

# Role of Agricultural Credits and Efficiency of Commercial Banks in Pakistan

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## ABSTRACT

Agricultural sector is the largest contributor to Pakistan's GDP. Commercial banks are the most important component of Pakistan's financial sector and at the same time an important source for agricultural credit. This study estimated the technical efficiency of commercial banks operating in Pakistan by employing Data envelopment analysis (DEA) under variable returns to scale (VRS) after intensive agricultural lending by commercial banks. For this purpose, inputs and outputs of the commercial banks were defined on the basis of intermediation approach. After the estimation of technical efficiency, Tobit model was used to develop its relationship with bank specific variables. The result shows that the assets, ownership characteristic and after merger year affects are significant contributors to the technical efficiency, while agricultural lending has no significant impact over time on the efficiency of commercial banks.

**Key Word:** Agricultural credit; Efficiency; Data envelopment analysis; Commercial bank

## INTRODUCTION

In developing countries like Pakistan, agricultural sector plays an important role in its economic development. Agriculture is the largest sector of Pakistan's economy and contributed 20.9% to its gross domestic product (GDP) in year 2006-07 (Government of Pakistan, 2007). In Pakistan, this sector provides raw material to the industry (e.g. to textile, sugar, flour) and utilizes industrial products (like machinery, fertilizers, insecticides). Agricultural credit plays key role in the production of crops and utilization of industrial products in the agricultural sector. In Pakistan's economy, sources of agricultural credit are Zarai Taraqati Bank Limited (ZTBL), Commercial banks, Domestic Private Banks (although these are also commercial Banks, but due to ownership of domestic people named as Domestic Private Banks) and Punjab Provincial Cooperative Bank Ltd (PPCBL) (Government of Pakistan, 2003). Domestic Private Banks entered in agricultural lending in the fiscal year 2001-02 (Zaidi, 2005). After this entry, share of Domestic Private Banks and Commercial Banks increased substantively in agricultural lending.

Evaluation of commercial banks efficiency is a need of developing and developed countries. In developed countries, a number of studies have been carried out by the researchers to evaluate the efficiency of banks but in developing countries, like Pakistan, studies are scarce on this issue. In the measurement of efficiency, estimation of the frontier is the main issue, for which, two principal methods are used: Data Envelopment Analysis and Stochastic Frontier approach. Berger and Humphrey (1997) reviewed 122 frontier studies of financial institutions and among these

studies, 69 used non-parametric techniques for the frontier estimation. Further out of these non-parametric studies, 62 used DEA.

Existing information suggests that a gradual increase in the share of commercial banks to agricultural lending was observed after 2000 (Table I). As in Pakistan, commercial banks are the most important component of Pakistan's financial sector and it is important to see the technical efficiency of commercial banks and factors affecting it after year 2000. This study was conducted to achieve the above mentioned objective along with suggestions for the improvement of the efficiency of commercial banks operating in Pakistan.

## MATERIALS AND METHODS

Data Envelopment Analysis (DEA) is proposed by Charnes *et al.* (1978) under input orientation and Constant Returns to Scale (CRS) for the measurement of the efficiency of decision making units, with the objective to minimize the inputs to achieve produced level of outputs. Its Variable Returns to Scale (VRS) form is proposed by Banker *et al.* (1984) and envelops data more tightly than the CRS specification of DEA.

Following Coelli *et al.* (1998), under input orientation and CRS specification of DEA, assume  $C$  commercial banks, which produce  $O$  outputs by utilizing  $I$  inputs. For  $C$  commercial banks,  $Y$  represents output matrix containing output data of all banks having order  $O \times C$  (each column represents the outputs produced by different banks under consideration) and  $X$  represents input matrix of all banks inputs having order  $I \times C$  (each column represents the inputs

used by different banks under consideration). For a particular p-th bank,  $X_p$  is a column vector representing measured inputs of the p-th bank and  $Y_p$  is column vector representing measured outputs of the p-th bank. The DEA linear programming problem under CRS for p-th bank's technical efficiency ( $TE_{CRS}$ ) is specified as:

$$\begin{aligned} & \text{Min}_{\lambda, \theta} (\theta) & (1) \\ & \text{Subject to} \\ & Y\lambda \geq Y_p \\ & \theta X_p - X\lambda \geq 0 \\ & \lambda \geq 0. \end{aligned}$$

In the above linear problem,  $\lambda$  is a column matrix having order  $C*1$  and containing vector of constants only while  $\theta$  is a scalar. The above model of CRS is modified to VRS by adding a constraint in the problem and VRS specification of the above model is given below:

$$\begin{aligned} & \text{Min}_{\lambda, \theta} (\theta) & (2) \\ & \text{Subject to} \\ & Y\lambda \geq Y_p \\ & \theta X_p - X\lambda \geq 0 \\ & K'\lambda = 1 \\ & \lambda \geq 0. \end{aligned}$$

