The Effects of Privatization, Competition and Regulation on Banking Efficiency in Pakistan, 1991 – 2000

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Abid A. Burki and Ghulam Shabbir Khan Niazi

Abstract:

The banking industry in Pakistan has experienced extensive reforms since 1990 including privatization, liberalization and institutional strengthening of the central bank. This paper analyzes the impact of policy reforms on performance of individual banks by using banking data over the period 1991 – 2000. For analytical purposes banks are divided into three categories, namely: state-owned, private and foreign banks. We measure performance by cost efficiency of banks using DEA and isolate the contribution to cost efficiency of allocative, technical, pure technical, and scale efficiency. The paper addresses three questions. First, does privatization lead to enhanced efficiency? Second, what impact does policy of liberalization have on performance of banks by ownership? Third, does independence of regulator matter in banking efficiency? In the first step of the study we construct efficiency measures for individual banks while in the second step we use the fixed effects model on panel data to regress efficiency measures on policy variables of interest. Our results show that individual policy reforms instead of paying-off have led to significant decline in banking efficiency. We hypothesize that in the absence of favorable macroeconomic environment in the country, individual policy reforms would fail to bear fruit.

1. Introduction

Analysis of financial institutions in developing countries in the light of changes taking place in their structures and regulatory environment has immense value for regulators, policy makers, managers and investors. In particular, how these policy reforms effect efficiency of banks in developing countries has a wider appeal. Over the past decade a number of developing countries have embarked on a reform path and have witnessed improvements in their financial systems while others are contemplating on doing so. But there is no reason to expect that impact of reforms on performance would be positive and uniform across countries. In particular, it is not obvious how the reform process is influenced if economic growth environment in the country is not conducive.

The banking industry in Pakistan has experienced change in its ownership structure, level of competition, regulatory environment, instruments of market discipline and greater supervision since 1990. After nationalization of the entire banking and insurance sector in Pakistan in early seventies, the financial sector had become one of the most regulated sectors in the country. At

that time, after merger of some banks five nationalized commercial banks (NCBs) were set up.[1] These NCBs maintained their dominance in providing financial intermediation services in the country till 1991. Due to restriction on opening of private banks, the NCBs kept on expanding their financial networks without much concern on how efficiently they transformed various inputs into financial services and products. Since Pakistan Banking Council maintained its supervisory role on NCBs, the powers of State Bank of Pakistan (the central bank) were effectively curtailed. Subsidized credit attracted political beneficiaries into the NCBs loans leading to swelling of portfolio of non-performing loans while credit rationing promoted financial repression.

At the end of fiscal year 1990, the banking sector did not provide a level playing field for competition because public sector banks dominated the scene with 92% share in total banking assets. By the year 2000, 31 private or foreign banks were competing with 8 state-owned banks with their share in total banking assets dropped to 70%. A series of financial sector reforms were implemented in 1990s. The reforms included privatization of NCBs, liberalization of banking sector and granting of full autonomy to State Bank of Pakistan (the central bank) as regulator of banking industry. It should, however, be noted that these reforms were accompanied by slower GDP growth rates in the country, which fell from 6.1% (on average) in 1980s to only 4.1% in 1990s. How these adverse economic conditions influence the impact of policy reforms on banking efficiency is also not obvious, which needs to be examined.

With a view to drawing some broad policy conclusions, this paper investigates the impact of policy reforms on performance of individual banks by using data of all commercial banks over the period 1991-2000. For analytical purposes banks are divided into three categories, namely: state-owned, private and foreign banks. We measure performance by cost efficiency of banks using data envelopment analysis (DEA) and isolate the contribution to cost efficiency of allocative efficiency, technical efficiency, pure technical efficiency, and scale efficiency. The paper addresses three questions. First, does privatization lead to enhanced efficiency? Second, what impact does policy of enhanced competition have on performance of banks by ownership? Third, does independence of regulator matter in banking efficiency? In the first step of the study we construct efficiency measures for individual banks by using DEA method while in the second

[1] These banks included Habib Bank Limited, National Bank of Pakistan, United Bank Limited, Muslim Commercial Bank, and Allied Bank Limited.

step we use the fixed effects model on panel data to regress efficiency measures on a number of policy variables, but after controlling for some bank related attributes. Our results show that individual policy reforms instead of paying-off have led to significant decline in banking efficiency. We hypothesize that in the absence of favorable macroeconomic environment in the country, individual policy reforms would fail to bear fruit.

The paper is structured as follows. Section 2 introduces the data envelopment analysis methods that we have employed to measure banking efficiency. Section 3 describes the data and construction of some key variables. Section 4 presents and discusses the empirical results on efficiency of banks. Section 5 investigates the effect of policy reforms on banking efficiency while Section 6 presents the conclusions.

2. Methodology

Following Fare et al. (1994), we use input price vector to specify and calculate a measure of total cost efficiency (*CE*) for each bank by solving this envelopment form of linear programming 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 ith 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. In other words, the cost efficiency is the ratio of minimum cost to the observed cost written as $CE = w_i' x_i' / w_i' x_i$.

The allocative efficiency will be calculated residually by dividing cost efficiency (*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.

To measure technical efficiency (*TE*), we specify input oriented linear programming problem of the form

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

In this problem, θ is a scalar; λ is a $n \times 1$ vector of constants; X is the $(k \times n)$ matrix of inputs where n represents the number of DMUs ; Y is the $(m \times n)$ matrix of outputs. For the ith DMU, the vectors x_i and y_i represent the inputs and outputs, respectively. After solving the linear programming problem given above, the value of θ will represent the efficiency score for the ith DMU, where the condition $\theta \leq 1$ will hold. To obtain the value of θ for each DMU, the linear programming problem will be solved n times. Due to constant returns to scale the LP problem in (2) does not fully envelop the data set and thus enlarges the feasible region. Therefore, in the second step, we relax the assumption of CRS by introducing the convexity constraint $NI'\lambda = 1$ in to (2) to write

$$\begin{aligned} &\min_{\theta,\lambda} \theta \\ &\text{subject to} \\ &\theta x_i - X\lambda \geq 0 \\ &-y_i + Y\lambda \geq 0 \\ &NI'\lambda = 1 \\ &\lambda \geq 0 \end{aligned} \tag{3}$$

where NI is an $n \times 1$ vector while all other symbols are defined as previously. A measure of scale efficiency is obtained by substituting the $NI'\lambda = 1$ restriction with $NI'\lambda \leq 1$in (2).

