SBP Working Paper Series

No. 12 June, 2006

An Empirical Investigation of Cost Efficiency in the Banking Sector of Pakistan

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STATE BANK OF PAKISTAN

SBP Working Paper Series

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I.I. Chundrigar Road, P.O. Box No. 4456,
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Published by: Editor, SBP Working Paper Series, State Bank of Pakistan, I.I. Chundrigar Road, Karachi, Pakistan.

http://www.sbp.org.pk

Printed at the SBPBSC (Bank) – Printing Press, Karachi, Pakistan

Abstract

This study uses the distribution free approach to estimate levels of cost efficiency of individual banks operating in Pakistan. Furthermore, these levels of efficiency are analyzed under CAMELS indicators to provide micro insights of their financial standings to justify their prevailing positions. The results show that banks are significantly distinct at different efficiency levels ranging from 87 percent to 49 percent. Technology has played a significant role in reducing the cost of banking industry. However, the banking industry is still operating under diseconomies of scale. Moreover, non-performing loans have adversely impacted the cost structure of banking industry. CAMELS ratios indicate that the most efficient banks are those with lesser amount of non-performing loans, high capital adequacy, and lesser non-interest expenditure which leads to high profitability. Overall, there is great room in the banking industry to minimize cost by eliminating the inefficiency elements.

The author is highly obliged to Aliya H. Khan, Daniel C. Hardy (IMF), Panagiota Tzamourani (Bank of Greece), and Azma Asif for sending their helpful comments. He also acknowledges Abid A. Burki (Lahore University of Management Sciences) for his valuable support in the conduct of this study.

1. Introduction

The objective of this paper is to undertake an empirical investigation of relative cost efficiency of individual banks operating in Pakistan. The study focuses on the banking industry due to its predominant role in Pakistan's financial sector, with a 67.8 percent share in the total assets of the financial system.[1] All banks are operating under similar kinds of macroeconomic environment, prudential regulations and external spillover. Therefore, it will be interesting to investigate the factors, other than the aforementioned variables, which contribute to place them at distinct efficiency levels. Moreover, the opening of a number of banks and privatization of some public sector banks in the early 1990s, as a result of financial sector reforms, boosted the competitive environment in the banking industry. This accelerated competition prompted banks to achieve high cost efficiency for their survival in the banking industry.

As cost competitiveness and financial health are important factors in determining the cost efficiency/inefficiency of banks, this study estimates the distinct efficiency level of each bank through appropriate frontier approaches and assesses its financial health through various financial indicators. It will also be worthwhile to explore if cost competitive banks (empirically investigated) are also financially healthy. Therefore, this study uses CAMELS[2] ratios (financial indicators to assess financial health) to justify the financial analysis of distinct efficient banks. These ratios will give a clear vision of financial soundness and indigenous strengths of banks by detailing various aspects of capital adequacy, asset quality, management capability, earning capacity, liquidity and sensitivity to risk.

The last decade, especially the second half, is characterized by various advanced technological adoptions by banks, for example, E-Banking, Automated Teller Machines (ATMs), Credit Cards, M net, Society for Worldwide International Facilitation Transfers (SWIFT), National Institutional Facilitation Technologies (NIFT), etc. The aim of adopting advanced technologies, despite bearing the heavy fixed cost for it, was to speed up the process of financial transactions through broad automated networking that resulted in low transaction cost per unit as well as customer facilitation in terms of fast human interaction. To empirically capture that, the present study also attempts to quantify the impact of technology on per unit average cost of the banking industry.

[1] See, State Bank of Pakistan (2002)
[2] CAMELS: C=Capital, A=Assets, M=Management, E=Earnings, L=Liquidity, S=Sensitivity to Risk.

Until the recent past, the huge amount of non-performing loans (NPL) has been a serious concern to the banking management as well as to financial regulators. Whereas the NPL portfolio is still substantial, its growth has been minimized due to financial sector reforms. These infected loans swallow the profitability, as they become part of losses (and hence expenses) after passing through the standard provisioning cycle. Therefore, this study also attempts to quantify the impact of NPLs upon the cost structure of banks. Moreover, the expanded business portfolio, especially of large-sized banks, points towards a serious concern: Are banks potentially compliant with expanded business activities? In literature, this concern has been widely analyzed through estimating economies of scale that has been included in this study.

A number of studies have analyzed various aspects of cost[3] efficiencies including scale efficiency, scope efficiency, allocative efficiency, technical efficiency, pure technical efficiency etc.[Burki and Niazi (2003), Berger (1993), Berger and Mester (1997), Humphrey and Pulley (1997), Sathye (2001)]. With reference to Pakistan, in the light of immense degree of financial sector reforms and structural changes in the ownership of Pakistani banking industry, some studies conclude that large-sized banks (mostly public sector banks) are relatively more cost efficient than small-sized banks (mostly foreign and private commercial banks) [Iimi (2004), Iimi (2002), Hardy and Patti (2001), Burki and Niazi (2003)].

