (SFA) also called Econometric Frontier Approach (EFA), as in Koetter (2005).
IV. Thick Frontier Approach (TFA) as in De Young (1998).[5]
V.   Distribution Free Approach (DFA) as in Berger, Hancock, and Humphrey (1993).

This paper follows the DEA nonparametric approach. In this regard, Farrell (1957) originally developed this non-parametric efficiency approach. The DEA is non-parametric in the sense that it simply constructs the frontier of the observed input-output ratios by linear programming techniques (Iqbal and Molyneux (2005). For an introduction to DEA methodology, see for instance Coelli *et al*. (1998) and Thanassoulis (2001).

In this sense, the DEA was initially developed by Charnes *et al*. (1978) to evaluate the efficiency of public sector non-profit organizations. However, Sherman and Gold (1985) were the first to apply DEA to banking. The DEA technique is extensively used in many recent banking efficiency studies like (Halkos and Salamouris, 2004; Havrylchyk, 2006; Drake *et al*., 2006; and others).The advantage of the DEA approach is that no functional or distributional

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[4] The first two approaches are non-parametric, and the others are parametric. See (Berger and Humphrey, 1997; Berger and Mester, 1997; Weill, 2004).
[5] Thick frontier approach, developed by Berger and Humphrey (1991), is scarcely applied in banking.

forms need to be specified; however, all deviations from the frontier are attributed to inefficiency, since no allowance for noise is made (Thanassoulis, 2001).

Technical efficiency reflects the ability of a firm to obtain maximum output from a given set of inputs (Farrell, 1957). There is an increasing concern in measuring and comparing efficiency of firms under different environments and activities. One of the simplest and easiest ways to measure efficiency is:

$$\text{Efficiency} = \frac{output}{input} \qquad (1)$$

If a firm produces only one output, using one input this could be done easily. However, this method is often inadequate as firms normally produce multiple outputs by using various inputs related to different resources.

The measurement of relative efficiency which involves multiple, possibly incommensurate inputs and outputs was first addressed by Farrell (1957). The aim of this technique is to define a frontier of most efficient decision making units (DMUs) and then to measure how far from the frontiers are the less efficient units. The relative efficiency can be measured as:

$$\text{Efficiency} = \frac{weighted \;\; sum \;\; of \;\; outputs}{weighted \;\; sum \;\; of \;\; inputs} \qquad (2)$$

By using usual notations, this efficiency measure can be written as:

$$\text{Efficiency of unit j} = \frac{u_1 \, y_{1j} + u_2 \, y_{2j} + ...}{v_1 x_{1j} + v_2 x_{2j} + ...} \qquad (3)$$

where:

u_1 is the weight given to output 1.

y_{1j} is the amount of output 1 from unit j.

v_1 is the weight given to input 1

x_{1j} is the amount of input 1 to unit j

This measure of efficiency assumes a common set of weights to be applied across all units. This raises the problem of how much an agreed common set of weights can be applied to all units. In cases where there is only one input and one output, often efficiency is measured as an output-input ratio. But, a typical DMU will have multiple inputs and outputs. Efficiency can be measured by using a weighted average of the outputs and a weighted average of inputs. When comparing efficiency between DMUs, the above measure can be most readily applied when a common set of weights for the DMUs is applicable.

In this regard, the DEA Excel Solver developed by Zhu (2002) is used to solve the following models as summarized by Zhu. He summarizes the cost efficiency model as

$$\min \sum_{i=1}^{m} p_i^o \, \widetilde{x}_{io}$$

subject to

$$\text{CRS} \qquad \sum_{j=1}^{n} \lambda_j \, x_{ij} \leq \widetilde{x}_{io} \qquad i = 1,2,...,m; \tag{4}$$

$$\sum_{j=1}^{n} \lambda_j \, y_{rj} \geq y_{ro} \qquad r = 1,2,...,s;$$

$$\lambda_j, \widetilde{x}_{io} \geq 0$$

Zhu summarizes the revenue efficiency model as:

$$\max \sum_{r=1}^{s} q_r^o \, y_{ro}$$

subject to

$$\text{CRS} \qquad \sum_{j=1}^{n} \lambda_j \, x_{ij} \leq x_{io} \qquad i = 1,2,...,m; \tag{5}$$

$$\sum_{i=1}^{n} \lambda_j \, y_{rj} \geq \widetilde{y}_{ro} \qquad r = 1,2,...,s;$$

$$\lambda_j, \widetilde{y}_{ro} \geq 0$$

where p_i^o and q_r^o are the unit price of the input i and unit price of the output r of DMU_o, respectively. These price data may vary from one DMU to another. The cost efficiency and revenue efficiency of DMU_o is defined as -

$$\frac{\sum_{i=1}^{m} p_i^o \, \widetilde{x}_{io}^{*}}{\sum_{i=1}^{m} p_i^o \, x_{io}} \tag{6}$$

and

$$\frac{\displaystyle\sum_{r=1}^{s} q_r^o\, y_{ro}}{\displaystyle\sum_{r=1}^{s} q_r^o\, \widetilde{y}_{ro}^{\,*}} \tag{7}$$

The cost and revenue efficiency scores are within the range of 0 and 1. Finally, Zhu defines the profit efficiency model as:

$$\max \sum_{r=1}^{s} q_r^o\, \widetilde{y}_{ro} - \sum_{i=1}^{m} p_i^o\, \widetilde{x}_{io}$$

subject to

CRS
$$\sum_{j=1}^{n} \lambda_j x_{ij} \le \widetilde{x}_{io} \qquad i = 1,2,...,m$$

$$\sum_{j=1}^{n} \lambda_j\, y_{rj} \ge \widetilde{y}_{ro} \qquad r = 1,2,...,s \tag{8}$$

$$\widetilde{x}_{io} \le x_{io}, \widetilde{y}_{ro} \ge y_{ro}$$
$$\lambda_j \ge 0$$

The profit efficiency of DMU_o is defined as

$$\frac{\displaystyle\sum_{r=1}^{s} q_r^o\, y_{ro} - \sum_{i=1}^{m} p_i^o\, x_{io}}{\displaystyle\sum_{r=1}^{s} q_r^o\, \widetilde{y}_{ro}^{\,*} - \sum_{i=1}^{m} p_i^o\, \widetilde{x}_{io}^{\,*}} \tag{9}$$

Variables Selection

All variables are measured in millions of U.S. dollars. All banks, within the intermediation framework in this study,[6] are modeled as multi-product firms, producing three outputs employing three inputs as summarized in Table 1.

The intermediation approach may be more appropriate for evaluating entire

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[6] *The intermediation approach* was suggested by Sealey and Lindley (1977). It views bank as an intermediator of financial services and assumes that banks collect funds (deposits and purchased funds with the assistance of labour and capital) and transform these into loans and other assets. The intermediation approach is preferred over the *production approach*, first proposed by Benston (1965) because it suits the nature of the banking industry more than the production approach.

financial institutions because this approach is inclusive of interest and/or funding expenses, which often account for between one-half and two-thirds of total costs. Moreover, the intermediation approach may be superior for evaluating the importance of frontier efficiency for the profitability of financial institutions, since the minimization of total costs, and not just production costs, is needed to maximize profits (Iqbal and Molyneux, 2005).

4. RESULTS

4.1 Overall Efficiency Results: Conventional, Islamic, and All Banks

A bank can be cost efficient if it can create a relatively high volume of income-generating assets and liabilities for a given level of capital. A revenue and profit efficient bank can generate a relatively high volume of income from its services and intermediation operations with the given level of inputs. This is the basis used to measure and compare these three aspects of efficiency of banks.

Table 2 is a summary of the descriptive statistics and statistical tests of significance for all banks in the sample.[7] On average, there is a considerable level of *in*efficiency in banks investigated in this study. Another way of interpreting this result is to suggest that these banks have slacks in not fully using the resources efficiently to produce the same outputs. Therefore, the levels of inefficiency are 23.3, 14.7, and 8.9 percent, respectively in producing the outputs.[8] Hence, the same outputs could have been produced by that many percentages of fewer inputs. These results mean that the average bank could have used only 91.8 percent of the resources actually utilized to produce the same level of output. In other words, the average bank has wasted 8.9 percent of its inputs, or it could have saved 8.9 percent of its inputs to produce the same level of outputs. Hence, there was substantial room for significant cost savings for these banks if they have had employed their inputs more efficiently.

However, it was noted that, on average, banks are more efficient in using their resources compared to their ability to generate revenues and profits. For revenue efficiency, the average bank could only generate 81.1 percent of the revenues it was expected to generate. Thus, there is a slack of 23 percent, meaning that the average bank lost an opportunity to receive 23.3 percent more revenue, giving the same amount of resources. Clearly, the highest level of inefficiency is on the revenue side, followed by the profits. Similarly, the average bank could earn 87.2 percent of what was available, and lost the opportunity to make 14.7 percent more profits

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[7] All the results in the paper are based on CRS assumption which is preferred over the VRS assumption.
[8] The relationship between efficiency (E) and inefficiency (IE) is IE= (1-E)/E. Thus, the 91.8 percent efficiency implies 8.9 percent inefficiency, not 8.2 percent (or not 1-0.918). See Isik and Hassan (2002a).

utilizing the same level of inputs.[9]

Table – 1

Inputs, Outputs, Input Prices and Output Prices[10]

Variable	V. Name	Definition
Dependent Variables		
C	Total Costs	Total of interest and non-interest operating costs
R	Revenue	Total Revenues
π	Profit	Total revenue −Total costs − Taxes
Independent Variables		
Inputs		
X_1	Labor	Total expenditures on employees (personal expenses)
X_2	Fixed Assets	The sum of physical capital and premises
X_3	Total Funds	Total deposits plus total borrowed funds
Outputs		
Y_1	Total loans	Total of short-term and long-term loans
Y_2	Other earning assets	Sum of investment securities, inter-bank funds sold and loans to special sectors (directed lending)
Y_3	Off-balance sheet items	The value of the off-balance sheet activities (nominal values).
Input Prices		
PI_1	Price of labor	Total personal expenses divided by the total funds[11]
PI_2	Price of F.A.	Depreciation expenses divided by the fixed assets
PI_3	Price of funds	Interest expenses on deposits and non-deposits funds plus other operating expenses divided by the total funds
Output Prices		
PO_1	Price of loans	Interest income divided by total loans
PO_2	Price of O.E.A.	Other operating income divided by other earning assets
PO_3	Price of Off-B.S. items	Net commission revenue plus net earning income divided by off-balance sheet items

Table 2 also presents the summary statistics of the efficiency measures calculated relative to separate frontiers for both banking streams for the years 1990–2005. It compares the cost, revenue, and profit efficiency of conventional versus Islamic banks. It is noteworthy that all the inefficiency levels in both banking streams are in the same order as the averages in all banks, *i.e.* both banking systems are better in utilizing inputs more than generating optimal outputs. Perhaps, this is due to the ability of banks' management to better control the usage of their internal resources rather than controlling the outcomes which is normally

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[9] The above interpretation of the findings can be applied to the subsequent findings respectively. To avoid redundancy, there will be no more such interpretation in the subsequent sections.

[10] See Isik and Hassan (2002a)

[11] Following other studies in the literature, total funds replaced the numbers of employees as the later are not available for most banks in the sample.

influenced by external factors such as competition, regulations, GDP, and other macroeconomic factors. The Mann-Whitney U test is a relevant test for two independent samples coming from populations having the same distribution[12]. The test statistics summarized in Table 2 do not indicate any significant results; all *p* values are greater than the standard level at 5 percent.

Table - 2

**Descriptive Statistics: Cost, Revenue and Profit of
Conventional, Islamic and All Banks**

Banks Category	Descriptive Statistics	Cost Efficiency	Revenue Efficiency	Profit Efficiency
Conventional Banks	N	37	37	37
	Mean	**0.935**	**0.806**	**0.863**
	Std. Deviation	0.0789	0.168	0.137
	Maximum	1.00	1.00	1.00
	Minimum	0.601	0.264	0.437
Islamic Banks	N	43	43	43
	Mean	**0.903**	**0.817**	**0.879**
	Std. Deviation	0.114	0.174	0.205
	Maximum	1.00	1.00	1.396
	Minimum	0.446	0.281	0.292
All Banks (Total)	N	80	80	80
	Mean	**0.918**	**0.811**	**0.872**
	Std. Deviation	0.10	0.171	0.176
	Maximum	1.00	1.00	1.396
	Minimum	0.446	0.264	0.292
Mann-Whitney Test	Asymp. Sig. (2-tailed)*	0.38	0.59	0.15

* There are no significant results at 5 percent level.

Efficiency of Big versus Small Banks

The literature documents relationship between size and level of efficiencies of banks (Bos and Kool, 2006; Kwan, 2006). Size, as measured by total assets, is an important factor that affects the variation in efficiency across banks, indeed all firms. To operate at optimal level of scale and scope economies, firms should posses a certain size (Isik and Hassan, 2002a). In addition, high competitive pressures might induce more incentives for smaller banks to be efficient. Table 3 summarizes the efficiency scores for big and small banks in general, and big and small conventional and Islamic banks, respectively. The findings in the table show that, on average for the overall sample, big banks are relatively more cost, revenue and profit efficient than small banks.

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[12] The data violate the stringent assumptions of the independent groups't-test, so it was decided that Mann-Whitney U tests should be used [see Coakes and Steed (2003)].

Table – 3
Descriptive Statistics: Average Cost, Revenue, and Profit
Efficiency Scores for Big versus Small Banks

Size/Classification	Descriptive Statistics	Cost Efficiency	Revenue Efficiency	Profit Efficiency
Big Banks	N	38	38	38
	Mean	**0.934**	**0.844**	**0.874**
	Std. Deviation	0.073	0.144	0.152
	Maximum	1.00	1.00	1.00
	Minimum	0.717	0.281	0.297
Small Banks	N	42	42	42
	Mean	**0.903**	**0.782**	**0.869**
	Std. Deviation	0.118	0.188	0.197
	Maximum	1.00	1.00	1.396
	Minimum	0.446	0.264	0.292
Mann-Whitney Test	Asymp. Sig. (2-tailed)	0.35	0.09	0.86
Big Conventional	N	18	18	18
	Mean	**0.956**	**0.852**	**0.901**
	Std. Deviation	0.039	0.117	0.845
	Maximum	1	1	1
	Minimum	0.873	0.530	0.754
Big Islamic	N	20	20	20
	Mean	**0.914**	**0.837**	**0.850**
	Std. Deviation	0.091	0.168	0.193
	Maximum	1	1	1
	Minimum	0.717	0.281	0.297
Mann-Whitney Test	Asymp. Sig. (2- tailed)	0.30	0.95	0.91
Small Conventional	N	19	19	19
	Mean	**0.915**	**0.762**	**0.827**
	Std. Deviation	0.101	0.199	0.167
	Maximum	1	1	1
	Minimum	0.601	0.264	0.437
Small Islamic	N	23	23	23
	Mean	**0.892**	**0.798**	**0.904**
	Std. Deviation	0.132	0.181	0.215
	Maximum	1	1	1.396
	Minimum	0.446	0.352	0.292
Mann-Whitney Test	Asymp. Sig. (2-tailed)	**0.83**	**0.47**	**0.08**

* No significant results at 5 percent level.

