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Impact of Financial Reforms on Efficiency of State-owned, Private and Foreign Banks in Pakistan

Abid A. Burki
G.S.K. Niazi

LAHORE UNIVERSITY OF
MANAGEMENT SCIENCES

Centre for Management and Economic Research (CMER)
Lahore University of Management Sciences (LUMS)
Opposite Sector 'U', D.H.A, Cantt, Lahore, 54792
Pakistan
URL:http//ravi.lums.edu.pk/cmer

Abid. A. Burki
Director CMER
Professor Department of Economics
School of Humanities and Social Sciences

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Abid A. Burki

Professor of Economics
Lahore University of Management Sciences
Lahore, Pakistan
E-mail: burki@lums.edu.pk

G.S.K.Niazi

Assistant Professor of Administrative Science
Quaid-i-Azam University,
Islamabad, Pakistan
E-mail: gskniazi@yahoo.com

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Abid A. Burki
Professor of Economics

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1. Introduction

Over the past two decades, a large number of developing and transition countries have implemented financial reforms, which are only beginning to attract attention of researchers who want to study banking efficiency in diverse market structures and environments. For example, government ownership of banks is very common in emerging markets where, after decades of excessive government regulatory controls and dominance of state-owned banks, foreign and private banks have recently been allowed to compete freely. Empirical evidence from developing countries increasingly suggests that state-owned banks are least efficient in utilization of banking resources [Barth et al. (1999), Berger et al. (2005), Patti and Hardy (2005)]. Of central concern has been political rent-seeking through lending practices of state-owned banks.[1] Rent-seeking firms are found to borrow more from government banks leading to growing non-performing loan portfolios [Khwaja and Mian (2005)]. Likewise, Berger et al. (2004) have noted that domination of state-owned banks in developing countries may lower GDP growth.

Liberalization and reforms have been introduced in many developing countries to address similar set of issues. Under this approach foreign and private banks have been allowed to compete freely with state-owned banks. Presence of foreign-owned banks in developing and transition countries has been associated with mixed performance.[2] Although empirical research on comparative efficiency of foreign and domestic banks has largely remained limited, yet it has a wider appeal.

In this paper we contribute to the literature on comparative efficiency of domestic and foreign banks with specific reference to Pakistan, which offers an interesting case study. Financial reforms in Pakistan have transformed the banking industry during the 1990s. These reforms included licensing of several new private and foreign banks, higher supervision and strengthening of prudential regulations aimed at improving financial systems and monetary management. To this end, we use a unique bank level data of 40 commercial banks of Pakistan for the period 1991–2000 and use frontier efficiency measure of data envelopment analysis (DEA) to construct efficiency indexes for each bank. For analytical purposes, we divide our sample into state-owned, private and foreign banks. We construct efficiency frontiers on pooled data of each yearly cross-section of banks after standard parametric and non-parametric tests confirmed that these banks come from the same population distribution. To study temporal relationships, we divide the sample into pre-reform (1991-92), first-reform (1993-96) and second-reform (1997-00) periods.[3]

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[1] See for instance LaPorta et al. (2002), Dinc (2005), Brown and Dinc (2005), Khawaja and Mian (2005), Faccio (2006).

[2] See among others Havrylchyk (2006), Patti and Hardy (2005), Ataullah et al. (2004), Hasan and Marton (2003), Isik and Hassan (2002), Grigorian and Manole (2002), Bhattacharyya et al. (1997).

[3] This classification resembles with Patti and Hardy (2005) who consider a pre-reform period (pre-1993), first-reform period (1993-97) and second-reform period (1998-02).

The results obtained indicate strong evidence that banks adjust to enhanced competition in the initial period of reforms when banks move away from their efficient frontier, but efficiency significantly improves in more advanced stages of reforms. The results suggest that the first-phase of reforms failed to convert cost inefficient banks into efficient banks. A comparison of measured efficiency provides some useful insights and shows that foreign and private banks post superior performance while state-owned banks struggle to compete during the reform process. Our multivariate regression results predict the importance of link between bank size, asset quality, bank branches, and share of non-performing to total loans with efficiency indexes.

Section 2 outlines the financial reforms and the evolving role of private and foreign banks in Pakistan. Section 3 lays out the empirical design for measurement of frontier efficiency while Section 4 provides description of the data and construction of variables. Section 5 pertains to measurement of efficiency and interpretation of results while Section 6 discusses the determinants of banking efficiency. Finally, Section 7 concludes the paper with commentary on major findings.

2. Financial Reforms and Embryonic Role of Foreign and Private Banks in Pakistan

In Pakistan, with nationalization of the entire banking and insurance sector in 1972, five nationalized commercial banks (NCBs) were set up after merger of some nationalized banks. These NCBs maintained their dominance in providing financial intermediation services in the country from 1972 to 1990. By this time, five public sector banks dominated the scene with their holding of 92% share in total banking assets while the rest of the share was in the hands of foreign commercial banks [State Bank of Pakistan (2003)].

Since the nationalization of commercial banks in 1972, private ownership of banks was not allowed until this ban was lifted as part of financial sector reforms in 1991. The first-reform period was characterized by liberalization and institutional strengthening of the banking sector [State Bank of Pakistan (2003)]. Liberalization started when ten new private banks were granted permission to operate in 1991, of which eight banks started operations in the later-half of 1992 and the other two joined later. Three new foreign banks were also established in later half of 1992 while two provincial government banks were scheduled in September 1994. Competition was also introduced by privatization of government owned Muslim Commercial Bank and Allied Bank with transfer of control to the private sector by 1993.

While a moratorium was introduced on new banks in 1995, private and foreign banks were allowed to grow and extend operations by easing of branch policy in 1995 whereby controls on opening of new bank branches were removed. Self governance of banks was also strengthened by amendments in Banking Companies Ordinance 1962 in February 1993 while prudential regulations were strengthened in 1994 with focus on capital adequacy, adequate provisioning for non-performing loans and loan recovery mechanisms.

The first set of reforms became effective from 1993-96 while a second set of further reforms were initiated between 1997 and 2000. For example, in January 1997 eligible banks were allowed to offer fund management and investment advisory services, while

in May 1997 the Banking Council of Pakistan was dissolved and the control of state-owned banks was given directly to State Bank of Pakistan. In the same year, CAMELS framework was introduced in line with the Basil Accord. Moreover, minimum paid-up capital requirement was set at Rs.500 million in December 1997.

Due to the embryonic role of foreign and private banks, the share of state-owned banks in bank deposits gradually declined from 93% in 1990 to only 56% in 2000 while the share of private banks increased from zero to about 30% in the same period. Because the financial reforms changed the general business environment in which the state-owned, private and foreign banks operated, it is very likely that the efficiency and productivity of these banks may have varied over time. In particular, improved bank management practices due to enhanced competition, prudential regulations especially those relating to elimination of directed credit for state-owned banks, provisioning for the non-performing loans, and restructuring of some state-owned banks etc., are likely to be most significant in determining their comparative efficiency.