Most of the previous studies estimate cost, profit or revenue efficiencies of specific groups of banks rather than those of individual banks. In this way, one or group of some out-performing bank(s) may supersede the dismal efficiency levels of the remaining banks of the same group presenting a misleading picture of that particular group. However, this study estimates the efficiency level of all individual banks in the sample to avoid the problem of dominance of one bank over others within the same group. The efficiency estimates of all individual banks are further analyzed with various CAMELS ratios to strengthen the analysis.

The study is organized as follows: Section 2 discusses the theoretical framework of estimating efficiency levels. It also includes the various approaches used to define inputs/outputs specific to the intermediary nature of banks. Section 3 describes the methodology including a brief description of various parametric/non-parametric approaches of estimation. Section 4 details the technical interpretations of empirical results. Section 5 analyzes the extreme groups of

[3] Some studies also measure the profit and revenue efficiency [Hardy and Patti (2001)].

efficient/inefficient banks with the help of CAMELS indicators, which differentiates this study from others. Conclusion follows in section 6.

2. Theoretical Underpinnings of Estimating Cost Efficiency of Banking Industry

A bank is cost efficient if it produces the given level of output(s) using the mix of given inputs at minimum possible cost.

Estimating cost efficiency is based upon the observed cost values of any firm relative to the best practicing firm. Therefore, cost efficiency is defined as the ratio between the minimum cost $C*$, at which a firm can produce a given vector of output, and actual cost C. Thus, cost efficiency $CE = C^{*} / C$ implies that it would be possible to produce the same vector of outputs with a saving in costs of (1 – CE) percent. The best practicing firm is, by assumption, operating at 100 percent efficiency level, as CE for best practice firms is 1. It is important to note that achieving 100 percent cost efficiency is a relative measure by comparing best practice firms with others. Therefore, the relative cost efficiency will exist within the range of 0 to 100 percent.

Theoretically, cost of any specific bank may deviate from that of the best-practice bank due to two main factors: uncontrollable random shocks and controllable bank specific cost inefficiencies. The uncontrollable random shocks include internal/external shocks, accounting errors, amendments in policy vector,[4] and a number of other factors. The controllable cost inefficiencies can be a function of administrative mismanagements, non-optimal diversification of assets portfolio, misallocation of inputs, and so forth.

Cost inefficiency has been further categorized into four inefficiencies: scale inefficiency, scope inefficiency, technical inefficiency, and allocative inefficiency. Scale inefficiency takes place as a consequence of producing non-optimal level of output(s). Scope inefficiency exists on account of producing non-optimal mix of outputs. Technical inefficiency is associated with wastage of inputs and allocative efficiency takes place due to selecting wrong combination of inputs.

Another important issue is to determine the vector of inputs/outputs of banks in the light of their financial intermediary nature. Theoretically, inputs/outputs of banks can be classified under two

[4] For example, imposed restriction to increase capital base or change in tax policy, etc.

broad approaches: (a) production approach, and (b) intermediation approach. According to the "production approach", banks use capital and labor as inputs to produce individual accounts of various sizes and incur operating cost in the process. Operating costs are incurred in the course of processing deposits and loan documentation. Therefore, the number of deposits and loan accounts is, according to this approach, a measure of bank's output, while average account size is used as proxy to the characteristics of this output. Consequently, total bank cost in this approach includes only operating costs by excluding interest costs. However, according to "the intermediation approach", banks collect deposits and purchased funds from outer sources, and use them as a source of generating earning assets, like, loans, bonds and shares, etc. The latter approach considers earning assets as a proxy to bank's outputs while deposits, capital and labor as its inputs.

This study uses intermediation approach and evaluates the cost efficiency of individual banks operating in Pakistan. The production approach is preferable when the aim is to investigate operational cost efficiency of banks. As intermediation approach only incorporates average account size, it is not possible to analyze the implications of a large number of small accounts since outputs are computed as outstanding amounts.

3. Methodology

It is of prior importance to estimate the cost frontier of best-practicing bank(s) to further assess the relative cost efficiencies of other banks. In this regard, various econometric approaches have been used including parametric approaches (stochastic frontier approach, thick frontier approach and distribution free approach) as well as a non-parametric approach (data envelopment approach).

Broadly speaking, these approaches differ in distributional assumptions of residual terms. The stochastic frontier approach (SFA) assumes that inefficiency follows an asymmetric half-normal distribution, while random errors follow a symmetric normal distribution. The thick frontier approach (TFA) follows the same distributional assumptions as SFA but estimates average cost of the efficient quartile of banks as cost frontier in order to reduce the effect of outliers (banks), which is more probabilistic in SFA. Moreover, TFA assumes inter quartile deviations as random errors while intra quartile as cost inefficiencies. Berger (1993) found that when the inefficiencies were unrestricted, the efficiencies were much more like systematic normal distributions than half normal (as in SFA). By using the panel data, some of the maintained distributional assumptions in the stochastic frontier approach can be relaxed and this approach can be termed as distribution free approach (DFA). The data envelopment approach (DEA) assumes that there are random fluctuations, so that all deviations from the estimated frontier represent inefficiency. If there is any luck or measurement error in an observation not on the estimated frontier, it will be mistakenly included in that firm's measured efficiency. If there is a random error in an observation on the frontier, it will be mistakenly reflected in the measured efficiency of all firms that are measured relative to that part of the frontier. The choice of any specific approach depends upon the research objectives and available data. However, the non-parametric approach is highly sensitive to outliers as parametric models are considered relatively more robust.