A common difficulty encountered in the measurement of technical efficiency with the DEA approach is known as input-slacks and output-slacks. These are sections of the piecewise linear frontier that run parallel to the x-axis or y-axis, which may lead to inaccurate measurement of technical, pure technical and scale efficiency in the LP problems specified above. We use a multi-stage methodology suggested by Coelli (1997) that takes care of the problem of slacks successfully.

3. Data and Construction of Variables

This paper uses time-series cross-section data of commercial banks operating in Pakistan for the period 1991–2000. There is no single source where data on Pakistani commercial banks could be obtained in the form desired for such an analysis. Our source of data is the balance sheets of respective banks for included years. The total number of scheduled commercial banks operating in Pakistan has varied from only 24 in 1991 to 40 in 2000. Our sample includes state-owned, private and foreign commercial banks that have operated in Pakistan during 1991–2000. Only two commercial banks, namely Gulf Commercial Bank and Bank of Ceylon were excluded due to non-availability of their balance sheet data for even a single year. Those banks for which the required balance sheet for a particular year was not available from any source were also excluded for that year. This gives us a total of 366 observations with an average of more than 36 banks per annum. The number of observations varied across time due to entry or exit of banks during the decade. In this way we were able to 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. Data on number of employees, which was not reported in the balance sheets, was supplemented by obtaining it directly from the State Bank of Pakistan.

Defining costs, outputs, and inputs has never been easy in the perspective of banking sector due to which difference of opinion has persisted in the banking literature. Two alternative approaches, the intermediation and the production approach, compete with each other on the definition of banking costs, inputs and outputs.[2] The first approach takes the view that banks use deposits as input together with other inputs, and produce financial services.[3] In contrast, the second approach takes the view that banks produce loans and deposit accounts, where interest on deposits is treated as input along with other inputs. However, we adopt the intermediation approach in this paper by following many recent studies in banking literature.[4] The three outputs we define are: (i) loans and advances, (ii) investments, and (iii) contra accounts, while four inputs defined are: (i) labour, (ii) physical capital, (iii) operating cost, and (iv) financial capital.

[2] For a review of these and other definitional issues, see Berger and Humphrey (1997).

[3]The intermediation approach takes deposit-taking institutions (specifically, commercial banks) as financial intermediaries, which raise retail deposits together with purchased inputs to produce various categories of bank earning assets.

[4] See, for instance, Isik and Hassan (2002), Mukerjee et al. (2001), Berger and Mester (1997).

Table 1 presents our definition of outputs, inputs, price of inputs, and total cost used for estimation purposes. Summary statistics for outputs and inputs are reported in Table 2.

4. Empirical Results

We construct separate banking efficiency frontiers for all the years, which offer more flexibility than a single multi-year cost frontier.[5] Due to longer time duration, we expect that impact of changes in business conditions, enunciation of various prudential and other regulations, and liberalization of financial sector may have influenced banking technology and brought structural change into the sector as a whole. Our use of continuous time-frame and assumption of separate cost frontiers for each year allows us to capture changes in the performance of these banks.

We conduct efficiency analysis by minimizing linear programming problems specified above by assuming that efficient production technology is same within a year, but may be different across time. Choosing banks in a particular year as unit of analysis leaves a sample between 23 to 40 banks in respective years. We calculate efficiency measures, namely *CE*, *AE*, *TE*, *PTE* and *SE* for all years and banks. Summary statistics of the mean values of frontier estimation results by yearly means and by type of bank ownership are presented in Table 3 and Table 4.[6]

Turning first to results in Table 3, we observe that mean *CE* over the entire period is 0.745 indicating that the banks could have saved 25.5% of costs had they been fully cost efficient. We also note a lot of diversity within the banking sector over time where the *CE* index varies from highest efficiency of 0.923 in 1991 to lowest efficiency of 0.464 in 1996. Decomposition of *CE* into *AE* and *TE* gives relative sizes of these two measures indicating the source of *CE*. Table 3 also shows that mean *AE* (0.836) contributes more to cost inefficiency than mean *TE* (0.882).

[5]As noted by Isik and Hassan (2002), separate frontier alleviates the problem of lack of random error in DEA because firms that are inefficient in one period may be efficient in another period under the assumption that errors are not consistent over time due to luck or data problems. See also Bauer et al. (1993), DeYoung and Hasan (1998).

[6] Initially, we assumed that state-owned, private and foreign banks operate in a different business environment leading to different production technologies. Hence we separated yearly samples of banks into state-owned, private and foreign, but the DEA efficiency measures from separate frontier were always greater than those obtained from pooled sample irrespective of the year and the type of bank. This is an indication that common frontier always envelops separate frontier in our sample (see, Elyasiani and Mehdian (1992) for a geometric proof). We also employed the analysis of variance (ANOVA), Kruskal-Wallis and the Median tests, which failed to reject the null hypothesis that the three types of banks follow same production technology, which implies that the data of three types of banks can be pooled.

However, both mean *AE* and *TE* indices also peaked in 1991 while the lowest efficiency levels were achieved in 1996.

