Cost Efficiency of Pakistani Banking Sector:
A Stochastic Frontier Analysis

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ABSTRACT

Pakistan's banking system is one of the safest banking systems in the world with attraction of considerably high profitability but the cost dimension is still under-researched. This research endeavors to evaluate the cost efficiency of the Pakistan's banking sector. We estimate a Transcendental Logarithmic (translog) cost function cost frontier on quarterly panel data based on the Stochastic Frontier Analysis (SFA) principles. The cost frontier is used to establish the individual banks and overall sector efficiency score over the period 2005-2013. Analysis of the cost function reveals the fact that Pakistan's banking sector has a high margin of improvement in its cost efficiency either by maximizing the output through diversification or reduction in the price of input resources. However, it is suggested that a shift in banking process and products is highly desirable.

Keywords: Cost Efficiency,Parametric approach, StochasticFrontier Approach, Banking Sector

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Introduction

The financial sector plays a vital role in the development of the country. Worldwide financial services industry is changing rapidly and is becoming more competitive. Over the last few decades, around the world the banking sectors have gone through drastic changes in terms of financial globalization and technological

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competition. Banks also experienced increasing antagonism and rising costs as a consequence of increased strictness in regulatory requirements, innovative financial and technological up grading and challenges of the recent financial crisis. The banking sector of an economy is generally the most significant player and performs three main functions including facilitation of the payments, mobilization of savings, and allocation of loan able funds.

Economic growth and financial sector developments are considered as inter-related in any developing country like Pakistan. In Pakistan banks accounts for 95% of financial sector (Hussain, 2005) and the banking sector has been confronting with amplified competition and rivalry of the foreign commercial banks. Evaluation of the bank's performance and financial health has become a substantial concern in these recent years, especially in developing countries (Nazir & Alam, 2010). In the present time, Pakistani banks are under great pressure to maintain their cost efficiency and to face the increased competition due to rapidly changing global financial environment, new technology, foreign competition and more sticker regulations of State Bank of Pakistan.

The profit efficiency is obviously an ultimate goal for every commercial organization including banks and other financial and non-financial institutions but the cost efficiency is considered as an imperative factor to attain long-run profit efficiency. Furthermore, the cost inefficiency of the banking industry can influence the overall financial intermediation cost, adoption of new technology and allocation of financial resources. Therefore, this study is focused to assess the cost efficiency of Pakistani banks by a stochastic cost frontier model developed by Battese and Coelli (1995).

Literature Review

Banking efficiency has always been an attractive aspiration for many researchers by analyzing the responsiveness of the banking sector towards financial restructuring reforms. Performance and efficiency of banking sector has been investigated and tested by many scholars and researchers. For instance, Edward Chang, Hasan and Hunter (1998) estimated the cost inefficiency of domestic and foreign/ multinational banks in US. They analyzed data for the period of 1984-1989 and used translog method to estimate stochastic cost frontier. His results indicate that US banks were more cost efficient than foreign banks.In the context of Pakistan, Hardy and Patti (2005) calculated the cost and profit efficiency of 33 Pakistani banks in the period 1981 to 1997. They segregated the study period into two parts, first

period from 1981-1992 and the second period from 1993-1997. The underlying goal was to figure out the responsiveness of profitability and the cost effectiveness of banking industry towards financial sector reforms. They used Distribution Free Approach (DFA) for analysis and figured out that the liberalization has significantly increased the sales performance of all banks in general and of private banks in particular. The benefits of improvements in yield efficiency were ultimately handed over to customers. The robustness of these results was also enhanced by another study conducted by Khan and Khan (2007) which was focused on the financial sector restructuring and its impact on economic growth and overall macroeconomic stability of Pakistan. The study concluded that the restructuring positively impact the overall financial sector performance and leads to other phases of reforms after one and other.

Arby (2003) also analyzed the performance of 35 commercial banks operating in Pakistan during the year 1990 to 1999 by using the key indicators such as the Gini coefficient, Lorenz curve, concentration ratio and Herfindhal index. According to author the Pakistan banking industry is not competitive because the division of banking business has quite uneven and all variables were unevenly distributed. Burki and Niazi (2006) examine 10 years data from 1991 to 2000 and divide the sample into three phases pre-reform (1991-1992), the first reform (1993-1996) and the second reform (1997-2000). Their results indicated that foreign and private banks have demonstrated superior efficiency than public banks and initially banks efficiency fell down in first period of reforms, but then gradually improved over time. It was also pointed out in the results that the foreign and private banks have demonstrated superior efficiency to public banks. Whereas through traditional approach based on balance sheet information, public banks are more capable to recover their interest and non- interest expenses from there equivalent income (Nazir & Alam , 2010).