Test statistics summarized in Table 3 reveal that the results were not statistically significant in all efficiency measures. Thus, there is no significant difference between efficiency scores of big versus small banks, big conventional versus big Islamic, and small conventional versus small Islamic banks groups. However, the significance level of the revenue efficiency in big banks (9 percent) and the profit efficiency of small Islamic banks (8 percent) are interesting results as they are very close but not equal or less than the standard significance level (5 percent).

The relatively better efficiency performance of small Islamic banks relative to the conventional counterparts could be due to smaller differences in terms of capital size and history, and also the stiff competition among small conventional banks that affects their revenue and profits efficiency. Although the differences are

not statistically significant, the better performance of small Islamic banks suggests greater profitability and viability. These findings suggest that small Islamic banks need to pay more attention to how they use their resources if they wish to be considered as totally more efficient than the conventional banks as they reduce the slack further.

Information documented in Table 3 shows the magnitude of the different sizes in conventional banks and Islamic banks. The differences between the bank characteristics in conventional banking industry, i.e., the characteristics of a big conventional bank is clearly different from that of Islamic banking industry. Both conventional and Islamic big banks are more revenue efficient than their small counterparts. The observed higher revenue efficiency scores in big banks could be attributed to their competitive advantage over capital, experience, market share and higher public confidence compared to their smaller counterparts. Overall these findings are consistent with that documented by Isik and Hassan (2002a) on Turkish banks, reporting significantly low linkage between cost and profit efficiency. This suggests that, in the banking industry, it is possible to achieve high profit efficiency without greater cost efficiency.

Efficiency of Old versus New Banks

A strong relationship has been reported in the literature between bank efficiency and their age[13] (Fries and Taci, 2005). To date there is no documentation in the literature on the impact of age on efficiency scores of Islamic banks compared to conventional banks. The findings in Table 4 show the profit efficiency scores of the new banks are significantly higher than those of old banks (p = 0.01). However, there are no significant differences between old and new banks in respect to cost and revenue scores. The table shows that there are no significance differences in efficiency between old conventional versus old Islamic, and between new conventional versus new Islamic banking groups. Old Islamic banks need to reformulate business strategies based on the need of new Islamic banks to improve their profit performance.

It is also apparent from the findings reported in Table 4 that the cost and profit efficiency of old conventional banks is slightly better than old Islamic banks; the reverse applies to revenue efficiency. This can be justified by the consequences of the difference in time period experienced in old and new banks categories. The superior performance of new Islamic banks might be due to their advantage of learning from the experiences of older Islamic banks. Another explanation to this apparent good performance could be due to the fact that some new Islamic banks did not experience the difficult times during the financial crisis of 1997 to 1998 as they were established after that period. However, to survive the highly competitive industry, new Islamic banks need to seriously work to improve their cost and

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[13] Old banks are those that have been established before 1990, while new banks are those that have been established from 1990.

revenue efficiency.

The findings in Table 4 indicate that old conventional banks are more cost efficient than new conventional banks. This could be due to the advantage of scale and scope economies enjoyed by old conventional banks that are also larger in size than the new conventional banks. These advantages are enjoyed by old conventional banks because of having more assets, more experience, wider spread between the lending and borrowing rates, and enjoy better reputation and public confidence. However, the average revenue and profit efficiency in new conventional banks are slightly higher than old conventional banks.

Table – 4

**Descriptive Statistics of Cost, Revenue, and Profit Efficiency
Scores of Old and New Conventional and Islamic Banks**

Banks Group	Descriptive Statistics	Cost Efficiency	Revenue Efficiency	Profit Efficiency
	N	49	49	49
	Mean	**0.925**	**0.798**	**0.835**
Old Banks	Std. Deviation	0.074	0.183	0.184
	Maximum	1.00	1.00	1.00
	Minimum	0.717	0.264	0.292
	N	31	31	31
	Mean	**0.906**	**0.833**	**0.930**
New Banks	Std. Deviation	0.132	0.151	0.147
	Maximum	1.00	1.00	1.396
	Minimum	0.446	0.436	0.590
Mann-Whitney Test	Asymp. Sig. (2-tailed)	**0.67**	**0.42**	**0.01***
	N	27	27	27
	Mean	**0.944**	**0.792**	**0.854**
Old Conventional	Std. Deviation	0.053	0.191	0.148
	Maximum	1	1	1
	Minimum	0.826	0.264	0.437
	N	22	22	22
	Mean	**0.900**	**0.805**	**0.811**
Old Islamic	Std. Deviation	0.090	0.176	0.222
	Maximum	1	1	1
	Minimum	0.717	0.281	0.292
Mann-Whitney Test	Asymp. Sig. (2-tailed)	**0.11**	**0.98**	**0.84**
	N	10	10	10
	Mean	**0.906**	**0.843**	**0.888**
New Conventional	Std. Deviation	0.129	0.081	0.103
	Maximum	1	1	1
	Minimum	0.601	0.714	0.708
	N	21	21	21
	Mean	**0.906**	**0.833**	**0.930**
New Islamic	Std. Deviation	0.132	0.151	0.147
	Maximum	1	1	1.396
	Minimum	0.446	0.436	0.590
Mann-Whitney Test	Asymp. Sig. (2-tailed)	**0.87**	**0.61**	**0.11**

* Significance at 5 percent level.

These findings suggest that old Islamic banks should focus on increasing their profit efficiency. Though, overall, both old and new Islamic banks have considerable slacks to address their revenue and cost efficiencies, the maximum and minimum scores for new Islamic banks are significantly higher than those for the old Islamic banks. Therefore, old Islamic banks and big Islamic banks require some form of reorientation to help them identify the impediments to improving their efficiencies to survive the competitive banking industry.

Regional Efficiency Analysis

The investigation of banks' efficiency based on their geographical regions is of considerable interest for the assessment of the possible impact of regional characteristics on the cost, revenue and profit efficiencies of banks. There is documented literature (Brown and Skully, 2005; Bos and Kool, 2006) on the banks efficiency from regional prospective. Yet, the findings on efficiency of banks in both streams over different regions are inconclusive.

Table 5 shows that there is a significant difference in efficiencies of conventional and Islamic banks in the different regions. However, strong evidence of significant regional differences in efficiency scores are detected in Table 6. In this sense, revenue and profit efficiency mean scores are significantly different among regions (p = 0.04 and 0.01, respectively) based on their specialization being either conventional or Islamic.

Table 5: Kruskal-Wallis Test for All Banks Based on Regions and Type and Region

All Banks Based on Regions Kruskal-Wallis Test				Conventional versus Islamic Banks Kruskal-Wallis Test			
Test	**CE**	**RE**	**PE**	**Test**	**CE**	**RE**	**PE**
Asymp. Sig.*	0.97	0.69	0.52	Asymp. Sig.*	0.15	0.04*	0.01*

* Significant level is 5 percent.

Table 6 summarizes the average cost, revenue and profit efficiency scores for conventional and Islamic banks in three designated regions: Africa, Asia, and Middle East and Turkey. For comparative purposes the table also includes the results of all banks and all regions. For the Africa region, the findings indicate that conventional banks outperform Islamic banks in cost, revenue, and profit efficiency. In Asia, conventional banks had better cost and revenue efficiencies but Islamic banks had scores for profit efficiency. The maximum results in Islamic banks are better than conventional banks, whereas the minimum results are otherwise. This shows some evidence of both efficient and inefficient sampled Islamic banks. In the Middle East and Turkey, the results indicate that Islamic banks outperform the conventional banks in cost, revenue and profit efficiency.

Some non-parametric statistical tests using Kruskal-Wallis were done. The Kruskal-Wallis test is equivalent to the one-way ANOVA, and thus allows us to

examine possible differences between two or more groups. The test statistics reported in Table 6 indicate that cost, revenue, and profit efficiencies do not significantly differ across the three regions ($p > 0.05$).

Table - 6

Descriptive Statistics: Cost, Revenue and Profit Efficiency of Conventional and Islamic Banks Based on Regions

	Africa								
D.	**All Banks**			**Conventional Banks**			**Islamic Banks**		
Stat.	**CE**	**RE**	**PE**	**CE**	**RE**	**PE**	**CE**	**RE**	**PE**
N	21	21	21	10	10	10	11	11	11
Mean	**0.919**	**0.817**	**0.840**	**0.967**	**0.898**	**0.933**	**0.874**	**0.743**	**0.755**
StdD.	0.083	0.143	0.195	0.034	0.053	0.097	0.090	0.161	0.227
Max	1.000	1.000	1.000	1.000	1.000	1.000	0.984	0.956	1.000
Min	0.717	0.352	0.297	0.899	0.837	0.695	0.717	0.352	0.297
	Asia								
D.	**All Banks**			**Conventional Banks**			**Islamic Banks**		
Stat.	**CE**	**RE**	**PE**	**CE**	**RE**	**PE**	**CE**	**RE**	**PE**
N	19	19	19	9	9	9	10	10	10
Mean	**0.913**	**0.824**	**0.927**	**0.951**	**0.838**	**0.880**	**0.879**	**0.811**	**0.969**
StdD.	0.127	0.190	0.173	0.036	0.099	0.096	0.168	0.252	0.218
Max	1.000	0.981	1.396	0.983	0.952	0.979	1.000	0.981	1.396
Min	0.446	0.281	0.551	0.894	0.645	0.708	0.446	0.281	0.551
	Middle East and Turkey								
D.	**All Banks**			**Conventional Banks**			**Islamic Banks**		
Stat.	**CE**	**RE**	**PE**	**CE**	**RE**	**PE**	**CE**	**RE**	**PE**
N	40	40	40	18	18	18	22	22	22
Mean	**0.920**	**0.803**	**0.862**	**0.910**	**0.739**	**0.815**	**0.928**	**0.855**	**0.900**
StdD.	0.096	0.178	0.164	0.103	0.209	0.157	0.092	0.130	0.163
Max	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Min	0.601	0.264	0.292	0.601	0.264	0.437	0.717	0.539	0.292
	All Regions								
D.	**All Banks**			**Conventional Banks**			**Islamic Banks**		
Stat.	**CE**	**RE**	**PE**	**CE**	**RE**	**PE**	**CE**	**RE**	**PE**
N	80	80	80	37	37	37	43	43	43
Mean	**0.918**	**0.811**	**0.872**	**0.935**	**0.806**	**0.863**	**0.903**	**0.816**	**0.879**
StdD.	0.100	0.171	0.176	0.079	0.168	0.137	0.114	0.174	0.205
Max	1.000	1.000	1.396	1.000	1.000	1.000	1.000	1.000	1.396
Min	0.446	0.264	0.292	0.601	0.264	0.437	0.446	0.281	0.292

4.2 Tests of Consistency of the Results (Robustness Tests)[14]

Readers might suspect that the current overall results obtained by comparing all conventional versus all Islamic banks in the selected sample may be *not* consistent with another set of results obtained on country basis or on a two selected groups of countries based on their economic developments. Therefore, a set of robustness tests has been offered in this section. The main conclusion emerged from those

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[14] We acknowledge the useful views given by Prof. Sayful Azhar Rosly and the anonymous reviewer of this paper who suggested these tests.

tests that the overall DEA results are consistent to a very great extent with the results on the single-country basis and with the results obtained from two groups; one represents relatively less-developed countries and the other represents relatively more-developed countries.

Based on DEA results, Table 7 provides evidence that there are no significant differences in cost, revenue, and profit mean scores between conventional and Islamic banks. The other argument claims that the results might change if we compare two different groups; one selected from relatively less-developed countries and the other from relatively more-developed country due to different economic environments. Hence, another proof on the consistency of the results in this study is offered on Table 8 which reports insignificant differences in cost, revenue, and profit mean scores between conventional and Islamic banks.[15]

Table – 7
Single-Country Cost, Revenue, and Profit Efficiency DEA Results

Country Name	Type of Banks	Cost Efficiency	Revenue Efficiency	Profit Efficiency	Notes
AG (Algeria)	Conventional	0.99543	0.86280	0.98280	Consistent with the overall results
	Islamic	0.81105	0.78284	0.75613	
T-test	**P-value**	**0.301**	**0.129**	**0.128**	
BH (Bahrain)	Conventional	0.90743	0.52133	0.72747	Consistent with the overall results
	Islamic	0.77117	0.70420	0.55249	
T-test	**P-value**	**0.318**	**0.521**	**0.635**	
BD (Bangladesh)	Conventional	0.93500	0.85193	0.89095	Consistent with the overall results
	Islamic	0.94267	0.35857	0.77541	
T-test	**P-value**	**0.906**	**0.076**	**0.698**	
BN (Brunei)	Conventional	0.92951	0.78776	0.79651	Consistent with the overall results
	Islamic	0.66512	0.91709	1.00941	
T-test	**P-value**	**0.613**	**0.338**	**0.412**	
EG (Egypt)	Conventional	0.91996	0.88431	0.83762	Consistent with the overall results
	Islamic	0.86097	0.57297	0.37564	
T-test	**P-value**	**0.211**	**0.386**	**0.138**	
GM (Gambia)	Conventional	0.99289	0.90046	0.98119	Consistent with the overall results
	Islamic	0.98146	0.65988	0.80997	
T-test	**P-value**	**0.523**	**0.054**	**0.120**	
ID (Indonesia)	Conventional	0.98227	0.79883	0.94920	Consistent with the overall results
	Islamic	0.92110	0.86042	0.87444	

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[15] In these tests, the relatively less-developed selected countries are (Bangladesh, Egypt, and Indonesia) while the relatively more-developed selected countries are (Bahrain, Kuwait, and the United Arab Emirates).

