The relative efficiency of bank branches in lending and borrowing: an application of data envelopment analysis

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Abstract

The relative efficiency of fifty-two branches of a small South African bank was estimated using Data Envelopment Analysis (DEA). A factor responsible for the difference in efficiency between branches might be the difference in managing the asset (loans) and the liability (deposit) side of the balance sheet. For this reason, the relative efficiency of the lending and borrowing activities was also estimated and compared to the relative efficiency of the combined (lending and borrowing) activities.

In the case of the efficiency estimates for loans and deposits, the indications are that the branches were more efficient in managing the liability side (deposits) than in managing the asset side (loans). This means that purchased funds were not utilised efficiently.

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1 Introduction

Banks are managers of risk and one of the fundamental risks that are faced by all banks is the interest rate risk. A bank's asset and liability management committee (ALCO) is responsible for measuring and monitoring interest rate risk. It also recommends pricing, investment, funding and marketing strategies to achieve the desired trade-off between risk and expected return (Koch, 1995: 244). In managing the interest rate risk the ALCO co-ordinates, or directs, changes in the maturities and types of bank assets and liabilities to sustain profitability in a changing economic environment (Falkena *et al*., 1987: 5).

The profitability of a bank is thus determined, *inter alia,* by the amount of interest income generated by that bank. The differences in profitability among various banks (or branches) might be due to a number of factors. Some of these factors are differences in costs and incomes, but also differences in efficiency within the banks (branches). One bank (branch) might be more efficient in lending, while another bank (branch) might be more efficient in borrowing (deposit taking). This means that one bank (branch) might be more efficient than another bank (branch) in managing the asset side of its balance sheet, while the other bank (branch) might be more efficient in managing the liability side of its balance sheet.

Most summary measures of bank performance are calculated as financial ratios (Gardner & Mills, 1994: 668-669). Financial ratio measures that are used both within and outside the banking industry include the rate of return on assets (ROA), the rate of return on equity (ROE), the ratio of bad debts to assets, the ratio of staff costs to assets plus liabilities, and total costs per employee. Financial ratio measures peculiar to the banking and finance industry include the ratio of non-interest income to interest income, and ratios that measure liquidity and credit risk associated with loan portfolios. Rates of growth (e.g. in deposits and advances), net interest income (NII) and the net interest margin (NIM) are also used as summary measures of performance in the banking industry.

There are at least two problems with performance measures of this type. First, they are only meaningful when compared to a benchmark, and finding a suitable benchmark (e.g. the exact ROE that must be obtained before a bank is regarded as performing well) may be difficult (Yeh, 1996: 980). Second, each performance measure is partial in the sense that it is calculated using only a subset of the data available on the firm. The problem with partial measures is that a bank may perform well using one measure (e.g. ratio of bad debts to assets) but badly using another (e.g. total costs per employee). What is needed is a single measure of total performance that is calculated using all the input and output data available on the firm.

The two most widely used quantitative techniques for measuring relative productivity (or relative efficiency) are Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA). DEA is a technique for combining all the input and output data on the firm into a single measure of productive efficiency, which lies between zero (meaning the firm is totally inefficient) and one (which signals that the firm is fully efficient). DEA has previously been used to study the performance of banks at both the firm/corporate level (e.g. Drake, 2001; Devaney & Weber, 2000; Berger & Humphrey, 1997; Mendes & Rebello, 1999; Resti, 1997), and at the branch level (e.g. Sherman & Ladino, 1995; Sherman & Gold, 1985; Vassiloglou & Giokas, 1990; Oral & Yolalan, 1990, O'Donnell & van der Westhuizen, 2002, Van der Westhuizen & Oberholzer, 2003; Oberholzer & van der Westhuizen, 2004).

This paper uses Data Envelopment Analysis (DEA) to measure the performance of a small South African bank at branch level and to compare the performance of each branch with regard to lending and borrowing activities. DEA is used because it lends itself more easily to the analysis of multiple-output firms, especially in cases where the behavioural objective of the firms may not be clear (perhaps because of government regulations or other constraining features of the firms' operating environment).

The remainder of the paper is divided into four sections. In Section 2 the researched method used is described. In Section 3 the model and the approach used are explained. In Section 4 the DEA results are presented and discussed. The paper is concluded in Section 5.

2 Research method used

Analysts of firm efficiency are usually interested in four main types of efficiency, namely technical, allocative, cost and scale efficiency. A firm is said to be technically efficient if it produces a given set of outputs using the smallest possible amount of inputs. Allocative efficiency reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices. A firm is cost efficient if it is both technically and allocatively efficient. The firm is said to be scale efficient if it operates on a scale that maximises productivity.

Charnes *et al*. (1978) developed DEA as a linear programming technique to evaluate the efficiency of public sector non-profit organisations. According to Molyneux *et al*. (1996), Sherman and Gold (1985) were the first to apply DEA to banking.

