Performance and Cost Efficiency of Islamic Banks in Pakistan; Alternative Models

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DEDICATED

To

Hassaan Omer, Haiqa Omer and their mother

ABSTRACT

Efforts were exerted at several fronts by many socio-economic institutions of Pakistan to establish Islamic financial system in Pakistan. In 2002 authorities established such a system where Islamic and conventional institutions are working side by side after different trials to implement interest free financial system in Pakistan. Data from 2001-2009 have been used to estimate cost efficiency time variant fixed effect model for entire banking industry and from 2006-2009 to estimate cost efficiency model for Islamic banking industry in Pakistan through data envelopment analysis. This study compares the cost efficiency of Islamic banking with that of conventional banking system of Pakistan. The results indicate that as a group Islamic banks are relatively more cost efficient than conventional banks. Within conventional banking industry, public sector banks are the most cost efficient banks and specialized banks are the least cost efficient banks. It is allocative inefficiency which is primarily contributing to the cost inefficiency of Islamic banks in Pakistan. When we break down the efficiency scores we find that source of cost inefficiency for Pakistani banks are few banks in their individual capacity.

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CHAPTER-1

INTRODUCTION

1.1 Background

Financial institutions are imperative organs of the economic structure. A very close relationship lies between nature and extent of economic growth and the health and efficiency of financial sector (Levine 1997, Patrick 1966). In the development literature, considerable emphasis has been laid on the development of sound financial sector. Overall economic stability is heavily dependent on efficient allocation of resources by financial institutions when they are performing as financial intermediary between savers and investor in the economy (Kunt and Levine 2004). As in developing countries bonds and capital markets are not as developed as in the developed countries so bank financing is favored by the investor over bond and capital market (Niazi 2003). In last two decades financial system of the world has become vibrant undergoing many changes and developments. It has offered some new products and paradigms to cater financial requirements of the economy. Recent financial crisis has changed the perspective of the people about financial matters of the world.

Out of these new developments, Islamic banking and finance is the most significant one in the new financial framework of the world. In 2010 assets of Islamic banking worth more than US$ 1 trillion in assets (M. I. Hussein 2010) and it enjoys a healthy

growth rate of 8.85 percent (The Banker 2010). Today Islamic banking has become worldwide phenomenon. Islamic banking has extended its network to more than 60 countries that goes beyond the Islamic world covering leading global financial centers (Akhtar 2007). Even conventional financial institutions realizing the importance of Islamic financing techniques and they have started to incorporate these techniques into their lending practices and through separate Islamic departments or windows. Hence conventional banks now compete with Islamic institutions either directly or through their own Islamic operations (Brown, Hassan and Skully 2007)

1.2 Motivation

Quran, *Sunnah* and ethical beliefs of Islam are quiet explicit over the efficient use of resources as a whole and on other side there is strong condemnation of wastage of resources. In this respect, a saying of Prophet (SAW) "*If one sees the end of the world while he has in his hand little plant and he is able to plant it in the ground, he should do it Allah (SWT) will reward him*[1]" the word Hass'an and Ah'san which means better and best, have been used more than 300 times in Quran as an adjective for different acts of Muslims daily life which include economic social and political affairs. So Allah (SWA) demands from Muslims to behave not in better but a best way in their daily life. This attitude of efficient execution of task becomes more obvious when we deeply look into the prudential regulation of Islamic financial contracts. In Islamic Economic framework it is not the absolute concept of efficiency which is required but along with the efficiency

[1] Al-Munawi, Fayd al-Qadir, iii. 30.

there are other objectives also been required which are termed as *Maqisd-u-Sharia'h* (Objectives of Islamic law).

In the second half of 20th century new form of Islamic banking started its operations as an alternative to commercial banking in the Muslim world. On the basis of those theoretical foundations which were in contrast with the commercial banking fundamentals. Islamic banking is a trillion dollar industry working parallel to commercial banking both in Muslims and other parts of the world. Now it is natural to ask which way of doing financial intermediation is most economical or efficient. Both methods are dealing with the same issue of financial intermediation between investors and savers in the economy. Researchers have answered this question both quantitatively (Brown, Hassan and Skully 2007) and quantitatively (Badar et al, 2008; Mohammad et al, 2007; Hassan, 2005; Yudistira, 2003; Al-jarrah & Molyenux, 2007) and find mixed results. In some studies Islamic banks are found to be more efficient and in some studies (Al-jarrah and Philip, 2007; Hussein, 2004) opposite results are found(Hassan, 2005; Mokhtar et al, 2006; Yudistira, 2003). Still the literature on the efficiency comparison of both financial systems is near to the ground.

The quest for interest free banking in Pakistan was started with the independence of Pakistan. But initially it was at personal level and more of theoretical nature rather than practical initiative. In1985 government had taken the initiative of transforming the whole financial system of the country into interest free financial system. But it was failed, because few prerequisites to this initiative like *Shariah* compliance, training of agents and proper financial contract to conduct *shariah* based financing were not taken care of properly. *Federal Shariat court* in 1991 and *Supreme Court* in 1999 nullify all

efforts by government to setup Islamic financial system and declare all these initiatives not in accordance with *shariah*. Second effort was made by both private and public sectors in 2000 and start Islamic banking side by side with conventional banks but this time Islamic banking had to prove its merits on standalone basis. SBP policies were quite clear regarding Islamic banking in new framework.

> *The basic difference in SBP's current policies regarding Islamic banking and the previous efforts is the approach adopted by it. SBP has not approached Islamic Banking solely as a religious or a legal issue. It considers it to be more of a change management issue.....The new system will be implemented, tried and tested and therefore would prove its merit on a standalone basis. The roll out will be market led rather than through legal means or as a religious dictate (SBP, 2007).*

As Islamic and conventional banks perform the same function with the difference of *Sharia'h* compliance and it is natural to ask which course of action to perform the function of financial intermediation is more efficient. Answer to this question become more inevitable when we see the affairs of Islamic banks in the new regulatory and legal framework where Islamic banks have to work in a competitive environment with their conventional counterparts. Along with this change management policy of SBP Islamic banks are facing Deposit Investment gap problem in recent years. In 2010 this gap has reached up to 95 billion rupees. Operating expenses to income ratio for Islamic banks is much higher than conventional banks which are 71.8% and 52.8% respectively (SBP, 2010). Islamic banks are also facing a recovery issue because of some *Sharia'h* constraints. Non-performing financing (NPF) of Islamic banking industry is very critical to soundness of these institutions this NPF is more than 10.6 billion rupees in year 2010

(SBP, 2010). How all these factors affect the cost structure of Islamic banks and then the cost efficiency of these banks in Pakistani banking industry? The literature on Islamic banking efficiency of Pakistan is quite silent over these questions. Financial reforms and their impact on financial sector efficiency is the only issue which has been explored in little detail for conventional banks (Burki and Niazi 2009, Qayyum 2008, Patti and Hardy 2005)[2]. In efficiency perspective only one study (Qayyum 2010) available that addresses the issue of productivity of Islamic banks in Pakistan. So the cost structure of Islamic banks, impact of Non-performing loans over this structure and then the Cost efficiency of Islamic banks are still those questions which need analytical attention.

1.3 Objective

This study attempts to provide empirical evidence on the Cost efficiency of Islamic Banks of Pakistani banking industry. The specific objectives of the study are

- To examine the impact of Non-performing loans on the Cost structure of Pakistani banks
- To explore the Time variant cost efficiency scores of Islamic banks in Pakistan.
- To look into the differences in cost efficiency scores of different banks(Islamic as well as conventional) on the size, type and ownership basis

[2] For details see Chapter 3 on literature review

1.4 Methodology

Both parametric and non-parametric techniques have been used to investigate the cost efficiency structure of Pakistani banking industry in general and Islamic banks in particular. For a parametric approach translog cost function has been used to represent the technology of the industry. Time-variant cost efficiency scores have been estimated with fixed effect model. Data envelopment analyses have been used to investigate the intra Islamic banking industry comparison of cost efficiency. For input and output variable selection we have used intermediation approach. Panel of 38 banks have been used in this study where 6 banks are Islamic and 32 are conventional banks and data ranges from 2001 to 2009. Because of entry and exit, renaming of banks, mergers and acquisition number of banks differ with time. That is why we observed unbalanced panel for the period of our study

1.5 Organization

This study is divided into six parts. Chapter one is devoted to the introduction, Chapter two provides the history of Islamic banking. Chapter three reviews the relevant literature, Chapter four describes the Data and methodology used in present study. Chapter five presents empirical results and their analysis. Conclusion and policy implications of this study are given in Chapter six.

CHAPTER-2

HISTORY OF ISLAMIC BANKING

2.1 Rational of Islamic banking

One of the most established Islamic economic fact is "*Prohibition of riba*" (interest)[3]. *Quran, Sunnah* and all other sources of *Sharia'h* are in consensus over the prohibition of *riba*. It has been concluded by the respected and globally acceptable forum of Jeddah *Fiqh* academy that commercial and banking interest is not allowed under *Sharia'h* as it comes under the definition of *riba* (Usmani, 1998). The 1999 Supreme Court of Pakistan Judgement explains the *Sharia'h's* view point over *riba* as:

> *"Early and contemporary Islamic scholars unanimously maintain that any predetermined excess or return over and above the loan capital taken for either commercial or consumption purpose is strictly prohibited by all the sources of Sharia'h"*

Now the second very important aspect which needs to be answered is the *Sharia'h's* view point about the financial intermediation. In the early history of Muslims a financial contract is reported *al mudarib udarib* in which an agent mobilizes funds on *mudarabah* basis and then extends these funds to other persons on *mudarabah* basis and same function was performed with *ijarah* (lease) contract. Some precedents of financial

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[3] Al-Quran 30:39,4:161,3:130,2:275-281
Hadith - Sahih Bukhari, Volume 3, No. 299; Narrated 'Aun bin Abu Juhaifah, r.a.
Hadith - Sahih Bukhari, 2.468, Narrated Samura bin Jundab, r.a.
It is the principle of Islamic jurisprudence if a *hukam* is established through explicit text of *Quran* and *Sunnah* (primary sources) then no other secondary source abrogate or even elaborate the *hukam* so *Riba* is *haram* (prohibited). There is consensus (Ijmmah) of *Ummah* that contemporary practice of banks comes under the domain of *Riba*

intermediation in Islamic history have also been reported by Gilani (2005). As noted by Iqbal, Ahmad and Khan (1998) that "*Islamic scholars consider the earning of profits from an intermediary role as a genuine occupation*" but this financial intermediation must be interlinked with trade and production of goods and services.

Combining the preceding facts of prohibition of *Riba* and practice of financial intermediation within Islamic society rationalizes the need of such financial system which is not based on *Riba* and also in conformity with principles of *Sharia'h*. Here Islamic banking comes into the coliseum of financial intermediation.

2.2 Model of Islamic Banking

As financial intermediation is the most efficient way of mobilizing funds from savers and then extending these funds to investors in the economy. Financial intermediation is also acceptable in *Sharia'h*. Commercial financial institutions perform this function of financial intermediation by paying interest to depositors and charging interest from the investor and the difference between two is the profit of the financial institutions which is not in conformity with *Sharia'h*. Fig. 2.1 explains this process graphically.

Islamic banks perform the same function of financial intermediation as their conventional counterparts but in a different way. The initial model of Islamic banking is named as *Dual-Mudarabah* or *Two tiers Mubarbah Model*. This is the first workable model of Islamic banking (Tahir, 2009) which makes this model very important at least for theoretical reasons. This model works as follows:

On deposit mobilization side Islamic bank works as working agent for depositors and they share the profit as pre agreed rate and in the case of loss depositor will bear the

whole loss. At lending side Islamic bank acts as sleeping partner and investor becomes the working agent and they share profits as pre agreed ratio and Islamic bank will bear the entire loss as previously depositor was bearing it. Fig. 2.2 explains this process graphically. The current model of Islamic banking based on various Islamic financial contracts on both deposit mobilization and lending side these contracts may vary country to country. Fig. 2.3 explains this process graphically.

Figure 2.1

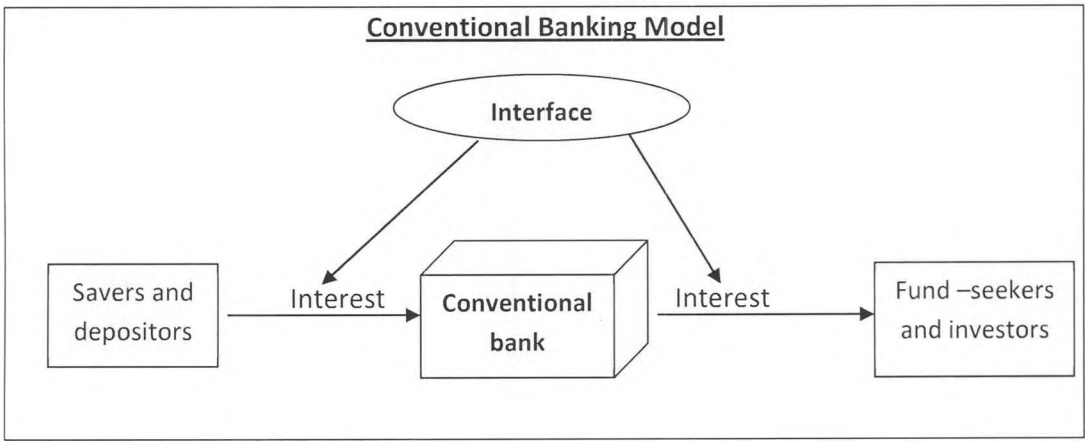


Figure 2.2

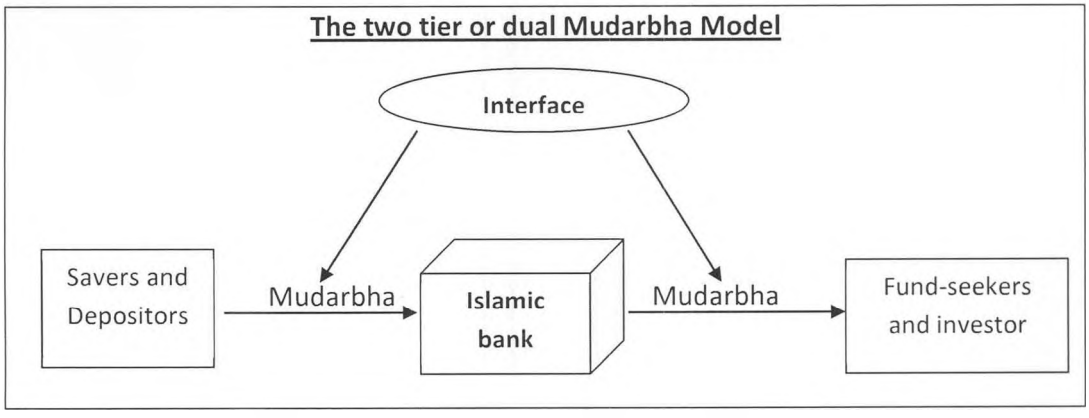
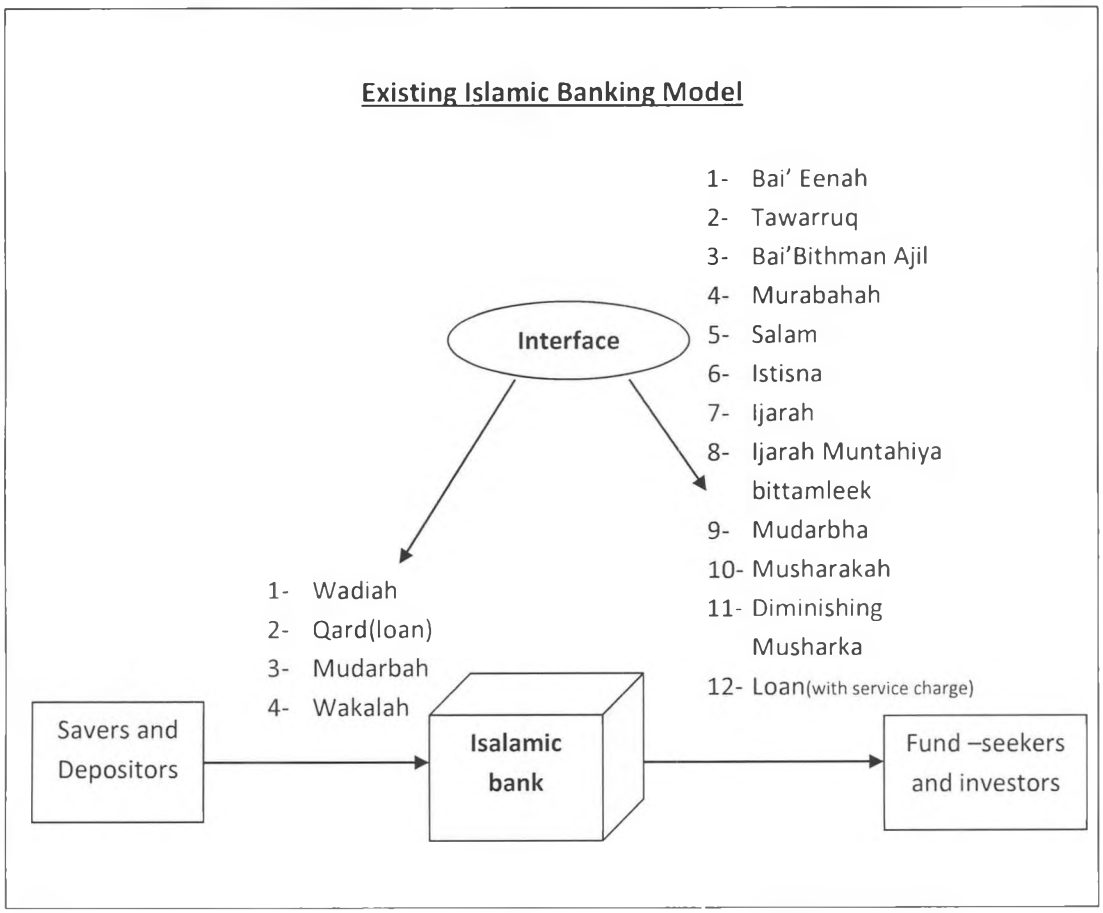