Country Name	Type of Banks	Cost Efficiency	Revenue Efficiency	Profit Efficiency	Notes
T-test	**P-value**	**0.115**	**0.783**	**0.642**	
JO (Jordan)	Conventional	0.90705	0.86079	0.77443	Consistent with the overall results
	Islamic	0.96799	0.73769	0.96249	
T-test	**P-value**	**0.537**	**0.585**	**0.479**	
KW (Kuwait)	Conventional	0.97962	0.75176	0.92862	Consistent with the overall results
	Islamic	0.97092	0.93916	0.97964	
T-test	**P-value**	**0.697**	**0.147**	**0.452**	
LB (Lebanon)	Conventional	0.90364	0.51856	0.59535	Consistent with the overall results
	Islamic	1.00000	0.99676	1.00000	
T-test	**P-value**	**0.064**	**0.311**	**0.238**	
MY (Malaysia)	Conventional	0.98015	0.92938	0.96669	Consistent with the overall results
	Islamic	0.86408	0.94904	1.18409	
T-test	**P-value**	**0.469**	**0.195**	**0.491**	
PK (Pakistan)	Conventional	0.91571	0.79737	0.75479	Consistent with the overall results
	Islamic	1.00000	0.97188	1.00000	
T-test	**P-value**	**0.058**	**0.148**	**0.119**	
QR (Qatar)	Conventional	0.86574	0.79677	0.86407	Consistent with the overall results
	Islamic	0.96662	0.86260	0.92799	
T-test	**P-value**	**0.533**	**0.571**	**0.629**	
SA (Saudi Arabia)	Conventional	0.96305	0.61688	0.74579	Consistent with the overall results
	Islamic	0.98515	0.85330	0.94718	
T-test	**P-value**	**0.334**	**0.087**	**0.155**	
SL (Senegal)	Conventional	0.95381	0.86329	0.90301	Consistent with the overall results
	Islamic	0.84697	0.95587	1.00000	
T-test	**P-value**	**0.162**	**0.283**	**0.563**	
TN (Tunisia)	Conventional	0.97422	0.97805	0.96185	Consistent with the overall results
	Islamic	0.98274	0.86765	0.93580	
T-test	**P-value**	**0.880**	**0.211**	**0.761**	
TY (Turkey)	Conventional	0.75860	0.96420	0.90907	Consistent with the overall results
	Islamic	0.99950	0.90590	1.00000	
T-test	**P-value**	**0.396**	**0.647**	**0.124**	
UAE (Emirates)	Conventional	0.93671	0.93500	0.93041	Consistent with the overall results
	Islamic	0.85833	0.90811	0.94164	
T-test	**P-value**	**0.682**	**0.757**	**0.913**	
YE (Yemen)	Conventional	0.96405	0.68472	0.86161	Consistent with the overall results
	Islamic	0.97771	0.95827	0.95481	
T-test	**P-value**	**0.650**	**0.313**	**0.484**	

Table - 8

Cost, Revenue, and Profit Efficiency DEA Results in Relatively Less-Developed Countries Vs. Relatively More-Developed Countries

Country Name	Type of Banks	Cost Efficiency	Revenue Efficiency	Profit Efficiency	Note
Relatively Less Developed (BD, EG, ID)	Conventional	0.94574	0.84502	0.89259	Consistent with the overall results
	Islamic	0.90825	0.59732	0.67516	
T-test **(P-value)**		**0.169**	**0.086**	**0.133**	
R. More Developed (BH, KW, UAE)	Conventional	0.94125	0.73603	0.86217	Consistent with the overall results
	Islamic	0.86680	0.85049	0.82459	
T-test **(P-value)**		**0.253**	**0.317**	**0.775**	
Conventional banks in R. less developed countries		0.94574	0.84502	0.89259	Consistent with the overall results
Conventional banks in R. more developed countries		0.94125	0.73603	0.86217	
T-test **(P-value)**		**0.899**	**0.328**	**0.703**	
Islamic banks in R. less developed countries		0.90825	0.59732	0.67516	Consistent with the overall results
Islamic banks in R. more developed countries		0.86680	0.85049	0.82459	
T-test **(P-value)**		**0.484**	**0.071**	**0.378**	
Conventional banks in R. less developed countries		0.94574	0.84502	0.89259	Consistent with the overall results
Islamic banks in R. more developed countries		0.86680	0.85049	0.82459	
T-test **(P-value)**		**0.376**	**0.371**	**0.203**	
Conventional banks in R. more developed countries		0.94125	0.73603	0.86217	Consistent with the overall results
Islamic banks in R. less developed countries		0.90825	0.59732	0.67516	
T-test **(P-value)**		**0.202**	**0.938**	**0.587**	

4.3 Overtime Results

It could be argued that it is more informative to construct a dynamic panel compared to the static panel, which is employed in this study as a dynamic panel may shed light on the trends over time. Therefore, this paper provides a dynamic analysis and a considerable number of Tables and Figures to show the changes in efficiency results over the 16 years time period of the study.

Annual Efficiency Results: Conventional, Islamic, and All Banks

This section provides the findings on cost, revenue and profit efficiency over the 16 years for the three bank groups. Table 9 summarizes these findings on average

bank cost, revenue, and profit efficiency over the 1990 to 2005 period.

Table - 9

Annual Cost, Revenue, and Profit Efficiency Scores for Conventional, Islamic, and All Banks over the Period 1990-2005

	All Banks			**Conventional Banks**			**Islamic Banks**		
Year	CE*	RE	PE	CE	RE	PE	CE	RE	PE
1990	0.943	0.685	1.000	0.943	0.685	1.000	n. a.**	n. a.	n. a.
1991	0.936	0.664	0.946	0.936	0.664	0.946	n. a.	n. a.	n. a.
1992	0.947	0.775	0.911	0.938	0.756	0.932	0.964	0.809	0.875
1993	0.907	0.751	0.764	0.930	0.770	0.834	0.877	0.727	0.675
1994	0.936	0.795	0.899	0.964	0.803	0.919	0.896	0.783	0.870
1995	0.946	0.775	0.837	0.957	0.767	0.815	0.933	0.784	0.862
1996	0.910	0.788	0.846	0.929	0.799	0.810	0.889	0.774	0.886
1997	0.894	0.758	0.779	0.899	0.771	0.743	0.890	0.746	0.813
1998	0.903	0.703	0.752	0.917	0.731	0.780	0.889	0.675	0.725
1999	0.913	0.716	0.775	0.929	0.714	0.819	0.897	0.717	0.730
2000	0.905	0.729	0.843	0.946	0.737	0.772	0.865	0.722	0.913
2001	0.915	0.787	0.812	0.949	0.795	0.781	0.882	0.779	0.843
2002	0.902	0.795	0.898	0.956	0.778	0.867	0.851	0.811	0.928
2003	0.891	0.813	0.869	0.914	0.808	0.843	0.870	0.818	0.892
2004	0.913	0.852	0.766	0.940	0.837	0.917	0.888	0.866	0.627
2005	0.923	0.841	0.945	0.955	0.844	0.872	0.888	0.839	1.020

* CE = Cost Efficiency, RE = Revenue Efficiency, PE = Profit Efficiency.
** n. a.: Data is not available for Islamic banks over the period 1990-1991.

The findings show that conventional banks are more cost efficient than Islamic banks in all the years except 1992. On average, revenue efficiency scores for both banking streams are lower than the profit and costs respectively. However, conventional banks exhibit more stable revenue and profit performance over the years compared to the Islamic banks.

Figure 1, a graph of the time series of scores, shows cost, revenue, and profit efficiency lines over all years for all banks. The cost efficiency line indicates higher efficiency and greater stability compared to the revenue and profit lines. The revenue line indicates the least efficiency over the years except in year 2004 when it had better efficiency than profits. Even though, the revenue efficiency line reflects the lowest efficiency scores, it had a stable upward trend since the year 2000. Over the sample period, the average efficiency scores ranged between 66.4 and 100 percent.

Figure 2 also shows the line charts for average cost, revenue, and profit efficiency scores in conventional banks during 1990 to 2005. The trends depicted by the lines are similar to that observed for all banks category in Figure 1 above.

The cost line in conventional banks shows greater and more stable efficiency compared to revenue and profit lines.

Figure – 1

**Cost, Revenue, and Profit Efficiency of
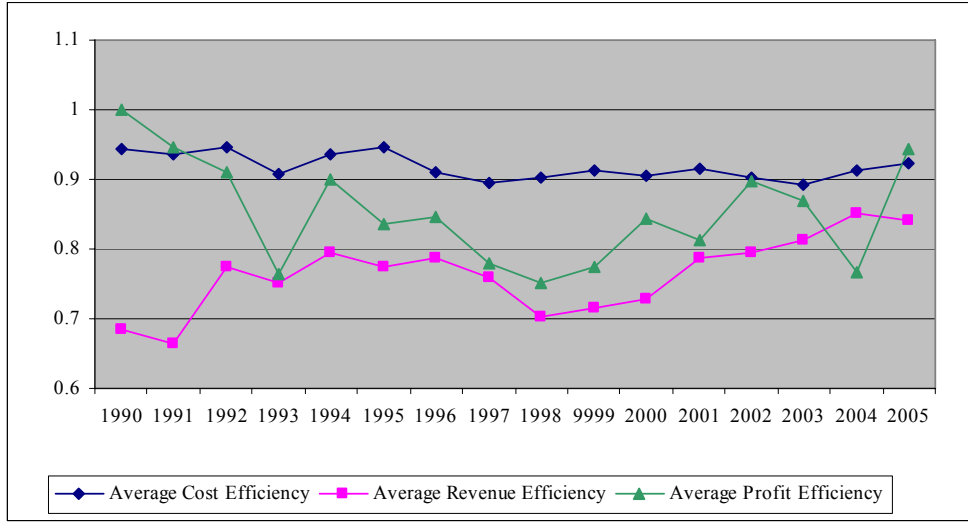All Banks over the Period 1990-2005**

Figure – 2

**Cost, Revenue and Profit Efficiency of Conventional Banks
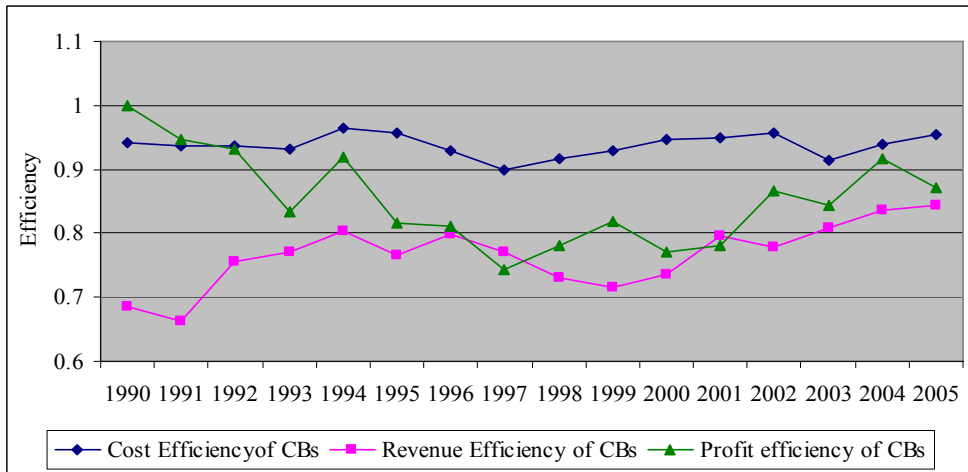over the Period 1990-2005**

Figure 3 shows the line charts for the average cost, revenue, and profit efficiency scores of Islamic banks over the 16-year sample period. The lines show a

similar pattern of cost, revenue and profit efficiency of conventional and all banks samples. That is, the banks are relatively more cost efficient and least revenue efficient. However, for Islamic banks, the revenue efficiency line had a steady upward trend indicating an improvement of revenue efficiency over time, but the profit efficiency was rather unstable. Probably, this shows the learning effect in this new market place. The cost efficiency line had a slight downward trend indicating a deterioration of cost efficiency over time. For the sample period, the average efficiency scores ranged between 60 and 100 percent.

Figure – 3

**Cost, Revenue, and Profit Efficiency of Islamic Banks
over the Period 1992-2005**
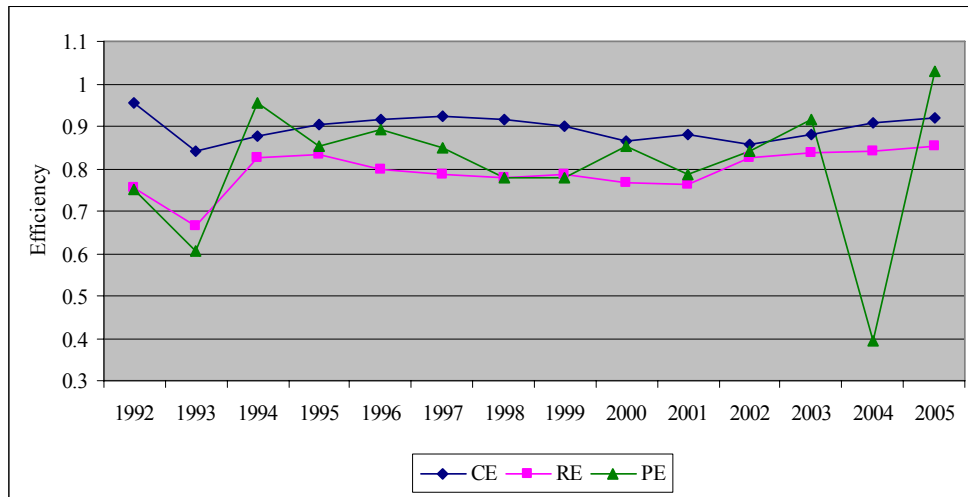
The information content from the line charts for the different samples indicate no clear evidence of significant improvements in the cost and the profit efficiencies, though there is a consistent positive trend for revenue efficiency. Since the cost efficiency line is the most stable and unlike revenue and profit efficiency lines, we could say that efficiency was not much affected by the financial crises in 1997-1999. However, on average, both the conventional and the Islamic banking entities show improvements in efficiency since the year 2000 onwards, possibly as the after-effects of the government's reform initiatives to make this industry more resilient to adverse economic conditions.

Further efficiency analysis of Islamic banks over the years shows that, on average, most cost efficiency scores for Islamic banks are higher than profit scores in the 1990s. However, the trend reversed since 2000, as indicated by a decreasing trend in cost efficiency and increasing trend in revenue and profit efficiency. For single year results, the best mean cost efficiency score of 95.8 percent was achieved in 1992, and the worst was 85.2 percent in the year 2002. In terms of

profit efficiency, the best mean score was achieved in 2005 at 103 percent, while the worst score was 64.6 percent observed a year earlier in 2004 due to bad performance of bank Mandiri (Indonesian) bank in that year.

In general, unlike the revenue efficiency, there is no clear learning curve effect for cost and profit efficiencies. On the contrary, there seems to be a decline in cost efficiency over the years. Though the financial crises in the late 1990s had an adverse impact on all categories of efficiency in general, the cost efficiency was more resilient than revenue and profit efficiencies. For the Islamic banks, cost efficiency appears to decline but was better than those of conventional banks until the late 1990s. In fact, profit efficiency improved since 2000 possibly due to the significant improvement in profitability of small Islamic banks as will be discussed in a subsequent section.