3. Empirical Design for Frontier Efficiency

We measure banking efficiency by the Data Envelopment Analysis (DEA), which was originally developed by Charnes et al. (1978) and has been used by many recent studies in estimating banking efficiency [see, among others, Havrylchyk (2006), Beccalli et al. (2006), Drake et al. (2006), Izik and Hassan (2002)].[4] Some major benefits associated with the DEA method are i) its parsimonious nature toward the data, and ii) its property of not imposing a functional form on the data due to which it operates well with mixed sizes of banks. Because the objective of this paper is to examine efficiency of each yearly cross-section of banks from 1991-2000 and our data have mixed sizes of banks, we prefer the DEA approach over other alternatives.

It should be emphasized that estimates of cost efficiency have dominated the recent banking literature on the assumption that bank management has better control over their costs rather than their outputs [Goddard et al. (2001)]. Since our interest in this paper is also to evaluate how banks were able to reduce their costs after the financial reforms, cost efficiency measurement is our preferred choice.

The DEA method to frontier estimation involves construction of non-parametric best-practice frontier or a piecewise linear surface obtained from the observed data set, which serves as the reference point or benchmark for comparison. The resultant efficiency measure, ranging between zero (least efficient) and one (most efficient), depicts the distance from each unit to frontier. Cost (or economic) efficiency (CE) of a bank defines a composite measure of productive efficiency that includes allocative efficiency (AE) and technical efficiency (TE). Allocative inefficiency refers to failure of banks in choosing correct input combination given their factor prices while TE measures the ratio of inputs technically necessary to the inputs actually employed.

The non-parametric cost minimizing approach used in this paper allows us to break down CE into its different components. Following Fare et al. (1994), we use input price

[1]For a review of this literature, see among others, Berger and Humphrey (1997), and Lovell (1993).

vector to specify and calculate a measure of total *CE* for each bank by solving this envelopment form of linear programming (LP) problem

$$\begin{aligned} &\min_{\lambda, x_i^*} w_i x_i^* \\ &\text{subject to} \\ &-y_i + Y\lambda \geq 0, \\ &x_i^* - X\lambda \geq 0, \\ &N1'\lambda = 1, \\ &\lambda \geq 0 \end{aligned} \qquad (1)$$

where w_i and y_i is for input prices and output levels, respectively for the *i*th decision-making units (DMU) and x_{i^*} represents the cost minimizing vector of input quantities. The cost efficiency of each observation indicates the amount by which cost of production is increased due to technical and allocative inefficiency. For example, a CE score of 0.85 for a bank indicates that the bank could save 15% of the costs by being fully efficient.

In our context, TE simply means the maximum possible output for each combination of inputs. Banks producing on the frontier are efficient, while banks inside the frontier are inefficient. For illustration purposes, consider a banking industry which uses a single input, which can be converted into output. In this case, a bank using one unit of the input to produce one unit of output would get TE score of 1 (1/1) or 100% efficiency. Another bank using six units of input and producing three units of output would get TE score of 0.5 (3/6) or 50% efficiency. A score of 0.5 for a bank indicates that the bank could raise output by 50% by becoming efficient and moving to the frontier. To measure TE, we specify input oriented linear programming problem of the form

$$\begin{aligned} &\min_{\theta, \lambda} \theta \\ &\text{subject to} \\ &-y_i + Y\lambda \geq 0, \\ &\theta x_i - X\lambda \geq 0, \\ &\lambda \geq 0 \end{aligned} \qquad (2)$$

The allocative efficiency is calculated residually by dividing CE with technical efficiency (TE), or *AE = CE/TE*. By its nature, the above procedure of cost efficiency includes any slacks into allocative efficiency, which is justified by Ferrier and Lovell (1990) on the grounds that slacks reflect sub-optimal input mix.

In this problem, θ is a scalar; λ is a *n x 1* vector of constants; *X* is the (*k x n*) matrix of inputs where *n* represents the number of DMUs ; *Y* is the (*m x n*) matrix of outputs. For the *i*th DMU, the vectors x_i and y_i represent the inputs and outputs, respectively. The value of θ represents TE score for the *i*th DMU, where the condition $\theta \leq 1$ holds. To obtain the value of θ for each DMU we solve LP problem *n* times. Due to constant returns to scale the LP problem in Eq.(2) does not fully envelop the data set and thus enlarges the feasible region. Therefore, in the second step, to measure

PTE scores we relax the assumption of CRS by introducing the convexity constraint $N1'\lambda=1$, in to Eq.(2). A measure of scale efficiency is obtained by taking the ratio of scores for TE and PTE. A problem in measuring scale efficiency (SE) with the above approach is that it does not identify the returns to scale. We resolve this problem by running an additional DEA problem by imposing non-increasing returns to scale (NIRS), which implies substituting the $N1'\lambda=1$, restriction with $N1'\lambda\leq1$,.

A common difficulty in measurement of TE with DEA approach is known as input- and output-slacks. These are sections of the piecewise linear frontier that run parallel to the x-axis or y-axis, which could lead to inaccurate measurement of technical, pure technical and scale efficiency. We use a multi-stage methodology suggested by Coelli et al. (1998) that takes care of the problem of slacks successfully.

4. Data and Construction of Variables

While most previous studies on banking efficiency in Pakistan have employed the data from *Banking Statistics of Pakistan* published by the State Bank of Pakistan (2001), inappropriate aggregation of assets, liabilities, costs and revenues and lack of data on the number of bank employees has been cited as major problems in this data [Saeed (2002), Razzaq (2002), Patti and Hardy (2005)].

Hence for this paper we collect data from the annual reports of banks for the period 1991 through 2000.[5] The data are unique in terms of detail and coverage. Our sample consists of all state-owned, private and foreign banks that operate at some point in time between 1991 and 2000. Two small banks (e.g., Gulf Commercial Bank and Bank of Ceylon) were excluded from the sample because their annual reports were not available from any source.

Our sample consists of 40 banks out of which 21 banks had complete data from 1991 to 2000 while 33 banks had time-series data from 1992 to 2000. The final sample consists of 366 observations over the ten year period with an average of more than 36 banks per annum. Due to entry of several new banks in early and mid-1990s and exit/merger of a couple of banks after 1998, the number of observations varies over time. In this way we collect data of 23 commercial banks for the year 1991, 36 banks for the period 1992–1994, 39 banks for 1995, 40 banks for 1996–1998, 39 banks for 1999, and 37 banks for 2000.

A long standing debate in the banking literature on the definition and physical measurement of bank inputs and outputs has failed to produce a consensus on how best to measure them [Sealey and Lindley (1977)]. However, researchers generally adopt either the production or the intermediation approach. The production approach takes the view that banks are producers of loans and deposit account services by using labour and capital as key inputs. Hence the number of accounts best measure output as opposed to dollar value of deposits. Under this approach cost of production includes operatingcosts exclusive of interest expenses.

[5]The annual reports were obtained from the State Bank of Pakistan, Karachi; Ministry of Finance, and the Statistics Division of the Government of Pakistan, Islamabad; Securities and Exchange Commission, Islamabad; Head offices of commercial banks; and branch offices of commercial banks.

The intermediation approach, however, takes the view that banks are intermediaries of financial services whereby they collect purchased funds and convert them into loans, advances, investments and other assets while total costs are defined to include interest costs along with other operating costs.

