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The impact of bank efficiency on share performance: Evidence from Pakistan

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This study examines the relationship between bank efficiency and share performance. Data regarding seven banks listed on Karachi Stock Exchange were collected for a period of five years (2003 to 2007). Data analysis comprises three steps. Firstly, cumulative annual share returns (CASR) is calculated, secondly, Data Envelopment Analysis (DEA) is used to measure bank efficiency and finally, share performance is regressed over change in efficiency. The results reveal that, a positive and significant link exists between change in annual bank efficiency and share performance.

Key words: Bank efficiency, share performance, data envelopment analysis, Pareto optimality, KSE, Pakistan.

INTRODUCTION

The banking sector of Pakistan has flourished tremendously after its liberalization started in 1990 (SBP, 2003). It has operated competently and innovatively in recent years and has captured huge share in the services sector of the country. Resultantly, shareholders and investors have become increasingly interested in knowing determinants of bank performance and its relationship with share performance (Beccalli et al., 2006). Factors affecting share prices have been focal research area for academicians as well as practitioners. Literature on this subject has become voluminous. Bank efficiency contributes in share performance (Beccalli et al., 2006). Several studies have been conducted to measure efficiency of organizations particularly banks over the past years in several countries.¹ Some studies examine

foreign and domestic banks efficiency². Share prices provide insights of earnings which are dependent on efficiency. Literature reveals that, stock prices depict the publically available information³. Relationship of efficiency with share price has remained an area of interest for researchers and financial managers.

Bank efficiency and share performance has been studied in many countries⁴. In some prior studies, share price behavior was examined against traditional accounting performance parameters like earnings and return on assets. Berger and Humphrey (1997) criticized traditional accounting performance measures for comparing efficiency of organizations and pointed out that, frontier approaches offer better tool for comparing efficiency. Beccalli et al. (2006) found evidence that, frontier approaches are robust than traditional accounting measures. He also determined that improvements in operating efficiency are depicted through improvements in share performance. Recently, Burki and Niazi (2010)

¹First study for US banks was conducted by Berger and Humphrey during 1991 followed by Berger (1993); Jagtiani and Khanthavit (1996); Miller and Noulas (1996). Similar studies have also been carried out in Australia (Sathye, 2001; Sturm and Williams, 2004), India (Ataullah and Le, 2004), Italy (Resti, 1997; Girardone et al., 2004), Japan (Altunbas et al., 2000; Drake and Hall, 2003), Korea (Park and Weber, 2006), Portugal (Mendes and Rebelo, 1999; Canhoto and Dermine, 2003), Spain (Lozano-Vivas, 1997, 1998), Taiwan (Huang, 2000; Chen, 2001), Turkey (Isik and Hassan, 2002, 2003), UK (Drake, 2001), and Ukraina (Mertens and Urga, 2001). Cross-country studies have also been conducted (Maudos et al., 2002; Fries and Taci, 2005; Kasman and Yildirim, 2006).

²Mahajan et al., 1996; Sabi, 1996; Havrylychuk, 2006; Kraft et. al., 2006; Sensarma, 2006; Burki and Niazi, 2010

³Ball and Kothari, 1994

⁴Adenso-Diaz and Gascon (1997) in Spain, Chu and Lim (1998) in Singapore, Eisenbeis et al., (1999) in US, Sufian- and Majid (2006) in Malaysia, Kirkwood and Nahm (2006) in Australia, Beccalli et al. (2006) in Europe, Pasiouras et al. (2007) in Greece, Fiordelisi (2008) in France, German, Italy and UK, Erdem et al., (2008) in Turkey and Hadad et al., (2010) in Indonesia

have studied efficiency of Pakistani banks following frontier approach - DEA. However, no study on relationship between bank efficiency and share performance has come in our knowledge in context of Pakistan. This study contributes to literature in two ways. Firstly, there is paucity of research on bank efficiency in developing countries particularly Pakistan. A few studies which have been conducted in Pakistan are based on old data. Present study using latest data for the period 2003 to 2007 attempts to fill the gap and gives present outlook of banking industry. Secondly, the study attempts to examine the relationship between banks' efficiency measured through DEA and share prices which is completely missing in literature for Pakistani banking sector. This study examines relationship of efficiency with share performance of Pakistani banks following frontier approach. On the pattern of Beccalli et al. (2006), Erdem and Erdem (2008), and Pasioras et al. (2008), our analysis has three parts. Firstly, cumulative annual share returns (CASR) of listed commercial banks operating in Pakistan is calculated for each year from 2003 to 2007. Secondly, using DEA efficiency of the banks is estimated. Finally, annual share returns have been regressed over annual change in efficiency while controlling all other bank financial characteristics.