Statistical Tests of Significance for Overall Results

The significance of the findings was tested using three types of statistical nonparametric tests.[16] In particular, Friedman's Test was used to examine the first three main hypotheses and the Mann-Whitney's Test was used to test the remaining hypotheses.[17]

Friedman Tests of the Differences in Banks Efficiencies

The Friedman test is used to compare two or more related samples, and it is equivalent to the repeated measures or within-subjects ANOVA.[18] Table 10 shows the results of the three Friedman tests of significant differences in terms of cost, revenue, and profit efficiencies of conventional, Islamic, and all banks groups. It was hypothesized that efficiency scores would not differ significantly across banks' mean scores in each group.

Table 10 summarizes the results of Friedman tests for the all banks, conventional banks, and Islamic banks groups. First, significant differences do exist between cost and revenue efficiency scores (at the $p < 0.05$). Second, there is no significant difference between cost and profit scores. Third, there is no significant difference between revenue and profit efficiency scores. Therefore, the tests reject the null hypotheses that the cost, revenue, and profit mean efficiency scores in the all banks are significantly different. In addition, in terms of the mean rank, cost efficiency was the best with the highest mean score, followed by profit efficiency and with revenue perceived as least efficient. Furthermore, the tests show that there are significant differences between cost, revenue, and profit

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[16] In all the statistical tests, cost, revenue, and profit efficiency scores act as dependent variables.

[17] While Friedman's Tests used to compare two related samples, Mann-Whitney's Test is used to compare two independent samples.

[18] The data violate the stringent assumptions of repeated measures ANOVA, so it was decided that Friedman tests should be performed. See Coakes and Steed (2003).

efficiency scores within conventional banks and within Islamic banks as well (p values < 5 percent). This implies that there is real difference between cost, revenue and profit efficiencies between both conventional and Islamic banks, and the all banks group.

Table – 10

Friedman Tests of the Differences in Banks' Cost, Revenue and Profit Efficiencies

	All Banks			Conventional Banks			Islamic Banks		
	Ranks	**Test Statistics (a)**		**Ranks**	**Test Statistics (a)**		**Ranks**	**Test Statistics (a)**	
E	Mean Rank	N	80	Mean Rank	N	37	Mean Rank	N	43
CE	2.50	Chi-Square	46.59	2.50	Chi-Square	34.15	2.30	Chi-Square	19.76
RE	1.47	df	2	1.47	df	2	1.48	df	2
PE	2.03	Asymp. Sig.	0.00*	2.03	Asymp. Sig.	0.00*	2.22	Asymp. Sig.	0.00*

(a) Friedman Tests, E=Efficiency, CE=Cost Efficiency, RE=Revenue Efficiency, PE=Profit Efficiency
* Significant at 0.05 level.

Two Independent Samples Tests: Conventional versus Islamic Banks

The Mann-Whitney U test is a relevant test for two independent samples coming from populations having the same distribution. This test is equivalent to the independent groups T-test.[19]

Table - 11

Mann-Whitney Test for Differences in Cost, Revenue and Profit Efficiencies between Conventional and Islamic Banks

			Ranks		Test Statistics (a)			
E	Banks	N	Mean Rank	Sum of Ranks	Tests	CE	RE	PE
CE	CBs	37	42.95	1589	Mann-Whitney U	705	740	646
	IBs	43	38.40	1651				
	Total	80			Wilcoxon W	1651	1443	1349
RE	CBs	37	39.00	1443				
	IBs	43	41.79	1797	Z	-0.87	-0.54	-1.45
	Total	80						
PE	CBs	37	36.46	1349	Asymp. Sig. (2-tailed)*			
	IBs	43	43.98	1891		0.38	0.59	0.15
	Total	80						

(a) Grouping Variable: Specialization.
* There are no significant results at 5 percent level.

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[19] The data violate the stringent assumptions of the independent groups't-test, so it was decided that Mann-Whitney U tests should be used [(see Coakes and Steed (2003)].

It is used to test the significances of results for different pairs of banking groups. It was hypothesized that efficiency scores of conventional banks are significantly higher than those of Islamic banks. In particular, the task of this test is to check the significance of the following main null hypotheses. First, the mean cost efficiency of conventional banks is significantly higher than those of cost efficiency of Islamic Banks. Second, the mean revenue efficiency of conventional banks is significantly higher than those of revenue efficiency of Islamic Banks. Third, the mean profit efficiency of conventional banks is significantly higher than those of profit efficiency of Islamic Banks.

The test statistics summarized in Table 11 do not indicate any significant results,[20] all *p* values are greater than the standard level at 5 percent. The output indicates that the result, with correction for ties and Z-scores conversion, were not significant (p> 0.05) implying no significant differences in efficiencies exist between conventional and Islamic banks. Though, on average, both banking systems have similar cost, revenue and profit efficiencies, there were some indication that conventional banks had greater profit efficiency, i.e. profit efficiency seems to be the closest to the standard level of significance at 5 percent, and less in revenue efficiency, but test didn't accept the null hypotheses.

Efficiency Results for the Sample Period: Big versus Small Banks

As discussed earlier, the literature contains some inconclusive evidence on the relationship between bank efficiency and their size. However, there is no discussion in the literature on the relationship between size and efficiency of Islamic banks compared to conventional banks over a 16-years period as done in this study.

Table 12 is a summary of the results on the cost, revenue, and profit efficiency of both banking streams based on their assets size. The findings in the table enable the reader to compare between efficiency scores *within* the same banking system as well as comparing the results for the efficiency scores *between* both banking systems.

Comparing the results of the four groups shows that the highest cost efficiency score (100 percent) was obtained by the small conventional banks in 1990, while the lowest (81.8 percent) score was observed for the small Islamic banks in 2005. The big conventional banks scored the highest revenue efficiency (92.6 percent) in 1995, while the lowest (35.3 percent) was scored in 1991 by the small conventional banks. The highest profit efficiency score (103 percent) was achieved by the big Islamic banks in 2005, while the big Islamic banks scored the lowest profit efficiency mean (39.6 percent) in 2004.

There are some interesting findings observed from the table. First, revenue and

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[20] To interpret the output from the Mann-Whitney U test, analysts need to consider the Z-score and two-tailed p-value, which have been corrected for ties.

profit efficiency scores over the years are relatively more volatile than cost efficiency in all groups. Second, the average cost efficiency, over the years, is higher than revenue and profit efficiencies in both banking streams. Third, although fluctuating over the years, all efficiency scores of big conventional and big Islamic banks have a positive trend after 2000, except for profit efficiency score for big Islamic banks in 2004.[21]

Table – 12

Annual Cost, Revenue, and Profit Efficiency Scores for Big and Small Conventional and Islamic Banks

	Big Conventional Banks			Small Conventional Banks		
Year	CE	RE	PE	CE	RE	PE
1990	0.900	0.874	1.000	1.000	0.432	1.000
1991	0.919	0.819	1.000	0.970	0.353	0.839
1992	0.935	0.806	0.933	0.942	0.666	0.931
1993	0.942	0.837	0.906	0.915	0.687	0.742
1994	0.976	0.859	0.971	0.949	0.737	0.858
1995	0.962	0.926	0.949	0.952	0.593	0.670
1996	0.927	0.875	0.838	0.931	0.709	0.778
1997	0.945	0.850	0.792	0.854	0.691	0.694
1998	0.967	0.788	0.910	0.867	0.675	0.651
1999	0.960	0.745	0.806	0.898	0.684	0.833
2000	0.958	0.784	0.804	0.935	0.689	0.739
2001	0.954	0.818	0.786	0.945	0.771	0.774
2002	0.981	0.831	0.937	0.932	0.729	0.801
2003	0.965	0.846	0.920	0.866	0.769	0.765
2004	0.972	0.894	0.978	0.907	0.777	0.852
2005	0.977	0.887	0.932	0.921	0.777	0.779
	Big Islamic Banks			Small Islamic Banks		
Year	CE	RE	PE	CE	RE	PE
1992	0.953	0.756	0.751	0.974	0.863	1.000
1993	0.839	0.665	0.606	0.927	0.809	0.768
1994	0.877	0.824	0.953	0.918	0.737	0.776
1995	0.902	0.832	0.853	0.980	0.713	0.875
1996	0.917	0.798	0.893	0.847	0.739	0.875
1997	0.923	0.784	0.848	0.847	0.698	0.768
1998	0.915	0.779	0.777	0.862	0.562	0.668
1999	0.899	0.785	0.779	0.895	0.653	0.684
2000	0.864	0.769	0.852	0.865	0.675	0.975
2001	0.880	0.764	0.786	0.883	0.794	0.901
2002	0.856	0.825	0.840	0.846	0.798	1.008
2003	0.882	0.839	0.916	0.859	0.800	0.873
2004	0.907	0.843	0.396	0.866	0.892	0.884
2005	0.921	0.853	1.030	0.818	0.808	1.000

Fourth, the inter-temporal comparison of the efficiency scores suggests that, although cost, revenue and profit efficiencies of the banks were practically stable

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[21] Double check of the data led to the same results.

between 1992 and 1996, they significantly declined between 1997 and 1998 (possibly due to the financial crisis) and inclined thereafter. This decline is closely associated with well documented South East Asian financial crisis. Finally, the variation in cost, revenue, and profit efficiencies seems to have increased over time, indicating that the efficiency gap between the efficient and relatively inefficient banks is getting wider.

Figure 4 depicts the line graphs drawn from the information documented in Table 12 for big conventional banks. The cost efficiency is stable and has a slight positive trend after the crisis period. The revenue and profit efficiency lines show high variations over the years and were affected by the crisis but banks recovered resiliently after the crisis period. All efficiency scores ranged between 75 and 100 percent. Finally, unlike the cases of all banks category, this figure shows that revenue efficiency line is higher than profit line in some years.

Figure – 4

**Cost, Revenue, and Profit Efficiency of Big
Conventional Banks over the Period 1990-2005**
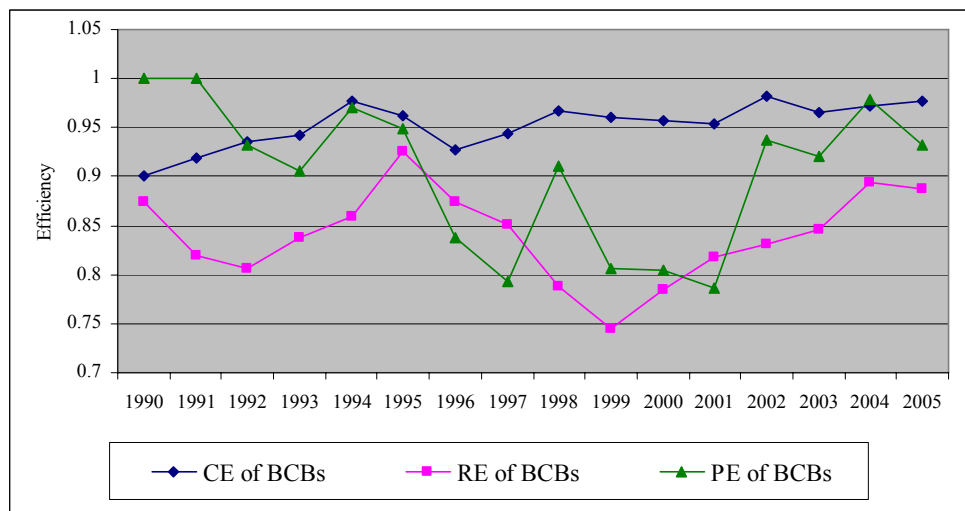
Figure 5 shows the cost, revenue and profit efficiency lines over the 14-years period for big Islamic banks. It shows that the cost and revenue efficiency lines of these banks are stable and improves over time. The profit efficiency line is very unstable and had a sharp decline in 2004. This seems to be quite a consistent trend for profit efficiency in all size sub-samples. This could be due to the nature of profit generating activities that are predominantly affected by external factors beyond the control of the banks management. While profit efficiency line did surpass the cost efficiency line in some years (1994 and 2003), the revenue efficiency was never better than the cost efficiency in any single year over the analysis period. This implies that the big Islamic banks are better at utilizing their

resources rather than generating outcomes.

Figure 6 shows statistics on the cost, revenue, and profit efficiency lines for small conventional banks. The cost efficiency is rather stable but is declining over the years, whereas the revenue efficiency was rather low in 1991 and thereafter increased significantly till the year 1996 and was stable thereafter until 2005, despite the financial crisis. Profit efficiency declined from 1991 to 1998 and then increased and stabilized until 2005.

Figure – 5

Cost, Revenue, and Profit Efficiency of Big Islamic Banks over the Period 1990-2005
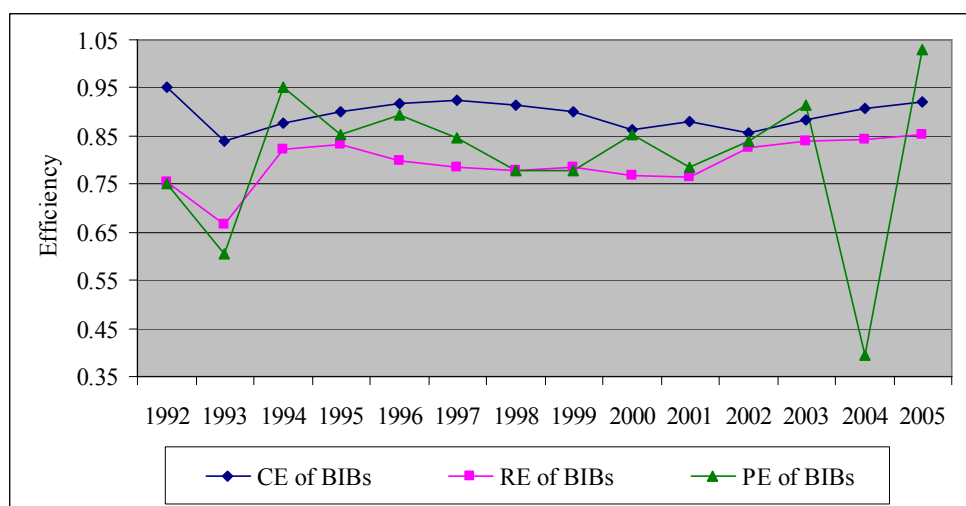
The profit efficiency was always better than the revenue efficiency over the whole analysis period. The decreasing trend in profit efficiency could be explained due to the stiff competition, changing regulations and financial crisis. The improvement in the profit efficiency after 1998 could be explained by the government's reform program for the banking sector. Overall, small conventional banks were more cost and profit efficient compared to revenue efficiency.

Figure 7 relates to the cost, revenue and profit efficiency lines of small Islamic banks over the 14-year period. There is a clear decreasing trend in the cost efficiency of small Islamic banks. From 1992 to 1999 the trend in cost, revenue and profit efficiency is on the decline until 1999, with these banks being more cost efficient followed by profit and revenue efficiency. After 1999, there was a significant upward trend in all the efficiencies with profit efficiency dominating the cost and revenue efficiency. In 2003 the revenue efficiency was better than cost efficiency but profit efficiency was the best.