Table 1 Definition of variables used in efficiency measurement

Variable symbol	Variable Name	Description
TC	Total cost	Wage bill including directors fee + depreci ation on and repair to banks property + operating cost + interest paid on deposits and borrowing
Outputs:		
y_1	Loans & Advances	The value of loans and advances, which include loans, cash credits, overdrafts and bills discounted and purchased
y_2	Investments	The amount of investment made by the bank consisting of government securities, treasury bills, shares fully paid-up, debentures, bonds and other investments, like NIT & gold
y_3	Contra Accounts	The value of contra accounts in Pak rupees, which in cludes liabilities, acceptances, endorsement and other obligations as per contra and the bills for collection being receivable as per contra
Inputs:		
x_1	Labour	Number of full time employees
x_2	Physical Capital	Includes book value of fixed assets, premises, furniture and fixtures
x_3	Operating cost	Total operating cost of bank includes rent, insurance, law charges, postage, telegrams, stamps, auditor's fee, stationary, printing and advertisement, etc.
x_4	Financial Capital	Total deposits +borrowing from other banks and agents
Input prices:		
w_1	Price of labour	Total expenditures on employees' salary including directors' fees divided by the total number of employees
w_2	Price of physical capital	Equal to the depreciation on and repairs of bank property divided by total book value of physical capital
w_3	Price of operating cost	Total operating cost divided by total deposits
w_4	Price of financial capital	Total interest paid on deposits & borrowing divided by financial capital

For our purposes, the intermediation approach seems more relevant because interest costs account for more than 70% of the total costs in Pakistani banks. Therefore, like several other studies[6] on banking efficiency (including those dealing with issues of multi-period efficiency of banks), we also adopt the intermediation approach. We take deposits as input and include interest costs in the total costs. To calculate various efficiency measures we use three outputs: (i) loans and advances, (ii) investments, and (iii) contra accounts, and four inputs: (i) labour, (ii) physical capital, (iii) operating cost, and (iv) financial capital. Table 1 presents our definition of total cost, outputs, inputs and price of inputs while Table 2 reports summary statistics of these variables.

[6]See for instance, Berger and Mester (1997), Mukherjee et al. (2001), Isik and Hassan (2002), Patti and Hardy (2005), Kwan (2006), and Havrylchyk (2006) among many others.

Table 2 Summary statistics of variables used in efficiency measurement (Rs. million)

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Loans & Advances (y_1)	Mean	10087.3	7548.0	9560.5	10398.0	11933.1	12847.9	14525.2	14701.7	17135.3	20930.1
	SD	20247.7	17812.7	21987.8	22708.6	25454.8	27416.5	29707.1	31251.1	35430.3	41614.2
Investments (y_2)	Mean	6444.5	6405.9	6873.7	8318.7	7995.0	8951.5	10055.6	10514.5	8521.7	9068.2
	SD	12079.2	14316.2	14253.8	18167.1	19009.7	20110.0	20161.8	21416.3	19393.0	18122.8
Contra Account (y_3)	Mean	9794.7	7339.8	7757.1	10096.5	10737.7	10449.7	8892.5	8604.3	10419.0	9483.4
	SD	20971.5	17525.4	17420.3	20789.2	22117.9	23878.1	18049.1	19629.1	22519.5	19457.3
Labour (x_1)	Mean	4475.9	2887.1	2924.5	2954.2	2811.4	2830.6	2331.4	2250.7	2220.7	2431.4
	SD	9066.9	7295.6	7283.3	7243.6	7026.0	7028.3	5372.0	5213.1	5037.6	6171.2
Physical Capital (x_2)	Mean	145.4	137.9	161.4	192.0	225.4	245.8	476.5	645.9	732.0	713.7
	SD	287.3	293.4	329.9	369.2	428.7	410.5	1142.5	1412.1	1532.3	1518.7
Operating Cost (x_3)	Mean	108.9	92.3	116.4	136.2	156.1	179.6	159.1	173.8	192.2	203.7
	SD	223.0	214.3	267.0	307.8	350.2	418.1	260.6	278.4	318.0	339.1
Financial Capital (x_4)	Mean	19332.2	15995.6	18627.3	21882.6	23677.5	25991.0	29128.6	31102.2	34449.3	35725.7
	SD	36988.1	36261.3	39722.3	45188.6	49920.3	54530.1	56674.5	61590.7	68010.6	71512.1
Price of Labour (w_1)	Mean	0.11202	0.13196	0.16668	0.19410	0.22864	0.25490	0.31302	0.35519	0.38807	0.39404
	SD	0.04914	0.06510	0.06782	0.08493	0.12549	0.13086	0.19914	0.24003	0.24701	0.22693
Price of Physical Capital (w_2)	Mean	0.29700	0.38975	0.43573	0.33955	0.32271	0.22946	0.18520	0.17573	0.18992	0.22451
	SD	0.23597	0.41582	0.37842	0.21893	0.24194	0.21862	0.11052	0.10671	0.13897	0.19717
Price of Operating Cost (w_3)	Mean	0.00723	0.00888	0.00757	0.00749	0.00797	0.00867	0.00731	0.00845	0.00944	0.00903
	SD	0.00382	0.00591	0.00270	0.00257	0.00300	0.00375	0.00270	0.00367	0.00518	0.00416
Price of Financial Capital (w_4)	Mean	0.05219	0.04621	0.06131	0.07261	0.08286	0.09430	0.09878	0.10878	0.10241	0.08253
	SD	0.01883	0.01927	0.01595	0.00257	0.02490	0.04624	0.04195	0.03156	0.05038	0.03168

Note: All the data in rupee values have been deflated by the GDP deflator with base year 1990-91=100.

5. Results

5.1 Production Frontier for State-owned, Private and Foreign Banks

We begin by asking if state-owned, private and foreign banks in our sample employ same or somewhat different production technologies.[7] If they operate in different legal and business environments, then pooling of the data in each cross-section may not be appropriate. To address this issue, we compute DEA cost, allocative, technical, pure technical and scale efficiency of state-owned, private and foreign banks relative to their pooled and separate frontiers.[8]

To allow inefficiency to vary over time, we construct efficiency frontiers for each yearly cross section of banks by solving LP problems rather than constructing one multi-year frontier.[9]

The efficiency measures for pooled and separate frontiers are presented in Table 3 where we note that mean efficiency of separate frontier for each yearly cross-section and bank type is either equal to or greater than mean efficiency of pooled frontier, which is an indication that pooled frontier always envelops separate frontier in our sample. Following Elyasiani and Mehdian (1990) and Isik and Hassan (2002), we continue and test the null hypothesis that efficiency distributions of the state-owned, private and foreign banks obtained from pooled sample are same as the distributions obtained from separate frontier by a) the analysis of variance test; b) Kruskal-Wallis test; and c) the Median test. From test statistics reported in Table 4, we fail to reject the null hypothesis that the three banking samples follow identical production technology, which indicates that the data of three types of banks can be pooled. This is consistent with the results obtained, for pooled frontier always envelops separate frontier in our sample. Following Elyasiani and Mehdian (1990) and Isik and Hassan (2002), we continue and test the null hypothesis that efficiency distributions of the state-owned, private and foreign banks obtained from pooled sample are same as the distributions obtained from separate frontier by a) the analysis of variance test; b) Kruskal-Wallis test; and c) the Median test. From test statistics reported in Table 4, we fail to reject the null hypothesis that the three banking samples follow identical production technology, which indicates that the data of three types of banks can be pooled. This is consistent with the results obtained, for example, by Sathye (2001) and Isik and Hassan (2002) who also failed to reject the null hypothesis for the Australian and Turkish banks, respectively.