In terms of technical efficiency overall banks become more efficient after the year 2000 but the foreign banks were highly efficient as compare to local public and private sector banks (Akmal and Saleem 2008) these results were also verified by Baig (2008), the foreign banks were more technically efficient in comparison of private and state owned banks with technical efficiency score 98%, 97% and 87% respectively. The overall efficiency of all banks was 93%. They also indicate that the inefficiency of state owned banks might be because of overstaffing and cost ineffectiveness. NPLs largely contributed in the cost inefficiency of banks. The foreign private banks were again found to be the best practice banks on the cost frontier. The average efficiency level of all commercial banks was around 82.22 %

which shows that there is sufficient room for improvements in banking operations (Janjua and Malik, 2011).

Qayyum and Riaz (2012) conducted a study on Pakistani financial sector by using the (DEA) technique through boot strapping procedure to avoid drawback of DEA. They also scrutinized the determinants of bank efficiency by using Tobit model approach. The data consist of 28 Commercial Banks including six Islamic banks for the period of 2003-2010. The study found that public sector conventional banks were the doing well followed by private conventional and private Islamic banks with an average bias of 10%. Moreover, the results suggest that conventional banks were more efficient compared to Islamic banks. This study also point out that the public ownership, the ratio of financing to deposits (FDR) and the market share of bank in terms of deposits had statistically noteworthy positive influence on efficiency.

The above discussion substantiates the strong relationship between internal and external factors on bank's efficiency and profitability. There is a substantial amount of literature concerning bank efficiency exists across the globe. But the researcher has used the DEA and other efficiency measuring techniques to scrutinize the performance and efficiency of banking sector. However, a variation of choices exists between variables used as inputs or outputs. This study tries to evaluate the Pakistani bank's cost efficiency in terms of the individual country assessment based on high frequency quarterly data of input and output variables.

Theoretical Framework

Efficiency can be defined as "a level of performance that describes a process that uses the lowest amount of inputs to create the greatest amount of outputs" it has widely varying meanings in different disciplines. In economics, "efficiency is the use of resources so as to maximize the production of goods and services. An economic system is said to be more efficient than another (in relative terms) if it can provide more goods and services without using more resources".In banks related literature, there is a wide range of definitions of efficiency. The term is approached from various angles. Efficiency is analyzed from the point of economic theory and organization theory. According to Siudek (2008), "it is possible to investigate efficiency at the level of bank or at the level its organizational units, and for particular bank' activities.

According to Drucker, who explains the difference between efficiency and effectiveness, "efficiency means doing things right, and effectiveness means doing the right things". Pure economic concept of efficiency assumes that efficiency as the

ratio of total output with respect to input resources. The higher level of this ratio shows more efficiency. Rose (1997) defines efficiency as an indicator showing the ability of bank managers and its staff to keep the rate of increase in revenues and income at the level that exceeds the rate of increase in operational costs. Up to Jaworski (2006), efficient activities are those activities which not only lead to achieving intended goals but also assure economic benefits higher than inputs. In the literature different techniques have been employed to estimate efficiency. Most economists generally accept the principle of rational behavior and analyze banks utilizing the neo-classical theory of the firm. Such approach makes possible to use traditional economic measures of efficiency (inputs, outputs, cost constraints, etc). The concept of efficiency was initially presented by Farrell (1957). He separated the measurement of efficiency into technical and allocative efficiency. Both the measurements are considered as overall efficiency.
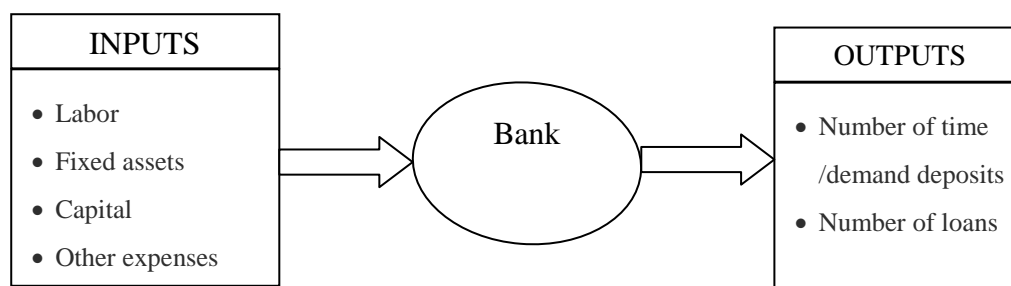
Efficiency Measurement Approaches

There are two basic approaches use for measurement of efficiency:

1. Production Approach

2. Intermediation Approach

It is a continuous debate to select which approach is better representation of the actual inputs and outputs of a banking firm.