Table 4 reports that highest average *CE* was achieved by foreign banks (79.7%) followed by private banks (75.1%) while least cost efficiency was achieved by state-owned banks (60.5%). A closer examination shows that among twelve top performing banks; there was only one domestic private bank while all others were foreign banks. Similarly, from amongst 10 least performing banks, seven banks were state-owned, one was private and two were foreign banks. It appears from these results that as compared with their domestic counterparts foreign commercial banks show superior performance in cost efficiency. But, the performance of private commercial banks as a group is remarkable given the fact that private banks were newly established and most of them were small in size.[7] Poor performance of state-owned commercial banks is alarming because due to its predominant market share it sets a trend for overall banking industry.[8] However, state-owned banks were finding it increasingly difficult to maintain their hold on account of increasing competition from private and foreign banks. [9]

A dispersion of mean allocative efficiency (*AE*) based on data for all years is at 0.836 where mean allocative efficiency score of 0.869 is for a foreign bank as compared with the average score of 0.847 for private and 0.736 for state-owned banks (see Table 4). It appears from these results that state-owned banks were more constrained by lack of independence due to excessive management controls and political interference leading to sub-optimal utilization of banking resources.

In terms of mean *TE* of commercial banks there was roughly a constant trend from 1992 to 1995 with a fall in efficiency score in 1996, which stabilized for the most part in later period. A main source of divergence from efficient frontier by state-owned and private banks was their use of more banking resources than technically necessary to produce banking output. Foreign banks,

[7] For instance, eight private commercial banks started functioning in 1992 while four more private commercial banks were established in fiscal year 1994-95 and 1995-96.

[8] Despite a decline in their relative market share, state-owned banks had a lion's share in banking sector even in 2000. For instance, these banks controlled more than 70% of all banking assets, 68% share on bank advances, 72% share on investment, and 74% share on deposits [State Bank of Pakistan (2003)].

[9] The problems of state-owned banks are frequently linked to a host of political and managerial attributes. 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, high administrative expenses, huge losses and eroding capital base" [State Bank of Pakistan (2003)].

however, led technical efficiency drive in the banking sector because they introduced new and superior banking services and customer support services that were non-existent in domestic banking sector until few years ago.

Evaluating the two components of *TE,* namely pure technical efficiency (*PTE*) and scale efficiency (*SE*), we find that the source of deviation from *TE* is roughly equally distributed between *PTE* (i.e., inefficient utilization of existing resources) and *SE* (i.e., inappropriate scale of production). A major source of *TE* for state-owned and private banks is *PTE* while for foreign banks scale inefficiency is more significant (see Table 4). For private banks, *PTE* was quite high in the beginning that faced a steep decline in 1996 before a recovery in the later period. This trend may be explained by a steep rise in operating cost in 1996 when a slowdown in deposit growth of private banks forced them to borrow money at high interest rates to maintain a momentum in advances [State Bank of Pakistan (2003)]. Foreign banks were performing 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, which led to a sharp fall in their deposits and contraction of their assets.

Turning to scale efficiency of banks, we show a mixed trend over the study period (Table 3). For scale efficiency sources, we impose non-increasing returns to scale to obtain frequencies of scale efficiency. Most Pakistani commercial banks operate on the flatter portion of their cost curves. Only 23% of the banks exhibited increasing returns to scale and 33% were at a point of decreasing returns.

Table 6 provides further insights on economies of scale by ownership status of banks where we find that a large majority of state-owned banks in full sample (56.4%) have experienced decreasing returns to scale (DRS), which confirms the extra cost incurred by state-owned banks in 1990s. The trend in returns to scale for private banks also paints a dismal picture where from twelve private banks; an average of six banks has expanded operations beyond their efficient scale after 1995, which is the main source of scale inefficiency of private banks. More recently, this trend seems to have been curbed by the minimum capital requirement of the State Bank, which has prompted mergers and take-over of inefficient banks after 2000 by relatively big players.

Our results also suggest that most foreign banks (58%) operated on their flat portion of average cost curves in the full sample, which reveals that they were operating at the right scale

and have no gains to changing the scale of production. A relatively smaller proportion of foreign banks were operating at IRS, while only few exhibit DRS.

5. Effect of Policy Reforms on Banking Efficiency

The nationalized commercial banks maintained their financial hold in financial services industry till the early part of 1990s before a major shake-up leading up to liberalization and reforms, which was instrumental in restructuring of the entire banking industry in 1990s. From a policy point of view the most important question is that how these reforms have influenced efficiency of commercial banks in subsequent period? Having measured cost efficiency and its components, we now consider effect of these policy reforms on measured efficiency by regressing efficiency indexes on a vector of control and policy variables.

To define the empirical relationships to be estimated, consider a panel of N banks by type of ownership, indexed by i (i = 1, . . ., N) for T years (t = 1, . . . , T). Denoting the efficiency indexes for each of these banks at time t by y_{it} the basic pooled model using Ordinary Least Squares (OLS) regression can be expressed as

$$y_{it} = \alpha + C_{it}\gamma + X_{it}\beta + e_{it} \qquad (4)$$

where α is the overall intercept, C_{it} is the matrix of control variables while our policy variables are represented by X_{it} matrix with γ and β being the vector of coefficients for all observations and e_{it} is a random error term with zero mean, representing unmeasured factors influencing efficiency. Investigating this empirical relationship with a cross-section (of banks) that are observed for more than one time period (time-series) requires specification of the model in such a way so that it captures individual differences by type of ownership. As observed in previous section, foreign and private sector banks have performed much better than state-owned banks. To allow this intercept to vary to capture differences by type of bank ownership, we modify the specification of empirical relationship as

$$y_{it} = \overline{\alpha} + \mu_i + X_{it}\,\beta + e_{it} \qquad (5)$$

where $\overline{\alpha} + \mu_i$ is the intercept for ith bank type and $\overline{\alpha}$ represents the population mean intercept. Two alternative methods of estimation for the model in (5) depend on whether the bank specific

effects denoted by μ_i are best modeled by a fixed or random effects model. The random effect model assumes that the observations were randomly drawn from a common distribution such that inferences can be made for the entire population from which the sample was drawn. However, this is not the case in our sample. Therefore, the fixed effects model may be preferable. This is also tested by the Hausman specification test, which is a test of equality between the coefficients obtained from the fixed and the random effects models.