This study uses DFA to estimate the relative cost inefficiencies of individual banks operating in Pakistan by using the panel data from 1991 to 2002. In DFA, estimated inefficiencies are assumed to be stable over the sample period while random errors average out. Moreover, this study uses Fixed Effect Model (FEM) as the panel data enables standard models of fixed and random effects to be estimated without any prior assumptions about the distribution of inefficiency terms, provided that efficiency is constant over time [Schmidt and Sickles (1984)].

Banks usually generate earning assets through financial intermediation. Therefore, the cost structure of banks can be classified as a function of vector of output (earning assets), vector of input prices, random error, and level of inefficiency as in the following equation:

$$C = f(Y, W) + u + v \tag{1}$$

Where C is abbreviated for total cost, Y represents vector of outputs, W indicates vector of inputs prices, v signifies random error and u level of inefficiency of banks. The residual terms of the model are decomposed into two terms: one indicates the level of inefficiency (u) while the other random errors (v).

In measuring cost inefficiencies, there is a problem with isolating inefficiency terms from random errors in the model. To overcome this problem, this study uses fixed effect model in which the bank's specific constant incorporates the inefficiency elements associated with that specific bank. The following econometric equation represents the generic form of the model:

$$C_{it} = \alpha + \beta X_{it} + u_{it} + v_{it} \tag{2}$$

Where $i = 1,2,.....N$ indexes the 37 included banks, $t = 1,2,...T$ indexes the time period from 1991 to 2002, C_{it} symbolizes total cost of i^{th} bank at time t, v_{it} represents random errors associated with i^{th} bank at time t and u_{it} indicates inefficiency level of i^{th} bank at time t. Similarly, X_{it} represents the vector of exogenous variables. It is important to recall that the efficiency associated with each bank remains stable over time in FEM.[5]

The random errors and efficiency terms have the following assumptions: (i) The v_{it} term is uncorrelated with the regressors X_{it} such as corr($X_{it}V_{it}$) $= 0$; (ii) The inefficiency level of best practice banks (as a bench mark) is assumed zero at any point of time; (iii) $u_i\,s$ are assumed to follow identically independent distribution (iid) with mean μ and variance S_u^2; (iv) $Corr(u_{i,}, v_i) = 0$.

By using FEM, it is assumed that the differences in intercepts are driven by distinct level of inefficiencies associated with each bank. The impact of exogenous variables upon cost structure is taken as same for all banks. This can be justified by the fact that all banks are operating under the same macroeconomic conditions, prudential regulations, imposed fiscal restrictions, and external effects. Therefore, the general format of model given in Equation (2) can be modified as:

$$C_{it} = (\alpha + u_{it}) + \beta X_{it} + v_{it} \tag{2a}$$

$$C_{it} = \alpha_{it} + \beta X_{it} + v_{it} \tag{2b}$$

The associated difference in inefficiency for each bank has led a_{it} to be different for all banks. However, it is important to empirically estimate whether these differences are statistically significant and for this a simple Wald test can serve the purpose.

[5] The stable inefficiencies over the whole sample period have been criticized on the ground that it reflects the adoption of consistent administrative and financial measures regardless of the prevalent efficiency level [see, Maudos and Pastor (2003)].

Equation (2a) estimates separate intercepts of individual banks (see appendix Table 1) by assuming that best practice bank is 100 percent efficient having minimum intercept in magnitude such that $a_{\min} = a_1 + u_1 = a_1 + 0 = a_1$. Given that estimated model is expressed in log form, the relative inefficiencies of remaining individual banks, a_i , can be computed by using their respective estimated intercepts such as $\hat{u}_i = a_i - a_{\min}$. The estimate of intercepts and μ_i are asymptotically consistent [Schmidt and Sickles (1984)].

The expression of efficiency can be computed by following the given expression:

$$E_i = (C_{\min} / C_i) = \exp(-u_i) = \exp(a_i - a_{\min}) \tag{2c}$$

The proxies of inputs/outputs of banks are consistent with the definition of intermediation approach as discussed earlier. This study is based upon unbalanced micro panel data[6] of 37 banks operating in Pakistan from 1991 to 2002. These 37 banks contained 92.64 percent capital, 92.25 percent assets, 91.48 percent expenses, 92.9 percent employment, 98.87 percent deposits and 87.58 percent advances of the banking industry. Therefore, it would be fair to assume that data coverage of banking sample size represents almost the whole banking industry.