Production Approach

According to the production approach, the aim of bank is to maximize the financial services output for the given levels of input resources or to minimize the consumption of resources used for provision of a range of products and services. Hence, the spirit of production modeling is to recognize those input resources that are essential to produce main outputs, in this approach the outputs are generally measured in terms of number of transactions or accounts instead of dollars. In production approach the deposits are treated as banks output. For example, the main inputs and outputs of banks can be considered as:
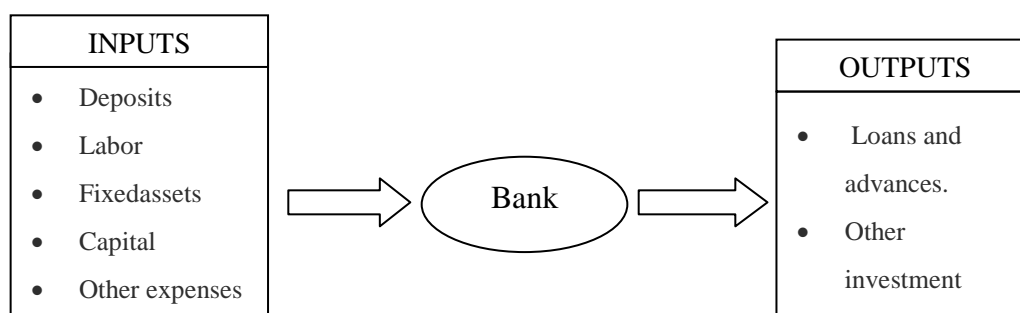
INPUTS		OUTPUTS
• Labor	Bank	• Number of time /demand deposits
• Fixed assets		• Number of loans
• Capital		
• Other expenses		

Source: Authors' formulation

This approach usually ignored the interest expenses due to its stronger emphasis on operations it makes the production approach more appropriate to study operating efficiency.

IntermediationApproach

On the other hand, there is an intermediation approach, as the name suggests that banks worked as intermediaries they raised funds in the form of deposits and lentthose funds to companies in the form of loans and other investmentsvehicles to generate earnings. In this approach, the expenses incurred on raising funds for this intermediation process are generallyconsidered as inputs, whereas the funds loaned and generated income through investments are treatedas outputs.

INPUTS		OUTPUTS
• Deposits	Bank	• Loans and advances.
• Labor		• Other investment
• Fixedassets		
• Capital		
• Other expenses		

Source: Authors' formulation.

The researchers mostly support intermediation approach according to Berger & Humphrey (1997) "the intermediation approach is best to measure the firm level efficiency while the production approach is good for branch level efficiency". Favero and Papi (1995) considered intermediation approach more suitable for the measuring bank efficiency. In this study, we have employed the intermediation approach which is commonly used in the conventional bank cost function literature.
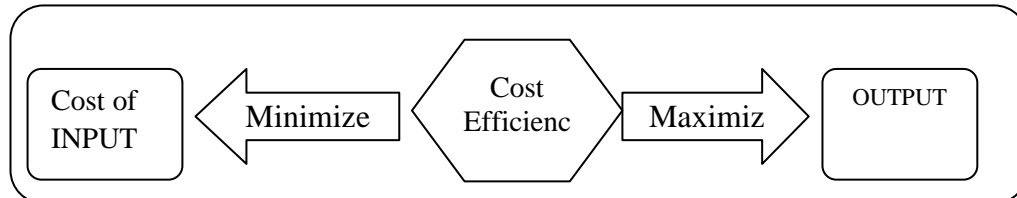
Cost Function
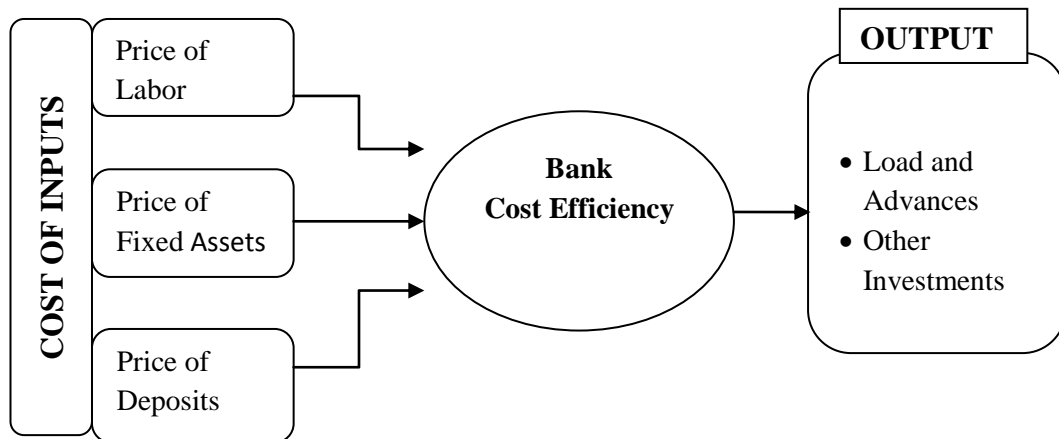
Source: Authors' formulation.