In this model,  $K$  is a matrix of order  $c*1$  having ones only while  $K'$  is transpose of  $K$  matrix. To measure the technical efficiency of each bank in the sample we have to estimate  $C$  times this linear programming problem. Many studies used intermediation approach to define outputs and inputs of bank (Isik & Hassan, 2002; Maghyreh, 2004; Burki & Niazi, 2006). Following this approach, data of commercial banks advances, investment and lending to financial institutions are considered as outputs, while number of employees, operating fixed assets (capital), deposits and other accounts, bills payable and borrowing from financial institutions are considered as inputs.

Tobit model is used to determine the influence of different factors on the estimated efficiency. Seven qualitative and six quantitative variables are considered as explanatory variable in the Tobit model and following Tobit model is estimated to develop average relationship between the technical efficiency scores obtained under VRS and the factors affecting it:

$$\begin{aligned} Y_{it} = & C + \beta_1 \ln TASSETS_{it} + \beta_2 \ln TLABIL_{it} + \beta_3 \ln TMIEARN_{it} + \beta_4 \ln TNMIEARN_{it} \\ & + \beta_5 \ln TMRIEXPEN_{it} + \beta_6 \ln TNMIEXPEN_{it} + \beta_7 DPUBLIC_{it} + \beta_8 DFOREIGN_{it} + \beta_9 DMYEAR_{it} \\ & + \beta_{10} DMYEARAF_{it} + \beta_{11} D2002_{it} + \beta_{12} D2003_{it} + \beta_{13} D2004_{it} + \mu_{it} \end{aligned} \quad (1)$$

where,

$Y_{it}$  = Technical efficiency score obtained by i-th bank in time period t under VRS.

$TASSETS_{it}$  = Total assets, which i-th bank have in time period t.

$TLABIL_{it}$  = Total liabilities, which i-th bank have in time period t.

$TMIEARN_{it}$  = Total mark-up/return/interest earned by

i-th bank in time period t.

$TNMIEARN_{it}$  = Total non-mark-up/return/interest earned by i-th bank in time period t.

$TMRIEXPEN_{it}$  = Total mark-up/return/interest expenses made by i-th bank in time period t.

$TNMIEXPEN_{it}$  = Total non-mark-up/return/interest expenses by i-th bank in time period t.

$DPUBLIC_{it}$  = 1 if i-th bank in time period t is owned by government otherwise 0.

$DFOREIGN_{it}$  = 1 if i-th bank in time period t is owned by foreigners otherwise 0.

$DMYEAR_{it}$  = 1 if i-th bank in time period t is merged with other bank otherwise 0.

$DMYEARAF_{it}$  = 1 if i-th bank in time period before t is merged with other bank otherwise 0.

$D2002_{it}$  = 1 if data of i-th bank belong to year 2002 other wise 0.

$D2003_{it}$  = 1 if data of i-th bank belong to year 2003 other wise 0.

$D2004_{it}$  = 1 if data of i-th bank belong to year 2004 other wise 0.

$C, \beta_1, \beta_2, \dots, \beta_{13}$  are the regression coefficients to be estimated by using the Tobit model.

For the estimation of technical efficiency, panel data of commercial banks operating in Pakistan for the period 2001 to 2004 is used. Number of banks used to estimate the frontier was 35 in 2001, 31 in 2002, 31 in 2003 and 29 in 2004. The source of data is Banking Statistics of Pakistan (various issues), different Pakistan: Financial Sector Assessment reports and different issues of Pakistan Economic Surveys. Data Envelopment Analysis Program (DEAP) (Computer program) developed by Coelli (1996) is used to estimate the technical efficiency of commercial banks under VRS assumption. Efficiency frontier of the commercial banks is estimated for each year by using that year's output-input variables data of the banks.

## RESULTS AND DISCUSSION

Under VRS specification of DEA, technical efficiency scores of commercial banks for year 2001, 2002, 2003 and 2004 were calculated. For year 2001, 30 commercial banks were fully efficient and out of these, 16 were local (six were public sector & ten were private sector) and 14 were foreign. The most inefficient bank for this year was Union Bank with estimated efficiency score of 0.877. This bank could be converted to technical efficient under VRS, if it was able to produce the level of output by utilizing 12.3% less of currently utilized inputs. Similarly 17 (six public & 11 private), 17 (five public & 12 private), and 19 (four public & 15 private) local commercial banks and ten, nine and six foreign commercial banks were highly efficient for year 2002, 2003 and 2004, respectively. In 2002, the most inefficient bank was Saudi Pak Commercial Bank Ltd. with estimated technical efficiency score of 0.881, while in 2003 Bolan Bank Ltd. with estimated technical efficiency score of