LITERATURE REVIEW

Frontier approach of measuring efficiency got huge attention of researchers after seminal paper of Farret (1957). Frontier approach determines how close the bank is with best frontier. Frontier approach literature can be divided into two types, first is programming approach and other one is econometric approach. Programming approach is non-parametric and deterministic while econometric approach is parametric and stochastic. In literature, there are at least five parametric and non-parametric efficiency measuring techniques applied to financial institutions in different countries (Berger and Humphrey, 1997). Most commonly used efficiency measures are Stochastic Frontier Approach (SFA) and Data Envelopment Analysis (DEA). The prior is parametric while latter is non-parametric in nature. SFA is sometimes referred to as econometric approach while DEA is referred to as programming approach. Both approaches have their own merits and demerits. The following study adopts DEA for measuring Bank efficiency due to its economical nature to the data. It has no functional form, operates well with different size of banks and produces optimal results even for a small sample size.

Data envelopment analysis (DEA)

Charnes et al. (1978) initially developed DEA and it is

used in many current studies⁵. Essence of DEA measure is Pareto optimality which states that, a unit is not efficient if (a) output of the unit can be raised without raising input while keeping other outputs same and (b) input can be lowered without decreasing output while keeping other inputs same (Charnes et al., 1981). DEA analysis can be conducted by controlling inputs or outputs. Output efficiency indicates the extent to which output can be raised without additional input through improvement in efficiency measures. While input efficiency indicates the extent to which input can be reduced without lowering output (Thanassoulis, 2001). DEA takes a broader view of performance capturing interactions among multiple inputs and multiple outputs. It estimates overall performance of a specific unit relative to best practice in the group. This characteristic of DEA is its distinct advantage over traditional ratio analysis which has two variables only and each ratio is compared with some bench mark ratio, one at a time keeping other factors constant (Yeh, 1996).

DEA and banking

Introduction of DEA in financial sector began through behavior model for financial institutions which was used basically to comprehend the production possibilities (Avkiran, 2006). Remarkable research is present on bank efficiency measures using DEA. However, each study has used different variables for inputs and outputs (Akhtar, 2010). Akhtar (2002) used DEA to compare efficiency of 40 Pakistani banks. Inputs used were deposits and capital while outputs were investment portfolio and loans and advances. Intermediation approach was used to compute efficiency. For overall efficiency score of Pakistani banks was discovered 0.80 in 1998. Debasish (2006) measured the relative performance of Indian banks for the period 1998 to 2004 using DEA model. He discovered foreign banks more efficient than domestic banks. Likewise, large sized and small sized banks were found relatively more efficient than medium sized banks over the period of analysis. Sturm and Williams (2004) evaluated the impact of foreign bank entry on bank efficiency across Australia for the period of 1988 to 2001 using DEA and stochastic frontier approaches.

They concluded that phenomenon of deregulation and competition via entry of foreign banks has helped banks to improve efficiency across Australia. Later, Sturm and Williams (2007) examined factors that determine efficiency differences among foreign banks in Australia using framework of comparative advantage. Sathye (2001) measured efficiency scores of 29 domestic commercial banks of Australia for the year 1996 using Data Envelopment Analysis. He estimated efficiency scores by taking labor, physical capital and loanable funds, as

⁵See Isik and Hassan, 2002; Yildirim, 2002; Casu and Molyneux, 2003; Damar, 2006.

inputs while loan and demand deposit as outputs. Drake et al. (2006) appraised the relative technical efficiency of banks in Hong Kong. Having incorporated the market and environmental factors into efficiency analysis, they discovered a differential impact of these factors. Their analysis revealed that, factors like accession of Hong Kong to China, financial deregulation and Asian economic crisis of 1997 to 1998 did not appear to have any significant impact on the relative efficiency of banks across Hong Kong. Chu and Lin (1998) studied banking efficiency of Singaporean banking industry. They used two models in their study: one for profit and the other for cost efficiency. They took a sample of six commercial banks which held 70% of market share during 1992 to 1996. For cost efficiency, they used shareholder funds, operating expense and interest expense as inputs and annual increase in average assets and total income as output. For profit efficiency, inputs were kept same while profit was taken as output. Using a two-stage model of banking, Lim and Randhawa (2005) estimated X-efficiency of Hong Kong and Singapore banks. In their analysis, they discovered that bank size, leading to economies of scale, and nature of ownership had a greater impact on X-efficiency of banks across two countries. They used different sets of inputs and outputs under the production and intermediation stages of banking business. Chen et al. (2005) examined cost and technical efficiency of 43 Chinese banks over the period of 1993 to 2000.