In efficiency measurement the term efficiency can be used in two ways:

(1) Maximization of output and

(2) Minimization of cost.

Source: Authors' formulation.

The benefits of efficiency measurement with a specific objective are that the performance of commercial banks can be gauged in comparison with other banks and the efficiency estimates of commercial banks are also indicates about the impacts of government policies on commercial banks (Wheelock and Wilson, 1995).

Efficiency Analysis Approaches

There are various methods available to compute the banking sector efficiency, each have their own merits and demerits. But mainly two basic approaches are applied. One is parametric techniques and other is non-parametric techniques. Both of these techniques are different in terms of their approach to examine efficiency. The parametric approach typically involves use of econometric models of profit, production and cost function. It goes well with the concepts of cost and profit

efficiency. Parametric approach is consist of three sub approaches e.g. stochastic frontier approach (SFA henceforth), Thick Frontier Approach (TFA) and the distribution free approach (DFA). In contrast, the non- parametric technique does not involve specification in the particular functional form to create a target frontier (Thanassoulis, 2001). The nonparametric approach includes free disposal Hull (FDH) and data envelopment analysis (DEA).

Efficiency Analysis

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                    Efficiency Analysis
                   /                    \
          Parametric Approach      Non Parametric Approach
          /      |      \              /            \
      [SFA]   [TFA]   [DFA]        [DEA]          [FDH]
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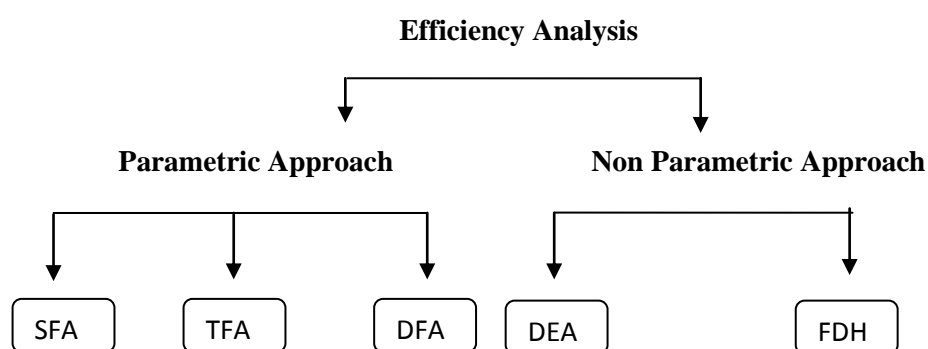
Source: Authors' formulation.

Data and Methodology

To evaluate the cost efficiency of Pakistani banking sector, we used quarterly data of 26 commercial banks from March 2005 to March 2013. The sample of the study includes state owned, private and foreign commercial banks. The other commercial banks were excluded due to non-availability of data and changes in ownership due to mergers. The variable consist of four basic inputs for the banking sector, which are fixed asset, labor, deposits and borrowing from other institutions and two outputs, measured as Investment and Loans and advances. The inputs are defined as X_1 = Labor, X_2 = Fixed assets, X_3 = Deposits and X_4 = Borrowing from other institutions. The outputs are defined as Y_1 = Investment Y_2 = Loans and Advances, and. The input prices are defined as:

$$P_1 = \frac{Total\ expenditure\ on\ salaries\ and\ other\ benefits}{Total\ number\ of\ employees},$$

$$P_2 = \frac{Depreciation\ cost}{Fixed\ assets},$$

$$P_3 = \frac{Total\ interest\ paid\ on\ deposits}{Total\ deposits},$$

$$P_4 = \frac{Total\ interest\ paid\ on\ borrowing}{Total\ borrowing}.$$

The sample includes three publics sector Pakistani banks, nineteen private Pakistani banks and four foreign banks and the sample period covered from 2005-2013. As indicated by Berger and Mester (1997), cost efficiency shows how close a firm/ bank costs are to the costs of efficient firm/bank. The bank positioned on the frontier, produce the more output under the same conditions. This can be derived from a cost function, as shown below:

$$C = C\ (w,\ y,\ v,\ u) \tag{1}$$

where c measures the cost, w is the vector input price, y is the output quantities vector, v is the normal random error and u stand for an inefficiency factor (technical, cost or allocative according to function used), due to which the costs may increase above the best practice level, such as:

$$lnC = \int \ln(w, y, z) + \ln vc + \ln uc \tag{2}$$

Where f denotes some functional form and the termination is treated as a compound error termination. The cost efficiency is defined as the quotient between the minimum costs that can generate a specific output vector if the underlying company was as efficient as another company in the sample (Jorge and Oswaldo, 2006).In this study the stochastic cost frontier approach by Aigner, Lovell and Schmidt (1977) is used with the help of translog function to estimate the cost efficiency of commercial banks in Pakistan.

The standard stochastic cost frontier model is:

$$C = \int (Y_i, P_m) + \varepsilon_i \tag{3}$$

i= 1….n

The error term further decomposed into

$$\varepsilon = v_i + \mu_i$$

v_i represents the random error or symmetric disturbance. They assumed to be independently and identically distributed. The error component $u_i$is an inefficacy term and it is assumed to be distributed independently of v_i. Translog functions are linear in parameters and can be estimated using least squares method. To estimate the cost efficiency the translog cost function is usually used. The equation of cost function C = f (Y, P) is assumed to take the form of:

$$ln(TC) = \alpha + \sum_{i=1}^{2} \alpha\, In|Yi| + \sum_{m=1}^{4} \beta_{mn}\, In|P_m| + \frac{1}{2}\sum_{i=1}^{2}\sum_{j=1}^{2} \alpha_{ij}\, In|Y_i|In|Y_j|$$

$$+ \frac{1}{2}\sum_{m=1}^{2}\sum_{n=1}^{2} \beta_{ij}\, In|P_m|In|P_n| + \sum_{i=1}^{2}\sum_{m=1}^{2} \gamma_{im}\, In|P_m|In|Y_i|$$

Where TC = Total Cost

Y_i = i[th] Output

P_m = m[th] price of factor inputs

t = Time Index

Empirical Results

Herfindahl-Hirschman Index (HHI)

While measuring the cost efficiency of commercial banks, we also measured the overall market structure of Pakistan banking industry either it is monopoly or competition. For this purpose, I calculated HHI on basis of total assets and total deposits of all banks and then further confirmed our conclusion on basis of HHI of big five banks.Table 1 shows the means of the structural indicators of market concentration across sample of 26 banks over the period 2005-2013. The Herfindahl-Hirshman index (HHI) represents the market share (in terms of total assets and total deposits) of every firm in the market. The results show that banking sector conditions vary considerably across the years and this is reflected as highly competitive market structures of the commercial banking industry in Pakistan.

Table 1 shows a relatively low concentration in sector whereas if we look at the separate information of big five commercial banks (Table 2), they also seem to operate in competitive or less concentrated market. During the eight years period from 2005, there is a decrease in overall market share concentration from 13.56% to 8.39% where as in Table 2 (measured as the market share of the five largest banks) in terms of assets decreased more from 21% to 7% as compare to 11% to 7% in terms of total deposits.

Table 1: Concentration Measures: Industry Herfindahl-Hirschman Index (HHI)

Quarters	Total Assets	Deposit	Quarters	Total Assets	Deposit
Mar-05	13.56%	12.24%	Jun-09	8.63%	8.99%
Jun-05	10.75%	11.26%	Sep-09	8.46%	8.68%
Sep-05	9.65%	10.25%	Dec-09	8.28%	8.76%
Dec-05	9.75%	10.10%	Mar-10	8.14%	8.60%
Mar-06	10.30%	11.06%	Jun-10	8.29%	8.76%
Jun-06	9.57%	9.88%	Sep-10	8.17%	8.46%
Sep-06	9.33%	9.54%	Dec-10	8.21%	8.57%
Dec-06	9.04%	9.27%	Mar-11	7.95%	8.08%
Mar-07	8.70%	9.09%	Jun-11	8.03%	8.37%
Jun-07	8.65%	9.10%	Sep-11	7.80%	8.13%
Sep-07	8.46%	8.79%	Dec-11	7.93%	8.34%
Dec-07	8.63%	8.79%	Mar-12	7.96%	8.18%
Mar-08	8.46%	8.60%	Jun-12	8.16%	8.37%
Jun-08	8.19%	8.42%	Sep-12	8.07%	8.29%
Sep-08	8.51%	8.74%	Dec-12	8.41%	8.56%
Dec-08	8.74%	8.98%	Mar-13	8.39%	8.53%
Mar-09	8.68%	8.96%			