[7]We use the definition of the State Bank of Pakistan to categorize commercial banks into state-owned, private and foreign banks [State Bank of Pakistan (2003), chapter 3].

[8]We do not extend the hypothesis test to PTE and SE because they are obtained by decomposing TE and, therefore, are expected to follow same pattern as *TE*.

[9]For some other multi-year efficiency studies constructing frontiers for each cross-section see Bauer et al. (1993), DeYoung and Hasan (1998), Isik and Hassan (2002), Havrylchyk (2006).

Table 3 Efficiency measures relative to separate and pooled frontiers

a) State-owned Banks:

Year	Separate frontier			Pooled frontiers		
	CE	*AE*	*TE*	*CE*	*AE*	*TE*
1991	0.938	0.951	0.985	0.793	0.848	0.956
1992	0.879	0.914	0.942	0.672	0.850	0.793
1993	0.870	0.894	0.974	0.712	0.864	0.827
1994	0.912	0.947	0.963	0.728	0.826	0.886
1995	0.919	0.929	0.990	0.617	0.711	0.884
1996	0.918	0.965	0.950	0.321	0.489	0.672
1997	0.958	0.970	0.985	0.587	0.687	0.856
1998	0.918	0.947	0.968	0.465	0.627	0.758
1999	0.820	0.905	0.898	0.646	0.764	0.846
2000	0.822	0.903	0.899	0.538	0.704	0.769
1991-2000	0.898	0.934	0.956	0.605	0.736	0.822

b) Private Banks:

Year	*CE*	*AE*	*TE*	*CE*	*AE*	*TE*
1991	--	--	--	--	--	--
1992	0.921	0.936	0.978	0.846	0.879	0.957
1993	0.935	0.953	0.980	0.885	0.946	0.936
1994	0.936	0.951	0.983	0.859	0.924	0.930
1995	0.857	0.886	0.964	0.789	0.862	0.908
1996	0.917	0.959	0.956	0.434	0.663	0.672
1997	0.947	0.973	0.971	0.733	0.816	0.897
1998	0.729	0.800	0.914	0.680	0.796	0.853
1999	0.868	0.927	0.932	0.817	0.910	0.984
2000	0.916	0.958	0.951	0.795	0.890	0.889
1991-2000	0.978	0.927	0.959	0.751	0.847	0.879

-- Not available

c) Foreign Banks:

Year	*CE*	*AE*	*TE*	*CE*	*AE*	*TE*
1991	0.979	0.979	1.000	0.979	0.979	1.000
1992	0.943	0.964	0.968	0.933	0.964	0.966
1993	0.914	0.963	0.944	0.909	0.958	0.942
1994	0.880	0.948	0.923	0.880	0.949	0.923
1995	0.903	0.933	0.964	0.844	0.883	0.951
1996	0.575	0.695	0.822	0.539	0.657	0.817
1997	0.745	0.818	0.908	0.744	0.822	0.904
1998	0.758	0.846	0.896	0.689	0.786	0.874
1999	0.798	0.874	0.911	0.769	0.854	0.906
2000	0.828	0.930	0.882	0.828	0.933	0.878
1991-2000	0.925	0.922	0.923	0.797	0.869	0.908

Table 4 Summary of tests for same or distinct frontiers by bank ownership

Efficiency Measures	Analysis of variance (ANOVA)[a]	Kruskal-Wallis test[b]	Median test[c]
	F (Prob > *F*)	χ^2 (Prob > χ^2)	χ^2 (Prob > χ^2)
1991			
CE	3.22* (0.087)	2.99* (0.084)	Test not possible [d]
AE	1.91 (0.182)	2.75* (0.097)	Test not possible
TE	1.15 (0.334)	1.17 (0.190)	Test not possible
1992			
CE	0.34 (0.712)	1.52 (0.466)	1.47 (0.479)
AE	0.86 (0.430)	1.46 (0.481)	1.47 (0.479)
TE	0.23 (0.791)	0.52 (0.469)	Test not possible
1993			
CE	0.46 (0.633)	1.90 (0.386)	2.58 (0.275)
AE	1.62 (0.213)	3.73 (0.155)	2.48 (0.289)
TE	0.43 (0.653)	1.02 (0.311)	Test not possible
1994			
CE	0.91 (0.409)	1.03 (0.596)	1.08 (0.581)
AE	0.01 (0.989)	0.07 (0.961)	0.66 (0.718)
TE	0.78 (0.464)	0.06 (0.796)	Test not possible
1995			
CE	0.55 (0.577)	2.10 (0.349)	3.95 (0.139)
AE	0.58 (0.563)	2.82 (0.244)	3.95 (0.139)
TE	0.46 (0.629)	0.83 (0.361)	Test not possible
1996			
CE	3.44 (0.689)	4.46 (0.101)	4.53 (0.209)
AE	1.40 (0.525)	1.86 (0.103)	6.53 (0.338)
TE	3.03 (0.160)	0.20 (0.651)	Test not possible
1997			
CE	4.43 (0.123)	8.20 (0.258)	9.63 (0.509)
AE	6.62 (0.136)	9.31 (0.191)	8.13 (0.783)
TE	3.20 (0.109)	0.83 (0.361)	Test not possible
1998			
CE	3.66 (0.235)	7.48 (0.224)	3.33 (0.189)
AE	4.88 (0.113)	8.64 (0.130)	11.20 (0.104)
TE	0.66 (0.518)	0.22 (0.632)	Test not possible
1999			
CE	0.64 (0.533)	2.47 (0.290)	2.62 (0.269)
AE	1.74 (0.189)	2.48 (0.288)	2.62 (0.269)
TE	0.14 (0.869)	0.45 (0.499)	Test not possible
2000			
CE	0.92 (0.406)	2.73 (0.255)	2.34 (0.310)
AE	0.89 (0.419)	3.67 (0.159)	9.01** (0.011)
TE	0.75 (0.479)	0.23 (0.625)	Test not possible

Notes: P-values are in parenthesis. **, * indicate significance at 5% and 10% levels.

[a]Null hypothesis for ANOVA test is that mean^s = mean^p = mean^f, where superscripts s, p and f stand for state-owned, private, and foreign banks, respectively.

[b]Null hypothesis for Kruskal-Wallis test is that the efficiency distributions for sate-owned, private and foreign banks are same.

[c]Median test has the null hypothesis that the median of the efficiency measures for state-owned, private and foreign banks are equal.

[d]All values were less than or equal to the median, therefore, median test cannot be performed.

5.2 Financial Reforms and Trends in Banking Efficiency

To investigate the impact of financial reforms on banking efficiency, we evaluate time series properties of five DEA efficiency indexes for each cross-section of banks in our full sample (Table 5). In general, banks in our sample exhibit average cost efficiency of 74.5% from 1991 to 2000, which is in line with some other studies conducted on the banking sectors of emerging and developing economies [see, among others, Isik and Hassan (2002), Kwan (2006)]. From its highest levels in pre-reform period (1991-92) the indices of mean (median) efficiency consistently declines in first-reform period (1993-96). These results suggest that banks on average have moved away from the efficient cost frontier during the first reform period (1993-96).