By using the data of sampled banks, the estimated FEM can be expressed as:

$$\begin{aligned} TC_i &= a_i + \sum_{j=1}^{2} \beta_j Y_J + \sum_{k,\, j=1, k \le j}^{2} \beta_{kj} Y_k Y_j + \sum_{l=1}^{3} \gamma W_L + \sum_{r,s=1, r \le s}^{3} \gamma_s W_r W_s + \sum_{n=1, m=1}^{n=2, m=3} \delta_{nm} Y_n W_m \\ &+ NPL / ASSETS + \sum_{i=1}^{2} TY_i + \sum_{j=1}^{3} TW_j + T + e_i \end{aligned} \tag{3}$$

The given model estimates the unknown coefficients following the symmetry restriction:

$$\beta_{ij} = \beta_{ji}, \quad \gamma_{ij} = \gamma_{ji}, \quad \delta_{ij} = \delta_{ji}$$

In order to normalize the effect of differences in banks' sizes, all variables are expressed in ratio form. The list of variables used in the model is as follows:

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[6] Unbalanced banking data incorporates any specific bank before its merger/consolidation.

- TC= Total cost (administrative cost plus interest expenses) to total asset ratio
- Y_1= Ratio of total outstanding amount of loan and advances to total assets
- Y_2= Ratio of total investment to total assets
- NPL/Assets= percentage ratio of NPL to assets
- W_1= Price of financial capital calculated as the ratio of total interest expenses to total deposits and financial borrowing
- W_2= Price of physical asset calculated as the ratio of depreciation cost to total operating fixed assets
- W_3= Price of labor input, calculated as the ratio of salary expenses to total no. of employees.
- $i =$ Index of banks
- $t =$ Time subscript indicating the respective year, where i = 1.2…..,12
- $T =$ Time variable quantifies the impact of technological progress upon cost.

Note that all the above variables are expressed in logs excluding NPL to asset ratio and T.

4. Estimation and Analysis of Empirical Results

The trans log cost function is estimated by using the fixed effect model (FEM) assuming that residuals follow all fundamental assumptions of “distribution free” approach as stated above. Total expenses to total assets ratio is used as dependent variable while percentage of advances to assets, percentage of investment to assets, annual salary per employee (labor price), depreciation cost per million of operating fixed asset (price of physical capital) and interest expenses per million of borrowed funds (price of financial capital) are used as key independent variables. Moreover, the model is also estimated by adding the percentage of NPLs to total asset ratio and time dummy as an independent variable.

Equation (3) is a specific version of Equation (2) transformed into trans log cost function to estimate the relative cost efficiency of all individual banks in the sample. The relative inefficiencies measures mainly rely upon estimated values of intercepts for each bank. All intercepts are statistically significant at 99 percent level of confidence. The R^2 value is 0.84 and adjusted R^2 is 0.80 showing that 80 percent variations in the cost structure of banking industry is explained by given exogenous variables. F-statistic value is 22.96, which signifies the model in explaining cost structure of banking industry. The Durbin-Watson value of 2.01 shows no significant auto correlation amongst residual terms.

The standard Wald test[7] rejects the null hypothesis that all coefficients are restricted to be significantly similar to each other supported by the values of F-Statistics 263 and chi-square statistics 9478.[8] These results provide solid ground to argue that despite the same exogenous determinants for all banks, they are in line with different efficiency levels. The differences in efficiencies associated with each bank may be characterized by differences in administrative practices, choice in asset portfolios, risk management, labor skills, wastage of resources, the share of infected loans, over staffing, and various other factors.

The list of relative cost efficiency of all banks (see appendix Table 1) depicts that Bank V, a foreign private bank (FPB), is the best practice bank and estimated as a cost frontier[9] while the relative efficiencies of other banks fall within the range of 87 percent (Bank AD-FPB) to 49 percent [Bank AG- Public Sector Bank (PSB)]. The 49 percent relative efficiency of Bank AG means that this bank could have saved 51 percent cost in producing the current level of earning assets by eliminating the element of cost inefficiency. The average relative efficiency of top 5 best practice banks is 85.3 percent corresponding to 56.6 percent for 5 least efficient banks. The overall average efficiency level of banking industry is found to be 72 percent which depicts that there is great room in banking industry to minimize cost by eliminating the elements of inefficiencies.

The results show that one percent increase in non-performing loans to advances ratio leads 0.05 percent increase in cost to asset ratio (see appendix Table 3). This result warns that the continuous acceleration in non-performing loans can hit the financial soundness and profitability of the bank leading it towards dismal financial health. The amount of non-performing loans is substantially lesser in the most efficient group of banks relative to the least efficient group [see Fig 1(C)]. The least level of NPLs in total loan portfolio, as well as following the declining trend in efficient group, can be attributed to sound credit policies such as collateral standards,

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[7] The Wald test computes the test statistic by estimating the unrestricted regression without imposing the coefficient restrictions specified by the null hypothesis. The Wald statistic measures the degree of closeness that unrestricted estimates come to satisfying the restrictions under the null hypothesis. If the restrictions are in fact true, then the unrestricted estimates should come close to satisfying the restrictions.

[8] A detailed Wald Test is available from author on request.

[9] Efficiency level for Bank V (a Foreign Private Bank) is assumed 100 percent.

appropriate project feasibility, avoiding risky portfolios, and appropriate measures of hedging (for example, asset liability mismatch, exchange rate hedging, etc).