Results showed that, large and small banks were efficient than medium sized banks. Ariff and Can (2007) used non-parametric DEA technique to investigate cost and profit efficiency of 28 Chinese commercial banks during the period 1995 to 2004. In the second stage regression, they examined the influence of ownership type, size, risk profile, profitability and key environmental changes on bank efficiency by using Tobit regression. They found that, medium sized banks were more efficient than small and large banks. Yao et al. (2007) by employing stochastic frontier production function and using data of 22 banks for the period 1995 to 2001 investigated the effects of ownership structure and hard budget constraints on Chinese banks' efficiency. Their empirical results suggested that non-state banks were 8 to 18% more efficient than state banks. Moreover, banks facing a harder budget tend to perform better than those heavily capitalized by the state or regional governments. Chen and Yeh (1998) measured operating efficiency of 33 banks in Taiwan by applying DEA approach. Output variables were selected as loan services, portfolio investment, interest income and non-interest income.

While input variables were, number of staff employed, bank assets, number of bank branches, operating costs, and deposits. Gunay and Taltas (2006) compared bank

efficiency in Turkish banking sector in pre-crisis and post-crisis period using DEA for the period of 1990 to 2000. Ashton (2001) examined cost efficiency of British banks through using both production and intermediation, measured distribution-free cost efficiency, economies of scale, scope and cost complementarities. He found increasing economies of scale and low levels of dispersion in cost efficiency among banks across Britain. He also discovered that, smaller retail banks were more efficient than their large counterparts. Rime and Stiroh (2003) studied performance of Swiss banks for the period of 1996 to 1999 using Data Envelopment Analysis. They found that small and medium sized banks achieved but larger banks could not achieve economies of scale.

Bank efficiency and share performance

Beccalli et al. (2006) pointed out that, despite many paper on bank efficiency, there is little evidence to link efficiency of banks to their stock performance. Studies on stock market behavior indicate that there exists a link between stock prices and earnings (Kothari, 2001). Changes in share prices show changes in profit efficiencies of banks rather than cost efficiencies (Chu and Lim, 1998; Ioannidis et al., 2008; Sufian and Majid, 2006). Technical efficiency in banks is significantly and positively related with share performance (Pasiouras et al., 2008). Stocks of cost efficient banks perform little more than cost inefficient banks (Sufian et al., 2007). Kirkwood et al. (2003) calculated cost and profit efficiency for Australian banks for 1995 to 2002 by applying Data Envelopment Analysis. Results showed that efficiency of banks was reflected in their stock returns. Liadaki and Gaganis (2010) determined that, profit efficiency was positively related with stock performance while cost efficiency had no significant relation with stock returns.

DATA AND METHODOLOGY

This study incorporates a sample of seven commercial banks out of the commercial banks listed on Karachi Stock Exchange (KSE) 100 index as this index is the benchmark for the rest of the industry and one can make inferences about the banking industry of Pakistan through it. Only those banks are taken which have been included in KSE-100 index over the whole period 2003 to 2007. Our sample seems small but it is quite up to the mark, some studies like Reztis (2006) used only six banks, Pasiouras et al., (2008) took sample of only ten banks. Monthly data of stock price is collected from Karachi Stock Exchange database while financial statements information is gathered from the statistics database of the State Bank of Pakistan over the period 2003 to 2007. Due to relative small sample, only two inputs and one output are used (Pasiouras et al., 2008). We take operating expenses and interest expenses as inputs and net profit as output. Share performance is calculated by cumulative annual stock returns (CASR) by using the following formula, previously applied by (Pasiouras et al., 2007; Beccalli et al., 2006)

$$CASR_t = ((1 + \text{month 1 return}) * (1 + \text{month 2 return}) * \dots * (1 + \text{month n return})) - 1 \quad (1)$$

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Table 1. Input (interest expense and operating expenses) and outputs (total income).

	Total income (millions PKRs)	Interest Expenses (millions PKRs)	Operating Expenses (millions PKRs)
2003	1656.852	2781.292	1970.465
2004	2084.710	3134.742	1826.278
2005	4422.867	3631.930	3742.263
2006	5771.541	4325.332	6370.044
2007	6883.073	4913.413	9015.237

Table 2. Change in assets and CASRs.

	Assets	CASR
2003	na	na
2004	0.43925	-0.25434
2005	0.404	0.381718
2006	0.23275	-0.05299
2007	0.24325	-0.24088

Table 3. This table shows DEA efficiency scores and annual changes in efficiency.