Table 5 Time series properties of efficiency measures for all banks

		CE	*AE*	*TE*	*PTE*	*SE*
1991 (n = 23)	Mean	0.923	0.939	0.979	0.994	0.986
	(Median)	(0.977)	(0.977)	(1.000)	(1.000)	(1.000)
1992 (n=36)	Mean	0.853	0.918	0.925	0.964	0.959
	(Median)	(0.915)	(0.936)	(0.998)	(1.000)	(0.999)
1993 (n=36)	Mean	0.859	0.934	0.915	0.948	0.963
	(Median)	(0.917)	(0.967)	(1.000)	(1.000)	(1.000)
1994 (n=36)	Mean	0.841	0.915	0.917	0.955	0.960
	(Median)	(0.893)	(0.947)	(0.969)	(1.0000)	(0.998)
1995 (n=39)	Mean	0.780	0.841	0.924	0.945	0.976
	(Median)	(0.805)	(0.901)	(0.983)	(1.000)	(0.997)
1996 (n=40)	Mean	0.464	0.625	0.745	0.822	0.907
	(Median)	(0.388)	(0.601)	(0.762)	(0.977)	(0.979)
1997 (n=40)	Mean	0.709	0.793	0.892	0.942	0.946
	(Median)	(0.701)	(0.790)	(0.917)	(1.000)	(0.983)
1998 (n=40)	Mean	0.641	0.757	0.844	0.896	0.941
	(Median)	(0.634)	(0.760)	(0.910)	(1.000)	(0.998)
1999 (n=39)	Mean	0.758	0.852	0.890	0.927	0.958
	(Median)	(0.789)	(0.839)	(0.959)	(1.000)	(1.000)
2000 (n=37)	Mean	0.762	0.876	0.861	0.922	0.933
	(Median)	(0.827)	(0.922)	(0.931)	(1.000)	(0.980)
Full sample: 1991-2000	Mean	0.745	0.844	0.882	0.929	0.943
	Std. Dev	(0.123)	(0.079)	(0.095)	(0.085)	(0.072)

Part of the problem is that the earning and profitability of several banks fell in 1996 due to higher provisioning for exacerbated problem of non-performing loans.[10] However, in the second-reform period (1997-2000), mean and median efficiency indexes post a dramatic recovery in efficiency ratings first from 1996 to 1997 and then from 1998 to 2000 with mean CE of 72% for this period.

[10] While the ratio of non-performing loans to gross advances started rising in early 1990s, major provisioning for these loans took place in 1996. Before 1996 the banks followed a practice of rescheduling loans (called 'ever-greening) that otherwise should have become non-performing [State Bank of Pakistan (2003)].

Across the entire sample, CE efficiency index in 1991is 91%; this fell to 46% in 1996 before recovering to more than 76% in 2000 while mean AE and TE indexes also fell from more than 90% in 1991 to less than 75% in 1996 before their recovery to more than 86% in 2000. Likewise, PTE and SE indexes also follow a similar pattern in the study period. These results contradict the conclusions reached by some earlier studies on Pakistan's banking sector. For example, Patti and Hardy (2005) show that average efficiency of banks increased in pre-reform (1981-1992) and first-reform (1993-1997) periods, but they did not find enough evidence to suggest that efficiency of these banks increased in the second-reform period (1998-2002). However, Ataullah et al. (2004) conclude that banking efficiency increased in the pre-reform (1988-1991) and initial liberalization (1992-1994) periods, albeit at a slower pace, but significantly increased during 1995-1998 period. Different trends in efficiency found by earlier studies across the three time periods might relate to their data problems to which Patti and Hardy (2005) continue to draw our attention.

Next, we examine how long bank level efficiency has persisted over the period of financial reforms. This question is addressed by examining the temporal relationship of the cross-sectional rank order efficiency of each of the 33 banks in our sample for which we had complete time series data from 1992 to 2000. In Table 6, the Spearman's rank order correlation coefficients of efficiency estimates for 33 banks are reported, which suggest that the temporal rank orders of CE and PTE are significantly correlated for six subsequent years at the 1% level while AE, TE and SE indexes of efficiency did not persist for more than two years and demonstrated a more transitory pattern afterwards. This evidence is somewhat similar to the conclusions drawn by Kwan (2006) and Eisenbeis et al. (1999) for commercial banks in Hong Kong, and bank holding companies in the US, respectively. The analysis further reveals that, in general, the first phase of financial reforms (1993-96) failed to convert cost inefficient banks into efficient banks while in the second phase of reforms (1997-00) some success was achieved, but that too was transitory.

Table 6 Spearman rank correlation of efficiency estimates across time for 33 Banks from 1992 to 2000

Time period	CE	AE	TE	PTE	SE
1992	1	1	1	1	1
1993	0.566***	0.466***	0.534***	0.519***	0.487**
1994	0.624***	0.553***	0.600***	0.748***	0.546***
1995	0.650***	0.421**	0.362**	0.631***	0.132
1996	0.526***	0.190	0.248	0.584***	0.231
1997	0.539***	0.345**	0.401**	0.433***	0.571***
1998	0.452***	0.255	0.373**	0.549***	0.347**
1999	0.211	0.196	0.162	0.247	0.125
2000	0.482***	0.566***	0.245	0.357**	0.211
Sample size	33	33	33	33	33

***, ** indicate correlation is significant at the 1% and 5% levels, respectively.

5.3 Efficiency Differentials between State-owned, Private and Foreign Banks

Table 3 and Figure 1 through Figure 5 give efficiency results for the state-owned, private and foreign banks. A comparison of mean efficiency indexes indicates that foreign and private banks are generally more efficient than the state-owned banks.[11] These results suggest strong similarity between relative efficiency of domestic and foreign banks to that found by some other studies [see for instance, Ataullah et al. (2004) for Pakistan, and Kumbhakar and Sarkar (2003) for India].

In terms of cost efficiency we note in Figure 1 that foreign banks out-perform state-owned and private banks in pre-reform (1991-92) and first-reform period (1993-96). However, we witness a fall in mean efficiency of foreign banks vis-à-vis private banks around 1998, explained by freezing of foreign currency accounts leading to sharp fall in foreign currency deposits of foreign banks and a contraction in their assets.[12] These results are in line with the conclusions drawn by Ataullah et al. (2004) for Pakistani banks around the same period. Quite a similar picture is depicted in Figure 2 and Figure 3 about allocative and technical efficiency where foreign and private banks post much superior performance than state-owned banks The performance of private commercial banks as a group is remarkable given that they were newly established and were small in size.[13] Superior cost efficiency of private commercial banks vis-à-vis state-owned banks may be attributable to their better management techniques based on flexible market oriented policies aided by young, astute and energetic mid-level management, which was hard to find in state-owned banks. Poor performance of state-owned banks may be attributed to a host of political and managerial attributes.[14]

Figure 2 indicates that foreign and private banks experience highest AE scores (or lowest allocative inefficiency) while these scores are lowest for state-owned banks (or highest allocative inefficiency). High allocative inefficiency of state-owned banks could be attributed to their managers' inability to choose correct input mix due to lack of independence. Foreign banks post superior technical efficiency as compared with state-owned and private banks in first- and second-reform periods, except in post-1998 period (Figure 3) for the reasons discussed earlier. Foreign banks led technical efficiency drive by introducing new and superior banking and customer support services that were non-existent in domestic banking sector until few years ago.[15] TE roughly remains stable for all the three categories of banks in first-reform period (1993-00) with a fall in efficiency score in 1996, which shows remarkable recovery in second reform period

[12]The year 1998 was most eventful in Pakistan's history due to nuclear detonation followed by economic sanctions on Pakistan forcing the government to freeze the foreign currency accounts in summer 1998 in all Pakistani banks.