The results show that the technological progress has helped banks in reducing cost enormously. During the sample period, technological progress was widely seen in automation and its subsequent up-gradation; for example, introduction of ATMs, Tele Banking, Internet Banking, Credit and Debit Cards, etc. These advanced modes of banking have helped banks to facilitate financial transaction at cheaper cost.

The economies of scale depicts the percentage increase in the value of cost if all outputs increase by one percent in their value. It can be calculated as follows:

$$SE = \frac{1}{\sum_i \eta_{Y_i}} \quad \ldots\ldots\ldots\ldots\ldots\ldots.. \quad \forall i = 1....n$$

$SE > 1$ shows diseconomies of scale while $SE < 1$ depicts economies of scale. SE is estimated to be 1.24 showing that the percentage increase in the value of cost is more than the percentage increase in the value of outputs. It can strongly be argued that resources of banking industry have been capitalized more than their potential. Not interestingly, the large-size public sector banks are the most responsible participants for causing diseconomies of scale in the banking industry due to their huge balance sheet sizes. This study estimates scale inefficiency as one of the major causes driving inefficiency in the whole banking industry.

Despite the significant positive impact of salary upon cost, the most efficient banks offer high salaries to their employees as compared to the least ones. These attractive salary packages offered by efficient banks are associated with considerably high earning capacity of labor [(see Fig 1(E)]. In this scenario, it can be argued that most efficient banks are hiring comparatively skilled labor at high salaries and capable in optimal resources allocation, market information utilization and, risk management.

5. Cost Efficient/Inefficient Banks and CAMELS Indicators

CAMELS ratios are mostly used to quantify the financial soundness and health of banks through micro analysis of balance sheets and income statement items. These ratios are commonly used by central banks and rating agencies which help them to envisage the earlier signals of prospective problems in the financial health of banks. These prospects, including various financial indicators, incorporate quality of assets, financial soundness, management quality, earning capacity of assets, liquidity position and risk taking behavior of banks. Therefore it will be interesting to analyze the cost efficiency/inefficiency of these banks in relation to the CAMELS indicators. This study also analyzes two extreme groups, 5 best-cost efficient banks and 5 least cost-efficient banks, under the umbrella of CAMELS indicators to make the comparison more objective.

Capital adequacy: Capital adequacy provides insurance about financial soundness against unforeseen contingencies. It acts as a shield against expected losses associated with risk attached to banks. In this study, the cost-efficient group of banks remained under the compliance of high capital to liabilities ratio in comparison to low ratio of least cost-efficient group during the sample period [(see Fig 1(B)]. The high capital/liability ratio of efficient group is in line with lesser provisioning against bad debts, which ultimately becomes part of losses and gets eroded from the capital base of the bank. In addition, consistent high profit is the source of continuous rise in the capital base of most efficient banks. The sharp decline of capital/liability ratio faced by the inefficient group in the mid 1990s was observed due to imposed provisioning standards under the compliance of Basel Accord, 1988. However, the cost efficient groups maintained a high capital adequacy during the whole sample period. In addition, the cost efficient group also maintained a high percentage of capital to risk weighted assets[10] corresponding to consistently poor ratio of the least efficient group [(see Fig 1(A)]. In fact, accelerating risky portfolio with weak credit policy in cost inefficient group resulted in a high percentage of risk weighted assets and erosion of capital base associated with bad debts.

Asset Quality: One of the most commonly used indicators for asset quality is non-performing loans (NPLs) to total loans (TL) ratio. Theoretically speaking, NPLs are directly related to cost of banks as NPLs become (after provisioning) part of the non-interest expense of banks. In addition, the empirical results of this study provide significant positive impact of NPLs on the cost of banks. This will be further elaborated if the NPLs/TL of two cost extreme groups is compared.

[10] The calculation of Risk Weighted Assets started in 1997 under the prescribed rules of Basel Accord II.

The weighted average of NPL/TL of the efficient group is 6.76 against 20.95 percent of the least efficient group. The NPL/TL of the efficient group remained low and stable during the sample period against an accelerating trend in the inefficient group [(see Fig 1(C)]. The lower percentage of NPLs/TL in the cost efficient group is in line with credit disbursement adopting sound collateral standards, strong credit policy, having a broader vision of evaluating risks, while taking least political interference and appropriate measures of hedging (for example, asset liability mismatch, exchange rate hedging, etc).

The efficient cost group also concentrated at maintaining appropriate physical equipments and adopting advanced technology to run the business in a more feasible way which kept their non-earning asset to total assets ratio higher than the least efficient group. However, these non-earning assets are the potential assets, which are essential to enhance the earning capability of banks. For example, the non-earning assets mainly include the high value technological equipments (for example, ATM machines, soft wares, and computers), well-furnished and renovated offices, and other operating fixed assets.

Management: Management has an extremely vital role for banks to achieve their cost efficiency. The management decides the financing modes of banking operations, choice of asset portfolio, amount of risk taken and all operational strategies. It will be worthwhile to compare the management quality between most efficient and least efficient group of banks.

The interest rate spread is an important and commonly used indicator for evaluating efficiency of banks. The lower intermediation cost will lead a bank to gain lesser interest rate spread. In this study, the weighted average of interest rate spread of efficient group is 3.72 percent against 4.42 percent in the inefficient group. It depicts that the reduced cost structure of cost efficient group has made them well capable in charging lesser amount of interest rate spread.