Figure 2.3



2.3 Evolution of Islamic Banking

History of Islamic banking starts with the birth and emergence of Islam fourteen hundred years back. When we talk about Islamic banking history, it means we are talking about the practice and implementation of Islamic financial instruments. We can divide this evolution into two phases. The first phase of Islamic banking starts with the emergence of Islam and ends at colonial period. Second phase which is the revival of Islamic banking practices starts with the end of colonial era from Islamic world to the present

Pre-Colonial era

In the very early periods of Islamic culture Hazrat Muhammad (S.A.W) performed a *Mudarabah* contract as a manager for his wife Hazrat Khadija (R.A) in his early life. In the early seventh century tax of Iraq had been intermediated to *Madina* through *Mudarabah* contract. With the discovery of Geniza (Jewish manuscript) archives Cairo which ranges the history from 850 A.D. to as late as 1880 it become possible to put many new facts in the field of economics thought. As noted by (Cizakca 1995) *"thanks to the latest research conducted in the Geniza archives of Cairo it has been proved that Islamic partnership dominated the business world for centuries and that concept of interest found very little application in day-to-day transactions*" S. D. Goitein 1971 states that commerce and industry of Mediterranean region was mainly revolved around *Mudarabah* and *Musharkah* in 12^{th} and 13^{th} century. Many other researchers like Gerber (1975), Firestone (1975), Goitein (1964) and Roelofsz (1970) have found similar results as Cizakca (1995) for the different time periods and geographical locations.

Post-Colonial era

Second phase of Islamic banking starts with the end of colonial era in Muslim world. As Muslim world got independence from colonial regimes they had started thinking about those institutions which are endogenous and in accordance with Islamic world view. Emergence of commercial banking after industrial revolution posed a serious challenge to Islamic intelligentsia to give viable substitute for financial intermediation. Islamic financial institutions are the reply to this challenge!

Gilani (1945), Quraishi (1946), Siddiqi (1948) and Ahmad (1952) gave the intellectual breakthrough in the field of Islamic economics and particularly in Islamic finance. Uzair (1955) gave an explicit and workable model of Islamic bank first time. It was a pamphlet but become a great milestone in the field of Islamic economics. His work laid the foundation for the development and growth of IBF on modern lines. Shafi (1960), Maudodi (1961) and Al Sadar (1974) gave more comprehensive account of Islamic banking Model. There are some other classical works which have their value addition in this journey, for the brief account of these studies see Zaman (2008) and Siddiqi (1980). Alongside these intellectual breakthroughs practical initiatives had also been taken for the establishment of Islamic financial institutions. This practical initiative started with the establishment of Mitt Ghamar, Eygept (1963-1967) which was the first institution worked in accordance with Sharia'h. Then Nasser Social bank (1971) was also established in Egypt but at lager scale than its predecessor. The Pilgrimage Management Fund Board Malaysia launched an institution Tabung Hajji which managed and invested the funds of its members who wanted to go for pilgrimage in accordance with sharia. The most significant development in the Islamic banking history was the establishment of Islamic Development Bank (1975) it was the first initiative at international level by the members of Organization of Islamic countries. After that series of financial institutions were established in different parts of the world. Bahrain is now the hub for Islamic financial institutions with 33 Islamic banks 23 Takaful and 3 re-Takaful companies and host to many Islamic infrastructure institutions like AAOIFI, IIFM and IIRA. Saudi Arabia, Qatar, Jordan, Syria and United Arab Emirates are also the key players in Middle East region and there is no doubt without this middle eastern initiative this job cannot be accomplished.

In subcontinent Bangladesh is at top with about 15 percent of deposit share in its local market and seven full fledge Islamic banks. Local authorities of India recently in 2011 allowed operations of an Islamic bank in India. In Africa, Sudan has four Islamic banks and six Takful companies. Last but not least Islamic banking activities have been gradually growing in the Western world. Islamic Bank of Britain (2004) and European Islamic Investment Bank (2006) are working in United Kingdom (UK). Financial services authority has change prudential rules in 2003, 2005 and 2006 to accommodate Islamic financial services in UK. Islamic financial services are also practiced by some conventional financial institution in USA, Canada and Australia.

History of Islamic banking in Pakistan

In 1937 Allama Muhammad Iqbal (R.A) wrote an important letter to Quid-i-Aazm (R.A) in the reply of his question about economic affairs of Muslims in the Muslim state, where majority of Muslims were living in those areas of India which were less developed relative to other parts of the country. Iqbal wrote him that "*we should not be much concerned about the economic affairs of the Muslims. If we apply the Sharia'h framework in the proposed state then I believe that the problem of poverty and development can easily be solved*" (Ghazi, 2010). Personal vision of Quid-i-Aazm (R.A) is quite clear in his speech on the occasion of the opening ceremony of the state bank of Pakistan on 1st July, 1948

> *I shall watch with keenness the work of your Research Organization in evolving banking practices compatible with Islamic ideas of social and economic life. The economic system of the West has created almost insoluble problems for humanity……The adoption of Western economic theory*

and practice will not help us in achieving our goal of creating a happy and contended people. We must work our destiny in our own way and present to the world an economic system based on true Islamic concept of equality of manhood and social justice. (State Bank of Pakistan)

This commitment of founders with Islamic economic system continued to the legislative process which is quite clear from the objective resolution 1949 where state was asked to maintain a socio-economic justice based on Islamic principles. Article-28 of 1956 constitution requires the immediate elimination of *Riba* in all shapes from the economy. In 1962 and 1973 constitutions it is also required to eliminate *Riba* from the economy.

Council of Islamic ideology (CII) was established in 1962 and the foremost responsibility of CII is to advice government about real status of interest in *Quran* and *Sunnah*. In 1969 CII had given the verdict with full consensus of its members that "Bank interest is Riba and bank interest is prohibited in all its shapes". In 1977 a panel was setup in CII to give recommendation about elimination of *Riba* from the economy. This panel was dynamic in its nature. All heads of economics department, heads of all big banks, Deputy Governor of SBP and CII itself was the part of this panel. After two years of keen consideration a report was made. This was the most comprehensive work of its kind. This report got popular in no time all over the world and translation of this report in many languages had been made. This report set guidelines and framework for the future works of Islamization of economy.

Committees were setup in all banks and they have started their homework on those commendations and guidelines given by CII report. Circular No. 13 was issued in

1984 to call all banks to start their shift over and it was also mentioned that no interest based practice would be allowed after 1 July 1985. SBP approved 12 modes of financing to conduct financial services by all banks. But all this was happening under the cover of political interests. Because SBP had adjusted the nomenclature but the process was almost the same as it was earlier to these reforms.

Because of this cover of *profit loss sharing* for commercial banking, some petitions were filed in Federal Shariat Court (FSC) against the interest based practices of banks. Court had given its judgment that "*the existing banking and financial system in Pakistan had hitherto been based on interest and that the government should restructure it under Sharia'h by 30 June 1992*" (Khan and Bhatti, 2008). After this judgment commission for Islamization of economy (CIE) was setup to find major difficulties and hurdles in Islamization process. They submitted their report in 1992 but it was simply the review of previous literature so its effectiveness to become a base for practical initiative was very low. CIE asked for help from International Institute of Islamic economics (IIIE) in 1997. In reply IIIE presented them a very comprehensive work but not enough to convince political regime of that time.

As the judgment of FSC was declared government and some other people file petition against this judgment in *Sharait* Applet Bench of Supreme Court of Pakistan. In1999 Supreme Court upheld the FSC judgment-1992 and ordered government to setup Islamic financial framework in the economy by 30 June 2001 and then extended date to 30 June 2002. Again this initiative got politicized and by some political maneuvering this case was sent back to FSC for review.

In September 2001 it was decided by high officials from CII, SBP, and Finance Ministry that the transition from commercial finance based economy to Islamic finance is a gradual process. We should learn from the experiences of other countries like Egypt, Saudi Arabia and Malaysia where dual banking system is working efficiently (SBP, 2008).

New prudential framework for establishment of full fledge Islamic financial institution was announced in December 2001. Under these new regulations, Meezan Bank was the first bank to get the license for full fledge Islamic bank and start its operation in March 2002. Askari bank, National bank of Pakistan and Bank of Khayber were the first to start Islamic banking services under Islamic Bank branches (IBBs) category. In 2004 a separate section of Islamic Banking department (IBD) was established in SBP to regulate and oversee the emerging Islamic banking industry in Pakistan. Bank Islami Pakistan and Dubai Islamic bank started their operations in 2006. Dawood Islamic bank and Emirates Global Islamic Limited initiated their commercial activities in 2007.

Currently there are 6 full-fledge Islamic financial institutions are working and 13 conventional banks have licenses to operate dedicated Islamic banking branches (IBBs). Top five big commercial banks are providing Islamic financial services. The total assets of the Islamic banks are over Rs. 424 billion as of 30th June, 2010 which accounts for a market share of 6.4 percent of total Pakistani banking industry assets. The market share of deposits stands at 6.7 percent. Total branch network of the Islamic banking industry comprises of 684 branches SBP (2010).

CHAPTER-3

LITERATURE REVIEW

Literature on banking efficiency is generally very extensive in nature. Researchers have explored this topic from various dimensions and viewpoints. We can classify banking efficiency literature into many folds on the basis of methodologies, considered variables, type and number of banks, geographical positions, size and ownership of the considered financial institutions. While reviewing literature, in general we will focus on Islamic banking efficiency worldwide and efficiency of Pakistani banking industry in particular.

This chapter is structured as follows: section 3.1 will discuss the literature on Islamic banking efficiency, section 3.2 confers the efficiency literature on financial institutions in Pakistan in detail and section 3.3 elaborates the trends and patterns emerging from the previous sections.

3.1 Islamic banks

(Mohamad, Hassan and Bader 2007) Use a sample of 80 banks in 21 countries of Organization of Islamic Conference (OIC), comprising of 37 conventional banks and 43 Islamic banks over the period of 1990-2005, this study used SFA to calculate average scores for cost and alternative profit efficiencies. Translog function is used for functional specification. The average cost and profit efficiency scores for all 80 banks are 30.6% and 75.3% respectively. For conventional banks cost and profit efficiency are 29.3% and

75.4% respectively, whereas Islamic banks scored 31.8% and 75.1% respectively. This implies that Islamic banks have performed well relative to their counterparts. This result is not consistent with Hassan (2005).

Al-Jarrah and Molyenux (2007) Investigate Cost Efficiency, Scale Elasticity and Scale Economies of the Jordanian, Egyptian, Saudi Arabian and Bahraini banking systems using Stochastic frontier analysis(SFA). While choosing preferred model for cost efficiency they employed different techniques like log likelihood test to check whether Translog specification have some advantages over Fourier-flexible technique which has been used in recent literature. They find that Fourier-truncated form that excludes the control variables but includes all the environmental variables is preferred over all specifications. Islamic banks are found most cost efficient with average 98% score while investments banks are least efficient with 93% score. Based on bank asset size, large banks appear relatively more cost efficient with 96% Score. Geographically, Bahrain is the most cost efficient country with 99% score while Jordan was the least with 98% score. These results are consistent with (Mohamad, Hassan and Bader 2007) but not with Hassan (2005)

Al-Jarrah (2007) employs The Data Envelopment Analysis (DEA) approach to investigate cost efficiency levels of banks operating in Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000. This study uses the same panel which as in Al-jarrah and Molyenux (2007). The estimated cost efficiency is further decomposed into technical and allocative efficiency at both variables and constant returns to scale. Later on, the technical efficiency is further decomposed into pure technical and scale efficiency. The Cost efficiency scores are about 50% to 70% which is drastically different from the results

previously obtained using SFA which were 95% on average. Geographically Saudi Arabian banks are the most cost efficient banks, where in his previous work Bahrain's banks were the most cost efficient banking system. So the results are indeed sensitive to the techniques (parametric and non-parametric) and scores can vary over a range depending on which technique has been used.

Ahmad, Abdullah and Al-Habshi (2006) examine the efficiency of Malaysian banking industry in general and full fledge Islamic banks, Islamic windows and conventional banks in particular. Six year data is used which ranges from 1997-2003. 288 panel observations, 20 Islamic windows, 2 full fledge Islamic banks and 20 conventional banks were included as cross-sections. They had used SFA to estimate technical and cost efficiency; translog functional specification has been used. Over all technical and cost efficiency of conventional financial system is better than Islamic financial system in Malaysia. Overall efficiency scores are 80.1% and 83.5% for technical efficiency and 80.6% and 87.6% for cost efficiency respectively.

Hassan (2005) examines the profit, cost, revenue and X-efficiency for 43 Islamic banks in 21 countries for each year over the period 1994-2001. It employs SFA to calculate cost revenue and profit efficiency and data envelopment analysis (DEA) to calculate the overall, technical, pure technical, Allocative and scale efficiencies., Malmquist total factor productivity (TFP) indices are also calculated. Overall results for DEA analysis are Cost efficiency is 62%, Allocative efficiency 73%, Technical efficiency 84.3%, pure technical efficiency 95%, Scale efficiency 89.1%. For SFA results are Cost efficiency 73.5% and Profit efficiency 84.4% which means in profit making Islamic banks are more

efficient than curtailing cost. He also claims that over all Islamic financial institutions are less efficient than their counter parts.

3.2 Pakistani banking

Rehman and Raoof (2010) technical, allocative and cost efficiency scores have been calculated through DEA for the period of 1998-2007. This study institutes that public sector banks had performed well relative to foreign and private domestic banks and financial reforms have positive impact on banking efficiency.

Ahmed, Farooq and jalil (2009) Technical, pure technical and scale efficiency scores had been estimated by DEA for the period of 1998-2007. This study finds that overall TE of banks is 80 percent and foreign banks are most efficient followed by public sector banks this result is consistent with most of the studies in this area. Public sector banks have highest score of PTE at the level of 96 percent. But the most interesting result is that foreign banks are the most scale efficient banks, which is not consistent with other studies in this area.

Akhtar (2010) global advantage hypothesis has been tested against home field advantage hypotheses by the mean of efficiency analysis. TE, AE and OE for Pakistani banks have been estimated and the period of the study ranges from 2001-2006. Foreign banks are the most efficient banks with the 43 percent of OE and domestic banks are second with 27.5 percent OE. So in Pakistani banking industry home field advantage hypotheses has been rejected in favor of global advantage hypothesis.

Burki and Niazi (2009) comparative efficiency of domestic and foreign banks with specific reference to financial reforms in Pakistan is the main contribution of this study.

DEA has been used to calculate cost efficiency of Pakistani banking industry. Public sector banks are most inefficient and foreign banks are the efficient one and private banks are in the middle of these two. In first phase (1993-1996) of financial reforms CE declines but in the second phase it starts showing upward trend, this result is consistent with Qayyum (2006). Nonperforming loans are the major contributor to inefficiency and these loans have a very strong negative relationship with inefficiency which complements the results of Ansari (2006).

Burki and Ahmed (2008) estimate cost efficiency by using SFA model of Battese and coelli(1995) which allows for time varying inefficiencies for the unbalanced panel of 41 banks. This study finds that mean cost inefficiency of Pakistani banks is 36% but it is decreasing over time at the rate of 5.7% per annum. This study reveals the fact that privatization of state owned banks lead to short term losses but long term efficiency trends. In general cost efficiency levels of Pakistani banking industry increases after the series of financial reforms in Pakistan.