Source: Authors' Compilation

Table 2: Big Five Concentration Measures: Herfindahl-Hirschman Index (HHI)

Quarters	Total Assets	Deposit	Quarters	Total Assets	Deposit
Mar-05	21%	11%	Jun-09	7%	7%
Jun-05	10%	10%	Sep-09	7%	7%
Sep-05	8%	9%	Dec-09	7%	7%
Dec-05	8%	8%	Mar-10	6%	7%
Mar-06	8%	9%	Jun-10	7%	7%
Jun-06	8%	8%	Sep-10	6%	7%
Sep-06	8%	8%	Dec-10	7%	7%
Dec-06	7%	8%	Mar-11	6%	6%
Mar-07	7%	7%	Jun-11	6%	7%
Jun-07	7%	7%	Sep-11	6%	6%
Sep-07	7%	7%	Dec-11	6%	7%
Dec-07	7%	7%	Mar-12	6%	6%
Mar-08	7%	7%	Jun-12	7%	7%
Jun-08	7%	7%	Sep-12	6%	7%
Sep-08	7%	7%	Dec-12	7%	7%
Dec-08	7%	7%	Mar-13	7%	7%
Mar-09	7%	7%			

Source: Authors' Compilation

Stochastic Frontier Analysis - Cost Efficiency Analysis

Prices of inputs were computed in order to calculate cost efficiency; price of labor is measured by dividing the sum of expenditures on wages, salaries, and employee benefits with the number of employees. Price of deposits is calculated by dividing interest expenses by total deposits. As for price of fixed assets, there were several ways to calculate it. We measured by taking ratio of depreciation expense to total fixed assets.

The list of relative cost efficiency of all banks (see Table 3) depicts that a private Islamic bank, is IBMB the best practice bank and estimated as a cost frontier with cost efficiency of 78.08% followed by private commercial banks BBAF, BBM and CBAB respectively while the relative efficiencies of other banks fall within the range of 78.08% to 35.77% . The 35.77% relative efficiency of IBOI means that this bank could have saved 64.33% costs in producing the current level of earning assets by eliminating the element of cost inefficiency.

Table 3: Bank Wise Cost Efficiency

Rank	Bank Code	Cost Efficiency	Rank	Bank Code	Cost Efficiency
1	IBMB	78.08%	14	CBCB	68.35%
2	BBAF	71.53%	15	CBUB	67.22%
3	BBM	71.37%	16	IBAB	66.88%
4	CBAB	71.20%	17	BBST	66.24%
5	CBJ	71.18%	18	CBNB	65.90%
6	BBAS	71.01%	19	CBHB	65.73%
7	CBNI	70.91%	20	CBBK	65.40%
8	CBBP	70.42%	21	CBSU	64.49%
9	CBSB	70.23%	22	CBFB	63.31%
10	CBBA	69.93%	23	CBSM	62.85%
11	CBFB	69.80%	24	CBHM	62.33%
12	BBSB	69.56%	25	CBDB	50.14%
13	CBKB	69.25%	26	IBOI	35.77%
				Total	**66.48%**

The results of this estimation can also verify with the real life market performance of these banks e.g. an Islamic bank paid highest returns to its investors and depositors during last years. On the other hand the least efficient bank was recently acquired by a foreign bank which is now winding up its business from Pakistan. The average relative efficiency of top 5 best practice banks is 72.67% corresponding to 54.76% for 5 least efficient banks. The overall average efficiency level of banking industry is found to be 78.67% which depicts that there is a great

room in banking industry to minimize cost by eliminating the elements of inefficiencies.