Another indicator for management, operating expenditures (OE) to total expenditures (TE) ratio, shows that OE/TE is much lower for the efficient group than the inefficient group [see Fig 1(D)]. This implies that the cost efficient group has controlled and optimized operating expenditure in a more comprehensive way. The high portion of OE in TE of the least efficient group is associated with over sizing of employees leading to high salary expenses as well as using high portion of obsolete operating fixed assets thus incurring high depreciation cost. The earning per employee

(EPE) of efficient group is higher and on rise against the extremely low and stable trend of inefficient group [(see Fig 1(E)].

It is probably because of the efficient group's choice of better human resource from the market, at highly attractive salary packages, which are competent in optimal resource allocation, market information utilization, and forecasting and risk evaluation. Furthermore, the operating expense per employee is higher and increasing in the efficient group and advocates that per employee coverage of banking operations is higher in the efficient group than in the inefficient group.

Table 1: Weighted Average of CAMELS Indicators of Efficient/Inefficient Groups of Banks

	Efficient Group	Inefficient Group
Capital Adequacy		
Capital to risk weighted assets ratio	17.75	7.45
Capital to Liability ratio	10.38	2.76
Asset Quality		
Non-Performing Loans to Total Loans	6.77	20.95
Earning Assets to Total Assets Ratio	72.74	77.38
Management		
Total Expenditure to Total Income Ratio	68.02	104.74
Operating Expenditure to Total Expenditures	23.35	42.94
Earning per Employee Indicator*	7.70	0.92
Interest Rate Spread	3.72	4.43
Operating Expense Per Employee*	1.23	0.40
Earnings and Profitability		
Net Profit to Asset ratio	0.67	-0.73
Net profit to equity ratio	11.22	-5.70
Net Interest Margin	2.63	3.43
Interest Expense to total assets	6.46	5.10
Non-Interest Expense to total assets	1.87	4.30
Interest Expense to total Expenses	74.89	53.68
Liquidity		
Liquid Assets to Total Assets Ratio	40.91	38.68
Other Indicators		
Advances to total assets ratio	43.86	45.60
Investment to total assets ratio	24.05	29.03
Loan to deposit ratio	61.12	53.56

* Rs.Millions per employee

Earnings and Profitability: In the competitive banking environment, banks concentrate more on reducing cost than raising revenues to serve the rational of profit maximization. However, consistent income streams are also necessary which build the capital base of the bank. In this study, the cost efficient banks also have strong earnings and profitability.

The cost efficient banks contain a weighted average of profit to assets ratio as 0.67 against -0.73 of cost inefficient banks. Similarly, the net profit to equity ratio of cost efficient banks is 11.22 against -5.70 associated with the cost inefficient group.

Cost efficient banks have attained a very low level of non-interest expense to total expense ratio, that is, 1.87 percent against 4.3 percent associated with the inefficient group. The lower ratio of cost efficient banks is in line with optimized administrative cost and lesser amount of losses against non-performing loans. Interestingly, the interest expenses to total asset ratio is higher in the cost efficient group, which is 6.46 against 5.10 of the cost inefficient banks. This reflects that the efficient group is attracting depositors at higher interest rates.

Liquidity: Maintaining sufficient liquidity is necessary to meet the current and near future obligations. The efficient group is maintaining a higher portion of liquid asset in total assets (40.91 percent) than the inefficient group (38.68 percent). However, this ratio remained in a declining trend during the sample period for efficient banks, which is due to high expenditures made by this group in intangible fixed assets and technology.

6. Conclusion

This study has used the “distribution free” approach by applying it on transcendental logarithm (trans log) model for the unbalanced panel data of 37 scheduled banks operating in Pakistan from 1991 to 2002. It is found that all banks significantly differ in relative cost efficiency ranging from 87 percent to 49 percent. Most of the public sector banks exist in the least efficient group while the majority of foreign banks and some private commercial banks in the best efficient group. Non-performing loans have significantly enhanced the degree of cost inefficiency in the banking industry. In addition, these infected loans are also a considerable source of erosion of the capital base of banks, through standard provisioning against them, which has worsened the financial soundness of banks. The technological progress, which mainly comprised of computerization and automation of financial transactions, has significantly reduced the cost of banking industry during the sample period. The banking industry is over-utilizing its resources and operating under diseconomies of scale as the marginal cost is 24 percent more than the real value addition.

The CAMELS indicators provide additional information about the sound and strong financial position of cost efficient banks. These strengths can be indicated by various financial ratios including high capital to liability ratio or capital to risk weighted assets ratio, lesser amount of non-performing loans to total loan ratio, lower expenditure to income ratio, lower operating expenditure to total expenditure ratio, etc. These financial ratios advocate that besides achieving cost efficiency, the cost efficient group has also maintained robust financial health which resulted in higher profitability and strong financial soundness. Moreover, the efficient group is associated with lesser interest rate spread, which is another sound indicator of efficiency.