Akmal and Saleem (2008) DEA model has been estimated by using CRS and VRS for 30 banks. Results show that average efficiency scores for Pakistani banks are 88.2, 91.7 (CRS and VRS respectively). Foreign banks are again the most efficient banks but state owned banks are at top in TFP growth on the basis of ownership. Bank size, asset to total asset and equity to asset ratios have positive and significant relationship with technical efficiency scores.

Qayyum and Khan (2007) this study investigates X-efficiency, scale economies, technological progress in Pakistani banking industry through DFA for the period of 1998-

2005. Efficiency scores for domestic banks are high till 2000 but later foreign banks have performed well. This study reports that scale economies are higher for small banks and particularly for foreign banks. Technological progress is higher in foreign banks relative to domestic banks. By comparing concentration ratio to interest rates spread they find that there is a lack of competition in the banking sector. In the light of above results this study concludes that mergers are more likely to take place in small banks.

Ahmed and Gill (2007) presented that domestic banks started agricultural lending in 2001 after that total share of agricultural lending increased by 50% for domestic private and commercial banks. DEA has been used in this paper for period ranges from 2001 to 2004. This study finds that there is no significant decline in Pakistani banking industry after the start of intensive agricultural lending.

Ansari (2006) estimates the cost inefficiency through DFA (distribution free approach) and translog functional form. This study used the FEM (fixed effect model) by using the panel data from 1991-2002. This study further empowers its results through CAMEL approach. This study finds that NPL (Non-performing loans) lead to 0.05 percent increase in cost which means that NPL are the serious problem to Pakistani financial industry this result endorsed by the fact that top five most efficient banks have least NPL in their advances. Although Salaries have positive impact on cost but the most efficient banks offer high salaries to their employees as compared to inefficient ones. Over all banking relative efficiency ranges from 49 to 87 percent. Foreign banks and some commercial banks constitute the most efficient group and the majority of the public sector banks in the least efficient group.

Qayyum (2006) there has been a series of financial sector reforms in Pakistan at different time intervals. This study tries to empirically investigate the impact of these reforms on banking efficiency. TE, PTE and SE been calculated for the time period of 1991-2005. Group of inefficient banks is always crowded with public sector banks and some of public sector banks which were privatized under reforms have performed well and change their group to efficient ones. Scale inefficiency is always greater than pure technical inefficiency which means Pakistani financial industry facing a scale problem. Study concludes that financial sector reforms are successful in improving the efficiency of the domestic banks in as intermediary in Pakistan.

Patti and Hardy (2005) estimated cost and alternative profit function and decomposed the total variation in these variables into variation in productivity and business condition. This study suggest that in the first reforms 1991-1992 increased the profit productivity of the banks but in second phase of reforms 1998-2008 profit productivity declined and many banks recorded considerable losses the source these losses may be find in negative contribution from the business conditions. The evaluation of average efficiency of Pakistani banks in post and pre reform period show that state-owned bank are the least efficient, which is consistent with the findings in the literature the new private domestic banks generally proved to be among the most efficient, and sometimes outperformed the foreign banks.

Limi (2004) Economies of scale and scope and cost complementarities of Pakistani banking industry have been estimated, in perspective of banking sector reforms in Pakistan. Data ranges from 1998-2001. In this study SUR and SFA models been used to estimate cost efficiency. This study finds inconclusive results about pooling the data of dif-

ferent types of banks in Pakistan by using different estimation method like SFA and SUR models. There exist economies of scale and scope in Pakistani banking industry and non-performing loans are heavy burden for Pakistani financial institutions. Private Banks are the most Cost efficient banks which support the results of other studies on Pakistani banking efficiency. This study suggests that Pakistani banking authorities encourage small and medium size institutions.

Attaullah, Cockerill and Le (2004) calculate the technical efficiency scores for Indian and Pakistani banking industry by DEA method. Attaullah, Cockerill and Le (2004) finds that Pakistani banking industry improved technically from 47 percent to 62.6 percent after the financial reforms Non-performing loan is the worst problem to Pakistani financial industry in addition to it unlike in India financial liberalization in Pakistan unable to increase the efficiency of public sector banks in Pakistan.

Rizvi (2001) has used DEA to calculate technical efficiency scores for Pakistani banking industry for the period of 1993 to 1998 and analyze the effect of financial reforms on the efficiency of financial institution. This study finds that the major source of inefficiency to Pakistani financial industry is foreign owned banks, which is in contrast to other studies in this area and from 5 public sector banks three banks are among the 10 most efficient banks. This study also ascertains that financial reforms have no significant impact on the efficiency of Pakistani banking industry.

3.3 Conclusion

For Islamic banking efficiency literature is not as rich as for their counterparts and there are very few studies available which exclusively explore the efficiency structure of

Islamic financial institutions in Pakistan. Most of the studies in this area use cross country data to evaluate the Islamic banking performance (Badar et al, 2008; Mohammed et al, 2007; Hassan, 2005; Yudistira, 2003; Al-jarrah and Molyneux, 2007). Both parametric and non-parametric techniques have been used (Badrul Hisham et al, 2008 and Saaid et al, 2003). There are mix results regarding the comparative efficiency of Islamic banks over their conventional counterparts some studies found Islamic banks more efficient (Al-jarrah and Philip, 2007; Hussein, 2004) but some studies established opposite results (Hassan, 2005; Mokhtar et al, 2006; Yudistira, 2003) and some discovered no difference in performance of both institutions (Badar et al, 2008).

The observed literature on financial institutions of Pakistan is not only scant but is also of a recent epoch (Niazi, 2003). Main question which have been explored in the literature about financial institutions in Pakistan is financial reforms and their impact on banking efficiency, nine out of fifteen studies in table. 3.1 have answered this question. Studies on financial reforms are in consensus that efficiency of financial institutions in Pakistan have improved after these reforms except few have divergent view point (Rizvi, 2001) In general foreign banks are the most efficient and public sector banks are the most inefficient banks (Akhtar, 2010; Ansari, 2006; Burki and Ahmed, 2008) but contrary results are also been there but very few (Usman et al, 2010; Rizvi, 2001). Non parametric techniques dominated the econometric techniques; ten studies used DEA to evaluate the performance of banking sector. There is an agreement among all studies about the input-output definition of the banks. All 15 studies have used intermediation approach to define banks function.

Table 3.1 (a)

Summary of efficiency literature on banking industry of Pakistan

Author (Date)	*Sample period*	*Concept of Efficiency*	*Technique*	*Functional form*	*Input Output technique*
Rehman and Rsoof (2010)	1998-2007	TE,AE,CE	DEA	N/A	INT
Usman et al (2010)	2001-2008	TE,PTE,SE	DEA	N/A	INT
Akhtar (2010)	2001-2006	TE,AE,OE	DEA	N/A	INT
Burki and Niazi (2009)	1991-2000	TE,AE,CE	DEA	N/A	INT
Burki and Ahmed (2008)	1991-2005	CE	SFA	Translog	INT
Akmal and Saleem (2008)	1995-2005	TE,SE	DEA	N/A	INT
Qayyum and Khan (2007)	2000-2005	CE,SE,TECH	DFA	Fourier-flexible	INT
Ahmed and Gill (2007)	2001-2004	TE	DEA	N/A	INT

Ansari (2006)	1991-2002	CE,SE	DFA	Translog	INT
Qayyum (2006)	1991-2005	TEPTE,SE	DEA	N/A	INT
Patti and Hardy (2005)	1981-2002	CE,PE	SFA	Trans-log(LESS-FLEXIBLE)	INT
Atsushi Limi (2004)	1998-2001	CE,TE,SE,SC	SFA	Translog	INT
Attaullah, Cockerill and Le (2004)	1988-1998	TE,PTE,SE	DEA	N/A	INT/INCOME
Rizvi (2001)	1993-1998	TE,PTE,SE	DEA	N/A	INT

Table 3.1 (b)

Summary of efficiency literature on Islamic banking industry

Author (Date)	*Sample period*	*Concept of Efficiency*	*Technique*	*Functional form*	*Input Output technique*	*Region*
Badar et al (2008)	1990-2005	CE,RE,PE	DEA	N/A	INT	Countries sample from Asia Africa Middle East and Turkey
Mohammed et al (2007)	1990-2005	CE,PE	SFA	Translog	INT	Countries sample from Asia Africa Middle East and Turkey
Badrul Hisham et al (2008)	1998-2004	CE,PE,TE,AE,SE,PTE	DEA	N/A	INT	Malaysia
Hassan (2005)	1994-2001	CE,PE	SFE/DEA	Translog	INT	21 Muslim countries
Mokhtar et al (2006)	1997-2003	CE,TE	SFA	Translog	INT	Malaysia
Elzhai Said et al (2003)	1989-1998	CE,TE.AE	SFA	Translog	INT	SUDAN
Yudistira(2004)	1997-2000	TE,PTE,SE	DEA	N/A	INT	12 countries from Middle East, Africa, East Asia, Gulf
Al-Jarrah and Molyneux(2007)	1992-2000	CE,SE	SFA	Fourier-flexible	INT	Jordan,Egypt,Saudi Arab,Bahrain
Al-Jarrah(2007)	1992-2000	CE.TE.PTE, SE	DEA	N/A	INT	Jordan,Egypt,Saudi Arab,Bahrain

CHAPTER-4

DATA AND METHODOLOGY

4.1 Introduction

Study of efficient frontier began with the seminal paper of Farrell (1957). He split the efficiency into two components technical efficiency (maximum output with given inputs) and allocative efficiency (optimal mix of inputs at given prices). Before measuring the efficiency of any production unit, it is necessary to specify the concept of efficiency (Hassan, 2005). X- Efficiency[4], Technical efficiency and Economic efficiency[5] which further extended to Cost, Profit and Revenue efficiency are some of these concepts. According to Berger and Mester (1997), the two most important economic efficiency concepts are cost and profit efficiency.

There are two general approaches which are commonly used to measure efficiency scores. They are *parametric approach* using econometric techniques and *nonparametric approach* utilizing linear programming method Coelli (2005). The difference between these two approaches is mainly about how they handle the error term and assumptions about efficient frontier Ahmed et al (2006). Each of the techniques has its own strengths and weaknesses.

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[4] **X-inefficiency** is the difference between efficient behaviour of firms assumed or implied by economic theory and their observed behaviour in practice. It occurs when technical-efficiency is not being achieved due to a lack of competitive pressure Leibenstein, Harvey (1966)

[5] **Economic efficiency** refers to the use of resources so as to maximize the production of goods and services Sullivan, Arthur; Steven M. Sheffrin (2003)

The parametric approach has the advantage of allowing noise in the measurement of inefficiency but we need to specify functional form so there is a chance of misspecification. On the contrary in non-parametric approach there is no need to specify functional form and it is relatively less rigorous than parametric approach Coelli (2005). However, it suffers from the drawback that it does not allow for noise to be taken into account so all deviations from best practice bank will be attributed to inefficiency. Some parametric methods are the Stochastic Frontier Approach (SFA), Fixed effect approach (FEA), Thick Frontier Approach (TFA) and the Distribution Free Approach (DFA). Some non-parametric techniques are the Free Disposal Hull analysis (FDH) and the Data Envelopment Analysis (DEA).

In the present study two techniques one from each group (parametric and non-parametric) have been used. Time variant fixed effect model from the parametric group and data envelopment analysis from non-parametric group. Structure of bank's cost under these two techniques has also been discussed. Parametric technique has been used to estimate the cost efficiency results of whole banking sector so that we may be able to analyze the different paradigms of banking in Pakistan. Non-parametric technique has been used to examine the intra Islamic banking industry efficiency difference in Pakistan

4.2 Parametric Cost efficiency

At basic level, the objective of producers can be as simple as seeking to avoid waste, by obtaining maximum outputs from given inputs or minimizing inputs use for given outputs. In this case the notion of efficiency corresponds to what we call technical efficiency. At higher level, the objective of producers might demand the production of

given outputs at minimum cost or the utilization of given inputs to maximize revenue, or the allocation of inputs and outputs to maximize profit. In these cases productive efficiency corresponds to what we call economic efficiency, and the objective of producers become one of the attaining a higher degree of economic (cost, revenue, or profit) efficiency (Kumbhakar and Lovell, 2000).

So it is a behavioral objective of the producer that changes basic objective (technical efficiency) into a higher objective (economic efficiency). This behavioral objective can be cost minimization, revenue or profit maximization that ultimately leads to respective concept of (cost, revenue or profit) efficiency. In this study we will examine the cost efficiency concept analytically. We will focus on cost efficiency concept because of few reasons; first, under economies of scale some financial institutions do not correspond to the behavioral objective of profit maximization. Even in such cases, financial institutions minimize their costs (Iimi, 2004). Second, no doubt at cost minimization side Islamic financial institutions are behaving same as commercial banks but at profit maximization side they have to follow some other objectives along with profit maximization (Brown, Hassan and Skully 2007)

Cost efficiency is defined as for a given technology how far a bank's cost is from the best practice bank's cost, so we need to find an efficient cost frontier. The efficient frontier is determined by two conditions, Technical efficiency and Allocative efficiency. The nonexistence of either technical or allocative efficiency essentially leads to a departure from condition of cost minimization and creates inefficiency (Hassan 2005).

When we are estimating cost efficiency, we define cost efficiency as the ratio of minimum feasible cost (C*) to observed expenditure (C) (Kumbhakar and Lovell, 2000). Thus, cost efficiency CE = C*/C implies that, it would be possible to produce the same vector of production by reduction in cost of (1 – CE) percent (Ansari, 2006). Cost efficiency score attains values over (0,1]. A score of 0.8 for a bank implies that it is 80% cost efficient or it wastes 20% of its cost relative to a best practice bank in the sample. It implies that, 1 represents the best practicing bank while 0 refers to the worst one in the sample. Fries et al (2004) and Meeuseu & Broeck (1977) define firm's cost as:

$$C_b = C(Y, w, \varepsilon) \qquad (1)$$

The C_b total operational cost of the bank is a function of output vector Y, vector of input prices w and the composite error term ε. This is an indirect representation of bank's total cost. We will later specify some particular functional form for Bank's cost. Before that we need to briefly interpret the composite error term.

$$\varepsilon = \mu + \gamma \qquad (2)$$

μ is an inefficient factor which rises total cost of the bank. It accounts for the mistakes of the management like suboptimal mix of inputs or shirking behavior of the employees. So we may call it endogenous factor. γ is a statistical noise which accounts for misspecification of model or things which are not in control of the management of bank like economic environment and government policy. In logarithmic terms and assuming that the inefficiency and statistical noise terms are multiplicatively separable from the remaining arguments of the cost function,

$$\ln C_b = f(Y, w) + \ln\mu + \ln\gamma \qquad (3)$$

On the basis of the estimation of a particular functional form f, cost efficiency (E_C) is measured as the ratio between the minimum costs (C_{min}) necessary to produce the output vector and the realized costs (C) (Maudos, et al. 2002)

$$E_c = \frac{C^{min}}{C} = \frac{exp[f(Y,w)]exp(\ln\gamma)}{exp[f(Y,w)]exp(\ln\mu)exp(\ln\gamma)} = exp(-\ln\mu) \qquad (4)$$

Estimation of the Cost model

Before the seminal work of Pitt and Lee (1981), estimation of stochastic frontier models were restrained only to the cross-sectional data. Schmidt and Sickles (1984) have pointed out three major drawbacks in the estimation of cross-sectional stochastic frontier models. First, technical efficiency of any cross-sectional unit (firm or individual) cannot be estimated consistently. Second, MLE (maximum likelihood estimation) of the model required the assumption that technical inefficiency term be independent of the regressors. Third, MLE required some assumptions about the distribution of technical inefficiency and it is not clear how robust ones result after these assumption. Access to panel data enables us to avoid all above mentioned problems (for details see Schmidt and Sickles, 1984) along with those issues which are general to econometrics models like heterogeneity, multicollinearity and the omitted variable problem (Kennedy, 2008).

Panel data also allows us to use standard fixed and random effect models (Maudos, et al. 2002). Estimation of stochastic frontier models mostly revolves around three analytical techniques; MLE, Fixed effect (FEM) model and Random effect (RE)

model. We will use FEM panel data model to estimate cost efficiency of banking industry in Pakistan because of its relative advantages over other two techniques in our case.

The fixed effect model has some advantages over other alternative methods of estimating cost inefficiency with panel data like MLE and RE models. FEM diminish and might even avoid the simultaneous equation bias associated with single equation production function model (Ahmed, et al. 1996). MLE and RE require strong distributional assumptions (e.g., half-normal, exponential) over inefficiency term μ_b (Sena, 2003). Independence of inefficiency term μ_b from regressors is also required in these techniques which means that if a firm knows its inefficiency level it does not change its input choice (Schmidt and Sickles, 1984). This assumption is very unrealistic to efficiency analysis whereas fixed effect model has the ability to cope these problems while maintaining its simplicity and consistency.