**Cost, Revenue, and Profit Efficiency of
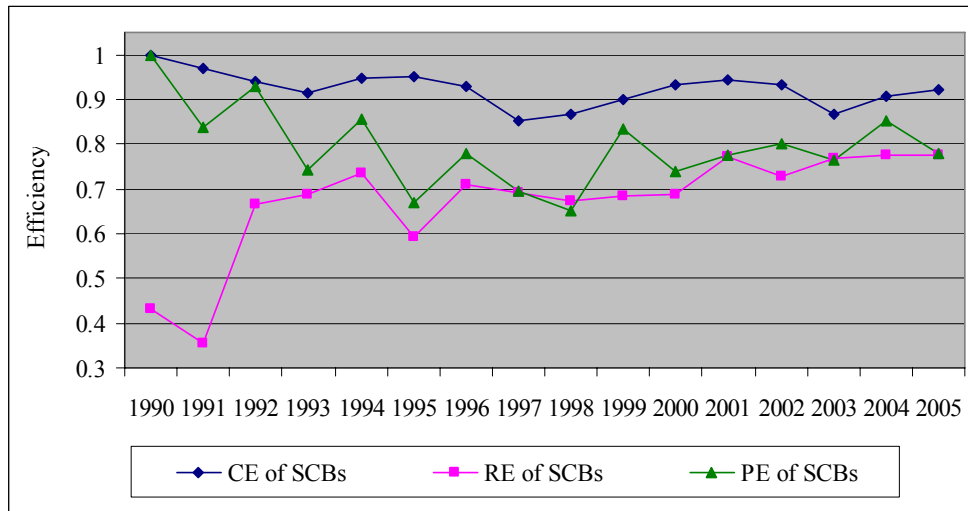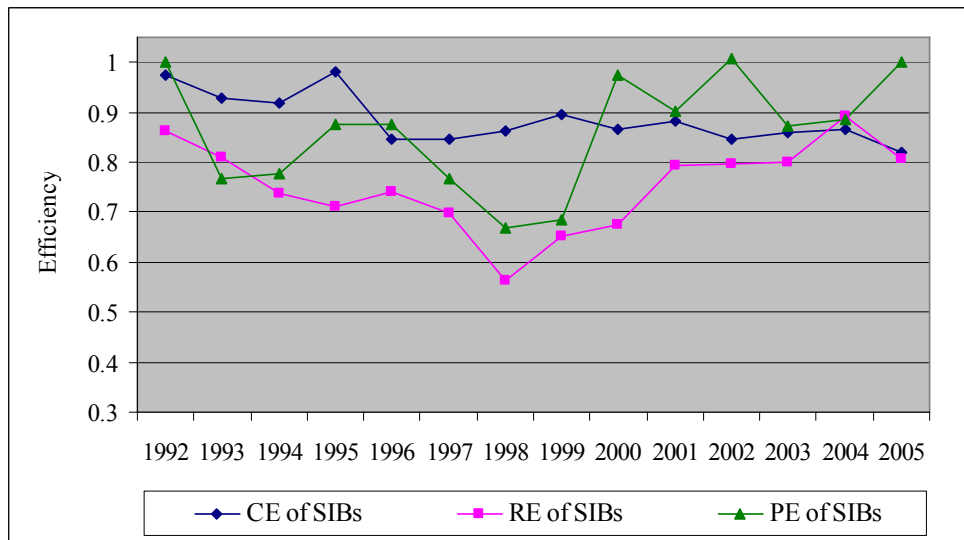Small Conventional Banks over the Period 1990-2005**

Figure – 7

**Cost, Revenue, and Profit Efficiency of
Small Islamic Banks over the Period 1992-2005**

The decreasing trend in profit and revenue efficiencies in the 1990s was dramatically reversed after 1999, which could be due the increasing awareness and acceptance of Islamic banking services worldwide, improvement in managerial

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investment decisions, introducing various other forms of Islamic financial services besides interest-free accounts, and initiatives by the managers to cope with the highly competitive environment.

4.4.2 Cost, revenue, and profit efficiency of old vs. new banks over the sample period (1990-2005)

Table – 13

Annual Cost, Revenue and Profit Efficiency Scores for Old and New Conventional and Islamic Banks[22]

	Old Conventional Banks			New Conventional Banks		
Year	CE	RE	PE	CE	RE	PE
1990	0.943	0.685	1.000	n. a.*	n. a.	n. a.
1991	0.936	0.664	0.946	n. a.	n. a.	n. a.
1992	0.938	0.756	0.932	n. a.	n. a.	n. a.
1993	0.926	0.757	0.824	1.000	1.000	1.000
1994	0.973	0.780	0.907	0.907	0.951	1.000
1995	0.958	0.797	0.845	0.952	0.565	0.619
1996	0.922	0.778	0.792	0.973	0.937	0.927
1997	0.917	0.765	0.740	0.811	0.801	0.757
1998	0.938	0.737	0.820	0.802	0.700	0.566
1999	0.945	0.694	0.799	0.877	0.781	0.885
2000	0.952	0.733	0.786	0.929	0.747	0.728
2001	0.947	0.763	0.763	0.958	0.896	0.836
2002	0.955	0.771	0.835	0.961	0.798	0.961
2003	0.933	0.792	0.817	0.864	0.856	0.919
2004	0.956	0.829	0.913	0.895	0.859	0.926
2005	0.950	0.831	0.852	0.975	0.890	0.945
	Old Islamic Banks			New Islamic Banks		
Year	CE	RE	PE	CE	RE	PE
1992	0.967	0.860	0.857	0.940	0.451	1.000
1993	0.869	0.718	0.650	0.976	0.847	1.000
1994	0.881	0.785	0.854	0.993	0.771	0.974
1995	0.911	0.798	0.816	1.000	0.742	1.000
1996	0.918	0.773	0.897	0.799	0.778	0.852
1997	0.891	0.725	0.737	0.886	0.792	0.974
1998	0.886	0.726	0.691	0.894	0.587	0.782
1999	0.895	0.752	0.698	0.900	0.659	0.782
2000	0.879	0.704	0.851	0.840	0.752	1.017
2001	0.898	0.795	0.825	0.859	0.756	0.870
2002	0.859	0.822	0.817	0.841	0.799	1.068
2003	0.871	0.790	0.852	0.869	0.850	0.940
2004	0.884	0.838	0.353	0.892	0.900	0.965
2005	0.878	0.819	1.034	0.903	0.868	1.000

* n. a.: Data is not available for new conventional banks over the period 1990-1992.

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[22] Data for new conventional banks is available starting from 1993, and data for Islamic banks is available starting from 1992.

Findings on the impact of age on both streams of banks' cost, revenue and profit efficiency over the sample period are summarized in Table 13. The findings reveal that cost efficiency scores over all years for the old conventional banks are above 91.7 percent. This means that the cost efficiency of old conventional banks is higher and is relatively more stable than revenue and profit efficiencies. It is also observed that only in 1997 old conventional banks had a lowest level of profit efficiency, probably due to the financial crisis. It was noted that the profit efficiency in old Islamic banks increased dramatically from 35.3 percent in 2004 to 136.9 percent in 2005.

It is also observed that, except in the year 2005, all cost efficiency scores for old Islamic banks are higher than revenue and profit efficiency scores. All efficiency scores for new banks seem to be volatile compared to the scores of old banks in both banking systems. Finally, except for exceptionally low (35 percent) profit efficiency of old Islamic banks in 2004, there is considerable improvement in cost, revenue and profit efficiency during the last few years in the sample period.

The line charts in Figure 8 are drawn based on the information content of Table 13. Cost efficiency of old conventional banks is stable and higher than revenue and profit efficiency over the sample period. The revenue efficiency line is positively sloped implying an improvement in revenue efficiency over time. The profit efficiency line dominates the revenue efficiency line and both had significant improvements in the last few years of the sample period.

Figure - 8

**Cost, Revenue, and Profit Efficiencies of
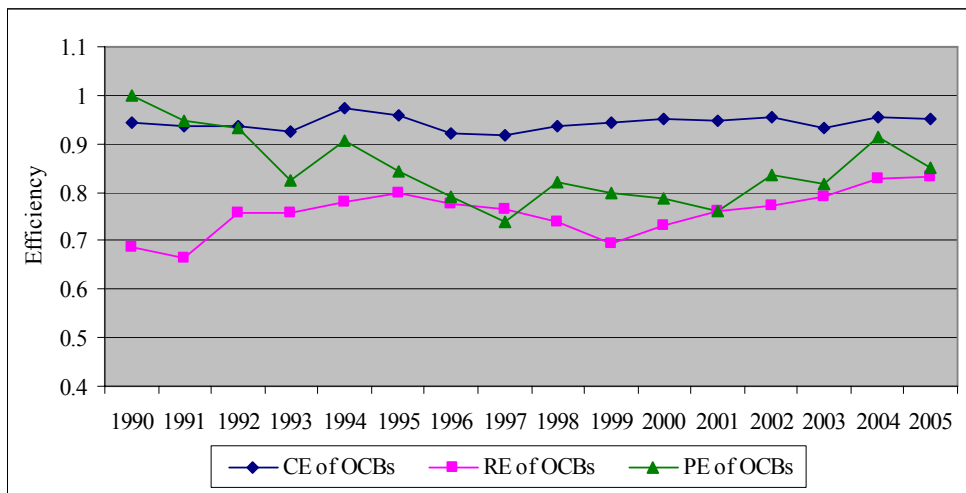Old Conventional Banks over the Period 1990-2005**

Figure 9 compares the cost, revenue, and profit efficiency of old Islamic banks over the 14 years sample period. Similar to the patterns observed for the old

conventional banks, the cost efficiency of the old Islamic banks was stable and was declining, but the revenue and profit efficiency dominated over the whole period. The revenue efficiency was also stable but had a positive trend after 1999. The profit efficiency scores of old Islamic banks were volatile and had a sharp dip in 2004 before recovering dramatically in 2005. The evidence suggests that old Islamic banks are practicing better in utilizing their resources more efficiently than generating outcomes.

Figure - 9

Cost, Revenue, and Profit Efficiency of
Old Islamic Banks over the Period 1992-2005
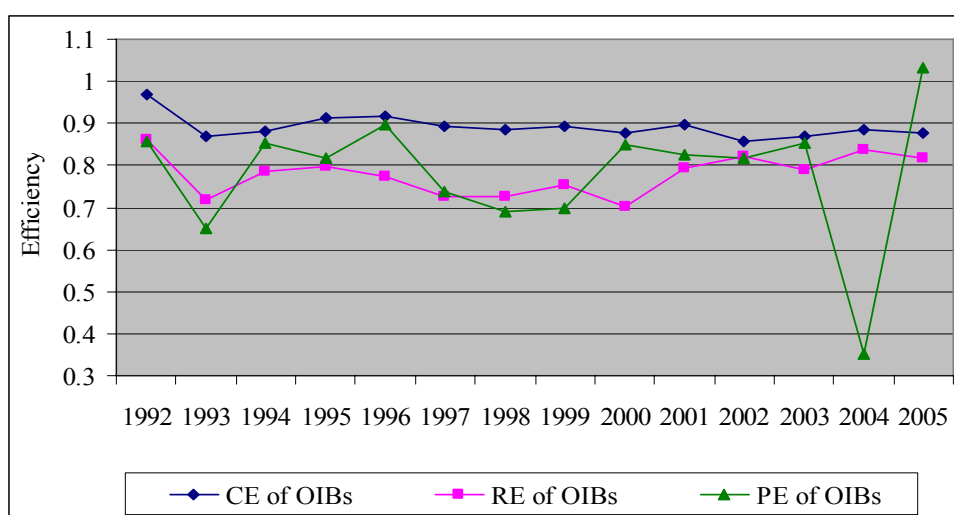
As shown in Figure 10, all efficiency lines for the new conventional banks are unstable over the sample period. There is a clear positive trend for revenue and profit efficiency in the last few years. It is noteworthy that revenue and profit efficiency improved significantly in the last few years of the sample period. The improvements could be attributed to government-initiated reform programs for the banking industry. Relatively, cost efficiency is higher, less stable and decreasing compared to profit and revenue efficiencies. In summary, the cost efficiency of new conventional banks dominated the revenue and profit efficiency.

It is apparent from Figure 11 that there is a decreasing trend in the cost efficiency for new Islamic banks, which has dominant profit efficiency. The profit efficiency line is volatile but is always better than revenue efficiency over the total period. Overall, new Islamic banks were better in generating profits followed by utilizing resources but experienced relatively lowest level of revenue efficiency. Probably they need more network and market share to generate greater revenue efficiency.

Figure – 10

**Cost, Revenue, and Profit Efficiency of
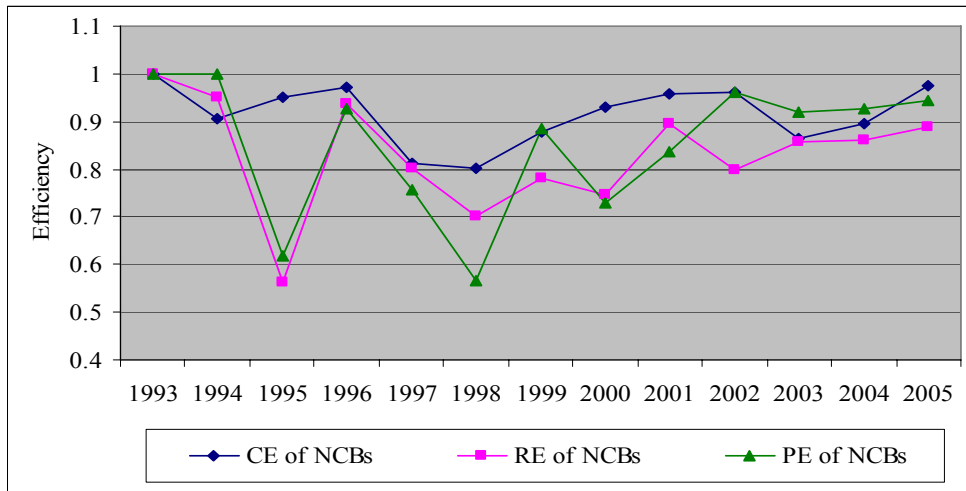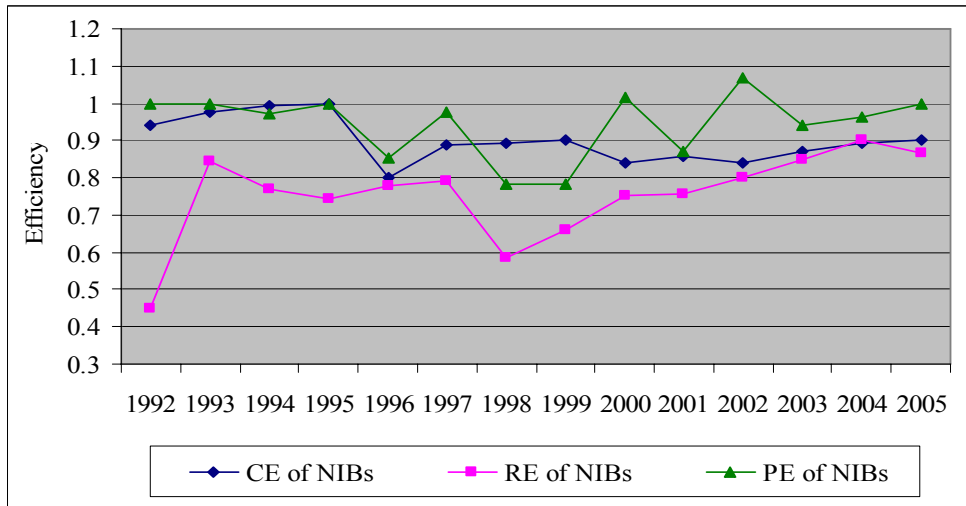New Conventional Banks over the Period 1993-2005**

Figure – 11

**Cost, Revenue, and Profit Efficiency of
New Islamic Banks over the Period 1992-2005**

4.5.2 Regional cost, revenue and profit efficiencies of both baking streams

Considerable differences between mean efficiency scores over the sample period in different regions are thus observed. Further, there are also differences in cost, revenue, and profit efficiency mean scores within the same region. These

differences are possibly caused by the different economic and political environments in each region and the changes that are taking place over the years. This section provides the mean regional efficiency scores for both banking streams through the relevant tables and figures.