[14]Some of these attributes relate to "political intervention, over-staffing, over-branching and inefficiencies", which have led "to the problems of large non-performing loans,13 high administrative expenses, huge losses and eroding capital base" [State Bank of Pakistan (2003)].

[15]More specifically, foreign banks provided such services as traveler's cheques, credit cards, automated teller machines (ATM), etc. more than a decade ago, while their domestic counterparts were not so quick in responding to these initiatives.

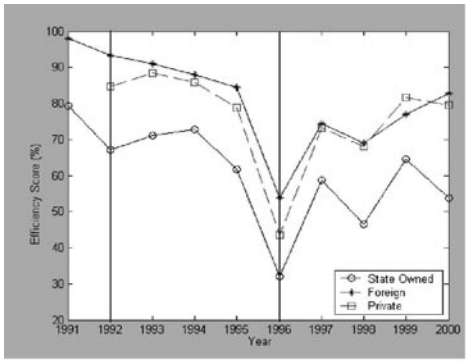

Figure 1: Mean Cost Efficiency of Banks, 1991-2000

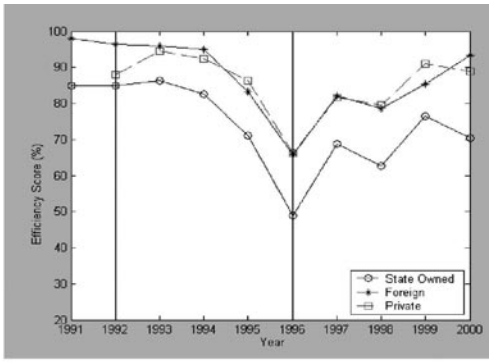

Figure 2: Mean Allocative Efficiency of Banks, 1991-2000

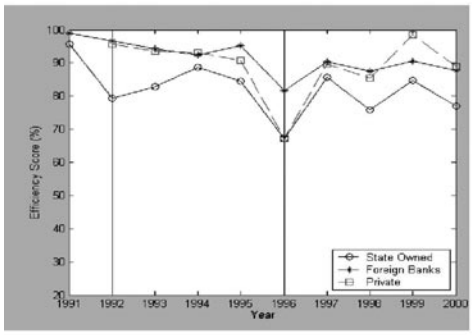

Figure 3: Mean Technical Efficiency of Banks, 1991-2000

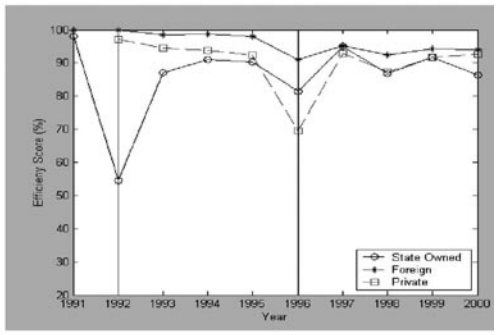

Figure 4: Mean Pure Technical Efficiency of Banks, 1991-2000

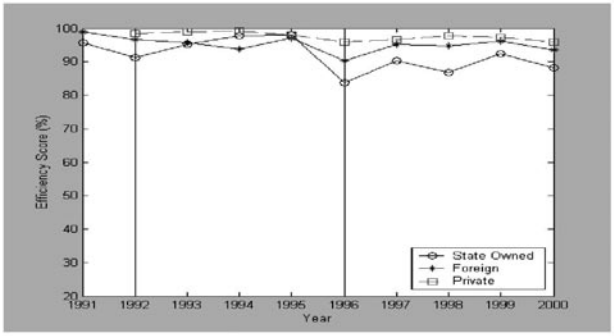

Figure 5: Mean Scale Efficiency of Banks, 1991-2000

(1997-00). The main source of divergence from efficient frontier around 1996 lies with state-owned and private banks because they used more banking resources than technically necessary to produce banking output. Liberalization and competition in later period forced domestic banks to take initiatives and introduce more modern technological innovations such as facility of ATMs, telephonic banking, and internet banking, etc.

A major source of technical inefficiency for state-owned and private banks is PTE while for foreign banks scale inefficiency is more significant (see Figure 4 & Figure 5). Due to superior service quality offered by private and foreign banks, state-owned banks faced difficulties in maintaining market share in deposits, advances and investment. State-owned banks were also plagued by the problems of high administrative expenses (due to over staffing, over branching and large non-performing loans) leading to input use inefficiency reflected by PTE, i.e., TE net of scale or output related effects. Foreign banks performed fairly well in terms of their PTE until 1995 after which they faced a rising trend in their operating cost (a) due to higher expense per employee, and (b) due to freezing of foreign currency accounts in 1998. Moreover, since foreign banks devoted more than 95% of their investment in government securities [State Bank of Pakistan (2003)], a declining yield on six-month treasury bills was also responsible for this input related inefficiency of foreign banks.

5.4 Returns to Scale

In Table 7 we report the returns to scale, which indicates that most Pakistani commercial banks operate on the flatter portion of their cost curves. However, 23% of the banks exhibit increasing returns to scale suggesting that these banks can gain by increasing their size because they operate on the downward sloping portion of their cost curve. By contrast, 33% of the banks exhibit decreasing returns suggesting that over-expansion is a cause for concern for these banks.

The majority of state-owned banks (56.4%) experience decreasing returns to scale (DRS) confirming the extra cost incurred by them. This result makes sense if seen in the historical perspective when in the pre-reform era, due to curbs on new entry, state-owned banks were meeting excess demand for financial services by producing more than the optimum scale. For the same reason, share of scale inefficient (DRS) state-owned banks is highest in 1992 after ten new banks entered the market. After a brief period of improvement in mid-1990s the share of scale inefficient banks peaked in 1997, which prompted policy makers to introduce major restructuring and downsizing plan. Due to these measures share of scale inefficient banks temporarily decreased (from 87.5% in 1997 to 37.5% in 1998) before rising in 2000. By contrast, state-owned banks operating on their downward sloping portion of average costs persistently failed to increase size to gain from scale economies.