This study will consider a single equation model and it is found in a Monte carlo evaluation that single equation models performed better than multi-equation model (Ahmed, et al. 1996). Translog functional specification has been used because of its parsimonious nature, flexibility and its ability to accommodate multiple outputs without violating curvature properties of output space (Kumbhakar and Lovell, 2000).

$$lnC_{bt} = \alpha_o + \sum_{i}^{2} \beta_i \, lny_{ibt} + \frac{1}{2}\sum_{i}^{2}\sum_{j}^{2} \beta_{ij} lny_{ibt} lny_{jbt} + \sum_{k}^{3} \delta_k \, lnw_{kbt}$$

$$+ \frac{1}{2}\sum_{k}^{3}\sum_{m}^{3} \delta_{km} ln\, w_{kbt} lnw_{mbt} + \sum_{i}^{2}\sum_{k}^{3} \rho_{ik} lny_{ibt} lnw_{kbt} + \tau_1 T$$

$$+ \frac{1}{2}\tau_2 T^2 + \sum_{i}^{2} \varphi_i T \, lny_{ibt} + \sum_{i}^{2} \pi_i T \, lnw_{kbt} + \gamma_{bt} + \mu_b \qquad (5)$$

$$b = 1,2, \ldots N, t = 1,2 \ldots T$$

Where b indexes banks, t indexes time period, y_{ibt} is the i_{th} output for the b_{th} bank in time t, w_{kbt} is the k_{th} input price for b_{th} bank in time t, T is a smooth time trend that accounts for the technological change, we assume that γ_{bt} are $iid(0, \sigma^2)$ which means they follow all distributional assumptions and characteristics of OLS residuals and it is not correlated with the regressors. μ_b is the cost inefficiency term and correspondingly $\mu_b \geq 0$ for all b. In FEM μ_b is treated as firm specific effects. They become producer specific intercept parameters, which are to be estimated along with slope parameters of equation (5). Now we can write an intercept term in a different way.

$$\alpha_{oi} = (\alpha_{oi} + \mu_b) \qquad (6)$$

Now it is prolific to write equations (5) in terms of equation (6)

$$lnC_{bt} = \alpha_{oi} + \sum_{i}^{2} \beta_i \, lny_{ibt} + \frac{1}{2}\sum_{i}^{2}\sum_{j}^{2} \beta_{ij} lny_{ibt} lny_{jbt} + \sum_{k}^{3} \delta_k \, lnw_{kbt}$$

$$+ \frac{1}{2}\sum_{k}^{3}\sum_{m}^{3} \delta_{km} ln\, w_{kbt} lnw_{mbt} + \sum_{i}^{2}\sum_{m}^{3} \rho_{ik} lny_{ibt} lnw_{mbt} + \tau_1 T$$

$$+ \frac{1}{2}\tau_2 T^2 + \sum_{i}^{2} \varphi_i T \, lny_{ibt} + \sum_{m}^{2} \pi_m T \, lnw_{mbt} + \gamma_{bt} \qquad (7)$$

Equation 7 can be estimated using least square dummy variable model (LSDV). Young's theorem requires the symmetry restrictions be imposed:

$\beta_{ij} = \beta_{ji} \quad \delta_{km} = \delta_{mk}$

Liner homogeneity in input prices which means if all input prices are doubled the costs are exactly doubled and parametric restriction for homogeneity is:

$\sum_{k}^{3} \delta_k = 1 \quad \sum_{m}^{3} \delta_{km} = 0 \quad \sum_{i}^{3} \rho_{ik} = 0 \quad \sum_{m}^{2} \pi_m = 0.$

$\alpha_{oi}, \beta_i, \beta_{ij}, \delta_k, \delta_{km}, \rho_{ik}, \tau_1, \tau_2, \varphi_i, \pi_m$ are the parameters to be estimated and definition of other variables are same as above. In the cost functions, costs and prices are normalized by the (w_1) to impose linear input price homogeneity. Intercept will be found with a minimum value by the means of normalization

$$\hat{\alpha}_o = min(\hat{\alpha}_{oi}) \qquad (8)$$

And then we calculate a measure of μ_b

$$\hat{\mu}_b = (\hat{\alpha}_{oi} - \hat{\alpha}_o) \qquad (9)$$

The expression of cost efficiency become

$$CE_b = exp(-\ln\mu_b) \qquad (10)$$

The important characteristic of $\hat{\mu}_b$, it is equal to zero for the most efficient firm in the sample. We do not interpret this inefficiency measure as an absolute inefficiency but inefficiency of a firm b relative to the other firms in the sample (Greene, 2002). Slope parameters and $\hat{\mu}_b$ can be estimated consistently by the mean of LSDV whether $\hat{\mu}_b$ is correlated with regressors or not as N and T $\rightarrow +\infty$ (Schmidt and Sickles, 1984).

4.3 Time varying inefficiency

Although fixed effects time invariant approach has many distinct characteristics like independence, consistency and requiring no distributional assumption on μ_b but if the time interval is longer the time invariance assumption is less tenable and robustness of the model make no economic sense (Green, 2007; Fried, Lovel and Shmidt, 2007; Sena, 2003). The assumption that Cost inefficiency is time invariant can be relaxed by allowing banks specific intercepts to vary over time but at the cost of additional parameters to be estimated. To estimate time varying inefficiency model we follow Cornwell, Schmidet, and Sickles (1990). This model can be estimated in two steps, in first step estimate equation (5) by OLS and get the composite error term ε_{it} and this composite error term is composed of both inefficiency and statistical noise

$$\varepsilon_{bt} = \mu_b + \gamma_{bt} \qquad (11)$$

In the second step, regress ε_{it} over banks specific dummies, time and time square

$$\varepsilon_{bt} = \sum \Omega_{i1} D_b + \sum \Omega_{b2} D_b T + \sum \Omega_{b3} D_b T^2 + \Pi_{bt} \quad (12)$$

Where D_b is bank specific dummies T is time variable and Π_{bt} follows all assumption of OLS residual $\Pi_{bt} \sim N(0, \sigma^2)$. The predicted values from equation (12) are μ_{bt} which varies across banks and time. Now we can write the time variant firm specific inefficiency estimates.

$$CE_{bt} = \frac{\exp(\hat{\mu}_{bt})}{max_b(\hat{\mu}_{bt})} \quad (13)$$

The quadratic specification allows us to get estimates of cost inefficiency which varies across producer and time. If $\Omega_{b2} = \Omega_{b3} = 0 \ \forall_i$ then this model will collapse to time invariant cost efficiency.

4.4 Nonparametric Cost efficiency

To explain the concept of cost efficiency (CE) consisting of allocative efficiency (AE) and technical efficiency (TE) we assume a bank which uses two inputs (i.e., x_1 and x_2) to produce one output (i.e., q). Let the efficient production function of a bank is

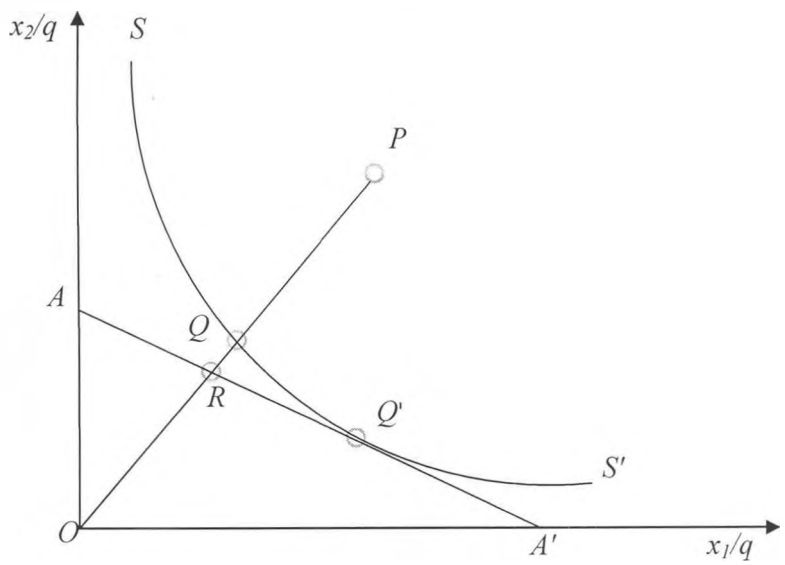
$$q = f(x_1, x_2) \quad (14)$$

If the constant return to scale[6] assumption is assumed equation 14 can be written as

$$1 = \left(\frac{x_1}{q}, \frac{x_2}{q}\right) \qquad (15)$$

After the transformation of equation 14 into equation 15 it is possible to present the technology in efficient unit isoquant (EUI) (Qayyum, 2008). This efficient unit isoquant is locus of all technically efficient combination of inputs used to produce one unit of output. Curve SS' in figure 4.1 present EUI[7]. All points on the right and above of SS' curve are inefficient and all points below and right of SS' curve are not feasible.

Figure: 4.1
Technical and Allocative Efficiencies from Input Orientation



[6] Constant return to scale assumption allows one to present a technology using unit isoquant it is also possible to present non-constant returns to scale, multiple inputs and multiple outputs (Coelli, Prasada and Battese 2005)

[7] This efficient frontier is not known in practice but one have to estimate it from sample data by using techniques like DEA and SFA (Lovell, 1993)

Let point P represent the combination of inputs x_1 and x_2 used by bank to produce a one unit of output q and this point P lies above the EUI. Technical efficiency (TE) of a bank using the input combination represented by point P is the ratio OQ/OP. Therefore 1-OQ/OP represents the technical inefficiency of a bank using the input combination represented by point P, this ratio represents the percentage by which all inputs need to be reduced to achieve technically efficient production while input ratio (x_1/x_2) and output level are constant (Coelli, Prasada, & Battese, 2005; Qayyum, 2008). Now the input oriented[8] measure of technical efficiency is

$$TE = OQ/OP$$

This indicator of technical efficiency would take values between zero and one and hence provide an indicator of the degree of technical efficiency of the bank (Coelli, Prasada and Battese 2005). A value closer to one indicates that level of inputs for a given output is closer to technically efficient point and vice versa. If the value TE is exactly equals to one it means the bank is fully efficient technically and its inputs combination for given output lies on efficient frontier and if the value is exactly zero it means that bank is completely technically inefficient and it lies away from the efficient frontier.

If the price information is available on inputs x_1 and x_2 then it is possible to find the combination of inputs which is economically efficient. Let's assume that price in-

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[8] Achieving minimum inputs use for given outputs is called input oriented technical efficiency alternatively one can achieve the other side of coin by achieving maximum outputs for a given inputs which is called out-put oriented technical efficiency for details see Coelli, Prasada and Battese (2005) and Kumbhakar and Lovell (2000)

formation is available and line AA' is an isoprofit line where its slope is ratio of input prices. Isocost line is a locus of those input combinations which minimize the cost of producing given level of output. This isoprofit line is tangent to EUI at Q' which is economically efficient input combination to produce given level of output q. difference between Q and Q' is that, Q is technically efficient point for a bank but not allocativelly efficient and Q' is both technically and allocativelly efficient point for a bank which means Q' is economically efficient input combination. Now if P is an input combination used by a bank then the measure of allocative efficiency is the ratio OR/OQ. Consequently the inefficiency is $1-(OR/OQ)$. So the measure of allocative inefficiency is

$$AE = OR/OQ$$

Value of allocative efficiency remains between zero and one. a value closer to one means a bank is producing more closer to the input combination which is allocativelly efficient and if a value is closer to zero it means the bank is away from the input combination which is allocativelly efficient. Allocative efficiency is independent of technical efficiency of the bank. The measure of overall cost efficiency (CE) can be obtained by the product of technical efficiency and Allocative efficiency measures (Farrell, 1957). So the measure of CE is

$$CE = TE \times AE = (OQ/OP) \times (OR/OQ) = (OR/OP)$$

Measure of cost efficiency is also bounded by zero and one and this measure have same explanation as AE and TE. Farrell's measures of CE dose not required any functional form

4.5 Data Envelopment Analysis

Data envelopment analysis (DEA) is a linear programing technique that has emerged as an alternative technique to estimate efficiency in the financial sector (Al-jarrah, 2007). Originally this idea was disscused in Farrel (1957) where he proposed an efficiency benchmark of piecewise-linear convex isoquant in such a manner that all point lie left or below of this isoquant (Qayyum 2008). Charnes, Cooper and Rhodes (CCR) (1978) was the first to use the term Data Envelopment Analysis in the literature for Farrel's idea of efficiency (Coelli, Prasada and Battese 2005). Model used by CCR could only accommodate constant return to scale (CRS) and had input orientation. In a major development by Banker, Charnes and Cooper (BCC) (1984) they have extended the CCR model to accommodate technologies that exhibit variable returns to scale (VRS) (Cooper, Seiford and Tone 2002). The subsequent literature on DEA is spinning around CCR-BCC models weather it is theoretical or applied in nature (Ray, 2004).

As econometric methodologies are largely based on central tendencies but DEA is a methodology which deals with frontiers. So in DEA we construct a frontier (piecewise linear surface) which rest on top of the data rather than fitting a line through center of the data as in classical linear regression (Cooper, Seiford and Zhu 2004). In DEA we construct frontier of input-output ratios of Decision-Making-Units (DMU)[9] by linear programing technique from sample data. These frontiers are determined by those DMUs which are the most efficient among other firms in the sample data (Al-jarrah,

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[9] This term was first proposed by Charnes, Cooper and Rhodes (1978) after that applied researchers start using 'DMU' instead of 'firm' in DEA litrature

2007). So if the DMUs are on the frontier it means they are most efficient one and they will receive the value of unity and if they are not on the frontier then they considered to be the inefficient one and receive a value less than unity.

The relationship between observations and frontier is not based on any explicit model so that is why DEA do not require any functional form. DEA has the ability to accommodate multiple inputs and multiple outputs. Independence of unit (both input and output) is another important feature of DEA which enhances the flexibility and capability of DEA.

DEA can accommodate both constant returns to scale (CRS) and variable returns to scale (VRS) assumptions. But the assumption of constant returns to scale is not appropriate when DMUs are not operating at optimal scale, facing financial constraints or imperfect competition. VRS is more appropriate assumption if DMU is facing any of the above conditions (Banker, Charnes and Cooper 1984). If price information is available then it is possible to estimate Cost, Revenue and Profit frontiers using DEA. To decompose above economic efficiency concepts into technical and allocative efficiency is less rigorous and easy to estimate in DEA than conventional econometric techniques.

For intra-industry analysis of Islamic banking industry, cost efficiency has been estimated through DEA and then decomposed cost efficiency into its technical and allocative parts. Input-oriented technical efficiency and VRS assumptions have been used to estimate final scores of cost efficiency. Econometric techniques cannot be used for intra industry analysis because of degree of freedom problem so DEA is preferred methodology in this case.

Efficiency measures attained through DEA or based on maximizing the ratio of all outputs over all inputs. To postulate the mathematical formulation assume that there are, *K,* DMUs which are producing M number of outputs by converting N number of inputs. For *i*-th DMU inputs are represented by column vector x_i and outputs are represented by a column vector y_i. Now the input Matrix $K \times N$ is denoted by X and output matrix $K \times M$ denoted by Y. Both X and Y represents the input-output data of all *K* DMUs. Assuming constant returns to scale the efficiency of DMU is represented by as following:

$$Max_{u,v}(u'y_i/v'x_i)$$

St:

$$u'y_j/v'x_j \leq 1, \qquad j = 1\,2\,3 \ldots\ldots K$$

$$u, v \geq 0 \tag{16}$$

u' and v' are vectors of outputs and inputs weights respectively. The problem is to find optimal weights by Liner Programing (LP) in such a way that *i*-th firm maximizes its own measure of efficiency, subject to the constraint that efficiency measure of a bank cannot exceed one and input and output weight are positive (Coelli, Prasada, & Battese, 2005; Qayyum, 2008)

The LP formulation (16) is known as *ratio* form, it is not liner in nature and it has the problem of infinite number of sloutions (Hassan 2005; Coelli, Prasada and Battese 2005). To avoind these problems one can impose a constraint $v'x_i = 1$ which provides the following mathimatical formulation which is known as *multiplier* form

$$Max_{\mu,v}(\boldsymbol{\mu}'y_i)$$

St:

$$\boldsymbol{v}'x_i=1$$

$$\boldsymbol{\mu}' y_j - \boldsymbol{v}' x_j = 1, \qquad j = 1\,2\,3 \ldots\ldots\ldots K$$

$$\boldsymbol{\mu}, \boldsymbol{v} \geq 0 \tag{17}$$

Change of notation from u and v to $\boldsymbol{\mu}$ and $\boldsymbol{v}$ is used to stress that it is a new LP problem. Dual of the above problem which is more preferred form to solve in literature is

$$Min_{\theta,\lambda}\, \theta$$

St

$$-y_i + Y\lambda \geq o$$

$$-\theta x_i + X\lambda \geq o$$

$$\lambda \geq o \tag{18}$$

Fewer constraints are required in above dual form so that's why it is more preferable form to solve in literature. θ is a scalar and λ is a vector of constants, other variables are same as above. θ is a measure of technical efficiency for the i-th firm (Ray 2004). The above LP problem is solved for each DMU, which means we have to solve this LP problem K times (Coelli, Prasada and Battese 2005).