For the second stage econometric analysis, we use bank specific measures for *CE*, *AE* and *TE* as dependent variable while the independent variables used in these regressions include: (a) control variables for bank size, asset quality and management soundness; and (b) banking policy variables. To illustrate, the control variables used are fairly standard that include asset size (*SIZE*), bank branches (*BRNH*), total expenditure to income (*EXPN*), loans to total assets (*LOAN*). Asset size (in natural logs) is used in 1991 rupees to define scale of operations measured by size of assets held by respective banks. Banks with larger asset holdings are expected to have advantage in terms of banking efficiency. Number of bank branches (*BRNH*) indicates diversity and coverage of operations. To the extent that state-owned banks maintain large but costly branch networks in urban and rural areas while private and foreign banks have not extended their presence beyond three metropolitan cities, we expect *BRNH* to be negatively correlated with efficiency indexes.

Policy variables used in panel regressions are privatization, competition and, regulation on central bank autonomy. In Pakistan, privatization of NCBs was introduced in early 1990s whereby two nationalized commercial banks were privatized. To evaluate the influence of privatization on efficiency of privatized banks, we specify privatization (*PRIV*) as a dummy variable taking on a value of one for the period when a bank has been privatized, and zero otherwise.

To increase competition among financial institutions and to liberalize the banking sector, ten new private commercial banks were allowed to start operations, eight of which started functioning by late 1992.[10] Dummy variable competition (*COMP*) is set equal to one for the period when there was competition and zero when there was no competition. Similarly, to allow private and foreign banks to grow, branch policy was eased in 1995 whereby controls on opening

[10]Ten new commercial banks in the private sector were allowed to operate in August 1991 while eleven more private or foreign banks were allowed to operate in subsequent period in 1990s. In addition, the government in 1994 also declared two provincial banks, namely the Bank of Khyber, and the Bank of Punjab as scheduled banks.

of new bank branches were removed. In order to test whether this opportunity to grow and geographically diversify operations enhances efficiency of banks, we include a branching dummy variable (*BH*) that equals one for 1995 and after, and zero otherwise.

Independence of the central bank indicates better quality of regulation and supervision. With consolidation of regulatory function of State Bank of Pakistan (the central bank) and its supervisory role enhanced in 1997, disclosure standards for banks were revised in the same year in line with international accounting standards. Likewise a system of performance evaluation based on off-site surveillance and on-site inspection of commercial banks was adopted by the SBP. To capture the impact of State Bank's independence on banking efficiency, we introduce a dummy variable independent regulator (*SBP*) that equals 1 for the period when SBP is independent (i.e., 1997 and after), and zero otherwise.

The empirical models specified in (4) and (5) were estimated on unbalanced panel data of banks, for the period 1991-2000, to find out the determinants of efficiency. A test for the random effects model vs. the fixed effects model was conducted by employing the Hausman specification test, which was rejected in favor of the fixed effects model (see Table 7). A specification test evaluating the OLS model against the fixed effects model was conducted by employing the *F*-tests, which were strongly rejected in favor of the fixed effects model (see Tables (7) – (9)). Therefore, we draw our inferences from the interpretation of results for the fixed effects model. Moreover, we did not detect presence of autocorrelation in any of the models confirmed by the Durbin-Watson test statistics at the 5% significance level. Since the fixed effects model is based on the fact that the disturbances are heteroscedastic, we obtain robust results by White heteroscedastic consistent standard errors.

Tables (7) – (9) present fixed effects parameter estimates with data for the full set of banks. We find robust results that bank efficiency is positively and significantly correlated with larger asset size of banks. However, as expected all efficiency measures are negatively associated with number of bank branches, but significantly so for *CE* and *AE* indicating that downsizing is optimal because it raises cost and allocative efficiency. In other words, more efficient commercial banks maintain fewer bank branches. This is not surprising given the fact that most state-owned banks operate large branch networks mostly with many loss making branches.

We find that efficiency increased for banks with smaller ratios of total expense to total income (*EXPN*) and for banks with larger ratios of loans to assets (*LOAN*). However, total

expense to total income variable was statistically insignificant in all regressions for *CE*. The coefficient on loans to assets ratio (*LOAN*) was positive and statistically significant in all the regressions, which indicates that banks with more liquid assets achieve higher levels of cost efficiency. This finding can be rationalized by the fact that banks with higher liquid assets hold fewer government papers. In other words, the flexibility enjoyed by these banks in deciding their portfolios enhances their ability to allocate their investment funds, which in turn is reflected in the form of higher efficiency. The bank fixed effects (*FN*, *PE*, and *SE*) corroborate our earlier finding that foreign banks are most efficient followed by private banks relative to state-owned banks, irrespective of which efficiency measure is considered.

Next, we investigate whether piecemeal policies of privatization, competition and regulation in Pakistan's banking industry have influenced banking efficiency. In Column 1 of Tables (7) – (9), we examine effects of individual reforms and take *PRIV*, *COMP* and *BH* variables as indicators of liberalization. We find that although the coefficient on *PRIV* dummy variable is negative, it is not significant in any of the regressions. These results show that efficiency of banks cannot be differentiated on the basis of privatization of banks alone. However, our results indicate that *COMP* dummy variable is negative and statistically significant in regressions for *CE* and *TE* indicating average difference in efficiency in pre- and post-competition period. More specifically, we find that introduction of competition led to a decline in average performance of banks in post-reform period. Not surprisingly, growing competition from private and foreign banks led to deterioration in state-owned banks' relative share in assets, deposits, advances, and investments, before their drift toward more optimal allocation of banking resources. The coefficient on *BH* dummy variable was negatively and significantly related to efficiency in all the regressions, which implies that on average all three categories of banks as a group performed poorly in the second half of 1990s. As noted earlier branch policy was eased to allow smaller private and foreign banks to grow, which could not take place due to other adverse factors including freezing of foreign currency accounts in May 1998 that severely affected performance of all banks, especially foreign-owned banks.

Further, to test whether the interaction of privatization and competition policies matter, we introduce a three-way interaction term for privatization, competition and branching (*LIB*) to test the combined effect of complete liberalization on banking efficiency. To carry out the test, we include interaction dummy *LIB*, representing complete liberalization, in place of individual

reforms, e.g., *PRIV*, *COMP* and *BH*. However, our results in Column 2 confirm that the coefficients on this interaction term remain negative but highly significant in *CE* and *AE* regressions suggesting that even full liberalization adversely affected banking efficiency.