The returns to scale of private banks also paint a dismal picture where out of 12 private banks, on average, six banks expanded operations after 1995 beyond their efficient scale. Most foreign banks (58%) operate on their flatter portion of average cost curve, or at the right scale, leaving no gain associated with change in scale of production. A relatively smaller proportion of foreign banks (25.4%) also operate at IRS, while quite a few of them (16.4%) operate at DRS. Note that in 1991 all foreign banks operate at the efficient scale, but entry of some new foreign banks in 1992, and

Table 7 Returns to scale, 1991 – 2000

Year	All banks			State-owned banks			Private banks			Foreign banks		
	IRS	CRS	DRS	IRS	CRS	DRS	IRS	CRS	DRS	IRS	CRS	DRS
1991 (n =23)	0	19	4	0	3	4	--	--	--	0	16	0
1992 (n =36)	7	18	11	2	0	6	2	4	3	3	14	2
1993 (n =36)	5	19	12	1	2	5	1	4	4	3	13	3
1994 (n =36)	11	15	10	2	2	4	4	2	3	5	11	3
1995 (n =39)	9	17	13	2	4	2	2	3	7	5	10	4
1996 (n =40)	15	11	14	2	1	5	5	2	5	8	8	4
1997 (n =40)	9	13	18	1	0	7	3	4	5	5	9	6
1998 (n =40)	13	18	9	2	3	3	4	3	5	8	11	1
1999 (n =39)	6	19	14	1	3	4	0	5	7	5	11	3
2000 (n =37)	9	11	17	1	2	4	2	2	8	6	7	5
Total (%)	84 (23.0)	160 (43.7)	122 (33.3)	14 (18.0)	20 (25.6)	44 (56.4)	23 (23.2)	29 (29.3)	47 (47.5)	48 (25.4)	110 (58.2)	31 (16.4)

-- Not available

rising competition from newly opened private banks pushed some foreign banks into incorrect scale. Moreover, scale inefficiency of foreign banks is also explained by their untapped potential of increasing returns (due to fewer bank branches) and, by their reliance on foreign currency accounts (due to which they failed to reach at the right scale). Scale inefficiency due to DRS of foreign banks is related to failure of established (large) foreign banks to achieve scale efficiency.

6. Explaining Determinants of Efficiency

We further investigate how banking efficiency measures are correlated with some key bank related attributes. Because our DEA efficiency measures are truncated above at 1, and there are many values of efficiency indexes being 1, this generates the Tobit model

$$y_i = X_i\beta + e_i \qquad \text{if } X_i\beta + e_i < 1,$$
$$= 1 \qquad \text{otherwise,}$$

where y_i represents the efficiency indexes *CE, AE, TE,* etc., X_i is a vector representing explanatory variables, β represents estimated parameters while e_i is for error term distributed ~N(0,σ^2).

The explanatory variables in this specification are discussed next. We use real asset size, measured by natural logarithm of bank total assets at 1990/91 constant rupee, to capture the effects of scale of operations on banking efficiency. While our initial findings suggest that foreign and private banks are most efficient vis-à-vis state-owned banks, the fact remains that all new foreign and private banks are typically small in size. Moreover, some large foreign and state-owned banks are also very efficient. Therefore, it would be interesting to see how asset size relates to different efficiency measures in our sample.

A larger share of earning assets to total assets is a sign of good asset quality, which leads to higher profitability at given level of expenses. Therefore, we construct earning assets to total assets variable to control for asset quality across banks in our sample. Loans are considered least liquid and hence most risky of the banking assets. At another level, loans are also a major source of operating income. To capture the liquidity and sensitivity to market risk, we construct loans to deposit ratio. Therefore, an increase in this ratio may associate with higher efficiency.

To control for the effects of ownership status of banks, we construct dummy variables for state-owned, private and foreign banks and use state-owned banks as the base category in the regressions. Finally, period dummies for three reform periods are also included (but not reported) namely, pre-reform (1991-92), first-reform (1993-96) and second-reform periods (1997-00) while taking pre-reform period as the benchmark. For estimation purposes, we use pooled data of all banks in our sample.

The results presented in Table 8 suggest that the indicators of asset quality, liquidity and sensitivity to market risk and bank size are strongly correlated with most of the efficiency measures. As expected, the ratio of earning assets to total assets associates positively with all the efficiency measures indicating that an increase in this ratio increases banking efficiency. Likewise, loans to asset ratio is also significantly positive in all the regressions indicating that concentration of banking assets on loans increases their relative efficiency in our sample. This result is consistent with the conclusion drawn by Isik and Hassan (2002) in the case of loans to total assets ratio for Turkish banks.

Table 8 Determinants of efficiency

Dependent variable	CE	AE	TE	PTE	SE
Constant	0.243***	0.766***	0.101*	0.323**	0.531***
	(2.70)	(11.13)	(1.89)	(2.51)	(7.55)
Log (Real assets)	0.038***	0.003	0.064***	0.073***	0.031***
	(4.74)	(0.58)	(7.41)	(5.90)	(5.18)
Interest income to earning assets	0.022**	0.010*	0.163***	0.038	0.165***
	(2.26)	(1.66)	(2.01)	(0.81)	(2.89)
Loans to deposits ratio	0.278***	0.093**	0.258***	0.232***	0.102***
	(5.75)	(2.52)	(4.63)	(3.32)	(2.63)
Foreign bank	0.264***	0.153***	0.257***	0.251***	0.136***
	(8.14)	(6.15)	(7.17)	(5.34)	(5.42)
Private bank	0.197***	0.125***	0.139***	0.026	0.109***
	(5.79)	(4.80)	(3.96)	(0.57)	(4.41)
Log-likelihood	20.21	105.14	?48.23	?95.33	30.16
Sample size	366	366	366	366	366

Note: Results are based on a Tobit regression censored above at 1. Numbers in parentheses are asymptotic *t*-values. *, **, and *** denote statistical significance at the 10, 5 and 1% levels, respectively. Control variables include period dummy for the first-reform (1993-96), and the second-reform (1997-00).

The estimated coefficients are in each case, except AE, positive for the log (real assets). To illustrate, the estimated coefficient in CE equation in Table 8 implies that an increase in the log (real assets) by 1.52 (its standard deviation) increases cost efficiency of banks by 5.9%. Such gains in efficiency associated with asset size are largest in the case of PTE, i.e., 11.2 %. Our results also suggest strong similarities

between the impact of bank size on allocative efficiency index to that found by Isik and Hassan (2002). We note that size of a bank is not significantly associated with its AE index indicating that, irrespective of their size, banks may fail in equating their marginal rates of substitution of factors with factor prices.

Our results on the effects of ownership type on cost efficiency of banks show that foreign and private banks are significantly more efficient than state-owned banks in our sample. The coefficient on foreign and private banks are large and positive in each case while the estimated coefficient in CE equation predicts that on average foreign and private banks are respectively 27% and 19% more cost efficient than state-owned banks.

In addition to the above, we also run related specifications where we examine the impact of non-performing loans and number of bank branches on efficiency indexes. Recent cross-country evidence from emerging markets shows that political influence on government-owned banks in major emerging markets increases their lending from government-owned banks [La Porta et al. (2002), Dinc (2005), Brown and Dinc (2005), Faccio (2006)]. More specifically, Khawaja and Mian (2005) present a stark picture of political rent seeking by the politically connected firms in Pakistan through their influence primarily on state-owned banks. Higher default rates of banks lead to swelling of non-performing loan in the Pakistani context to which Patti and Hardy (2005) and Ataullah et al. (2004) also continue to draw our attention. In essence, a rising trend in the ratio of non-performing to total loans signals deteriorating quality of a bank's asset portfolio, which in turn lowers net income and risks solvency.