**Table I. Share of domestic private banks and commercial banks to agricultural credit**

Year	Domestic Private Banks (Rs. Million)	Commercial Bank (Rs. Million)	(Rs. Total (Rs. Million)	% Share in Total Agricultural Credit	
				Domestic Private Banks	Commercial Banks
1996-97	0.00	4429.43	19547.67	0.00	22.66
1997-98	0.00	6109.70	33392.30	0.00	18.30
1998-99	0.00	7236.00	42852.00	0.00	16.89
1999-00	0.00	9312.50	39687.60	0.00	23.46
2000-01	0.00	12056.00	44790.40	0.00	26.92
2001-02	592.82	17486.12	52314.49	1.13	33.43
2002-03	1421.11	22738.60	58915.27	2.41	38.60
2003-04	2701.80	33247.45	73445.86	3.68	45.27
2004-05	12406.82	51319.78	108732.91	11.41	47.20
2005-06	16023.38	67967.40	137474.32	11.66	49.44

Source: Government of Pakistan (2007)

**Table II. Effect of different factors on technical efficiency scores of commercial banks**

	Coefficient	Standard Error	z-Statistic
C	0.827322	0.052250	15.83394*
LOG(TASSETS)	0.055224	0.027122	2.036150**
LOG(TLABILI)	-0.040756	0.025502	-1.598111
LOG(TMIEARN)	0.008351	0.009215	0.906217
LOG(TNMIEARN)	-0.006675	0.004222	-1.581221
LOG(TMRIEXPEN)	-0.004442	0.007386	-0.601475
LOG(TNMIEXPEN)	-0.004860	0.004805	-1.011504
DPUBLIC	0.008413	0.006714	1.253075
DFOREIGN	0.016781	0.005551	3.023102*
DMYEAR	0.005860	0.011551	0.507305
DMYEARAF	-0.025582	0.008450	-3.027313*
D2002	-0.000981	0.006728	-0.145854
D2003	-0.004310	0.010543	-0.408808
D2004	-0.003520	0.012142	-0.289938

\*significant at 1% level of significance

\*\*significant at 5% level of significance

\*\*\*significant at 10% level of significance

0.876 was the most inefficient. Possible reduction of inputs that should be carried out by these banks to produce obtained output at technical efficient point was 11.9 and 12.4%, respectively. For year 2004, KASB Bank Ltd. was the most inefficient with estimated technical efficiency score of 0.885 and possible reduction of inputs that this bank carried out for that year to produce obtained level of profit at technical efficient point was 11.5%.

Under this specification, bank having the highest technical efficiency score was assigned the rank one (bank having the second highest technical efficiency score was assigned the rank two & so on) and banks having same technical efficiency score were given the same rank. On the basis of obtained efficiency score, commercial banks for year 2001, 2002, 2003 and 2004 got six, five, six and five ranks, respectively.

**Determinants of technical efficiency under VRS.** To explain variation in the technical efficiency score of commercial banks under VRS due to important factors, equation 1 is estimated and results of this estimated Tobit model (Table II) shows that the assets of the bank and markup interest earning were positively related to the technical efficiency of the commercial banks, while liabilities of the bank, non-markup interest earnings, markup and non-markup interest expenses contributed negatively to quantitative variables considered in the equation 1.

Regarding qualitative variables of equation 1, dummy variables for public owned banks, foreign owned banks and merger year contributed positively with respect to benchmark category while dummy variable for year 2002, 2003, 2004 and after merger year contributed negatively. Significant contributors to efficiency were total assets and liabilities at 5% level of significances. Ownership characteristic of the bank was also significant contributor in the efficiency of commercial banks. Foreign owned (significant at 1% level of significance) banks efficiency was better than the private domestic banks, while after year merger effects were negative and significant at 1% level of significance.

In the estimated Tobit model, assets of the bank have significant positive impact on the technical efficiency of commercial banks under VRS and this is in line with the study of Ataullah and Le (2006), Burki and Niazi (2006), Pasiouras (2006), Maghyereh (2004), Grigorian and Manole (2002), Jackson and Fethi (2000) and Miller and Noulas (1996). As far as the liabilities of the bank are concerned, it has negative effect on the technical efficiency of commercial banks under VRS and inline with the study of Maghyereh (2004) and Miller and Noulas (1996) (as in Pakistan major part of liabilities of commercial banks was deposits). Commercial banks expenses can be categorized into markup interest expenses and non-markup interest

expenses. From estimated models, one can see that the expenses have negative impact on commercial banks efficiency and these results were in line with the study of Ataullah and Le (2006), Ataullah *et al.* (2004) and Burki and Niazi (2003).