Findings summarized in Table 14 for the African region show that not only are conventional banks more cost, revenue and profit efficient over the years but the trend in the efficiency scores is stable. However, the profit efficiency of Islamic banks in 2004 is very low and it recovered dramatically in 2005.

Table – 14

**Annual Cost, Revenue, and Profit Efficiency of
Conventional and Islamic Banks in Africa Region**

Africa								
	All Banks			**Conventional Banks**			**Islamic Banks**		
Years	CE	RE	PE	CE	RE	PE	CE	RE	PE
1990	0.819	0.918	1.000	0.819	0.918	1.000	n. a.	n. a.	n. a.
1991	0.954	0.826	1.000	0.954	0.826	1.000	n. a.	n. a.	n. a.
1992	1.000	0.878	1.000	1.000	0.791	1.000	1.000	0.965	1.000
1993	0.901	0.789	0.700	0.891	0.865	0.741	0.906	0.752	0.679
1994	0.917	0.730	0.776	0.973	0.841	1.000	0.862	0.618	0.551
1995	0.965	0.832	0.896	0.952	0.928	0.988	0.974	0.768	0.834
1996	0.883	0.755	0.814	0.949	0.947	0.969	0.840	0.627	0.710
1997	0.940	0.747	0.879	0.969	0.907	0.886	0.926	0.667	0.875
1998	0.908	0.730	0.793	0.971	0.882	0.943	0.868	0.635	0.699
1999	0.906	0.800	0.875	0.955	0.887	0.963	0.868	0.732	0.807
2000	0.892	0.711	0.851	0.962	0.843	0.846	0.844	0.605	0.855
2001	0.931	0.864	0.828	0.960	0.944	0.899	0.908	0.801	0.772
2002	0.881	0.845	0.896	0.956	0.874	0.877	0.821	0.822	0.911
2003	0.911	0.824	0.887	0.962	0.885	0.878	0.860	0.770	0.894
2004	0.904	0.864	0.240	0.951	0.927	0.887	0.852	0.793	-0.49
2005	0.894	0.738	0.891	0.887	0.837	0.670	0.906	0.590	1.223

Table 15 compares cost, revenue, and profit efficiency of Islamic versus conventional banks in Asia. Conventional banks dominate in respect to cost and revenue; efficiencies and Islamic banks had higher profit efficiency. The adverse effect of the Asian financial crisis in 1997-8 on the efficiencies scores of all banking streams is observed. In this region, Islamic banks are facing stiffer competition from conventional banks; however, revenue and profit efficiency scores are improving over the years.

The efficiency scores of banks in the Middle East and Turkey are summarized in Table 16. The Islamic banks apparently have better cost, revenue and profit efficiency than the conventional banks. Except that the profit efficiency of Islamic

banks is more volatile but is improving over time.

Table – 15

**Annual Cost, Revenue, and Profit Efficiency of
Conventional and Islamic Banks in Asia**

Asia									
	All Banks			**Conventional Banks**			**Islamic Banks**		
Years	CE	RE	PE	CE	RE	PE	CE	RE	PE
1990	0.973	0.939	1.000	0.973	0.939	1.000	n. a.	n. a.	n. a.
1991	0.919	0.945	1.000	0.919	0.945	1.000	n. a.	n. a.	n. a.
1992	0.940	0.672	0.553	0.957	0.888	0.828	0.906	0.239	0.002
1993	0.934	0.803	0.767	0.976	0.935	0.934	0.766	0.276	0.099
1994	1.000	0.791	1.000	1.000	0.891	1.000	1.000	0.491	1.000
1995	0.966	0.710	0.859	0.947	0.780	0.778	1.000	0.588	1.000
1996	0.893	0.825	0.940	0.947	0.895	0.900	0.813	0.720	1.000
1997	0.889	0.789	0.814	0.947	0.880	0.840	0.821	0.683	0.784
1998	0.871	0.678	0.675	0.904	0.773	0.701	0.832	0.567	0.644
1999	0.930	0.674	0.762	0.945	0.714	0.810	0.910	0.621	0.700
2000	0.872	0.781	0.900	0.929	0.763	0.739	0.797	0.804	1.107
2001	0.884	0.791	0.842	0.930	0.828	0.775	0.832	0.749	0.917
2002	0.896	0.796	1.100	0.983	0.815	0.963	0.809	0.777	1.255
2003	0.908	0.884	0.966	0.956	0.878	0.928	0.865	0.889	1.000
2004	0.915	0.899	0.972	0.977	0.853	0.975	0.859	0.941	0.970
2005	0.941	0.902	1.000	0.997	0.945	1.000	0.893	0.865	1.000

==Figure 12 and Figure 13 show the cost, revenue, and profit efficiency of conventional and Islamic banks, respectively, for the various designated regions. Both figures show that the cost efficiency scores over the years fluctuate between 80 to 100 percent in both banking streams in all regions.==

==The cost efficiency of conventional banks in Asia is more stable than the cost efficiency of similar banks in other regions. The Islamic banks in the Asia region had the least stable cost efficiency. African conventional banks represented the highest cost efficiency, whereas African Islamic banks represented the lowest cost efficiency. Even though banks in all regions could have utilized their resources better than what they actually did, cost efficiency lines in the above two figures appear higher and more stable than revenue and profit lines in the subsequent figures.==

Table – 16

**Annual Cost, Revenue, and Profit Efficiency of Conventional and
Islamic Banks in the Middle East and Turkey Region**

Middle East and Turkey								
	All Banks			Conventional Banks			Islamic Banks		
Years	CE	RE	PE	CE	RE	PE	CE	RE	PE
1990	0.997	0.505	1.000	0.997	0.505	1.000	n. a.	n. a.	n. a.
1991	0.933	0.596	0.928	0.933	0.596	0.928	n. a.	n. a.	n. a.
1992	0.934	0.769	0.960	0.921	0.723	0.939	0.961	0.861	1.000
1993	0.902	0.728	0.782	0.922	0.700	0.816	0.877	0.766	0.738
1994	0.919	0.822	0.908	0.943	0.747	0.852	0.888	0.922	0.983
1995	0.927	0.781	0.799	0.965	0.705	0.779	0.882	0.872	0.823
1996	0.929	0.785	0.818	0.913	0.702	0.713	0.948	0.885	0.945
1997	0.875	0.747	0.709	0.853	0.670	0.647	0.901	0.838	0.783
1998	0.916	0.701	0.770	0.904	0.657	0.762	0.929	0.749	0.778
1999	0.908	0.691	0.724	0.906	0.628	0.753	0.909	0.757	0.693
2000	0.930	0.713	0.807	0.949	0.664	0.752	0.910	0.761	0.862
2001	0.923	0.742	0.788	0.955	0.703	0.725	0.890	0.781	0.851
2002	0.916	0.770	0.804	0.943	0.718	0.815	0.889	0.822	0.793
2003	0.872	0.771	0.809	0.867	0.734	0.783	0.878	0.806	0.835
2004	0.916	0.823	0.901	0.915	0.781	0.901	0.916	0.858	0.902
2005	0.919	0.831	0.928	0.952	0.802	0.861	0.883	0.863	1.000

Figure – 12

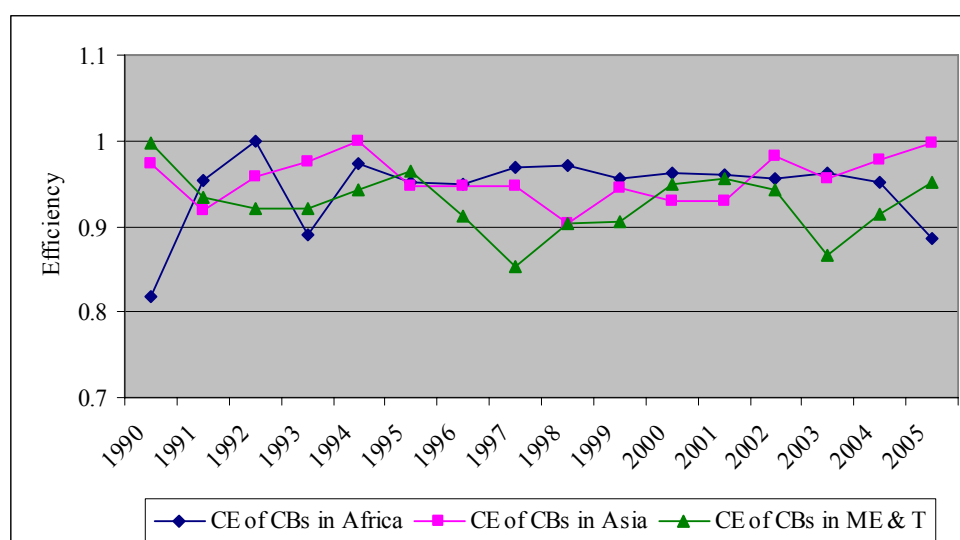**Cost Efficiency of Conventional Banks in the Selected Regions**

Figure – 13

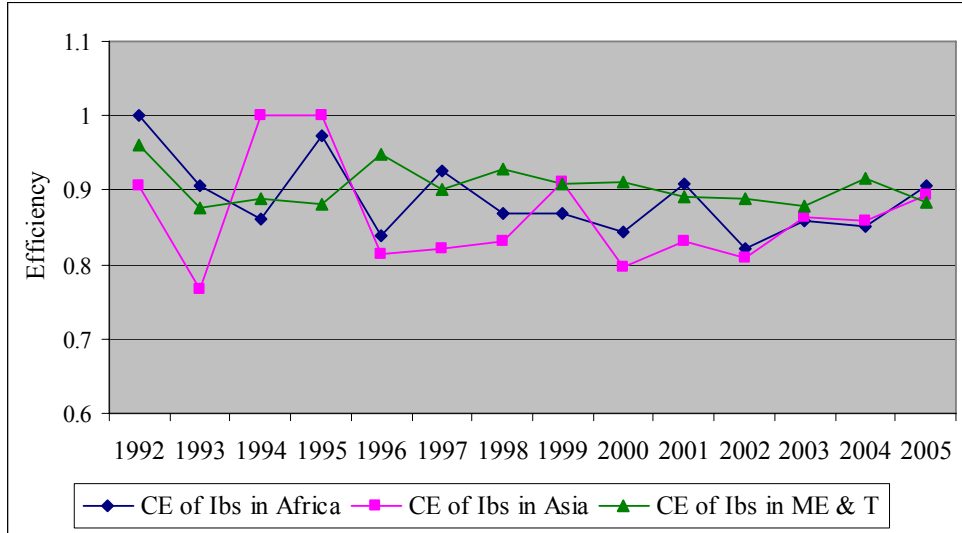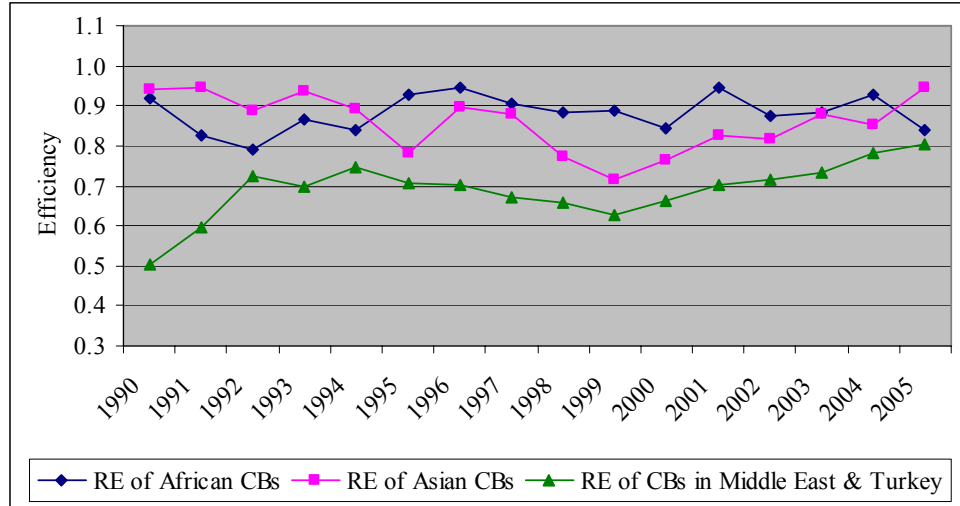**Cost Efficiency of Islamic Banks in the Selected Regions**

Figure 14 shows that the range of revenue efficiency of conventional banks over the period 1990-2005 is roughly between 50 percent and 99 percent. Conventional banks in Africa maintain higher and relatively more stable revenue efficiency than conventional banks in other regions. Even though they have improved in the last few years, conventional banks in the Middle East and Turkey had the lowest revenue efficiency.

Figure – 14

Revenue Efficiency of Conventional Banks in the Selected Regions

In Figure 15, the lines present the revenue efficiency of Islamic banks in the designated regions. The figure shows that revenue efficiency of these banks over the years range roughly between 20 percent and 95 percent. Islamic banks in the Middle East and Turkey have the highest and more relatively stable line among other regions. Revenue efficiency of Islamic banks in Asia is improving significantly over the years. In Islamic banks, the revenue line is constant in the Middle East and Turkey, moving upward in Asia, and fluctuating up and down in Africa.