The CRS LP problem (18) can easily be modified to accommodate VRS by adding a convexity constraint $K1'\lambda = 1$.

$$Min_{\theta,\lambda}\, \theta$$

St

$$-y_i + Y\lambda \geq o$$

$$-\theta x_i + X\lambda \geq o$$

$$K1'\lambda = 1$$

$$\lambda \geq o \tag{18}$$

If the information on prices is available then we can estimate cost minimization problem and decompose allocative and technical efficiencies. VRS cost minimization problem will be so

$$Min_{\lambda,x_i^*} w_i' x_i^*$$

St

$$-y_i + Y\lambda \geq o$$
$$x_i^* + X\lambda \geq o$$
$$K1'\lambda = 1$$
$$\lambda \geq o \qquad (19)$$

Where w_i' is a $N \times 1$ vector of input prices, x_i^* is a vector of cost minimizing input quantities for the i-th DMU and other variables are as discussed above. Now the measure of cost efficiency is defined as the ratio of minimum cost to observed cost.

$$\boldsymbol{CE = w_i' x_i^* / w_i' x_i}$$

The allocative efficiency is calculated residually (Ray 2004) and the measure of allocative efficiency is as following:

$$\boldsymbol{AE = CE/TE}$$

4.6 Data and construction of variables

Data is collected from the *Annual Reports* of banks and various issues of Banking Statistics of Pakistan for all scheduled banks operating in Pakistan. Banking statistics of Pakistan is issued by SBP, this statistical supplement has the annual financial information like different balance sheet items, expenditure, assets and revenue for all operating banks

in Pakistan. In this study we have used an un-balanced panel of 38 scheduled banks in Pakistan for the period of 2001-2009. First, we classify the sample on the basis of *Sharia'h* compliance in the financial institution, so out of these 38 banks 6 banks are Islamic and 32 banks are commercial. Second, we classify the sample on the basis of ownership, Nature of work, so we have 4 public sector commercial banks, 4 specialized banks, 24 domestic private banks and 6 foreign Banks, names and details are in (**Table A 4.1**).

Because of entry and exit, renaming of banks, mergers and acquisition number of banks differ with time. That is why we observe 24 banks for 2001; 25 banks for 2002; 26 banks for 2003; 28 banks for 2004; 29 banks for 2005; 34 banks for 2006; 37 banks for 2007; 38 banks for 2008; 38 banks for 2009.

Input and output variables Approaches

Although there is immense literature on banking efficiency but still there is no agreement over the definition of inputs and outputs for the financial institutions. Mainly there are three approaches competing in the literature, Intermediation, Production and User cost approach

In intermediation approach the role of financial institutions is considered to be an intermediator of funds between savers and investors. Under intermediation approach, deposits are considered inputs along with the physical inputs of the firm (i.e., Labour, Capital) and net earning assets are as outputs of the financial firm. Because deposits are considered as inputs so the cost is inclusive of both interest and operating expenses of financial institution (Sealey and Lindley, 1977).

Under production approach role of financial institutions is to produce financial services for their clients like loan applications, credit reports, demand drafts or other payment instruments, and insurance policy or claim forms (Berger and Humphry, 1997). Number of transactions completed is an output and only physical inputs are considered as inputs and only operating expenses are covered under cost.

The question that any financial product is input or output is answered in a very different way under User cost approach. Berger and Humphry (1992) defines it "*If the financial returns on an asset exceed the opportunity cost of funds or if the financial costs of a liability are less than the opportunity cost, then the instrument is considered to be an financial output. Otherwise, it is considered to be a financial input*". So it is the opportunity cost not the financial firms decision which plays a decisive role while making the input outputs decision. There are some difficulties and drawbacks in this approach; first, adjustment is required for the opportunity cost is required for different banking characteristics of financial products like liquidity, maturity and level of risk associated to particular financial product. Second, outputs become inputs and inputs become outputs due to slight changes in the data (Berger and Humphry, 1992)[10]. Because of these disadvantages frequency of this approach is very low in literature that is why production and intermediation approaches are dominant in the literature.

We have used intermediation approach rather than production approach because of the following advantages

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[10] Detail discussion on this approach is available in (Berger and Humphry, 1992) and (Hancock 1985a, 1985b)

- Intermediation approach is the most frequent approach in efficiency literature to model a financial firm (Kawn, 2002). The literature we have reviewed for present study in Table. 3.1(a) and Table. 3.1(b) not a single study has used production approach for modeling a financial firm. In another survey of literature (Ahmed et al, 2006) 35 out of 49 studies have used intermediation approach and only 5 have used production approach
- Intermediation approach has the advantage of being more comprehensive and able to capture the spirit of financial intermediation (Berger et al, 1997).
- As in this study we are evaluating the entire banking sector (Scheduled Banks) and intermediation approach is superior in such cases because it is inclusive of interest expense (Berger and Humphry, 1997).
- In cost minimization firms minimize not there production cost but the total cost but under production approach cost includes operating expense only on contrary intermediation approach includes both interest and operating expense (Berger and Humphry, 1997).
- The basic foundation of Islamic financial institutions model is equity participation, i.e. employing Profit and Loss sharing on both deposit mobilization (savers) and lending (investor). This tells us the significance of intermediary activities in Islamic financial institutions (Ahmed et al, 2006).

Construction of variable

We have modeled Islamic banks as multiproduct firms, producing two outputs employing three inputs. All variables except for the input factor labour are measured in thousands of Pak Rupees. Table 4.1 presents the definition of all variables used in the

study. The output vector include *Loans and Advances* (y_1) which includes loans and advances to different firms and individuals, credits, bills discounted and purchased and overdrafts; *Investments* ($y2$) which includes Market Treasury Bills, Pakistan Investment Bonds, Foreign Currency Bonds, Foreign Ordinary shares of listed companies, mutual funds Ordinary shares of unlisted companies, Listed term finance certificates, Unlisted term finance certificates and Open ended mutual funds. The input vector comprises of *Number of Employees* (x_1) which include permanent, contractual and outsourced employees; *Capital* (x_2) which include tangible operating assets owned and leased, Intangible assets and capital work in progress; *Total funds* (x_3) which include demand and time deposits and non-deposit funds. *Non-performing loans (NPL)* which include bad debts and directly written off's

As we are estimating cost function so we need to construct price for all inputs. Price of labour is (w1) is calculated as administrative expenses divided by number of employees; price of Capital (w2) is calculated by operating fixed assets divided by deposits and other accounts; price of total funds (w3) is calculated as interest expense[11] divided by deposits and other accounts.

Total cost(C) comprises of interest expense, administrative expenses and other-expenses, which are aggregates of different expenditures incurred by financial institutions. All variables except number of employees are deflated by GDP-deflator where the base year is (2001=100). Total coFst and outputs are divided by total assets (**TOTA**) so

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[11] Because Islamic banks involve in investment activity they used the term *Mark-up* instead of *interest expense* and *return* in place of *interest earned*

that we may incorporate the differences in size of different financial institutions and to control the heteroskedasticity problem (Patti and Hardy, 2005).

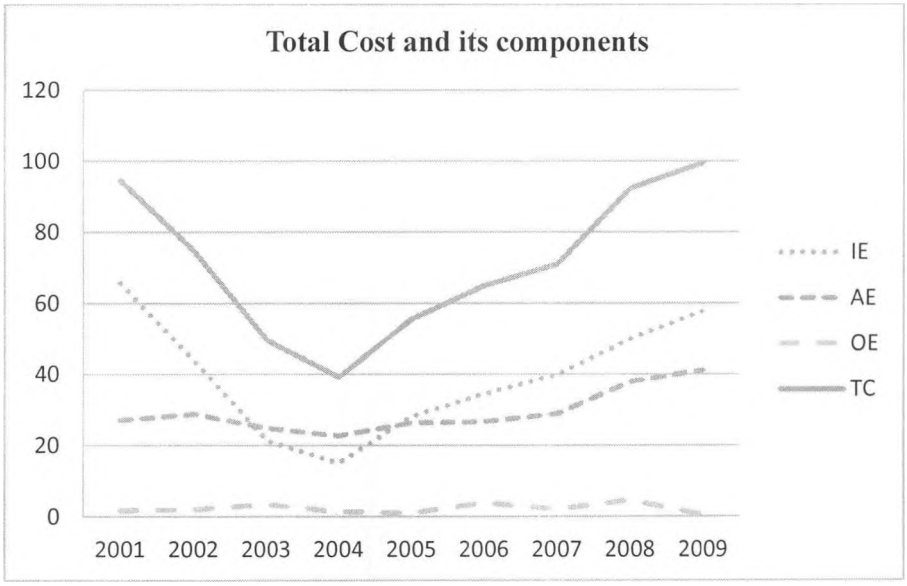
Total cost is comprised of Interest expense, administrative expenses and other-expenses which have different shares in cost over time. For the whole sample average share of interest expense (IE) is 53.6 percent administrative expenses is 43 percent and

Table 4.1

Definitions of Inputs, Outputs and Inputs Prices

Variable Symbol	Variable Name	Description
	Outputs	
y_1	*Loan and Advances*	Ratio of total loan and advances to total assets
y2	*Investments*	Ratio of total investment to total assets
	Inputs	
x_1	*Labour*	Include permanent, contractual and outsourced employees
x_2	*Capital*	include tangible operating assets – leased, tangible operating assets – owned, Intangible assets and capital work in progress
x_3	*Total funds*	include demand and time deposits and non-deposit funds
	Input Prices	
w_1	*Price of labour*	Price of Employee input is calculated as the ratio of salary expenses to total number of employees
w_2	*Price of Capital*	price of operating fixed assets is calculated by operating fixed assets divided by deposits and other accounts
w_3	*Price of Total funds*	Price of deposits and other accounts calculated as the ratio of total interest expenses/mark-up to total deposits and other accounts
C	*Total Cost*	Total cost (interest expense/mark-up + administrative expenses + other-expenses) to total assets
T	*Time*	Time variable quantifies the impact of technological progress upon cost.
NPL	*Non-performing loans*	Non-performing loans to loans and advances ratio

Figure 4.1



Other-expenses is 3.4 percent which again reinforce the importance of intermediation approach in the case of cost minimization because the share of interest expense is more than 50 percent and production approach does not consider it as a cost argument. From Fig. 4.1 we can see that cost is mainly driven by interest expense/mark-up as cost was declining from 2001-2004 and then increasing afterwards mainly because of the decrease and then increase in interest expense. Table 4.2 presents the summary statistic of cost, inputs, outputs and prices of inputs variables. In summary statistics we present means and standard deviations of all variables for the study period from 2001 to 2009.

Table 4.2

Summary statistics of Outputs, Inputs, Input prices and Total Cost for all banks (Rupees Thousand.)

Year		Advances	investments	No of Employees	Operating fixed Assets	deposits and other accounts	Price of Employees	Price of Capital	Price of total funds	Total Cost	Count
		Outputs		Inputs			Input Prices			Total Cost	
2001	Mean	30042195.8	11443327.2	3168.7	1104472.3	50184270.2	1565.477	0.039	0.166	5110981.1	24
	S.D	47174515.5	19686875.1	5227.9	1886507.9	88796587.5	3408.325	0.065	0.365	7605861.6	
2002	Mean	28193634.5	22804990.7	2941.1	1248226.9	54298898.2	1060.814	0.055	0.066	4237143.4	25
	S.D	42732271.1	40703960.0	4783.8	2099506.3	95978627.6	901.970	0.146	0.034	6525499.9	
2003	Mean	33172195.0	24816837.3	2872.5	1379669.1	60311068.0	1001.092	0.043	0.089	3192727.3	26
	S.D	47706344.9	46792787.4	4674.6	2241886.9	104418178.8	930.932	0.089	0.269	4446081.8	
2004	Mean	44588737.6	19839271.7	2785.5	1676913.4	68924983.2	1046.162	0.051	0.057	3022252.0	28
	S.D	65774524.0	37333082.9	4557.8	2859466.6	116793999.1	894.879	0.116	0.180	4530489.0	
2005	Mean	55047454.5	23641732.2	3331.9	2029713.2	78176047.6	935.132	0.097	0.059	4317502.4	29
	S.D	88987796.6	43425288.3	4668.1	4541731.7	135088800.5	760.935	0.226	0.059	9902207.6	
2006	Mean	56989279.0	27080039.8	3339.3	2722642.4	84041136.5	969.074	0.074	0.086	6800986.5	34
	S.D	88987796.6	43425288.3	4668.1	4541731.7	135088800.5	976.708	0.138	0.159	9902207.6	
2007	Mean	69869629.2	34601057.1	3659.2	3687596.1	99662862.7	1100.851	0.083	0.090	8099751.4	37
	S.D	97356980.6	50266881.3	4556.5	5845389.6	146055046.4	851.340	0.203	0.128	9739478.3	
2008	Mean	56989279.0	27080039.8	3339.3	2722642.4	84041136.5	1333.893	0.104	0.101	6800986.5	38
	S.D	115661211.4	41495171.7	4577.3	5924527.1	159936882.0	1030.064	0.298	0.105	12519507.6	
2009	Mean	80426662.2	46646115.3	3645.5	4924242.0	121761610.4	1665.067	0.100	0.108	12685904.8	38
	S.D	122712889.3	61051161.9	4637.6	6620791.0	182660798.0	1243.301	0.321	0.130	15584986.6	

CHAPTER-5

ESTIMATION AND RESULTS

In this chapter we have presented the cost efficiency results of different banks in Pakistan. These results are based on those models which are discussed in Chapter 4 of this study. Section 5.1 presents the result of DEA for Islamic banks in Pakistan and section 5.2 present the result of time variant fixed effect model for Pakistani banking industry.

5.1 Analysis of DEA results

In this section we will discuss the cost efficiency results of Islamic banks that have been obtained through DEA. Islamic banks have started their operation in 2002 so the number of Islamic banks available for the present study is not same for each year. That is why we observe; 1 bank for 2002; 1 bank for 2003; 2 banks for 2004; 2 banks for 2005; 4 banks for 2006; 6 banks for 2007; 6 banks for 2008; 6 banks for 2009.

DEA is a benchmarking technique where banks are compared with the best practice one in the sample. If there is only one or very few banks available in the sample, then a bank may be self-identified as 100% efficient not because it is the efficient one, but because there are no or very few banks are to compare with. Now only one Islamic bank is available for 2002 and 2003 and 2 Islamic banks are available for 2004 and 2005. So we have excluded first four years from the analysis to avoid self-identification problem which further biased the average efficiency results, and present the results of efficiency measures which are for the year 2006-2009

Descriptive statistics of all efficiency measures (i.e. cost efficiency, allocative efficiency and technical efficiency) are presented in Table 5.1. These efficiency measures are based on a sample data which ranges from 2006-2009.

Table 5.1

Descriptive Statistics of Efficiency Measures for Islamic Banks with DEA

Efficiency Measures	Average Efficiency	Std.	Max.	Min.
CE	0.94	0.03	0.97	0.90
TE	0.99	0.01	1	0.99
AE	0.94	0.03	0.97	0.90

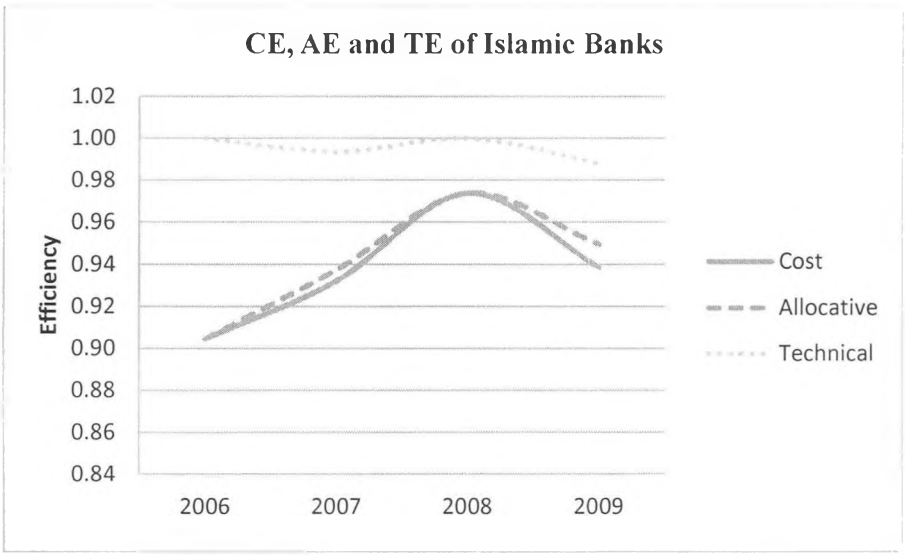
Cost Efficiency of Islamic banking Industry

Cost efficiency of Islamic banks for the entire period is 94 percent with a standard deviation of 0.03. This means that Islamic banks can save 6 percent of their cost while producing same level of output and services. As we look at the minimum and maximum values of cost efficiency scores in table 5.1which are 0.90 and 0.97 respectively, we find that yearly variation in efficiency scores is not very high.