The dummy variable for independent regulator, *SBP*, was found to have high correlation with *BH*. Therefore, to avoid high collinearity with *BH* and *SBP*, we include *LIB* representing full liberalization along with *SBP*. The estimated coefficients are reported in Column III, which clearly show that even independence of the regulator could not bring about a turnaround in the negative trend in efficiency measures. The significantly negative relationship of *SBP* to efficiency measures suggests that full autonomy given to regulator has not benefited the banking industry in general.

Finally, we quantify the effects of complete liberalization and autonomy of the regulator and define a dummy variable that is set to equal 1 if all three policies are in place and zero otherwise. In other words, we introduce a four-way interaction term (*SBPLIB*) defined as privatization, competition, branching and independent regulator. We find this variable to be negative and statistically significant at conventional levels in *CE* and *AE* regressions suggesting that efficiency of banks is lower in years of complete reform compared to the years of no reform.

It should be realized, however, that in addition to the quality of reforms the macroeconomic environment in the country is also crucial for the success of reforms. If we examine the behavior of macroeconomic variables in Pakistan during the study period, we find that GDP growth rates were much lower than the experience in 1980s. Consequently, national savings also fell from 14.8% of GDP in 1980s to 12.4% in 1990s. Inflation rate in the country was maintained at 10% on average in 1990s as compared with only 7% inflation in the earlier decade. Similarly, current account deficit also remained high in 1990s as compared with 1980s fueling a currency crisis with negative fall outs for liquidity of the financial system. The nuclear detonation by Pakistan in May 1998 prompted the government to freeze foreign currency accounts leading to liquidity problems for the banks. Due to external flows, foreign exchange reserves never remained satisfactory especially in the later part of 1990s. Moreover, exchange rate volatility in the country can be judged from the fact that monthly variance of exchange rate in 1980s was 10.5, which increased to 95.5 during the 1990s [State Bank of Pakistan (2003)]. Therefore, one may conjecture that unfavorable macroeconomic environment in the country is to blame for adverse

effects of policy reforms on banking efficiency. Hence, for individual policy reforms to bear fruit, it is imperative that the economic growth environment in the country is conducive.

6. Conclusions and Policy Implications

In this paper we have investigated the impact of policy reforms on performance of commercial banks with a unique panel data from Pakistan's banking sector over the period 1991 – 2000. For analytical purposes, banks were divided into three categories, namely: state-owned, private and foreign banks. We apply the non-parametric DEA method to measure performance by cost efficiency and isolate the contribution to cost efficiency of allocative efficiency, technical efficiency, pure technical efficiency and scale efficiency. We find that banking efficiency has varied over the study period from highest efficiency in 1991 to lowest efficiency in 1996. Investigating the source of mean cost inefficiency we find that allocative inefficiency contributes more than technical inefficiency. The highest levels of efficiency were achieved by foreign banks followed by private banks while state-owned banks achieved least cost efficiency.

In second-stage regressions, we used unbalanced panel data to find determinants of efficiency. The nature of sampling of banks and econometric tests indicated preference for the fixed effects model. We have regressed bank-specific efficiency measures for cost, allocative and technical efficiency on a set of control and policy variables to single out the impact of policy reforms on banking efficiency. Our results indicate that efficiency of banks cannot be differentiated on the basis of policy reform of privatization. Moreover, individual reforms promoting competition led to a decline in average performance of banks in post-reform period. Also complete liberalization of banking sector, instead of paying off in terms of improvement in efficiency, also led to a significant decline in all the efficiency measures. Presence of independent regulator in later part of 1990s was a sign of consolidation of regulatory function and enhanced supervisory role of the central bank. Nevertheless, it failed to dilute the adverse affects on banking efficiency as confirmed by statistically significant negative coefficients on independent regulator. Even complete liberalization and autonomy of the regulator seems to have failed to pay-off in terms of improvement in banking efficiency.

One possible explanation for the adverse effects of reforms on banking efficiency appears to be unfavorable macroeconomic environment in the country prevailing during most part of 1990s. While GDP growth rates in 1990s were much lower than those experienced in 1980s, slump in

real sectors where banking sector loans and investments were concentrated also played their part in triggering adverse effects on the banking industry in general. Not surprisingly, because slower growth is often associated with weak debt servicing of borrowers, it leads to more loan defaults and enhanced credit risks. This is exactly what had happened in Pakistan where due to poor economic growth record in 1990s loan default rates grew tremendously during the period. Therefore, one might hypothesize that individual policy reforms would bear fruit where economic growth environment is also conducive, which seems to provide better support to the reform process.

References:

Bauer, P.W., A.N. Berger, D.B. Humphrey (1993). Efficiency and Productivity Growth in US Banking. In H.O. Fried, C.A.K. Lovell, S.S. Schmidt (eds.) *The Measurement of Productive Efficiency: Techniques and Applications*. Oxford: Oxford University Press.

Berger, A. N., Humphrey D. B. (1997). Efficiency of Financial Institutions: International Survey and Directions for Future Research. *European Journal of Operational Research*, 98, 175 – 212.

Berger, A.N., and Mester, L.J. (1997). Inside the Black Box: What Explains Differences in the Efficiencies of Financial Institutions. *Journal of Banking and Finance*, 21, 895 – 947.

Coelli, T.J. (1996). A Guide to DEAP Verion 2.1: A Data Envelopment Analysis (Computer) Program, CEPA Working Paper No.8/96. Department of Economics, University of New England, Armingdale.

DeYoung, R., and Hassan, I. (1998). The Performance of De Novo Commercial Banks: A Profit Efficiency Approach. *Journal of Banking and Finance,* 22, 565 – 587.

Elyasiani, E., and Mehdian, S.M. (1992). Productive Efficiency Performance of Minority and Nonminority-Owned Banks: A Nonparametric Approach. *Journal of Banking and Finance*. 16, 933 – 948.