To test whether cost inefficiency effects are not present in the model, which is expressed by the null hypothesis ($\mathbf{H_o:}\lambda = 0$), where the parameter λ is defined by $\lambda = \frac{\sigma_\mu^2}{(\sigma_v^2 + \sigma_\mu^2)}$. The parameter λ is between zero and one, where λ is zero implying a full efficiency. Hence, the null hypothesis ($\mathbf{H_o:}\lambda = 0$) states that banking system is fully cost efficient and the alternative hypothesis ($\mathbf{H_1:}\lambda > 0$) states that part of the error term is due to the inefficiency in banking system. The results indicate a presence of cost inefficiency in Pakistani banking system. Moreover, $\lambda = 0.617$ implying that much of the variation in the composite error term (61.75%) can be attributed to the inefficiency component (Table 3).Table 4 presents the estimation of the cost frontier function. Overall, results show a good fit and the signs of estimated coefficients are in line with the theory. The coefficients of the investment and advances positively influence on cost means 1% increase in investment and advances will increase overall cost by 0.28% and 0.64 % in cost because more output will be generated will positively influence the overall cost. The price of labor and assets are showing the same trend whereas price of deposits have a highly positive and significant influence on total cost.An interesting finding of cost efficiency frontier of Pakistani banks revealed the best and the worst performers are very far apart on that frontier. Ranking for the full sample indicates that the Deutsche Bank is relatively the most efficient bank but in our results the foreign banks are among least efficient banks in terms of cost which is the results of international banking scenario i.e. global financial crisis (in late 2007) and state bank strict regulations.

Table 4: Cost Frontier

Variables	Para	Coef	Standard Error	z-stat	Variables	Para.	Coef.	Standard Error	z-stat
	α_o	1.3297	2.7814	-0.48	$0.5\times(\ln|pd| \times \ln|pd|)$	β_{33}	0.2997	0.0236	12.67
Ln| inv|	α_1	0.2862	0.0141	20.19	$(\ln|pl| \times \ln|pa|)$	β_{12}	0.0033	0.0121	0.28
ln |adv|	α_2	0.6471	0.0233	27.74	$(\ln|pl|\times \ln|pd|)$	β_{13}	-0.1557	0.0140	-11.12
$0.5\times(\ln|inv|\times \ln|inv|)$	α_{11}	-0.0178	0.0145	-1.22	$(\ln|pa|\times \ln|pd|)$	β_{23}	0.0006	0.0134	0.05
$0.5\times(\ln|inv| \times \ln|adv|)$	α_{22}	-0.0070	0.0155	-0.45	$(\ln|inv|\times \ln|pl|)$	γ_{11}	0.0009	0.0131	0.07
$0.5\times(\ln|adv|\times \ln|adv|)$	α_{12}	0.0599	0.0140	4.29	$(\ln|inv|\times \ln|pa|)$	γ_{12}	-0.0148	0.0119	-1.24
ln|PL|	β_1	0.2740	0.0134	20.4	$(\ln|inv|\times \ln|pd|)$	γ_{13}	-0.0234	0.0161	-1.45
ln|PA|	β_2	0.0285	0.0125	2.28	$(\ln|adv|\times\ln|pl|)$	γ_{21}	-0.0155	0.0133	-1.17
ln|PD|	β_3	0.5898	0.0188	31.44	$(\ln|adv|\times\ln|pa|)$	γ_{22}	0.0336	0.0122	2.75
$0.5\times(\ln|pl| \times \ln|pl|)$	β_{11}	0.1095	0.0135	8.12	$(\ln|adv|\times\ln|pd|)$	γ_{23}	0.0902	0.0170	5.3
$0.5\times(\ln|pa| \times \ln|pa|)$	β_{22}	-0.0099	0.0057	-1.73	-	-	-	-	-
M		1.1081	2.7818	0.4	$|\sigma^2|$		0.0937	0.0176	
ln$|\sigma^2|$		-2.3672	0.1881	-12.58	λ		0.6175	0.0731	
Ilgtλ		0.4790	0.3093	1.55	σ_{μ^2}		0.0579	0.0175	
					σ_{ν^2}		0.0359	0.0018	

Number of observation	854
Wald χ^2(20)	8629.15
Log likelihood	157.518

Conclusion

A bank may pursue many goals but profit efficiency is obviously its ultimate goal and the cost efficiency is an important means for achieving long-run profit efficiency. Since the cost efficiency of the banking industry is influenced by the overall financial markets stability and financial intermediation cost. A better allocation of financial resources indicates an improvement in bank performance and favorable investment growth.

The main objective of the current study is to analyze the cost efficiency of 26 commercial banks in Pakistan over the period 2005 to 2013. Measuring the efficiency of financial institutions has received considerable attention in recent time (Janjua & Malik, 2011). Such studies are significant for policymakers for the accurate assessment of the effects of their decisions on the institutions they supervise According to our results the banks could reduce their cost inefficiency by 33.52 % on average or in other words they could have used only 66.48% on average of their resources (inputs) to produce the same level of outputs. These results are consistent with Matthews (2010).