Table A-5.4 presents yearly cost efficiency trends, in year 2006 average cost efficiency score is 0.90 with 0.14 of standard deviation which indicate a higher level of dispersion in cost efficiency scores among Islamic banks. Minimum and maximum values are 0.71 and 1 respectively, which is also indicating towards higher spread in efficiency scores. Islamic banks have improved their cost efficiency scores from 0.90 to 0.93 in year 2007 in this year 2 new Islamic banks were also entered into Islamic banking mar-

ket. In year 2008 Islamic banking industry has given its best of 0.97 cost efficiency scores.

Figure 5.1



It is also observed that standard deviation of cost efficiency scores is relatively low for year 2008. Smaller difference between minimum and maximum values also confirms a lower dispersion. This lower spread of efficiency scores indicates that in year 2007 it was not only the average of whole Islamic banking industry but also the individual DMUs (Islamic Banks) which have improved their cost efficiency levels. Islamic banks have performed not relatively well in the year 2009 because their cost efficiency scores have declined from 0.97 to 0.94.

Positive trend of yearly average cost efficiency scores has been observed from 2006 to 2008. This positive trend can be attributed to increased competition in Islamic banking industry, healthy economic environment and the process of learning by doing in Islamic banking industry. Decline in cost efficiency of Islamic banks from in 2009 can be traced

back to the gap between deposits and financing which rose up to 20% in 2010. Islamic banks are struggling nowadays to find new investment opportunities and this is not a local trend but Islamic banks are operating with surplus funds worldwide (SBP, 2010).

Technical and Allocative efficiency of Islamic banking Industry

Cost efficiency is a product of allocative and Technical efficiency. So it is possible to find the source of cost inefficiency in Islamic banking industry by splitting cost efficiency into allocative and technical efficiency. On average the scores of allocative and technical efficiencies are 0.94 and 0.99 respectively. This is indicating to the face that allocative inefficiency is contributing more to the cost inefficiency relative to technical inefficiency.

Yearly results for allocative and technical efficiencies are reported in table 5.2. Technical efficiency of Islamic banks for the period 2006 to 2009 is almost 1 or 0.99 with low standard deviation. In year 2006 allocative efficiency of Islamic banks was 0.90 with high standard deviation of 0.14. High standard deviation means there is a dispersion of allocative inefficiency among Islamic banks.

Table 5.2
Yearly Means and Slandered Deviations of Efficiency Measures for Islamic Banks

Year		CE	TE	AE
2006	Mean	0.90	1.00	0.90
	S.D	0.14	0.00	0.14
2007	Mean	0.93	0.99	0.93
	S.D	0.11	0.02	0.10
2008	Mean	0.97	1.00	0.97
	S.D	0.04	0.00	0.04
2009	Mean	0.94	0.99	0.94
	S.D	0.07	0.03	0.07
	Mean All	0.94	0.99	0.94

For the year 2007 AE was 0.93 which is relatively better than the previous year. This upward trend of AE continues to the year 2008 with the score of 0.97 but after 2008 we have found that AE declines to 0.94. So it is Allocative inefficiency which is driving the course of cost inefficiency in Islamic banking industry.

Bank wise analysis of efficiency results

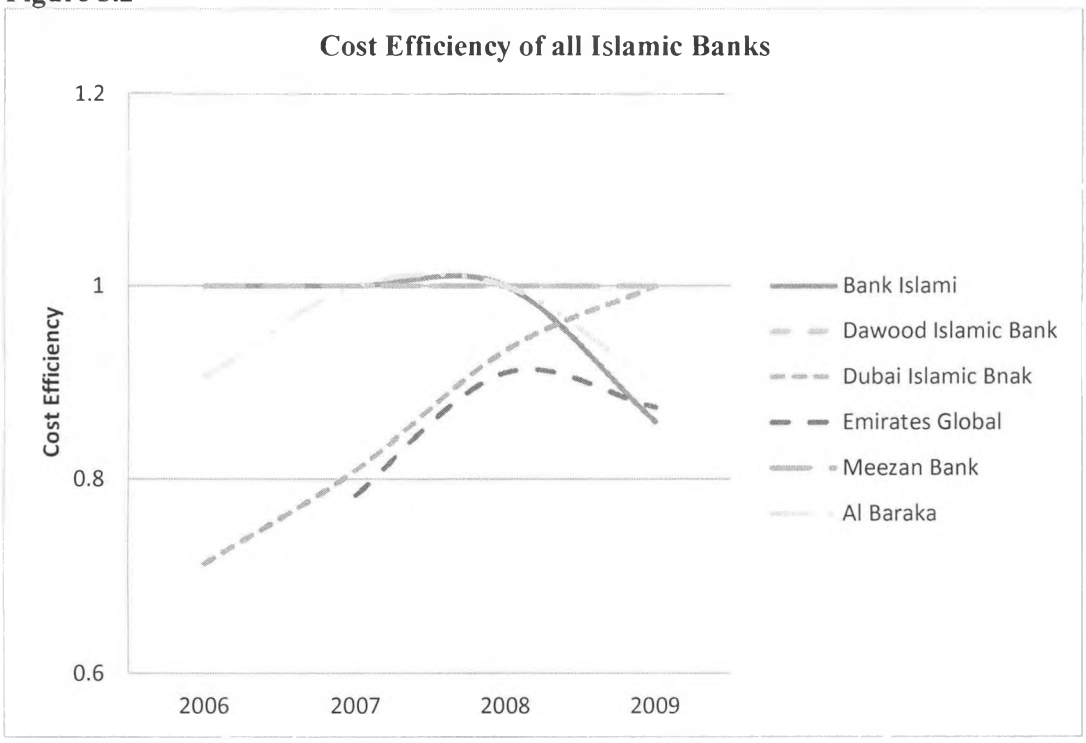
Bank wise efficiency results of Islamic banks are reported in Table 5.3 where it can be seen that *Meezan* and *Dawood* Islamic banks have performed best relative to other Islamic banks. They have remained on efficient frontier during the study period. *Meezan* bank is premier bank in Islamic banking industry where *Dawood Islamic bank* has entered into the market in 2007 but increasing its market share and offering innovative products.

Table 5.3
Yearly Means and Standard Deviations of Efficiency Measures for Islamic Banks

Years	Bank Islami Pakistan Ltd.			Dawood Islamic Bank Ltd.			Dubai Islamic Bank Pakistan Ltd.		
	CE	TE	AE	CE	TE	AE	CE	TE	AE
2006	1	1	1				0.71	1	0.71
2007	1	1	1	1	1	1	0.81	0.96	0.84
2008	1	1	1	1	1	1	0.93	1	0.93
2009	0.86	0.93	0.92	1	1	1	1	1	1
Average	0.96	0.98	0.98	1	1	1	0.86	0.99	0.87
Years	**Emirates Global Islamic Bank Ltd.**			**Meezan Bank Ltd.**			**Al Baraka Islamic Bank B.S.C. (E.C)**		
	CE	TE	AE	CE	TE	AE	CE	TE	AE
2006				1	1	1	0.91	1	0.91
2007	0.78	1	0.78	1	1	1	1	1	1
2008	0.91	1	0.91	1	1	1	1	1	1
2009	0.87	0.99	0.88	1	1	1	0.90	1	0.90
Average	0.86	0.99	0.86	1	1	1	0.95	1.00	0.95

Emirates Global Islamic bank is the least efficient bank with cost efficiency score of 0.86. *Emirates Global Islamic Bank* has never been to the efficient frontier and it is primarily because of it Allocative inefficiency.

Figure 5.2



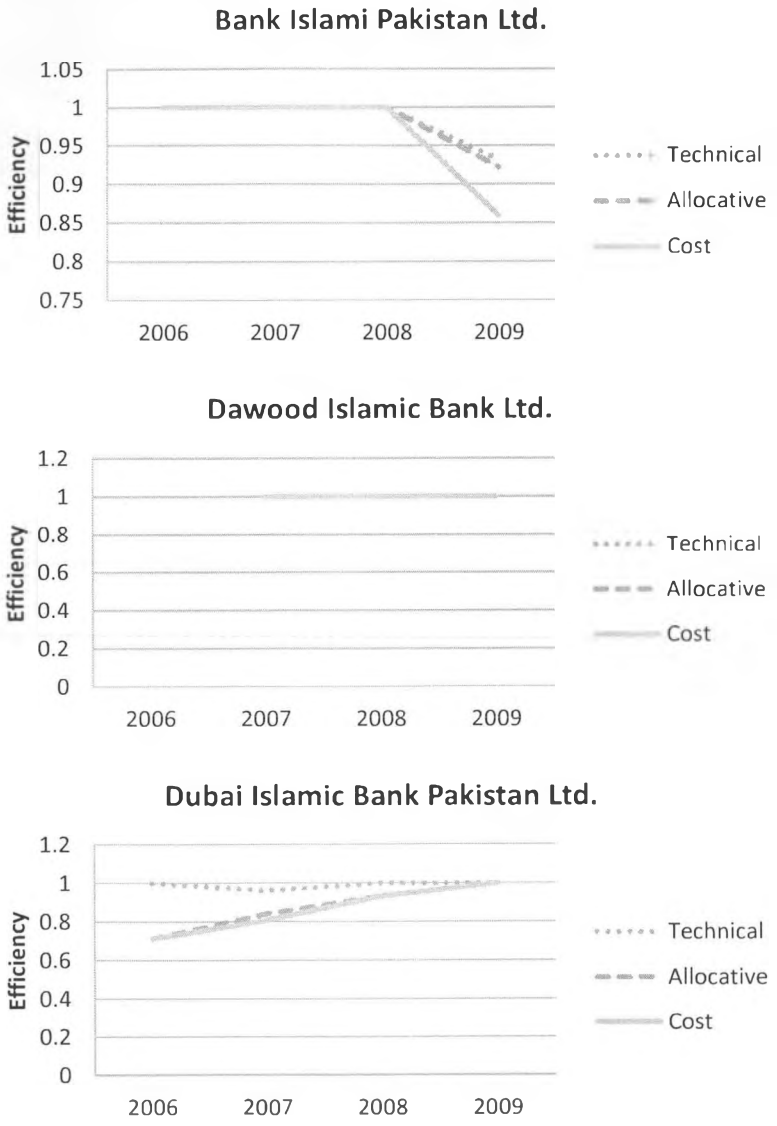
Bank Islamic Pakistan entered into the market in 2006 and performed better in terms of cost efficiency. It remains on efficient cost frontier from 2006 to 2008 but in 2009 its cost efficiency score is 0.86 and technical and allocative inefficiencies have equal contribution to this low cost efficiency score.

On average *Dubai Islamic Bank Pakistan* has a cost efficiency score of 0.86 which is equal to the score of *Emirates Global Islamic Bank*. This is the least efficient Islamic bank but the difference between two banks lies in their trends. *Dubai Islamic Bank Paki-*

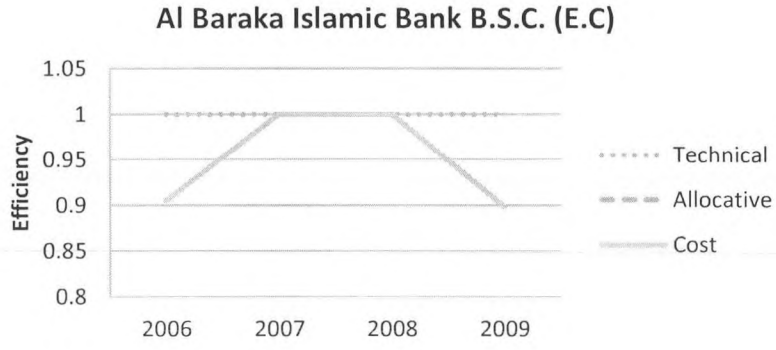
stan follows an upward trend which starts from cost efficiency score of 0.71 in 2006 to cost efficiency score of 1 in 2009. On the contrary *Emirates Global Islamic Bank* performs better in the first year but then follows the downward trend.

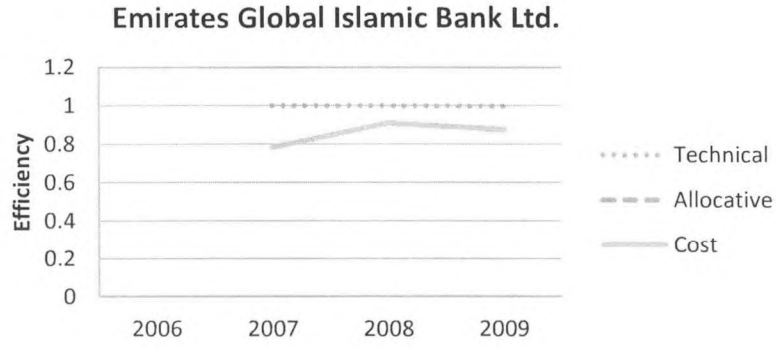
Al Baraka Islamic Bank has a long history in Pakistan but registered as a local bank in 2006. It remains on efficient cost frontier in year 2007 and 2008 but declines to 0.90 in 2009. Allocative inefficiency is only source of inefficiency for this bank.

Figure 5.3


Bank Islami Pakistan Ltd.
1.05
1
0.95
0.9
0.85
0.8
0.75
Efficiency
2006
2007
2008
2009
Technical
Allocative
Cost
Dawood Islamic Bank Ltd.
1.2
1
0.8
0.6
0.4
0.2
0
Efficiency
2006
2007
2008
2009
Technical
Allocative
Cost
Dubai Islamic Bank Pakistan Ltd.
1.2
1
0.8
0.6
0.4
0.2
0
Efficiency
2006
2007
2008
2009
Technical
Allocative
Cost


Meezan Bank Ltd.
1.2
1
0.8
0.6
0.4
0.2
0
Efficiency
2006
2007
2008
2009
Technical
Allocative
Cost


Al Baraka Islamic Bank B.S.C. (E.C)
1.05
1
0.95
0.9
0.85
0.8
Efficiency
2006
2007
2008
2009
Technical
Allocative
Cost


Emirates Global Islamic Bank Ltd.
1.2
1
0.8
0.6
0.4
0.2
0
Efficiency
2006
2007
2008
2009
Technical
Allocative
Cost

5.2 Analysis of Parametric model of cost efficiency

Before proceeding to the detail analysis of efficiency results we have to address few questions in detail. First, we will investigate whether the data on Islamic and conventional banks in Pakistan can be pooled together in one model. Second, if it is allowed to pool the data then from panel data models (Fixed effect model and Random effect model) which model should be preferred. Third, the efficiency results should be time-invariant or time-variant.

Poolability Assumption

If two types of banks working in different economic environment and they are not following the same prudential regulation, pooling of these types may cause biased results. In Pakistan Islamic banks are working with their conventional counter parts in the same economic environment and they share almost same legal frame work in which they have to operate. They also share the profit maximization motive in their own domains. Both these types of banks perform the function of financial intermediation in the same economy. Along with these commonalities they have some characteristics which are extremely different. In conjunction with profit maximization Islamic banks have to follow the *Sharia'h* compliance which comes prior to its all goals and which is the reason for its existence. That's why Islamic banks cannot perform financial intermediation on interest basis. So this paradoxical situation raises the question that whether Islamic and conventional banks follow the same production technology?

We test this hypothesis statistically if we would not able to reject the null hypothesis that both Islamic and conventional banks follow the same technology. Then we need not to worry about the pooling of the data and should pool the data to get more robust results. If the case is opposite, then we have to estimate these two groups independently and then calculate their efficiency results. We will use **a**) *Wald test* and **b**) *Chow test* to test our null hypothesis.

For Wald test we include type dummies for Islamic banks and conventional banks in a pooling model. If the hypothesis that coefficients of type dummies are equal to zero not rejected statistically then we would say Islamic and conventional banks in Pakistan are likely to share the same production technology. In standard Wald test there is not enough evidence to reject null-hypothesis even at 10% level of significance results are shown in table A 5.1[12]

Second test that we have used is Chow test. This econometric test is used to check whether the same model is applied to Islamic and conventional banks data, where these banks are the two subsets of pooled data. This test is performed with F statistics[13] (Greene, 2007). There is not enough evidence to reject the null hypothesis that the parameters of two groups (Islamic banks and conventional banks) are equal to corresponding pooled parameters at 5% level of significance. Now we have sufficient evidence and reason to pool the Islamic banks data with conventional banks.

---

[12] Results of hypothesis testing will be presented in this table A 5.1, mentioned otherwise.