Fare, R., S. Grosskopf, and Knox Lovell, C.A. (1994). *Production Frontiers.* Cambridge: Cambridge University Press.

Ferrier, G.D., and C.A. Knox Lovell (1990). Measuring Cost Efficiency in Banking: Econometric and Linear Programming Evidence. *Journal of Econometrics.* 46, 229 – 245.

Isik, I., and Hassan, M. K. (2002). Technical, Scale and Allocative Efficiencies of Turkish Banking Industry. *Journal of Banking and Finance,* 26, 719 – 766.

Mukherjee, K., Ray S.C. and Miller, S.M. (2001). Productivity Growth in Large US Commercial Banks: The Initial Post-Deregulation Experience. *Journal of Banking and Finance,* 25, 913 – 939.

Rezvanian, R., and Mehdian, S. (2002). An Examination of Cost Structure and Production Performance of Commercial Banks in Singapore. *Journal of Banking and Finance*, 26, 79 – 98.

State Bank of Pakistan (2003). *Pakistan Financial Assessment, 1990 – 2000.* Karachi: Research Department, State Bank of Pakistan.

Table 1: Definition of inputs, outputs and input prices

Variable symbol	Variable Name	Description
TC	Total cost	Wage bill including directors fee + depreciation 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 includes 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	Calculated by dividing total operating cost by total deposits
w_4	Price of financial capital	Total interest paid on deposits & borrowing divided by financial capital

Table 2 Summary statistics of outputs, inputs and input prices for all banks (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 DGP deflator with base year 1990-91=1.

Table 3: Yearly means and standard deviations of efficiency measures for all banks

Year		*CE*	*AE*	*TE*	*PTE*	*SE*
1991	Mean	0.923	0.939	0.979	0.994	0.986
(*N* = 23)	SD	(0.100)	(0.075)	(0.041)	(0.029)	(0.041)
1992	Mean	0.853	0.918	0.925	0.964	0.959
(*N*=36)	SD	(0.171)	(0.083)	(0.143)	(0.120)	(0.088)
1993	Mean	0.859	0.934	0.915	0.948	0.963
(*N*=36)	SD	(0.164)	(0.076)	(0.139)	(0.105)	(0.090)
1994	Mean	0.841	0.915	0.917	0.955	0.960
(*N*=36)	SD	(0.151)	(0.080)	(0.130)	(0.078)	(0.116)
1995	Mean	0.780	0.841	0.924	0.945	0.976
(*N*=39)	SD	(0.164)	(0.126)	(0.113)	(0.105)	(0.050)
1996	Mean	0.464	0.625	0.745	0.822	0.907
(*N*=40)	SD	(0.221)	(0.206)	(0.222)	(0.221)	(0.138)
1997	Mean	0.709	0.793	0.892	0.942	0.946
(*N*=40)	SD	(0.141)	(0.108)	(0.111)	(0.086)	(0.090)
1998	Mean	0.641	0.757	0.844	0.896	0.941
(*N*=40)	SD	(0.188)	(0.122)	(0.189)	(0.165)	(0.112)
1999	Mean	0.758	0.852	0.890	0.927	0.958
(*N*=39)	SD	(0.174)	(0.088)	(0.152)	(0.128)	(0.094)
2000	Mean	0.762	0.876	0.861	0.922	0.933
(*N*=37)	SD	(0.201)	(0.109)	(0.174)	(0.136)	(0.118)
1991-	Mean	0.745	0.836	0.882	0.929	0.943
2000	SD	(0.123)	(0.076)	(0.095)	(0.085)	(0.072)

Table 4: Yearly means and standard deviations of efficiency measures by type of banks

Year	State-owned Banks					Private Banks					Foreign Banks				
	CE	*AE*	*TE*	*PTE*	*SE*	*CE*	*AE*	*TE*	*PTE*	*SE*	*CE*	*AE*	*TE*	*PTE*	*SE*
1991	0.793	0.848	0.956	0.980	0.956	--	--	--	--	--	0.979	0.979	0.990	1.000	0.990
(N = 23)	(0.065)	(0.049)	(0.050)	(0.053)	(0.050)	--	--	--	--	--	(0.042)	(0.042)	(0.033)	(0.000)	(0.033)
1992	0.672	0.850	0.793	0.878	0.913	0.846	0.879	0.957	0.971	0.984	0.933	0.964	0.966	0.998	0.967
(N = 36)	(0.170)	(0.043)	(0.204)	(0.239)	(0.064)	(0.154)	(0.120)	(0.071)	(0.046)	(0.032)	(0.042)	(0.036)	(0.108)	(0.007)	(0.108)
1993	0.712	0.864	0.827	0.870	0.951	0.885	0.946	0.936	0.946	0.989	0.909	0.958	0.942	0.984	0.956
(N = 36)	(0.153)	(0.053)	(0.179)	(0.182)	(0.044)	(0.090)	(0.069)	(0.083)	(0.079)	(0.017)	(0.165)	(0.071)	(0.133)	(0.040)	(0.120)
1994	0.728	0.826	0.886	0.909	0.977	0.859	0.924	0.930	0.937	0.992	0.880	0.949	0.923	0.986	0.937
(N = 36)	(0.072)	(0.068)	(0.113)	(0.123)	(0.021)	(0.076)	(0.046)	(0.065)	(0.063)	(0.013)	(0.180)	(0.070)	(0.159)	(0.045)	(0.158)
1995	0.617	0.711	0.884	0.902	0.981	0.789	0.862	0.908	0.925	0.981	0.844	0.833	0.951	0.979	0.971
(N = 39)	(0.128)	(0.125)	(0.180)	(0.179)	(0.027)	(0.146)	(0.095)	(0.094)	(0.085)	(0.030)	(0.145)	(0.110)	(0.087)	(0.064)	(0.066)
1996	0.321	0.489	0.672	0.813	0.837	0.434	0.663	0.672	0.695	0.959	0.539	0.657	0.817	0.911	0.903
(N = 40)	(0.126)	(0.140)	(0.235)	(0.282)	(0.134)	(0.196)	(0.200)	(0.209)	(0.196)	(0.059)	(0.238)	(0.216)	(0.212)	(0.175)	(0.164)
1997	0.587	0.687	0.856	0.950	0.904	0.733	0.816	0.897	0.929	0.967	0.744	0.822	0.904	0.951	0.951
(N = 40)	(0.111)	(0.097)	(0.115)	(0.097)	(0.106)	(0.118)	(0.083)	(0.107)	(0.093)	(0.069)	(0.143)	(0.103)	(0.115)	(0.081)	(0.093)
1998	0.465	0.627	0.758	0.868	0.869	0.680	0.796	0.853	0.872	0.978	0.689	0.786	0.874	0.923	0.948
(N = 40)	(0.111)	(0.064)	(0.229)	(0.177)	(0.158)	(0.177)	(0.126)	(0.151)	(0.150)	(0.044)	(0.184)	(0.105)	(0.191)	(0.173)	(0.111)
1999	0.646	0.764	0.846	0.916	0.924	0.817	0.910	0.984	0.916	0.973	0.769	0.854	0.906	0.943	0.962
(N = 39)	(0.162)	(0.080)	(0.179)	(0.176)	(0.089)	(0.170)	(0.057)	(0.163)	(0.148)	(0.049)	(0.166)	(0.077)	(0.138)	(0.095)	(0.117)
2000	0.538	0.704	0.769	0.863	0.883	0.795	0.890	0.889	0.926	0.960	0.828	0.933	0.878	0.941	0.935
(N = 37)	(0.160)	(0.032)	(0.241)	(0.229)	(0.093)	(0.128)	(0.076)	(0.111)	(0.103)	(0.054)	(0.200)	(0.072)	(0.177)	(0.110)	(0.152)
Mean	0.605	0.736	0.822	0.893	0.922	0.751	0.847	0.879	0.899	0.975	0.797	0.869	0.908	0.962	0.945
	(0.053)	(0.039)	(0.099)	(0.127)	(0.051)	(0.084)	(0.055)	(0.074)	(0.070)	(0.016)	(0.121)	(0.071)	(0.097)	(0.060)	(0.092)