Though the banks are still earning profit but there are some elements which have adversely affected their cost efficiency. It is consistent with real time economics and banking scenario in Pakistan. During last decade the banking cost has been hampered due to reduction in spread between borrowings and lending interest rate, increase in labor and administrative cost and increase in non-interest expense. Furthermore, reduction in overall lending and growth activity within the economy has caused reduction in banking output in terms of loans and advances.

On the other hand, the banks are also behaving risk adverse and have started to focus on other banking services like remittance, electronic fund transfer or mobile banking etc. They also have increased investment their investment in risk free government securities. Findings of the study suggest, all Pakistani commercial banks need to improve their cost efficiencies.

References

Aigner, D., Lovell, C. A. L., & Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics, 6*(1), 21-37.

Akmal, M., & Saleem, M. (2008). Technical efficiency of the banking sector in Pakistan. *SBP Research Bulletin, 4*(1), 61-80.

Arby, M. F. (2003). Structure and performance of commercial banks in Pakistan. *University Library of Munich, Germany.MPRA Paper No. 4983,*

Baig, I. A., & Akram S. (2008) Quality reforms and change in technical efficiency: An evidence from banking sector in Pakistan *Journal of Quality and Technology Management, 4*(1), 1-8.

Berger, A. N., & Humphrey, D. B. (1997). Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research, 98*(2), 175-212.

Berger, A. N., & Mester, L. J. (1997). Inside the black box: What explains differences in the efficiencies of financial institutions? *Journal of Banking & Finance, 21* (7), 895-947.

Burki, A. A., & Niazi, G. S. K. (2006). Impact of financial reforms on efficiency of state-owned, private and foreign banks in Pakistan. *Applied Economics*, *42* (24), 3147-3160.

Edward Chang, C., Hasan, I., & Hunter, W. C. (1998). Efficiency of multinational banks: an empirical investigation. *Applied Financial Economics, 8*(6), 689-696.

Favero, C. A., & Papi, L. (1995). Technical efficiency and scale efficiency in the Italian banking sector: a non-parametric approach. *Applied Economics, 27*(4), 385-395.

Hardy, D. C. & Bonaccorsi di Patti, E. (2005). Financial sector liberalization, bank privatization, and efficiency: Evidence from Pakistan. *Journal of Banking & Finance*, *29*(8), 2381-2406.

Hussain, H. & Bhatti, G.A. (2010). Evidence on structure conduct performance hypothesis in Pakistani commercial banks, *International Journal of Business and Management, 5*(9), 174-187

Hussain, I. (2005). Banking sector reforms in Pakistan, blue chip, *The Business People's Magazine 1*, 15-21

Janjua, M. A., & Malik, M. H. (2011). The cost efficiency analysis of commercial banks in Pakistan: based on free distribution approach. *Pakistan Business Review, Market Report,* 694.

Khan, M. A. (2007). Financial sector restructuring in Pakistan. *MPRA Paper No.4141.*

Kiani, A. (2005). A comparison of domestic vs. foreign banks using stochastic frontier approach. *The Lahore Journal of Economics 10*(2), 55-74.

Matthews. K. (2007) Banking efficiency in emerging market economies. (No. E2010/12). *Cardiff Economics Working Papers*.

Nazir, M. S., & Alam, A. (2010). The impact of financial restructuring on the performance of Pakistani banks: a DEA approach. *The IUP Journal of Applied Finance, 16*(1), 71-86.

Qayyum, A., & Riaz, K. (2012). Technical efficiency of Pakistani banks: An application of bootstrapped data envelopment analysis approach. *World Applied Sciences Journal, 16*(12), 1837-1845.

Rangarajan, C. (1997). Role of monetary policy. *Economic and Political Weekly*, 3325-3328.

Siudek, T. (2008). Theoretical foundations of banks efficiency and empirical evidence from Poland. *Socialiniai Tyrimai, Social Research issue 3* (13), 150–158 2008(3).

Thanassoulis, E. (2001). Introduction to the theory and application of data envelopment analysis. *Dordrecht: Kluwer Academic Publishers*.

Wheelock, D. C., & Wilson, P. (1995). Evaluating the efficiency of commercial banks: does our view of what banks do matter? *Federal Reserve Bank of St. Louis Review*, 77.

Mahmood, H. Z., Khan, R., Mehmood, B. & Khan, K. (2014). Efficiency analysis of conventional vs. Islamic microfinance: An appraisal for sustainability in Pakistan, *International Journal of Empirical Finance, 3*(4): 192-201.