[13] F statistics for analysis is

$$F(K, n_{isl}+n_{conv}-2k) = \frac{SSE_{pooled} - (SSE_{isl} + SSE_{conv})/K}{(SSE_{isl} + SSE_{conv})/(n_{isl}+n_{conv}-2k)}$$

Fixed effect vs. Random effect

As it is cleared from Chow test and Wald test that we can pool the data of Islamic and conventional banks in one model, now the question is from effects model which model is preferred. We have used Hausman-test to compare fixed and random effects model under the null hypothesis that individual effects are uncorrelated with the other regressors in the model (Hausman, 1978). If we reject the null hypothesis statistically then this result favors fixed effect model. In our case null hypothesis is rejected at 1% level of significance. Which means Random effect model is strongly rejected in favor of fixed effect model.

Time variant vs. Time invariant efficiency Model

To answer the question whether cost efficiency is time-invariant or time-variant we have first estimated equation (7) which is time invariant cost efficiency model and report its result in table A 5.2. For time-variant efficiency we estimated equation (5) and get residuals ε_{bt} which is composed of both inefficiency and error term. Then regressed this composed residual over banks specific dummies, time and time square as mentioned in equation (12) and results are reports in table 5.4. Now using likelihood ratio test and F-test we find that time-invariant efficiency Model is strongly rejected in favor of time variant efficiency model.

Non-performing Loans

Next we test whether the inclusion of non-performing loans to advances ratio (NPL) into our cost function would increase the power of the model? We reject the null hypothesis at less than 5% level of significance that NPL have no power of explanation in

Table 5.4

Parameter estimates of the Time-variant Cost efficiency model.

Variable	Coefficient	S.E.	T-Value	P [|T|>t]	Mean of X
β_1	-.02682569	.20534488	-.131	.8962	.76166507
β_2	-1.35025140	.53200817	-2.538	.0117	.37046694
β_{11}	.20467537	.08331166	2.457	.0147	.36750527
β_{22}	-.45045072	.14005913	-3.216	.0015	.10000957
β_{12}	.20259814	.31783105	.637	.5244	.12514318
δ_1	1.96211792	.23122731	8.486	.0000	4.08001384
δ_2	-.14331063	.18728320	-.765	.4449	.22281598
δ_{11}	-.33383756	.05100914	-6.545	.0000	8.43111602
δ_{22}	-.08455218	.04369248	-1.935	.0541	.14978649
δ_{12}	.12598971	.07401798	1.702	.0899	.43821546
ρ_{11}	.03654259	.04676020	.781	.4352	3.11877343
ρ_{12}	.28022615	.11740211	2.387	.0177	1.51096400
ρ_{21}	- .08462031	.04331723	-1.954	.0519	.18451812
ρ_{22}	.06370405	.06273405	1.015	.3108	.08371444
τ_1	.05571061	.03492011	1.595	.1119	4.54379562
τ_2	.00227562	.00280291	.812	.4176	13.5127737
φ_1	- .01283032	.00720754	-1.780	.0762	18.3534593
φ_2	- .01214654	.00714660	-1.700	.0904	1.01086519
π_1	.02217887	.00935635	2.370	.0185	3.42578343
π_2	- .00673426	.01237622	-.544	.5868	1.61889189
NPL/Adv	.05917	.01701	3.479	.0000	
Constant	-5.09975499	.58687179	-8.690	.0000	

R-squared is (0.918), Durbin Watson stat is (2.12) and F stat (56.06) F-Prob (0.000)

cost efficiency model. Results show that if there is 1% increase in NPL then, there is 5.9 % increase in total operating cost of banking industry. These results are consistent with limi (2004) and Ansari (2006). The coefficient of NPL in limi (2004) was also around 5% which provide more evidence to the robustness of results. These results imply that NPL are heavy burden for Pakistani banking industry and because of these NPLs finan-

cial health, soundness and profitability of Pakistani banking industry is on stake. We have also found that those banks which come under least efficient banks group have high NPL same results are presented in Ansari (2006).

Results and Explanation

We have estimated Cost function with Fixed-effect time-variant technique to calculate the efficiency scores of 38 commercial banks in Pakistan. The data ranges from 2001 to 2009 where the panel of 38 banks is unbalanced. We have presented the descriptive statistics of efficiency scores for over all banking industry in Table 5.5

Efficiency scores of overall banking industry

We find that average Cost efficiency scores of Pakistani banking industry is around 92% which means Pakistani banking industry is utilizing its inputs 92% efficiently and they could save 8% of waste by good management. In 2001 average efficiency of Pakistani banking industry is 90% then its start increasing and remains steady at 94% in 2004 and 2005

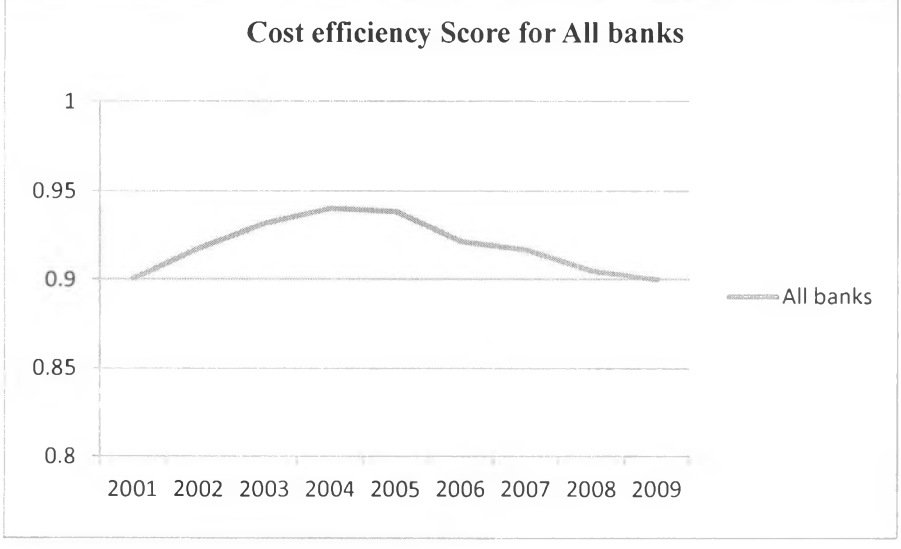
Table 5.5
Descriptive Statistics of cost efficiency scores for over all banking industry

Years	Average Efficiency	Std.	Max.	Min.
2001	0.90	0.08	1	0.67
2002	0.92	0.03	1	0.79
2003	0.93	0.07	1	0.77
2004	0.94	0.07	1	0.76
2005	0.94	0.08	1	0.76
2006	0.92	0.09	1	0.62
2007	0.92	0.07	1	0.74
2008	0.91	0.08	1	0.68
2009	0.90	0.11	1	0.59

. After that theses scores start declining and in 2009 average efficiency of Pakistani banking industry is 90% although the average efficiency scores are looking quite stable and converging towards its mean (see Fig. 5.1).

But when we look at the standard deviations they reveal a different picture. There is 6% or more than 6%t of dispersion in efficiency scores in each year as in 2009 it is 11%, which is indicating that there is lot of variation among banks in efficiency scores each year but these differences get average out when we take the mean of these efficiency scores. This intuition is confirmed when we look into the Min and Max values of efficiency scores as in 2009 where Max value is 100% and Min value is only 59%.

Figure 5.4



Islamic banking efficiency

Islamic banks in Pakistan on average following same cost efficiency pattern as the whole banking industry. Average efficiency of Islamic Banks for the study period is 94%. This means Islamic banking industry is slightly more cost efficient relative to en-

tire banking industry. Referring to table 5.6, cost efficiency of Islamic banks in 2002 when new Islamic financial framework was introduced and a licensed was issued to start Islamic banking under new framework. Cost efficiency of Islamic banking was 98% and remained stable up till 2005 with 97% cost efficiency level. Then there was a gradual decline of cost efficiency of Islamic banks which continued to 2009 when the cost efficiency score was only 85%. We have observed another phenomenon, when cost efficiency of Islamic banks start declining the dispersion of efficiency scores increased many times which is indicating to the fact that variation

Table 5.6
Yearly Means and slandered deviations of efficiency measures by type of banks

Year		PSB	SB	DPB	FB	IB	CB	BB
2001	Mean	0.93	0.79	0.91	0.93	N/A	0.90	0.91
	S.D	0.077	0.111	0.054	0.012	N/A	0.006	0.004
2002	Mean	0.95	0.83	0.92	0.92	0.98	0.91	0.92
	S.D	0.045	0.042	0.052	0.004	N/A	0.004	0.003
2003	Mean	0.97	0.86	0.93	0.92	0.99	0.93	0.93
	S.D	0.024	0.075	0.063	0.007	0.005	0.004	0.003
2004	Mean	0.98	0.89	0.94	0.92	0.98	0.94	0.94
	S.D	0.015	0.116	0.068	0.012	0.026	0.006	0.004
2005	Mean	0.99	0.93	0.93	0.92	0.97	0.94	0.94
	S.D	0.013	0.117	0.071	0.015	0.033	0.006	0.003
2006	Mean	0.98	0.90	0.93	0.92	0.86	0.93	0.95
	S.D	0.033	0.104	0.074	0.013	0.164	0.006	0.002
2007	Mean	0.95	0.87	0.91	0.91	0.95	0.91	0.93
	S.D	0.076	0.114	0.069	0.005	0.053	0.006	0.002
2008	Mean	0.94	0.85	0.90	0.93	0.92	0.90	0.92
	S.D	0.067	0.134	0.078	0.002	0.085	0.007	0.003
2009	Mean	1.00	0.79	0.90	0.95	0.85	0.91	0.95
	S.D	0.002	0.183	0.105	0.004	0.082	0.012	0.004
	Mean All	0.97	0.86	0.92	0.92	0.94	0.92	0.93

PSB= Public sector bank, SB=Specialized banks, DPB=Domestic private banks, IB=Islamic Banks, CB=Commercial banks BB=Big banks

of efficiency scores within Islamic banks is very high. The reason behind this efficiency decline can be traced back to the gap between deposits and financing which rose up to 20% in 2010. There is another interesting result in 2009 no Islamic bank is on efficient frontier which means Islamic banking industry is getting away from the efficient frontier which is alarming for Islamic banks. Islamic banks are struggling nowadays to find new investment opportunities and this is not a local trend but Islamic banks are operating with surplus funds worldwide (SBP, 2010).

Conventional banking efficiency

There are only six Islamic banks in Pakistani banking industry and all other banks in our sample of 38 banks are conventional banks. So it is expected that the average behavior of conventional banks would not be very different from over all banking industry. On the basis of ownership conventional banking industry is comprises of Public, Domestic Private, Foreign and Specialized banks. Out of these Public sector banks have performed best relative to other banks in terms of cost efficiency, their average efficiency for the study period is 97%. A very important point to note is the level of dispersion, which is very low for public sector banks. These results are consistent with Rizvi (2001). He mentioned that, experience of public sector banks, increased competition in the banking sector and liberalization of banking industry justifies these results. Foreign banks are the second best group among conventional banks with average efficiency score of 93% following by the Domestic private banks with 92% average efficiency score. The least efficient group among conventional banks is specialized banks with the average efficiency score of 86% (see Fig. 5.5). First, specialized banks do not make efforts towards deposit mobilization which we have considered as an output in our analysis. Second financial

industry has become very dynamic after the liberalization process so banks have to diversify their portfolio to face the risk of competition. Specialized banks are unable to diversify because of their specialized nature. Standard deviations of efficiency score for each year is high for domestic private banks and specialized banks which indicate that within group variation of efficiency scores are relatively high in these least efficient groups.

Islamic banking efficiency and other groups of banks

As we have seen earlier that Islamic banks have performed relatively better than their conventional counter parts (see Fig. 5.6). But when we analyzed different groups of conventional banks on ownership basis we have found that Islamic banks are less efficient than public sector banks but remain efficient relative to all other groups of conventional banks. We have also found from 10 most efficient banks, 2 banks are public sector banks, 5 domestic private banks, 2 foreign and 1 Islamic bank. Least efficient group of 10 banks comprises of 3 specialized banks, 4 domestic private banks, 2 Islamic banks and 1 foreign bank.

Figure 5.5

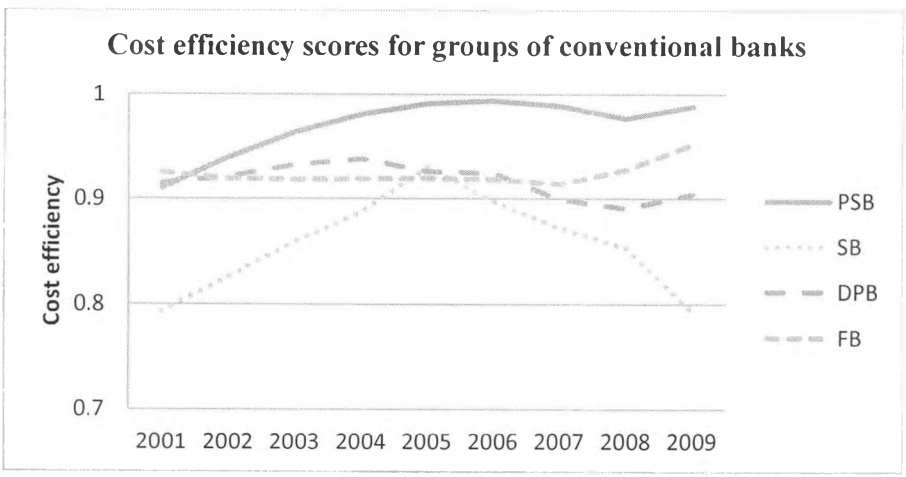
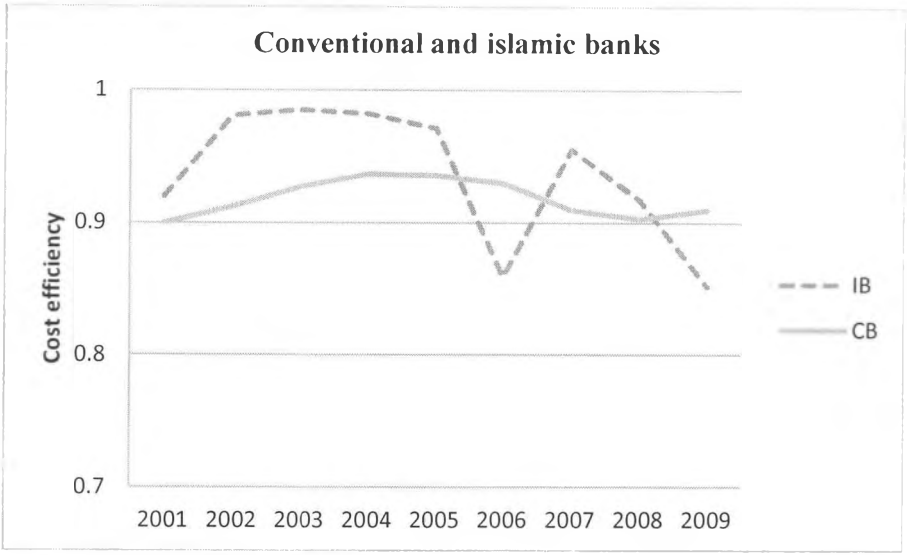


Figure 5.6



We have found a high level of dispersion in those groups where efficiency levels are relatively low and when there is decline of efficiency scores in any banks. It seems that there are few banks which are the sources of inefficiency for entire group. Secondly, average scores are unable to tell the whole story. So we categorized all groups of banks in three categories on the basis efficiency scores and find which banks are actually the sources of inefficiency for the banking sector. Good performers (EFF $\geq$ 95%), Average performers (90% $\leq$ EFF < 95%) and the last is Poor performers (EFF < 90%) (see Table 5.7).

We can see from table that only 7% of total inefficiency is coming from good performers group with 14 banks, 13% from Average performers with 5 banks and 80% from poor performers with 11 banks. When we deeply analyze the composition of poor performer banks we find that only 1 public sector bank with 2% of share, 6 domestic private banks with 43% of share, 1 foreign bank with 9% of share, 1 Islamic bank with 6% of

share and 2 specialized banks with 20% of share. These results imply that main sources of inefficiency for Pakistani banking sector are few banks in their individual capacity. In 2009 there are only 2 Islamic bank which come under second group of average performers and all other 4 Islamic banks come under third group which is the group of poor performers.