-- Not available. Note: The numbers in parentheses indicate standard deviations.

Table 5: Economies of scale for the sample of banks, 1991 – 2000

Year	IRS	CRS	DRS
1991 (N = 23)	0 (0%)	19 (82.6%)	4 (17.4%)
1992 (N = 36)	7 (19.4%)	18 (50.0%)	11 (30.6%)
1993 (N = 36)	5 (13.9%)	19 (52.8%)	12 (33.3%)
1994 (N = 36)	11 (30.6%)	15 (41.6%)	10 (27.8%)
1995 (N = 39)	9 (23.1%)	17 (43.6%)	13 (33.3%)
1996 (N = 40)	15 (37.5%)	11 (27.5%)	14 (35.0%)
1997 (N = 40)	9 (22.5%)	13 (32.5%)	18 (45.0%)
1998 (N = 40)	13 (32.5%)	18 (45.0%)	9 (22.5%)
1999 (N = 39)	6 (15.4%)	19 (48.7%)	14 (35.9%)
2000 (N = 37)	9 (24.3%)	11 (29.8%)	17 (45.9%)
Total	84 (23.0%)	160 (43.7%)	122 (33.3%)

Table 6: Economies of scale by ownership status of banks, 1991 – 2000

Year	State-owned Banks				Private Banks				Foreign Banks			
	IRS	CRS	DRS	Number of Banks	IRS	CRS	DRS	Number of Banks	IRS	CRS	DRS	Number of Banks
1991	0 (0%)	3 (42.9%)	4 (57.1%)	7	--	--	--	--	0 (0%)	16 (100%)	0 (0%)	16
1992	2 (25%)	0 (0%)	6 (75%)	8	2 (22.2%)	4 (44.5%)	3 (33.3%)	9	3 (15.8%)	14 (73.7%)	2 (10.5%)	19
1993	1 (12.5%)	2 (25%)	5 (62.5%)	8	1 (11%)	4 (44.5%)	4 (44.5%)	9	3 (15.8%)	13 (68.4%)	3 (15.8%)	19
1994	2 (25%)	2 (25%)	4 (50%)	8	4 (44.5%)	2 (22.5%)	3 (33.3%)	9	5 (26.3%)	11 (57.9%)	3 (15.8%)	19
1995	2 (25%)	4 (50%)	2 (25%)	8	2 (16.6%)	3 (25%)	7 (58.4%)	12	5 (26.3%)	10 (52.6%)	4 (21.1%)	19
1996	2 (25%)	1 (12.5%)	5 (62.5%)	8	5 (41.7%)	2 (16.6%)	5 (41.7%)	12	8 (40%)	8 (40%)	4 (20%)	20
1997	1 (12.5%)	0 (0%)	7 (87.5%)	8	3 (25%)	4 (33.3%)	5 (41.7%)	12	5 (25%)	9 (45%)	6 (30%)	20
1998	2 (25%)	3 (37.5%)	3 (37.5%)	8	4 (33.3%)	3 (25%)	5 (41.7%)	12	8 (40%)	11 (55%)	1 (5%)	20
1999	1 (12.5%)	3 (37.5%)	4 (50%)	8	0 (0%)	5 (41.7%)	7 (58.3%)	12	5 (26.3%)	11 (57.9%)	3 (15.8%)	19
2000	1 (14.3%)	2 (28.6%)	4 (57.1%)	7	2 (16.6%)	2 (16.6%)	8 (66.8%)	12	6 (33.3%)	7 (38.9%)	5 (27.8%)	18
Full Sample	14 (18.0%)	20 (25.6%)	44 (56.4%)	78	23 (23.2%)	29 (29.3%)	47 (47.5%)	99	48 (25.4%)	110 (58.2)	31 (16.4%)	189