Overall, there is a huge scope of cost saving in the banking industry of Pakistan which can be achieved through adopting corrective measures in administrative management, optimal diversification of asset portfolio, technological progress and reducing the amount of non-performing loans.

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Appendix

Table 1. List of Efficiency Estimates

Banks	Intercept	Intercept Value	S.E	t. Stats	Efficiency
Bank V-FPB*	$C_{V\text{-}FPB}$	7.54	1.20	6.28	100.00
Bank AD-FPB	$C_{AD\text{-}FPB}$	7.68	1.22	6.30	87.03
Bank N-FPB	$C_{N\text{-}FPB}$	7.75	1.23	6.31	81.63
Bank H-DPB**	$C_{H\text{-}DPBl}$	7.78	1.22	6.35	79.11
Bank G-DPB	$C_{G\text{-}DPB}$	7.78	1.23	6.34	78.62
Bank F-DPB	$C_{F\text{-}DPB}$	7.79	1.22	6.36	78.43
Bank Q-FPB	$C_{Q\text{-}FPB}$	7.79	1.23	6.32	78.29
Bank X-FPB	$C_{X\text{-}FPB}$	7.80	1.22	6.37	77.76
Bank W-FPB	$C_{W\text{-}FPB}$	7.80	1.23	6.36	77.21
Bank E-DPB	$C_{E\text{-}DPB}$	7.80	1.22	6.37	77.07
Bank AE-FPB	$C_{AE\text{-}FPB}$	7.81	1.22	6.42	76.86
Bank T-FPB	$C_{T\text{-}FPB}$	7.81	1.23	6.37	76.67
Bank AB-FPB	$C_{AB\text{-}FPB}$	7.81	1.23	6.36	76.45
Bank Z-FPB	$C_{Z\text{-}FPB}$	7.81	1.23	6.38	76.41
Bank AC-FPB	$C_{AC\text{-}FPB}$	7.82	1.23	6.33	76.13
Bank AA-FPB	$C_{AA\text{-}FPB}$	7.83	1.23	6.39	75.00
Bank A-DPB	$C_{A\text{-}DPB}$	7.83	1.22	6.40	74.78
Bank R-FPB	$C_{R\text{-}FPB}$	7.84	1.22	6.41	74.31
Bank J-DPB	$C_{J\text{-}DPB}$	7.84	1.23	6.40	74.20
Bank C-DPB	$C_{C\text{-}DPB}$	7.86	1.22	6.43	72.97
Bank B-DPB	$C_{B\text{-}DPB}$	7.86	1.22	6.46	72.86
Bank O-FPB	$C_{O\text{-}FPB}$	7.87	1.23	6.40	72.36
Bank AH-PSB***	$C_{AH\text{-}PSB}$	7.87	1.22	6.43	71.93
Bank U-FPB	$C_{U\text{-}FPB}$	7.89	1.23	6.43	70.75
Bank Y-FPB	$C_{Y\text{-}FPB}$	7.91	1.22	6.46	69.44
Bank S-FPB	$C_{S\text{-}FPB}$	7.91	1.22	6.49	69.31
Bank P-FPB	$C_{P\text{-}FPB}$	7.92	1.23	6.46	68.38
Bank K-DPB	$C_{K\text{-}DPB}$	7.96	1.23	6.49	66.08
Bank AJ-PSB	$C_{AJ\text{-}PSB}$	7.99	1.22	6.54	64.15
Bank AF-PSB	$C_{AF\text{-}PSB}$	8.01	1.23	6.52	62.78
Bank I-DPB	$C_{I(\text{-}DP}$	8.03	1.24	6.50	61.69
Bank AI-PSB	$C_{AI(\text{-}PBS}$	8.05	1.23	6.53	60.58
Bank AK-PSB	$C_{AK\text{-}PSB}$	8.05	1.22	6.62	60.55
Bank D-DPB	$C_{D\text{-}DPB}$	8.07	1.22	6.60	58.90
Bank L-DPB	$C_{L\text{-}DPB}$	8.07	1.22	6.60	58.84
Bank M-DPB	$C_{M\text{-}DPB}$	8.13	1.22	6.66	55.67
Bank AG-PSB	$C_{AG\text{-}PSB}$	8.26	1.24	6.66	49.03

*FPB=Foreign Private Bank
**DPB=Domestic Private Bank
***PSB=Public Sector Bank

Table 2. Cost Elasticity of Exogenous Variables

Cost elasticity of advances	$\eta_C^{Advances}$	0.713
Cost elasticity of investment	$\eta_C^{Investments}$	0.091
Cost elasticity of physical asset price	$\eta_C^{price-physical}$	0.28
Cost elasticity of salary	η_C^{Salary}	0.57
Cost elasticity of interest rates	$\eta_C^{\mathrm{Pr}\,ice-Financial}$	0.70
Cost elasticity of NPLs	η_C^{NPLs}	0.05
Cost elasticity of Technology change	η_C^{Time}	-0.538

Table 3. Regression Estimates of the Model

Dependent Variable: Total Cost
Method: Pooled Least Squares
Sample (adjusted): 1991 2002
Included observations: 12 after adjusting endpoints
Number of cross-sections used: 36
Total panel (unbalanced) observations: 338
Convergence achieved after 7 iteration(s)
Cross sections without valid observations dropped