Figure 16 shows the profit efficiency of conventional banks over designated regions. As they appear in the figure, the profit lines of conventional banks overlap over the study period. Therefore, there is unclear trend in profit efficiency in those three regions. The figure reveals that profit of African conventional banks is higher than other regions. While African banks have a decreasing trend in profit efficiency in recent years, conventional banks in Asia and Middle East and Turkey regions show an increasing trend. Islamic banks in Asia and Africa represent the highest and lowest profit efficiency lines, respectively. There is a negative value for profit efficiency of Islamic banks in the Africa region.[23]

Figure – 15

Revenue Efficiency of Islamic Banks in the Selected Regions

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[23] It is explained by the possibility of (below 1 and over 1) results in the profit efficiency using DEA approach, while results of cost and revenue efficiency must be between 0 and 1.
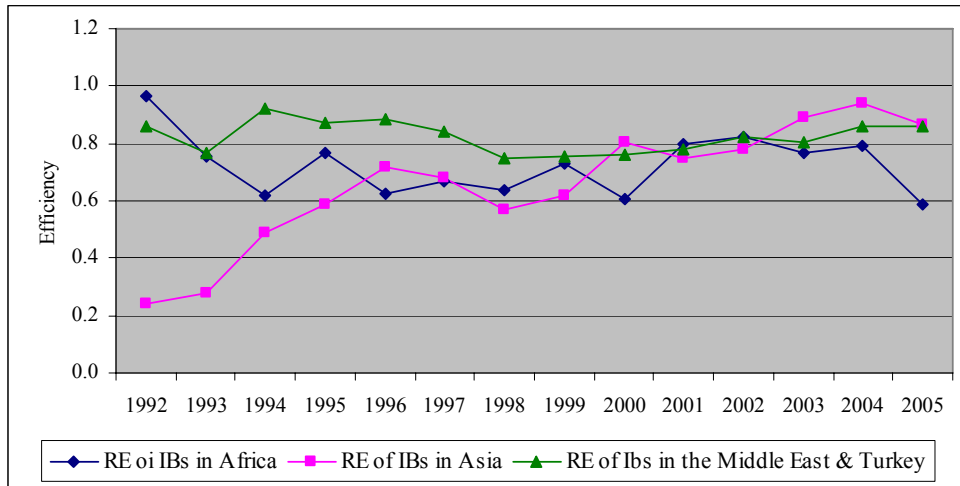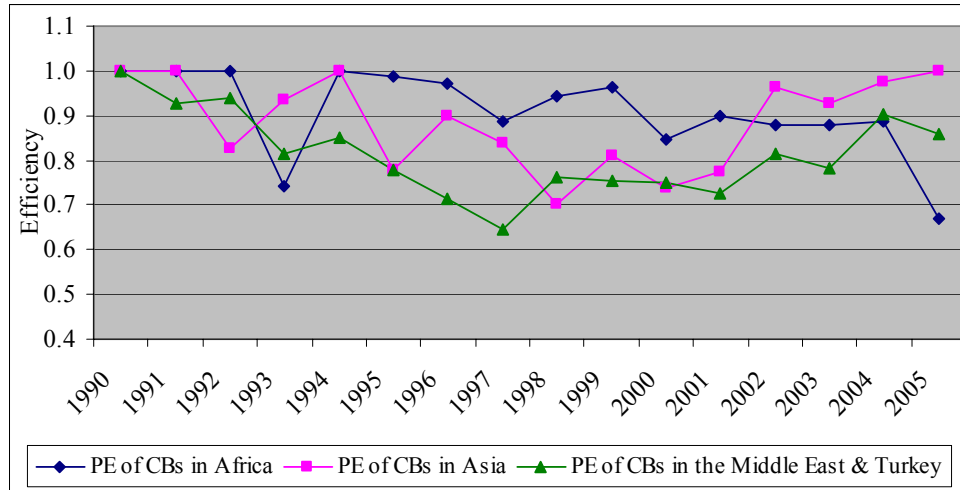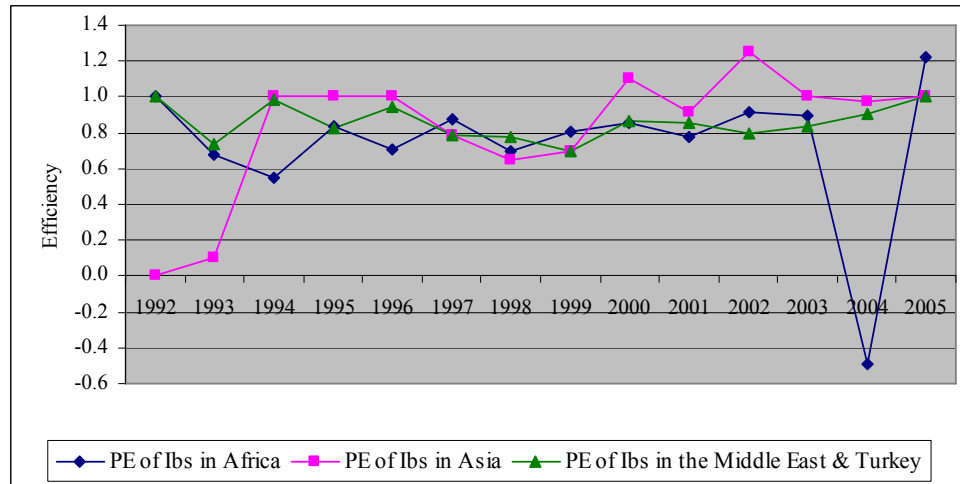
Figure – 16

Profit Efficiency of Conventional Banks in the Selected Regions

In both figures 16 and 17, the financial crisis during the late 1990s had clearly affected both conventional and Islamic banks in Asia, the Middle East and Turkey, and to some extent it also affected the African banks.

Figure – 17

Profit Efficiency of Islamic Banks in the Selected Regions

Implications of the Findings

Bank efficiency studies are of crucial importance for operational and academic purposes (Berger *et al.*, 1997). In this regard, managers, regulators, investors,

borrowers, and depositors find the efficiency studies helpful in evaluating bank performance. Equally, this study offers certain benefits to banks' stakeholders. For example, managers can determine the outcomes of the pervious management decisions and bank regulators are concerned about the safety and soundness of the banking system and preserving the public confidence in the banking systems. These findings could help them review their policies on the financial system. Further, efficiency evaluation in this study is most useful for individual investment or loan decisions. In addition, creditors and investors use such efficiency evaluation study in two general ways: First, to judge past performance and current position of banks. Second, to judge future potential and the risk connected with that potential. Consequently, drawing efficiency results of banks can help improve their overall investment performance.

These findings contribute to the government's policy reviewing the performance of the banks in different systems and on licensing new conventional and Islamic banks in the economy. Similarly, recent drive among banks towards downsizing, rightsizing and rationalization has direct implications on the issue of banks' cost, revenue and profit efficiency.[24] This study focused on the period 1996-2005 where significant changes occurred in the banking system. Therefore the findings on the changes of efficiency in the banking system over this period and efficiency analysis between different sizes, ages and regions provides an important input for revising guidelines making the banking industry globally competitive.

Finally, the study provides a guide for bankers to evaluate their cost, revenue, and profit performance and hence chart their milestones in achieving the desired level of performance over a designated period of time. Thus, the information from the evaluation can be used to improve managerial performance, identify the strength and weaknesses of the banks and strategies to improve over their competitors. In this regard, the results of this study are useful for stakeholders to help them make better decisions.

5. SUMMARY

The results in this paper indicate that there is a slack in the usage of resources across all banks, as measured by the efficiency results of the average bank. Therefore, there is substantial room for more cost, revenue, and profit efficiency in both banking systems. That means the slack needs to be removed.

The average bank is better in utilizing its resources than in generating profits and that most inefficiency comes from the revenue side. Thus, both conventional and Islamic banks had to improve their revenue efficiency. One of the main findings suggests that there is no significant difference between the overall efficiency results of conventional and Islamic banks. Given the advantages that the conventional banks enjoy over the Islamic banks, the results in this paper are in

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[24] See Berger and Humphrey, 1997; and Akhtar, 2002.

favor with the later banking system.

The research reported in this paper is substantially different from the prior work in this area in three main ways. First, it investigates cost, revenue, and profit efficiency, whereas previous studies focus on cost, profit, or cost and profit efficiency. Very few studies have investigated these three efficiency concepts and none of them compared conventional and Islamic banks. Second, this study distinguishes cost, revenue, and profit efficiency differences among big versus small, old versus new, and banks based in their regions, which make it possible to get more detailed view of the insights on the efficiency issue. Further, this paper compares both banking streams based on size, age, and region. Third, this paper addresses the age issue in Islamic banks. However, we suggest that possible extensions of the study must be considered, as this study is not an end in itself but serves as a starting point for further investigations.

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Appendix: TA - 1

List of all Banks Examined by this Study

No.	Bank Code*	Bank Name
1	ARA-AG-I-S-N	Al Rayan Algerian Bank
2	BBA-AG-I-B-N	Banque Al Baraka d'Algerie-Albaraka of Algeria
3	CAB-AG-C-S-N	CAB-Compagnie Algérienne de Banques
4	CPA-AG-C-B-O	Crédit Populaire d'Algérie
5	ABI-BH-I-S-O	Al Baraka Islamic Bank BSC
6	GIB-BH-C-B-O	Gulf International Bank BSC
7	SBB-BH-I-B-O	Shamil Bank of Bahrain EC
8	TAB-BH-C-S-O	TAIB Bank B.S.C.
9	AIB-BD-I-S-N	Al-Arafah Islami Bank Ltd.
10	IBB-BD-I-B-O	Islami Bank Bangladesh Limited
11	OBL-BD-C-S-N	One Bank Limited
12	SB-BD-C-B-O	Sonali Bank
13	BB-BN-C-S-N	Baiduri Bank
14	IBB-BN-I-B-O	Islamic Bank of Brunei bhd.
15	IDBB-BN-I-S-N	Islamic Development Bank of Brunei Bhd
16	ACM-EG-C-S-O	Alexandria Commercial and Maritime Bank SAE
17	ESF-EG-I-S-O	Egyptian Saudi Finance Bank
18	FIB-EG-I-B-O	Faisal Islamic Bank of Egypt
19	NBE-EG-C-B-O	National Bank of Egypt
20	AGI-GM-I-S-N	Arab Gambian Islamic Bank
21	GTB-GM-C-S-N	Guaranty Trust Bank (Gambia) Limited
22	TBL-GM-C-B-O	Trust Bank Limited (The Gambia)
23	BM-ID-C-B-N	Bank Mandiri
24	BS-ID-C-S-O	Bank Swadesi
25	BSM-ID-I-B-N	Bank Syariah Mandiri
26	PBMI-ID-I-S-N	PT Bank Muamalat Indonesia Tbk
27	BM-IR-I-B-O	Bank Mellat
28	BT-IR-I-B-O	Bank Tejarat
29	EDB-IR-I-S-N	Export Development Bank of Iran
30	KB-IR-I-S-O	Karafarin Bank
31	AB-JO-C-B-O	Arab Bank Plc
32	IIA-JO-I-S-N	Islamic International Arab Bank
33	JCB-JO-C-S-O	Jordan Commercial Bank
34	JIB-JO-I-B-O	Jordan Islamic Bank for Finance and Investment
35	ALI-KW-I-S-N	A'Ayan Leasing and Investment Company
36	BB-KW-C-S-O	Burgan Bank SAK
37	KFH-KW-I-B-O	Kuwait Finance House
38	NBK-KW-C-B-O	National Bank of Kuwait S.A.K.
39	ABL-LB-I-S-N	Al Baraka Bank Lebanon SAL
40	AFH-LB-I-B-N	Arab Finance House Holding SAL

No.	Bank Code*	Bank Name
41	BLOM-LB-C-B-O	BLOM Bank s.a.l.
42	NEC-LB-C-S-O	Near East Commercial Bank SAL
43	AMB-MY-C-S-O	AMBB Capital Berhad
44	BIM-MY-I-B-O	Bank Islam Malaysia Berhad
45	BMM-MY-I-S-N	Bank Muamalat Malaysia Berhad
46	MAY-MY-C-B-O	Malayan Banking Berhad - Maybank
47	AIB-PK-I-S-N	Albaraka Islamic Bank BSC (EC)-Pakistan Branches
48	FB-PK-I-B-N	Faysal Bank Ltd
49	MBL-PK-C-S-N	Mybank Ltd
50	NBP-PK-C-B-O	National Bank of Pakistan
51	QID-QA-C-S-N	Qatar Industrial Development Bank
52	QII-QA-I-S-N	Qatar International Islamic Bank
53	QIB-QA-I-B-O	Qatar Islamic Bank SAQ
54	QNB-QA-C-B-O	Qatar National Bank
55	ARB-SA-I-B-O	Al Rajhi Bank
56	BJ-SA-I-S-O	Bank Al-Jazira
57	NCB-SA-C-B-O	National Commercial Bank (The)
58	SHB-SA-C-S-O	Saudi Hollandi Bank
59	BIS-SL-I-S-N	Banque Islamique du Sénégal
60	ECO-SL-C-S-N	Ecobank Senegal
61	SGB-SL-C-B-O	Société Générale de Banques au Sénégal
62	BKH-SD-I-B-O	Bank of Khartoum
63	BNM-SD-I-S-O	Blue Nile Mashreq Bank Ltd
64	ONB-SD-I-B-N	Omdurman National Bank
65	TIS-SD-I-S-O	Tadamon Islamic Bank
66	BFT-TN-C-S-O	Banque Franco-Tunisienne
67	BES-TN-I-S-O	Beit Ettamouil Saoudi Tounsi - B.E.S.T. Bank
68	STB-TN-C-B-O	Société Tunisienne de Banque
69	ATK-TY-I-S-O	Albaraka Türk Katilim Bankasi AS-Albaraka Turk Participation Bank
70	AKB-TY-I-B-N	Asya Katilim Bankasi AS
71	CBK-TY-C-S-N	C Bank-Bankpozitif Kredi ve Kalkinma Bankasi AS
72	TIB-TY-C-B-O	Turkiye is Bankasi A.S. - ISBANK
73	BLC-AE-C-S-O	BLC Bank (France) SA.
74	DIB-AE-I-B-O	Dubai Islamic Bank plc
75	EIB-AE-I-S-O	Emirates Islamic Bank PJSC
76	NBA-AE-C-B-O	National Bank of Abu Dhabi
77	IBY-YE-I-S-N	Islamic Bank of Yemen for Finance and Investment
78	NBY-YE-C-B-O	National Bank of Yemen
79	SBY-YE-I-B-N	Shamil Bank of Yemen & Bahrain
80	YCB-YE-C-S-N	Yemen Commercial Bank

* Bank Code include the initials of the bank's name, initial of the bank's country, and the first letter of the bank's category, where I: Islamic; C: Conventional; B: Big; S: Small; O: Old; and N: New. For example, the code (**YCB-YE-C-S-N**) of bank number 80 in the above list points **Y**emen **C**ommercial **B**ank which is based in **YE**MEN and it is (**C**ommercial, **S**mall, and **N**ew bank).