We evaluate their impact on banking efficiency by regressing efficiency index of each bank on their ratio of non-performing to total loans. The results in Table 9 show that cost inefficiency of banks stemming from non-performing loan comes through failure of banks to be fully technically efficient. We find that every 10% increase in ratio of non-performing to total loans decreases banks' cost efficiency by 6%, technical efficiency by 8%, and pure technical efficiency by 12%.

Table 9 Effect of non-performing loans on efficiency

Dependent variable	CE	AE	TE	PTE	SE
Non-performing loans (ratio to total loans)	-0.198** (-2.45)	-0.083 (-1.46)	-0.234*** (-2.74)	-0.075 (-0.68)	-0.168*** (-3.26)
Control variables	YES	YES	YES	YES	YES
Log-likelihood	27.10	117.81	-56.87	-102.89	44.72
Sample size	331	331	331	331	331

Note: Results are based on a Tobit regression censored above at 1. Numbers in parentheses are asymptotic *t*-values. **, and *** denote statistical significance at the 5 and 1% levels, respectively. These results are based on 331 observations instead of 366 because the data on non-performing loans are not available for the remaining banks. Control variables include, earning assets to total assets, loans to deposit ratio, period dummy for first-reform (1993-96), period dummy for second-reform (1997-00), and foreign and private bank dummies.

Banks operating in rural markets maintain extended branch network, which is likely to be a cause of their poor efficiency score. Private and foreign banks only operate in big cities and towns with a limited network of bank branches. However, state-owned banks operate with extended branch network both in urban and rural areas. Since the delivery system in rural areas is very costly, banks operating rural branch network are expected to maintain several loss making branches, which reflect poorly on their efficiency. Therefore, number of bank branches, used as control for banking environment is expected to be negatively correlated with efficiency indexes. Our regressions results in Table 10 confirm that bank branches associate negatively with efficiency index of banks. The estimated coefficient in CE equation implies that a decrease in the log of the number of bank branches by 2.22 (its standard deviation) increases cost efficiency of banks in our sample by 7.1%.

Table 10 Effect of number of bank branches on efficiency

Dependent variable	CE	AE	TE	PTE	SE
Log (number of bank branches)	-0.032***	-0.028***	-0.016***	-0.012	-0.012***
	(-6.57)	(-7.85)	(-2.89)	(-1.46)	(-3.11)
Control variables	YES	YES	YES	YES	YES
Log-likelihood	10.07	110.73	-79.45	-129.83	16.59
Sample size	366	366	366	366	366

Note: Results are based on a Tobit regression censored above at 1. Numbers in parentheses are asymptotic *t*-values. *** denote statistical significance at the 1% levels. Control variables include, earning assets to total assets, loans to deposit ratio, period dummy for first-reform (1993 - 96), and period dummy for second-reform (1997 - 00), and foreign and private bank dummies.

7. Conclusions

This paper investigates the impact of financial reforms on banking efficiency of state-owned, private and foreign banks in Pakistan by employing DEA frontier efficiency measures using a unique data from 1991 to 2000. On the basis of estimation of yearly cross-section data of 40 commercial banks with the DEA methodology, we distinguish between cost, allocative, technical, pure technical and scale efficiency of banks. We applied parametric and non-parametric tests to conclude that the data of state-owned, private and foreign banks can be pooled because they employ identical production technology. The paper applied maximum likelihood Tobit regression analysis to identify the determinants of banking efficiency in Pakistan.

Measured efficiency of each yearly cross-section was found to decline in the first reform period (1993-96), suggesting that Pakistani banks moved away from their efficient cost frontier. This should not be surprising because consistent with the financial reform process, banks were adjusting to liberalization, enhanced competition and strengthening of prudential regulations of the banking sector. Moreover, the first phase of financial reforms also failed to convert cost inefficient banks into efficient banks as the rank order of cost efficiency of 33 banks (for which complete time series data was available) persisted for six years. However, the measured efficiency was found to improve after 1996 with the introduction of the second phase of financial reforms. Whereas we find that mean cost efficiency of all banks in our sample for the period 1991 to 2000 was around 75%, the mean cost efficiency of state-owned, private and

foreign banks was 60%, 75% and 80%, respectively. Therefore, the first general insight of the paper relates to the relative performance of banks where we find that foreign and private banks show superior performance in terms of factor productivity and in the use of right input-mix while state-owned banks most inefficiently convert inputs into outputs. This is consistent with the results obtained for Pakistani banks by other studies.

At the same time, our results also indicate that the performance of foreign banks as compared with domestic banks was much better in the first-reform period (1993-96) when consolidation of the banking sector was taking place due to financial reforms. Relative cost efficiency of foreign banks fell in the second-reform period (1997-00) vis-à-vis private banks, which may be attributed to the freezing of foreign currency deposits by the government. Even though most Pakistani commercial banks operated on the flatter portion of their cost curves about one-third of total banks were plagued by over expansion of operations of which a large majority was state-owned banks. Second, the paper shows the importance of the link between asset quality, measured by earning assets to total assets, loans to deposit ratio as a source of operating income and bank size measured by real total assets. The results from Tobit regressions suggest that holding other things as constant, these indicators strongly correlate with most of the efficiency indexes. While we establish a positive association between asset size and efficiency indexes, size of bank is not significantly associated with allocative efficiency of banks, which is a very similar result to those found by some other studies. Thus, banks may fail in optimally allocating banking resources irrespective of their size.

Third, the paper by shedding light on the effects of non-performing loans on the relative efficiency of banks complements the results of other recent studies by indicating the negative effects of political influence on bank decision-making, e.g., high default rates by politically connected firms. While such defaults lead to swelling of non-performing loan portfolios of Pakistani banks, we find that every 10% increase in the share of non-performing to total loans decreases the efficiency index of banks from 6% to 12%.

The fourth general insight our paper provides relates to the influence of extended bank branch network on efficiency index of these banks. Measured efficiency of banks was found to be negatively associated with the number of bank branches. Foreign and private banks mostly operate in urban areas with limited bank branches as compared with state-owned banks, which operate with vast branch network both in urban and rural areas where delivery system is costly. To the extent that over branching banks are found to be less efficient, re-structuring plans for public sector banks have potential pay-offs

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Abstract

This paper uses a unique bank level data from 1991 to 2000 and evaluates how financial reforms affect banking efficiency of domestic and foreign banks in Pakistan. The results suggest that banking efficiency falls during initial reform period when banks adjust to enhanced competition, but increases in more advanced stages of reform. While in general foreign and private banks show superior efficiency and factor productivity than state-owned banks, the relative performance of foreign banks worsens after the consolidation stage of the financial reforms is over. We show the importance of link between bank size, asset quality and bank branches with efficiency indexes, and also note that every 10% increase in share of non-performing to total loans decreases banking efficiency from 6% to 10%.

JEL Classification Code: G2, G21, G28, G32
Keywords: Bank efficiency, financial reforms, frontier analysis

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Centre for Management
and Economic Research

Lahore University of Management Sciences,
Opposite Sector 'U', Defence Housing Authority,
Lahore Cantt. 54792, Pakistan
Phone: 92-42-5722670-9 (Ext. 4201)
Fax: 92-42-5722591
http://ravi.lums.edu.pk/cmer/