In the estimated models, earning side of the commercial banks is captured by incorporating markup interest earning and non-markup interest earnings. Markup interest earnings have positive impact on the efficiency of commercial banks and this result was in line with the studies of Burki and Niazi (2006) and Miller and Noulas (1996). Similarly, ownership characteristic of the bank has significant impact on the efficiency of commercial banks and inline with the study of Isik and Hassan (2002).

## CONCLUSION

Commercial banks should increase assets to increase their efficiency, while at the same time government should not promote the mergers of banks in Pakistani market as it has negative effect on the technical efficiency of commercial banks. Foreign ownership has significant positive impact on the efficiency of commercial banks and government should facilitate foreign people to set their banking business in this part of the world to enhance the efficiency of the banking sector. As no significant decline in the efficiency of commercial banks is observed over time after the start of intensive agricultural lending by commercial banks, hence for the betterment of the agricultural sector it should be continued.

## REFERENCES

- Ataullah, A. and H. Le, 2006. Economic reforms and bank efficiency in developing countries: the case of Indian banking industry. *Appl. Finan. Econ.*, 16: 653–63
- Ataullah, A., T. Cockerill and H. Le, 2004. Financial Liberalization and bank efficiency: a comparative analysis of India and Pakistan. *Appl. Econ.*, 36: 1915–24
- Banker, R.D., A. Charnes and W.W. Cooper, 1984. Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Manag. Sci.*, 30: 1078–92
- Berger, A.N. and D.B. Humphrey, 1997. Efficiency of financial institutions: international survey and directions for future research. *European J. Operat. Res.*, 98: 175–212
- Burki, A.A. and G.S.K. Niazi, 2003. The effects of privatization, competition and regulation on banking efficiency in Pakistan, 1991–2000. *CRC Conference on: Regulatory Impact Assessment: Strengthening Regulation Policy and Practice*, Chancellors Conference Centre, 26–27 November. University of Manchester, Manchester, UK
- Burki, A.A. and G.S.K. Niazi, 2006. *Impact of Financial Reforms on Efficiency of State-owned, Private and Foreign Banks in Pakistan*. Centre for Management of Economic Research (CMER) working paper No. 06–49, Lahore University of Management Sciences, Lahore, Pakistan
- Charnes, A., W.W. Cooper and E. Rhodes, 1978. Measuring the efficiency of decision making units. *European J. Operat. Res.*, 2: 429–44
- Coelli, T., 1996. “A Guide to DEAP Version 2.1: A Data Envelopment Analysis (Computer) Program”. CEAP Working Paper No. 8/96. Department of Econometrics, University of New England, Armidale, Australia
- Coelli, T., D.S.P. Rao and G.E. Battese, 1998. *An Introduction to Efficiency and Productivity Analysis*. Kluwer Academic Publishers, 101 Philip Drive, Assinippi Park, Nowell, Massachusetts
- Government of Pakistan, 2003. Pakistan Economic Survey 2002–03, Economic Advisor’s Wing, Finance Division, Islamabad
- Government of Pakistan, 2007. Pakistan Economic Survey 2006–07, Economic Advisor’s Wing, Finance Division, Islamabad
- Grigorian, D.A. and V. Manole, 2002. *Determinants of Commercial Bank Performance in Transition: An Application of Data Envelopment Analysis*. World Bank Policy Research Working Paper 2850
- Isik, I. and M.K. Hassan, 2002. Technical, scale and allocative efficiencies of Turkish banking industry. *J. Bank Finan.*, 26: 719–66
- Jackson, P.M. and M.D. Fethi, 2000. *Evaluating the Technical Efficiency of Turkish Commercial Banks: An Application of DEA and Tobit Analysis*. Published by Efficiency and Productivity Research Unit, University of Leicester, UK. Available at <https://ira.le.ac.uk:443/bitstream/2381/369/1/dpno5.pdf> (accessed Oct. 5, 2007)
- Maghyreh, A., 2004. *The Effect of Financial Liberalization on the Efficiency of Financial Institutions: The Case of Jordanian*. Saving and Development, Quarterly Review 3
- Miller, S.M. and A.G. Noulas, 1996. The technical efficiency of large bank production. *J. Bank Finan.*, 20: 495–509
- Pasiouras, F., 2006. *Estimating the Technical and Scale Efficiency of Greek Commercial Banks: The Impact of Credit Risk, Off-balance Sheet Activities and International Operations*. Working Paper Series 2006.17, School of Management, University of Bath, UK
- Zaidi, S.A., 2005. *Issues in Pakistan’s Economy*. Oxford University Press, Karachi, Pakistan

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