	DEA Efficiency score (%)	DEA Efficiency score (%)	Change in efficiency (%)	Change in efficiency (%)
	TE ^{CRS}	TE ^{VRS}	TE ^{CRS}	TE ^{VRS}
2003	49.94	71.56	n.a.	n.a.
2004	69.64	90.79	39.45	26.87
2005	69.87	87.53	0.33	-3.59
2006	62.99	84.84	-9.85	-3.07
2007	49.90	65.30	-20.78	-23.03
Average	60.47	80.00		

where CASRs is cumulative annual stock returns for year t. To determine the relationship of stock performance and efficiency, CASR is regressed over related annual change in efficiency score. Efficiency score change is calculated by the following formula previously used by Beccalli et al. (2006).

Efficiency change in year t = (Efficiency score t - Efficiency score t-1) / Efficiency score t-1 (2)

Relationship between bank efficiency and stock performance is investigated through the following model

$$R_{j,t} = \beta_0 + \beta_1 E_{jt} + \beta_2 E_{j,t-1} + \beta_3 \Delta E_{j,t} \quad (3)$$

Where $R_{j,t}$ is cumulative annual return on bank j's stock for the annual period ending at time t and E_{jt} is bank j's annual percentage change in efficiency measured through DEA by both constant returns to scale (CRS) and variable returns to scale (VRS)⁶.

Data analysis

Inputs and output used for this study are reported in Table 1. Interest expenses increased 357% while operating expenses also mounted over 76.66% over the sample period. Profit is the consequence of expenses, so profit also increased 315% during the sample period. Total assets are taken as control variable for the seven banks which are listed in Karachi Stock Exchange. These values are in million denominated in Pak Rupee. The minimum asset value was 85386.90 million Pak rupees in 2003 and maximum was 762193.59 million Pak rupees in 2007. Assets of all the banks in our sample increased over the whole sample period. The growth of assets ranged 50.73% minimum to 1172.50% maximum in 2007 (assuming 2003 as base year). The existence of such growth differential signals loopholes which need to be eradicated to perform at an optimal level. This also shows a tremendous growth in assets of those banks which performed efficiently. Changes in assets and CASR are reported in Table 2. CASR of all banks ranged from 5.99 to 12.86% over the sample period.

⁶Some studies are in favor of using VRS (Banker et al., 1984;) suggesting CRS is only amenable when all firms are working on optimal level (Pasiouras et al., 2007), other suggest CRS more effective when sample consists different sizes of banks (Noulas, 1997).

Table 4. Panel regression results.

Variable	Coefficient	t-Statistics
Intercept	0.095309	0.000
TE ^{CRS}	0.002	0.757
TE ^{VRS}	4.931	2.976
Assets	-0.006	-0.582
F-Statistics	0.142**	
R ²	0.105	

Cumulative annual stock returns (CASR) are obtained from monthly stock returns using following formula. $CASR_t = ((1 + \text{month } 1 \text{ return}) * (1 + \text{month } 2 \text{ return}) * \dots * (1 + \text{month } n \text{ return})) - 1$. Changes in CASR are reported in Table 2. CASR of all banks ranged 5.99 to 12.86% over the sample period. Change in efficiency is determined as it is reflected in shares returns (Pasiouras et al., 2007; Beccalli et al., 2006). Change in efficiency is presented in Table 3. Change in efficiency was regressed with CASRs. The panel regression results for Equation 3 are reported in Table 4. Change in efficiency (CRS) coefficient is 0.002 with t-statistics 0.757 while change in efficiency (VRS) coefficient is 4.931 with t-statistics 2.976 which shows that, efficiency is positively associated with cumulative annual shares returns. It can be inferred that stock returns can be explained by change in bank efficiency. R square is 10.5% which shows that, variance in CASR is 10.5% explainable by change in bank efficiency.

DISCUSSION AND CONCLUSION

Studies conducted so far on Pakistani banks attempted only to measure bank efficiency while no study come in author's knowledge which attempted to investigate the relationship between bank efficiency and share performance. This study filled this gap by taking a sample of seven banks which were listed in Karachi stock exchange over the period of 2003 to 2007. Efficiency was measure by DEA due to its parsimonious nature and its power to give optimal results even for a small sample. Change in efficiency was regressed with cumulative annual share returns.

The results showed that, there existed significant relationship between change in bank efficiency and shares performance. Our results are in line with earlier findings of Pasiouras et al. (2008) who took evidence from Greece and Beccalli et al. (2006) who studied European banks. The findings of this study suggest that, stock returns of bank can be predicted through its changes in efficiency. The major limitation of this study was that, Stock prices in Pakistan had been fluctuating excessively during the period under review because of war against terrorism and political uncertainty in the country.

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