Variable	***Coefficient***	***Std. Error***	***t-Statistic***	***Prob.***
Advances	-0.56	0.31	-1.84	0.07
Advances^2	0.00	0.03	-0.05	0.96
Govt Securities*	-0.16	0.18	-0.90	0.37
Govt Securities^2	0.00	0.01	0.35	0.72
Salary	0.95	0.37	2.56	0.01
Salary^2	0.02	0.04	0.60	0.55
Price (Financial capital)	1.86	0.44	4.18	0.00
Price (Financial capital)^2	0.00	0.05	-0.01	0.99
Price (Physical capital)	0.32	0.21	1.52	0.13
Price (Physical capital)^2	0.00	0.00	0.30	0.77
Advances*Govt Securities	0.01	0.04	0.23	0.82
Salary*Price (Financial Capital)	0.14	0.06	2.25	0.03
Salary*Price (Physical Capital)	0.03	0.03	1.04	0.30
Price(Financial Capital)*Price Physical Capital	-0.02	0.04	-0.49	0.62
Advances*Salary	-0.04	0.07	-0.54	0.59
Advances*Price (Financial Capital)	-0.21	0.09	-2.35	0.02
Advances*Price (Physical Capital)	-0.08	0.04	-1.96	0.05
Govt Securities*Salary	-0.06	0.02	-2.31	0.02
Govt Securities*(Price Financial Capital)	0.00	0.03	-0.14	0.89
Govt Securities*(Price Physical Capital)	0.02	0.02	0.89	0.37
Time Dummy=T	-0.17	0.06	-2.76	0.01
Non Performing Loans=NPLs	0.00	0.00	3.94	0.00
T*Advances	0.01	0.01	0.60	0.55
T*Govt Securities	0.01	0.01	1.88	0.06
T*Salaries	-0.01	0.01	-1.40	0.16
T*Price (Physical Capital)	-0.01	0.01	-1.84	0.07
T*Price(Financial Capital)	-0.03	0.01	-2.26	0.02
$C_{A\text{-}DPB}$	7.83	1.22	6.40	0.00
$C_{B\text{-}DPB}$	7.86	1.22	6.46	0.00
$C_{C\text{-}DPB}$	7.86	1.22	6.43	0.00
$C_{D\text{-}DPB}$	8.07	1.22	6.60	0.00
$C_{E\text{-}DPB}$	7.80	1.22	6.37	0.00
$C_{F\text{-}DPB}$	7.79	1.22	6.36	0.00
$C_{G\text{-}DPB}$	7.78	1.23	6.34	0.00
$C_{H\text{-}DPB}$	7.78	1.22	6.35	0.00
$C_{I\text{-}DPB}$	8.03	1.24	6.50	0.00

Table 3 (Cont…)

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C_{J-DPB}	7.84	1.23	6.40	0.00
C_{K-DPB}	7.96	1.23	6.49	0.00
C_{L-DPB}	8.07	1.22	6.60	0.00
C_{M-DPB}	8.13	1.22	6.66	0.00
C_{N-FPB}	7.75	1.23	6.31	0.00
C_{O-FPB}	7.87	1.23	6.40	0.00
C_{P-FPB}	7.92	1.23	6.46	0.00
C_{Q-FPB}	7.79	1.23	6.32	0.00
C_{R-FPB}	7.84	1.22	6.41	0.00
C_{S-FPB}	7.91	1.22	6.49	0.00
C_{T-FPB}	7.81	1.23	6.37	0.00
C_{U-FPB}	7.89	1.23	6.43	0.00
C_{V-FPB}	7.54	1.20	6.28	0.00
C_{W-FPB}	7.80	1.23	6.36	0.00
C_{X-FPB}	7.80	1.22	6.37	0.00
C_{Y-FPB}	7.91	1.22	6.46	0.00
C_{Z-FPB}	7.81	1.23	6.38	0.00
C_{AA-FPB}	7.83	1.23	6.39	0.00
C_{AB-FPB}	7.81	1.23	6.36	0.00
C_{AC-FPB}	7.82	1.23	6.33	0.00
C_{AD-FPB}	7.68	1.22	6.30	0.00
C_{AE-FPB}	7.81	1.22	6.42	0.00
C_{AF-PSB}	8.01	1.23	6.52	0.00
C_{AG-PSB}	8.26	1.24	6.66	0.00
C_{AH-PSB}	7.87	1.22	6.43	0.00
$C_{AI(-PBS}$	8.05	1.23	6.53	0.00
C_{AJ-PSB}	7.99	1.22	6.54	0.00
C_{AK-PSB}	8.05	1.22	6.62	0.00

Additional Regression properties

R-squared	0.84	Mean dependent var	2.23
Adjusted R-squared	0.80	S.D. dependent var	0.28
S.E. of regression	0.12	Sum squared resid	4.27
F-statistic	22.96	Durbin-Watson stat	2.01
Prob (F-statistic)	0.00		

Fig1: Trends of Various CAMELS Ratios (in Percent)