Table 5.7

Panel(a) **Efficiency breakdown of different banks**

Eff≥95															
Year	Avg. Ineff.	PSB		SB		DPCB		FB		IB		CB		Total	
		No.	Share	No.	Share	No.	Share	No.	Share	No.	Share	No.	Share	No.	Share
2001	11.91	1	0.00	0	0.00	4	2.48	2	0.83	0	0.00	7	3.30	7	3.30
2002	9.44	1	0.03	0	0.00	5	4.98	1	0.31	1	1.69	7	5.33	8	7.01
2003	7.91	3	4.43	0	0.00	9	9.56	1	0.00	2	1.47	13	13.99	15	15.47
2004	7.09	3	2.43	1	1.67	11	7.40	2	1.73	2	1.89	17	13.24	19	15.13
2005	7.36	3	1.25	1	1.69	9	4.22	2	0.89	1	0.25	15	8.05	16	8.30
2006	9.77	3	0.77	2	0.89	9	1.82	2	0.97	1	0.84	16	4.45	17	5.29
2007	9.80	3	1.24	1	0.13	6	3.63	1	0.35	3	0.01	11	5.35	14	5.36
2008	11.45	2	0.16	1	0.00	6	4.00	2	1.08	2	0.00	11	5.24	13	5.24
2009	13.00	3	0.06	1	0.00	8	1.51	3	0.32	0	0.00	15	1.90	15	1.90
Total	**9.75**	**2**	**1.15**	**1**	**0.49**	**7**	**4.40**	**2**	**0.72**	**1**	**0.68**	**12**	**6.76**	**14**	**7.44**

Panel(b)

90≤Eff<95															
Year	Avg. Ineff.	PSB		SB		DPB		FB		IB		CB		Total	
		No.	Share	No.	Share	No.	Share	No.	Share	No.	Share	No.	Share	No.	Share
2001	11.91	1	4	0	0.00	2	6.6	0	0.00	0	0	3	10.56	3	10.56
2002	9.44	2	6.63	0	0.00	4	14.96	0	0.00	0	0.00	6	21.59	6	21.59
2003	7.91	0	0.00	1	0.91	1	2.98	1	3.89	0	0.00	3	7.78	3	7.78
2004	7.09	0	0.00	1	3.21	0	0.00	0	0.00	0	0.00	1	3.21	1	3.21
2005	7.36	0	0.00	0	0.00	1	3.15	0	0.00	1	2.60	1	3.15	2	5.75
2006	9.77	1	2.42	0	0.00	3	7.43	0	0.00	2	5.03	4	9.85	6	14.88
2007	9.80	0	0.00	1	2.03	6	14.46	2	4.62	2	4.34	9	21.11	11	25.45
2008	11.45	1	1.84	0	0.00	5	9.68	1	2.35	2	3.88	7	13.87	9	17.75
2009	13.00	0	0.00	0	0.00	2	3.31	1	2.12	2	3.96	3	5.43	5	9.39
Total	**9.75**	**1**	**1.7**	**0**	**0.68**	**3**	**7**	**1**	**1.44**	**1**	**2.54**	**4**	**10.73**	**5**	**12.93**

(Continued)

Panel(c)

Eff<90															
Year	Avg. Ineff.	PSB		SB		DPB		FB		IB		CB		Total	
		No.	Share	No.	Share	No.	Share	No.	Share	No.	Share	No.	Share	No.	Share
2001	**11.91**	1	7.30	3	30.15	2	42.92	0	8.76	0	0	6	86.13	6	89.18
2002	**9.44**	0	0.00	3	26.98	5	33.17	2	11.25	0	0.00	10	71.40	10	71.40
2003	**7.91**	0	0.00	2	19.92	5	42.94	1	9.96	0	0.00	8	72.82	8	72.82
2004	**7.09**	0	0.00	1	16.35	6	52.03	1	13.28	0	0.00	8	81.66	8	81.66
2005	**7.36**	0	0.00	1	15.05	7	57.54	1	13.37	0	0.00	9	85.95	9	85.95
2006	**9.77**	0	0.00	2	14.27	7	38.68	1	8.08	1	18.80	10	61.03	11	79.83
2007	**9.80**	1	5.45	2	15.66	7	38.28	1	5.90	1	3.90	11	65.28	12	69.18
2008	**11.45**	1	3.84	3	17.93	8	39.73	2	5.77	2	9.74	14	67.27	16	77.01
2009	**13.00**	0	0.00	2	19.48	9	46.19	1	3.30	4	19.75	12	68.97	16	88.72
Total	**9.75**	**0**	**1.84**	**2**	**19.53**	**6**	**43.49**	**1**	**8.85**	**1**	**6.14**	**10**	**73.39**	**11**	**79.53**

CHAPTER-6

SUMMARY AND CONCLUSION

Islamic banking has emerged as new viable alternative to contemporary finance in middle of seventies. This new system has proved its worth in the days of financial crisis when it has remained firm and stable and others were trembling and shaking worldwide. In Pakistan Islamic banking is working along with conventional banking system where market share of Islamic banking is not more than 7%. In this study we have compared these two systems on the basis of Cost efficiency.

In this study we have presented an overview of the rationale and theoretical foundations of Islamic banking in the Muslims world. We have found that prohibition of interest and provision for financial intermediation in Islamic framework worked as stimulus for the beginning of Islamic banking in recent epoch. Financial engineers of Islamic financial system made new financial contracts on the basis of historical classics like *Mudarabah Murabha* and *Ijarah.* In Pakistan we have observed a strong commitment of founders and common economic agents towards Islamic financial system. But there were few practical hurdles in implementation of this system. Now Islamic banking is on its discourse of evolution in Pakistan which is based on dual banking structure.

This study also presents a detailed review of most of the efficiency literature on comparison of Islamic banking and commercial banking efficiency worldwide. We find that there are mix results and no clear dominance of any system has been established.

Studies on efficiency of banking industry of Pakistan are very few and addressed only few questions about efficiency and its determinants.

After a proper model selection procedure fixed effect model has been adopted to estimate cost efficiency scores of 38 banks in Pakistan. Intermediation approach has been used to model banking industry of Pakistan. This approach is most frequently used in efficiency literature. Translog cost function which is famous for its flexibility and ability to accommodate multiple outputs has been used to model multiple outputs and multiple inputs financial firm. We have found that cost efficiency in Pakistan is time-variant in fixed effect model. Non-performing loans have also been regressed against the cost of banking industry of Pakistan. We found that these loans have significant impact over the cost of banks which means these loans are threat to the soundness of banking industry.

We have estimated cost efficiency scores for 38 banks in Pakistan by means of fixed effect model. On average cost efficiency of entire banking industry is 90%, conventional banks and Islamic banks are 92% and 94% respectively. This means Islamic banks have performed relatively better than entire banking industry and conventional banks. From efficiency trend we have found that Islamic banking is getting away from the efficient frontier on contrary conventional banks have reverse trend for recent years. This study also presents comparison cost efficiency scores with different ownerships categories and Islamic banks. We have found that Public sector banks are the most cost efficient group with 97% of cost efficiency and specialized banks are the least efficient one with 86%. Islamic banks have performed relatively better than all categories of banks in Pakistan except public sector banks. Big banks have no relative advantage in terms of efficiency and no Islamic bank comes under big bank category. Average inefficiency

break down revealed that only few banks in banking sector which are the sources of inefficiency.

For intra Islamic banking industry analysis we have used DEA. We have found that allocative inefficiency is the main contributing factor to the cost inefficiency of Islamic bank. Overall cost efficiency of Islamic banking industry is following a downward trend and this finding is also confirmed by the parametric efficiency results.

Policy recommendation for the improvement of banking sector in Pakistan made as under

- As Islamic banks are new entrants in banking industry and facing many regulatory issues like double taxation. Along with these prudential issues Islamic banks are getting away from the efficient frontier which is very alarming situation for the managers. Deregulation will be more help for Islamic banks to decrease their cost.
- The reduction of gap between deposit and advances (which is relatively high for Islamic banks) by the mean of more liberal lending will be helpful in reducing allocative inefficiency. Establishing interbank market for Islamic bank will also be helpful in coping this issue
- As cost efficiency of Islamic banks is primarily effecting through their allocative inefficiency. More sophisticated and efficient financial instruments may be used to reduce this because allocation process is mainly controlled by these financial instruments so only efficient financial instrument will i the efficient allocation

- Non-performing loans which are the serious threat to banking sector of Pakistan must be reduced by the mean of strict regulation about written offs and bad debts

It may be said that Islamic banking industry in Pakistan is in its early phase proper institutionalization, integrating polices with international framework and serious commitment are necessary to put Islamic banking in Pakistan to a right path.

APPENDIX TABLES

Table A 5.1
Hypothesis testing for model selection

Problem	Name of test	Null-Hypothesis	F-Statistics $F_{critical}$ $(Prob)$	Chi-Square $\chi_{critical}^2$ $(Prob)$	Decision
Pooling of data	Wald	$D_{isl} + D_{conv} = 0$	0.0023 (0.960)	0.0023 (0.96)	Accept H_0
	Chow	$\beta = \beta_i$	1.54 (0.057)		Accept H_0
Fixed versus Random effect	Hausman	$E(\alpha_i, X_i) = 0$		48.94 (0.005)	Reject H_0
Time-invariant versus Time-variant	Likelihood ratio	$\Omega_{i2} = \Omega_{i3} = 0$	257.277 (0.000)	3.285 (0.000)	Reject H_0
Non-Performing Loans	Wald	Coff (NPL)=0	3.285 (0.020)	3.285 (0.019)	Reject H_0

Table A 5.2 (a)
Parameter estimates of the Time-invariant Cost efficiency model.

Variable	Coefficient	S.E.	T-Value	P [|T|>t]	Mean of X
$\bar{\beta}_1$	.46500711	.20876599	2.227	.0268	-.76166507
β_2	.98448563	.46755017	2.106	.0362	.37046694
β_{11}	.06833932	.07026075	.973	.3316	.36750527
β_{22}	-.01974197	.12318836	-.160	.8728	.10000957
β_{12}	-.05212900	.29091087	-.179	.8579	.12514318
δ_1	.56478651	.26584150	2.125	.0346	4.08001384
δ_2	.13558246	.19443988	.697	.4862	.22281598
δ_{11}	-.10606938	.05366487	-1.977	.0492	8.43111602
δ_{22}	.02886985	.04213780	.685	.4939	.14978649
δ_{12}	.07967773	.07840250	1.016	.3105	.43821546
ρ_{11}	-.10981377	.04384855	-2.504	.0129	3.11877343
ρ_{12}	-.20462893	.10462966	-1.956	.0516	1.51096400
ρ_{21}	-.00358559	.04034446	-.089	.9293	.18451812
ρ_{22}	.14991690	.05236487	2.863	.0045	.08371444
τ_1	.03238674	.02964507	1.092	.2756	4.54379562
τ_2	-.00240069	.00234667	-1.023	.3073	13.5127737
φ_1	-.00525353	.00619045	-.849	.3969	18.3534593
φ_2	-.02741098	.00672410	-4.077	.0001	1.01086519
π_1	.01561706	.00770017	2.028	.0436	3.42578343
π_2	-.00482711	.01097976	-.440	.6606	1.61889189
NPL	.06114701	.23918151	.256	.7984	.01505741

R-squared is (0.881), Durbin Watson stat is (1.97) and F stat (41.61) F-Prob (0.000)

Table A 5.2 (b)
Estimated fixed effects of time-invariant efficiency model

	Coefficient	S.E.	T-Value	Prob
α_1	-1.1520	0.6935	-1.6611	0.0982
α_2	-1.0872	0.6957	-1.5628	0.1196
α_3	-1.2355	0.6926	-1.7839	0.0759
α_4	-1.2337	0.6954	-1.7741	0.0775
α_5	-1.3164	0.6964	-1.8904	0.0600
α_6	-1.2436	0.6950	-1.7892	0.0750
α_7	-1.2496	0.6963	-1.7946	0.0741
α_8	-1.1621	0.6900	-1.6842	0.0936
α_9	-1.3279	0.6870	-1.9328	0.0546
α_{10}	-1.1707	0.7017	-1.6684	0.0967
α_{11}	-1.2440	0.6883	-1.8075	0.0721
α_{12}	-1.3273	0.6977	-1.9025	0.0584
α_{13}	-1.0167	0.6988	-1.4551	0.1471
α_{14}	-1.1043	0.6977	-1.5827	0.1150
α_{15}	-1.2845	0.6954	-1.8472	0.0661
α_{16}	-1.2848	0.6863	-1.8720	0.0626
α_{17}	-1.1691	0.6934	-1.6861	0.0932
α_{18}	-1.1385	0.6946	-1.6391	0.0932
α_{19}	-1.1717	0.7030	-1.6668	0.0970
α_{20}	-1.1688	0.6924	-1.6882	0.0928
α_{21}	-1.2050	0.6996	-1.7225	0.0864
α_{22}	-1.3017	0.6942	-1.8752	0.0621
α_{23}	-1.2196	0.6905	-1.7663	0.0788
α_{24}	-1.2777	0.6936	-1.8422	0.0668
α_{25}	-1.3239	0.6715	-1.9716	0.0499
α_{26}	-1.2649	0.6934	-1.8240	0.0695
α_{27}	-1.2089	0.7005	-1.7257	0.0858
α_{28}	-1.2295	0.6968	-1.7645	0.0791
α_{29}	-1.1140	0.6985	-1.5949	0.1122
α_{30}	-1.2304	0.7047	-1.7459	0.0823
α_{31}	-1.0648	0.6953	-1.5313	0.1272
α_{32}	-1.1961	0.6939	-1.7237	0.0862
α_{33}	-1.2922	0.6834	-1.8907	0.0600
α_{34}	-1.2372	0.6989	-1.7701	0.0781

Table (continued)

	Coefficient	S.E.	T-Value	Prob
α_{35}	-1.0363	0.6999	-1.4807	0.1402
α_{36}	-1.3275	0.6649	-1.9967	0.0471
α_{37}	-1.1186	0.6946	-1.6104	0.1088
α_{38}	-1.8272	0.6596	-2.7700	0.0061

Table A 5.3

Yearly DEA cost efficiency scores of conventional banks

Years	CB	PSB	SB	DPB	FB
2001	0.57	0.71	0.46	0.63	0.55
2002	0.67	0.78	0.43	0.80	0.67
2003	0.59	0.83	0.51	0.64	0.55
2004	0.57	0.75	0.48	0.64	0.60
2005	0.44	0.37	0.55	0.46	0.55
2006	0.57	0.60	0.64	0.56	0.51
2007	0.57	0.62	0.67	0.60	0.63
2008	0.62	0.63	0.76	0.65	0.58
2009	0.75	0.74	0.79	0.78	0.61
Mean	0.59	0.67	0.58	0.64	0.58

Table A 5.4

Yearly Means and Standard deviations of Cost Efficiency Scores for Islamic Banks

Years	Average Efficiency	Std.	Max.	Min.
2006	0.90	0.14	1	0.71
2007	0.93	0.11	1	0.81
2008	0.97	0.04	1	0.91
2009	0.94	0.07	1	0.85

Table A 4.1

List of those banks used in present study

Scheduled Banks in Pakistan					
Serial No. In study	**Bank**	**Nature**	**Serial No. In study**	**Bank**	**Nature**
(A)	**Public Sector Commercial Bank**		24	Silk bank	*c*
13	First Women Bank Ltd.	*c*	26	Soneri Bank Ltd.	*c*
37	The Bank of Punjab	*c*	27	Standard Chartered Bank Pakistan Ltd.	*c*
28	The Bank of Khyber	*c*	29	United Bank Ltd.	*c*
21	National Bank of Pakistan	*c*	14	Habib Bank Ltd.	*c*
(B)	**Specialized Banks**		15	Habib Metropolitan Bank Ltd.	*c*
35	Industrial Development Bank of Pakistan	*c*	16	JS Bank Ltd.	*c*
36	Punjab Provincial Co-operative Bank Ltd.	*c*	17	KASB Bank Ltd.	*c*
25	SME Bank Ltd.	*c*	18	MCB Bank Ltd.	*c*
38	Zarai Taraqiati Bank Ltd.	*c*	19	Meezan Bank Ltd.	*i*
(C)	**Domestic Private Banks**		20	Mybank Ltd.	*c*
2	Allied bank of Pkaistan	*c*	**(D)**	**Foreign Banks**	
3	Arif Habib Rupali Bank	*c*	1	The Royal Bank of Scotland	*c*
4	Askari Commercial Bank	*c*	30	Al Baraka Islamic Bank B.S.C. (E.C)	*i*
5	Atlas Bank Ltd.	*c*	31	Barclay Bank Plc.	*c*
6	Bank Alfalah Ltd.	*c*	32	Citibank N.A.	*c*
7	Bank AIL Habib Ltd	*c*	33	Deutsche Bank AG	*c*
8	Bank Islami Pakistan Ltd.	*i*	34	The Hong Kong & Shanghai Banking Corporation Ltd.	*c*
9	Dawood Islamic Bank Ltd.	*i*			
10	Dubai Islamic Bank Pakistan Ltd.	*i*			
11	Emirates Global Islamic Bank Ltd.	*i*			
12	Faysal Bank Ltd.	*c*			
22	NIB Bank Ltd.	*c*			
23	Samba Bank Limited.	c			

'*c*' is for Commercial Banks and '*i*' is for Islamic banks

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