Appendix : TA - 2

List of the Details of Banks in this Study

Bank No.	Bank Code	Country	Total Assets (last year)	Years Analyzed	No. of Obser.	Estab. Year
1	ARA-AG-I-S-N	ALGERIA	5,200 mil DZD	2001-2003	3	2000
2	BBA-AG-I-B-N	ALGERIA	39 bil DZD	1995-2004	10	1991
3	CAB-AG-C-S-N	ALGERIA	7,347 mil DZD	2000-2002	3	1999
4	CPA-AG-C-B-O	ALGERIA	410 bil DZD	1994-2004	11	1966
5	ABI-BH-I-S-O	BAHRAIN	454 mil US$	1992-2004	13	1987
6	GIB-BH-C-B-O	BAHRAIN	22,857 mil US$	1998-2005	8	1975
7	SBB-BH-I-B-O	BAHRAIN	1,526 mil US$	1993-2005	13	1982
8	TAB-BH-C-S-O	BAHRAIN	435 mil US$	1990-2005	16	1979
9	AIB-BD-I-S-N	BANGLADESH	15,337 mil BDT	95-05 (ex 96, 00)	9	1995
10	IBB-BD-I-B-O	BANGLADESH	122,880 mil BDT	1992-2005	14	1983
11	OBL-BD-C-S-N	BANGLADESH	13,420 mil BDT	1999-2004	6	1999
12	SB-BD-C-B-O	BANGLADESH	337,687 mil BDT	1992-2005	14	1972
13	BB-BN-C-S-N	BRUNEI	1,713 mil BND	1994-2004	11	1994
14	IBB-BN-I-B-O	BRUNEI	2,649 mil BND	1997-2004	8	1980
15	IDBB-BN-I-S-N	BRUNEI	1,841 mil BND	1994-2004	11	1995
16	ACM-EG-C-S-O	EGYPT	2,011 mil EGP	1990-2005	16	1981
17	ESF-EG-I-S-O	EGYPT	4,492 mil EGP	1992-2004	13	1980
18	FIB-EG-I-B-O	EGYPT	15,615 mil EGP	1992-2005	14	1977
19	NBE-EG-C-B-O	EGYPT	160,116 mil EGP	1990-2005	16	1898
20	AGI-GM-I-S-N	GAMBIA	108 mil GMD	1997-2000	4	1997
21	GTB-GM-C-S-N	GAMBIA	350 mil GMD	2003-2004	2	2002
22	TBL-GM-C-B-O	GAMBIA	1,791 mil GMD	1999-2004	6	1978
23	BM-ID-C-B-N	INDONESIA	263,383 bil IDR	1999-2005	7	1999
24	BS-ID-C-S-O	INDONESIA	829 bil IDR	1993-2004 (ex 96)	11	1989
25	BSM-ID-I-B-N	INDONESIA	8,273 bil IDR	2000-2005	6	1999
26	PBMI-ID-I-S-N	INDONESIA	5,210 bil IDR	1996-2004	9	1992
27	BM-IR-I-B-O	IRAN	208,868 bil IRR	1992-2005	14	1980
28	BT-IR-I-B-O	IRAN	168,178 bil IRR	1993-2005	13	1979
29	EDB-IR-I-S-N	IRAN	11,999 bil IRR	1997-2005	9	1991
30	KB-IR-I-S-O	IRAN	6,544 bil IRR	2000-2005	6	1979
31	AB-JO-C-B-O	JORDAN	16,816 mil JOD	1990-2005	16	1930
32	IIA-JO-I-S-N	JORDAN	402 mil JOD	1998-2004	7	1998
33	JCB-JO-C-S-O	JORDAN	220 mil JOD	1993-2004	12	1977
34	JIB-JO-I-B-O	JORDAN	1,129 mil JOD	1992-2004	13	1978
35	ALI-KW-I-S-N	KUWAIT	265 mil KWD	2002-2004	3	1999
36	BB-KW-C-S-O	KUWAIT	1,890 mil KWD	1991-2005	15	1975
37	KFH-KW-I-B-O	KUWAIT	4,681 mil KWD	1993-2005	13	1977
38	NBK-KW-C-B-O	KUWAIT	6,200 mil KWD	1991-2005	15	1952
39	ABL-LB-I-S-N	LEBANON	38,189 mil LBP	2002-2003	2	1992
40	AFH-LB-I-B-N	LEBANON	74 mil US$	2004	1	2004
41	BLOM-LB-C-B-O	LEBANON	17,767 bil LBP	2000-2005	6	1951
42	NEC-LB-C-S-O	LEBANON	214 bil LBP	1992-2004	13	1950
43	AMB-MY-C-S-O	MALAYSIA	12,579 mil MYR	1995-2005	11	1976
44	BIM-MY-I-B-O	MALAYSIA	15,849 mil MYR	1995-2005	11	1983
45	BMM-MY-I-S-N	MALAYSIA	10,270 mil MYR	1999-2005	7	1998
46	MAY-MY-C-B-O	MALAYSIA	191,895 mil MYR	1993-2005	13	1960
47	AIB-PK-I-S-N	PAKISTAN	14,619 mil PKR	2003-2005	3	2002
48	FB-PK-I-B-N	PAKISTAN	110,664 mil PKR	2002-2005	4	1994
49	MBL-PK-C-S-N	PAKISTAN	17,219 mil PKR	1994-2005	12	1992
50	NBP-PK-C-B-O	PAKISTAN	577,719 mil PKR	1990-2005	16	1949
51	QID-QA-C-S-N	QATAR	351 mil QAR	1998-2004	7	1997
52	QII-QA-I-S-N	QATAR	6,336 mil QAR	1992-2005	14	1990

Bank No.	Bank Code	Country	Total Assets (last year)	Years Analyzed	No. of Obser.	Estab. Year
53	QIB-QA-I-B-O	QATAR	9,552 mil QAR	1995-2005	11	1982
54	QNB-QA-C-B-O	QATAR	50,060 mil QAR	1990-2005	16	1964
55	ARB-SA-I-B-O	SAUDIA ARABIA	95,038 mil SAR	2000-2005	6	1988
56	BJ-SA-I-S-O	SAUDIA ARABIA	14,169 mil SAR	1992-2005	14	1975
57	NCB-SA-C-B-O	SAUDIA ARABIA	145,789 mil SAR	1991-2005	15	1938
58	SHB-SA-C-S-O	SAUDIA ARABIA	39,958 mil SAR	1990-2005	16	1976
59	BIS-SL-I-S-N	SENEGAL	42,664 mil XOF	96-97 and 02-04	5	1990
60	ECO-SL-C-S-N	SENEGAL	75,199 mil XOF	1999-2005	7	1999
61	SGB-SL-C-B-O	SENEGAL	376,458 mil XOF	1994-2004	11	1962
62	BKH-SD-I-B-O	SUDAN	156,003 mil SDD	1997-2005	9	1913
63	BNM-SD-I-S-O	SUDAN	16,758 mil SDD	1999-2003	5	1982
64	ONB-SD-I-B-N	SUDAN	265,170 mil SDD	1995-2004	10	1993
65	TIS-SD-I-S-O	SUDAN	43,424 mil SDD	1993-2004	12	1981
66	BFT-TN-C-S-O	TUNISIA	106 mil TND	1998-2004	7	1989
67	BES-TN-I-S-O	TUNISIA	208 mil US$	1993-2004	12	1983
68	STB-TN-C-B-O	TUNISIA	4,501 mil TND	2003-2004	2	1957
69	ATK-TY-I-S-O	TURKEY	1,460,789 th TRZ	2004	1	1984
70	AKB-TY-I-B-N	TURKEY	2,641,933 th TRZ	2001-2005	5	1996
71	CBK-TY-C-S-N	TURKEY	222,405 th TRZ	2002-2005	4	1999
72	TIB-TY-C-B-O	TURKEY	71,364,544 th TRZ	2001-2005	5	1924
73	BLC-AE-C-S-O	UA EMIRATES	427 mil AED	2002-2003	2	1973
74	DIB-AE-I-B-O	UA EMIRATES	42,998 mil AED	1993-2005	13	1975
75	EIB-AE-I-S-O	UA EMIRATES	2,309 mil AED	2003-2004	2	1976
76	NBA-AE-C-B-O	UA EMIRATES	83,661 mil AED	1991-2005	15	1963
77	IBY-YE-I-S-N	YEMEN	17,573 mil YER	1998-2003	6	1995
78	NBY-YE-C-B-O	YEMEN	64,580 mil YER	1991-2005	15	1970
79	SBY-YE-I-B-N	YEMEN	1,526 mil US$	2004-2005	2	2002
80	YCB-YE-C-S-N	YEMEN	33,408 mil YER	1993-2005	13	1993

Total Observations = 752
Average observation per bank = 9.3875
Maximum observations = 16
Minimum observations = 1

Figure: A - 1

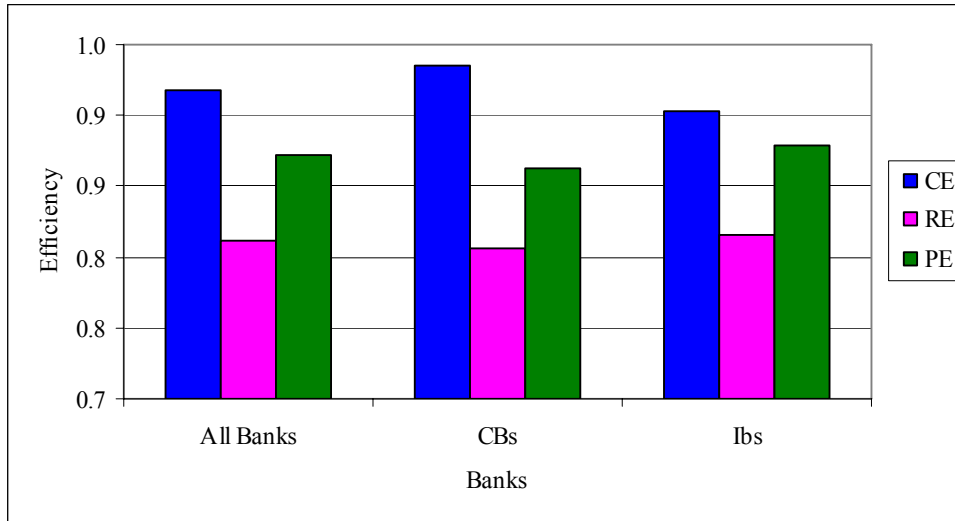**Average Cost, Revenue, and Profit Efficiency of Conventional, Islamic and All Banks**

Figure: A – 2

Average Cost, Revenue, and Profit Efficiency of Old versus New Conventional and Islamic Banks
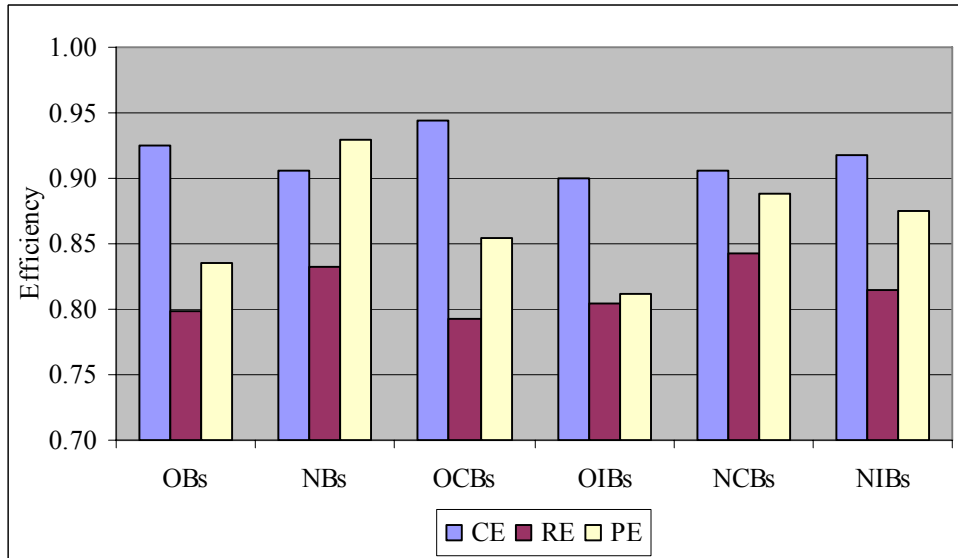
Figure: A – 3

**Cost, Revenue, and Profit Average Efficiency of
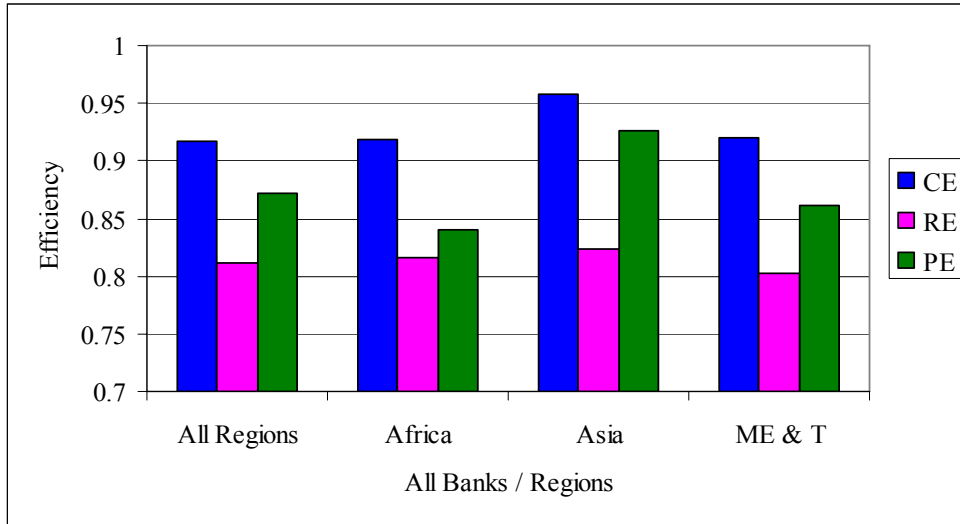All Banks in the Selected Regions**

Figure: A – 4

**Average Cost, Revenue, and Profit Efficiency of Conventional vs.
Islamic Banks in the Selected Regions**