-- Not available

Table 7: Fixed Effects Regressions on Cost Efficiency, 1991–2000

Variables	Symbol	*I*	*II*	*III*	*IV*
Control Variables:					
Bank branches (number)	BRNH	-0.000 (2.54)**	-0.000 (-1.77)*	-0.000 (-1.92)*	-0.000 (-1.80)*
Assets (Natural log of assets)	SIZE	0.055 (5.12)**	0.052 (4.33)**	0.053 (4.44)**	0.051 (4.26)**
Total expense to total income	EXPN	-0.0008 (-0.815)	-0.0007 (-0.70)	-0.001 (-1.26)	-0.0007 (-0.67)
Loans to total assets	LOAN	0.025 (4.14)**	0.024 (6.09)**	0.025 (5.95)	0.024 (6.03)**
Policy Variables:					
Privatization	PRIV	-0.034 (-0.98)	--	--	--
Competition	COMP	-0.047 (-2.26)**	--	--	--
Branching	BH	-0.164 (-8.68)**	--	--	--
Independent regulator	SBP	--	--	-0.058 (2.98)**	--
Privatization*competition*branching	LIB	--	-0.128 (-3.09)	-0.112 (-2.49)**	--
Privatization*competition*branching* independent regulator	SBPLIB	--		--	-0.085 (-1.90)*
Bank Fixed Effects:					
Foreign-owned	FN	-0.287	-0.348	-0.353	-0.331
Private-owned	PE	-0.333	-0.417	-0.416	-0.399
State-owned	SE	-0.507	-0.564	-0.568	-0.553
R^2		0.384	0.210	0.228	0.203
Adj. R^2		0.368	0.195	0.211	0.188
F-test of fixed effects		19.99 [0.000]	16.38 [0.000]	16.38 [0.000]	17.29 [0.000]
Hausman test statistics		3.63 [0.058]*	6.54 [0.038]**	7.50 [0.023]**	5.74 [0.057]*
Number of banks		366	366	366	366

Notes: Numbers in parentheses are *t*-values. Numbers in brackets are *p*-values. Single and double asterisks indicate statistical significance at the 10% and the 5% levels, respectively.

Table 8: Fixed Effects Regressions on Allocative Efficiency, 1991–2000

Variables	Symbol	*I*	*II*	*III*	*IV*
Control Variables:					
Bank branches (number)	BRNH	-0.000 (-3.15)**	-0.000 (-2.21)**	-0.000 (-2.34)**	-0.000 (-2.25)**
Assets (Natural log of assets)	SIZE	0.017 (2.29)**	0.015 (1.74)*	0.015 (1.82)*	0.014 (1.68)*
Total expense to total income	EXPN	-0.001 (-1.61)	-0.001 (-1.75)*	-0.001 (-1.29)	-0.001 (-1.80)*
Loans to total assets	LOAN	0.008 (3.23)**	0.009 (3.09)**	0.009 (3.60)**	0.009 (2.94)**
Policy Variables:					
Privatization	PRIV	-0.045 (-1.59)	--	--	--
Competition	COMP	-0.008 (-0.73)	--	--	--
Branching	BH	-0.137 (-11.5)**	--	--	--
Independent regulator	SBP	--	--	-0.035 (2.53)**	--
Privatization*competition*branching	LIB	--	-0.124 (-4.03)**	-0.115 (-3.41)**	--
Privatization*competition*branching* independent regulator	SBPLIB	--	--	--	-0.073 (-3.27)**
Bank Fixed Effects:					
Foreign-owned	FN	0.585	0.539	0.537	0.559
Private-owned	PE	0.571	0.509	0.510	0.528
State-owned	SE	0.497	0.457	0.455	0.468
R^2		0.334	0.168	0.182	0.154
Adj. R^2		0.321	0.152	0.163	0.138
F-test of fixed effects		6.09 [0.002]**	4.89 [0.008]**	4.77 [0.009]**	5.57 [0.004]**
Number of banks		366	366	366	366

Notes: Numbers in parentheses are *t*-values. Numbers in brackets are *p*-values. Single and double asterisks indicate statistical significance at the 10% and the 5% levels, respectively.

Table 9: Fixed Effects Regressions on Technical Efficiency, 1991–2000

Variables		*I*	*II*	*III*	*IV*
Control Variables:					
Bank branches (number)	BRNH	-0.000 (-0.63)	-0.000 (-0.36)	-0.000 (-0.43)	-0.000 (-0.37)
Assets (Natural log of assets)	SIZE	0.054 (5.89)**	0.052 (5.60)**	0.053 (5.65)**	0.052 (5.58)**
Total expense to total income	EXPN	-0.002 (-3.04)**	-0.002 (-3.07)**	-0.002 (-3.42)**	-0.002 (-3.07)**
Loans to total assets	LOAN	0.021 (3.86)**	0.020 (4.68)**	0.021 (4.43)**	0.020 (4.68)**
Policy Variables:					
Privatization	PRIV	0.003 (0.096)	--	--	--
Competition	COMP	-0.043 (-2.24)**	--	--	--
Branching	BH	-0.055 (-3.39)**	--	--	--
Independent regulator	SBP	--	--	-0.024 (-1.57)	--
Privatization*competition*branching	LIB	--	-0.036 (-0.833)	-0.029 (-0.673)	--
Privatization*competition*branching* independent regulator	SBPLIB	--	--	--	-0.035 (-0.59)
Bank Fixed Effects:					
Foreign-owned	FN	-0.219	-0.247	-0.249	-0.244
Private-owned	PE	-0.259	-0.297	-0.297	-0.294
State-owned	SE	-0.398	-0.425	-0.426	-0.423
R^2		0.125	0.205	0.211	0.204
Adj. R^2		0.108	0.189	0.193	0.189
F-test of fixed effects		18.97 [0.000]**	18.30 [0.000]**	18.20 [0.000]**	18.67 [0.000]**
Number of banks		366	366	366	366

Notes: Numbers in parentheses are *t*-values. Numbers in brackets are *p*-values. Single and double asterisks indicate statistical significance at the 10% and the 5% levels, respectively.