The original model proposed by Charnes *et al*. (1978) and adopted by Sherman and Gold (1985) is formulated as follows:

Objective function

$$\max E_o = \frac{\sum_{i=1}^{k} u_i \Psi_{io}}{\sum_{j=1}^{m} v_j x_{jo}}, \quad (1)$$

where

o = the branch being assessed from the set of $r = 1, 2, ..., n$ bank branches;
k = the number of outputs at the branches;
m = the number of inputs at the branches;
ψ_{ir} = observed output i at branch r;
χ_{ir} = observed input j at branch r.

Constraints

$$\frac{\sum_{i=1}^{m} u_i \Psi_{ir}}{\sum_{j=1}^{m} v_j x_{jr}} \leq 1 \; r = 1, ..., n \quad (2)$$

$$u_i, v_j > 0, i = 1, ..., k, j = 1, ..., m \quad (3)$$

The above analysis is performed repetitively, with each bank branch in the objective function, producing efficiency ratings for each of the n branches. The solution sought is the set of (u_i, v_i) values that maximise the efficiency ratio E_o of the bank branch being rated, without resulting in an output/input ratio 1 when applied to each of the other branches in the data set. Equation 1 can be interpreted as

maximise $\frac{\textit{output index}}{\textit{input index}}$, equation 2 as a boundary constraint and equation 3 as a non-negativity constraint.

3 Data and model

The data used in this paper were obtained from one of the smaller banks in South Africa. It is monthly data for eleven months for all the fifty-two branches of the bank. The fifty-two branches are grouped into nine regions. These regions are not entirely geographical regions, but are also set up for administrative purposes. For the purpose of this study the relative efficiency of the fifty-two branches, as well as the relative efficiency of the branches with regard to lending and borrowing, are compared.

Limited agreement exists in the banking literature on defining outputs, inputs and prices for the inputs. Up to five approaches have been suggested, of which the production approach and the intermediation approach (or variations of it) are the most commonly used ones. According to Berger *et al*. (1987: 508), under the production approach, banks produce accounts of various sizes by processing deposits and loans, incurring capital and labour costs. Under this approach operating costs are specified in the cost function and number of accounts are used as the output metric, while average account sizes are specified to control for other account characteristics. Under the intermediation approach, banks intermediate deposited and purchased funds into loans and other assets. Under this approach total operating cost plus interest cost are specified and the output is specified in dollars.

According to Resti (1997: 224), a pivotal issue throughout the whole literature based on stock measures of banking products, is the role of deposits. On the one hand, it is argued that they are an input in the production of loans (intermediation or asset approach). Yet, other lines of reasoning (value-added approach, or user cost approach) suggest that deposits themselves are an output, involving the creation of value added, and for which the customers bear an opportunity-cost.

In this paper the intermediation approach is adopted. The main reason for using this approach is because the production approach requires the number of accounts and transactions processed (output measures under the production approach) that were unavailable. Measuring scale and technical efficiency using DEA requires data on output and input quantities, while measuring allocative and cost efficiency also requires data on input prices.

Three models are specified in this paper. Similar inputs were used in all three models, but to compare the relative efficiency of the branches with regard to loans and deposits, the outputs were adjusted. The following models were specified:

Output model 1:	y_1 =	rand value of loans
	y_2 =	rand value of deposits
Output model 2	y_1 =	rand value of loans
	y_2 =	rand value of non-interest income
Output model 3	y_1 =	rand value of deposits
	y_2 =	rand value of interest income
Input:	x_1 =	rand value of labour
	x_2 =	rand value of capital costs
	x_3 =	rand value of purchased funds.
Input prices:	w_1 =	(x_1/number of staff)
	w_2 =	production price index (Index P0142.1 by Statistics, South Africa)
	w_3 =	(interest expenses)/x_3

The inputs used for all three models are very much similar to those used by Sherman and Gold (1985), Rangan *et al*. (1988), Aly *et al*. (1990), and Berger and Humphrey (1991), while the outputs for model 1 correspond with those used by the latter three authors. The outputs for model 2 and model 3 are a modified mixture of those used by Charnes *et al*. (1990) and Yue (1992). According to Favero and Papi (1995: 390) non-interest income (y_2 in model 2) can be regarded as a proxy for various services provided by banks, which are usually neglected by a strict acceptance of the intermediation or asset approach. Interest income (y_2 in model 3) can be regarded as a proxy for loans as this is the reward for the loan activity. This means that the outputs in model 2 represent the asset side of the balance sheet, while the outputs in model 3 represent the liability side of the balance sheet.

The descriptive statistics (values in rand) are presented in Table 1.

Table 1
Descriptive statistics (values in rand)

Variable	Mean	Std dev	Minimum	Maximum
Total deposits (R,000)	80526	35694	20211	172247
Total loans (R,000)	250	246	0,3	1274
Labour costs (R,000)	39	15	10	146
Interest income (R,000)	6	6	0,22	60
Capital cost (R,000)	15	9	1	100
Purchased funds (R,000)	232	240	0.06	1263
Non-interest income (R,000)	67	41	4	27

4 Empirical results

The software package DEAP Version 2.1 by Coelli (1996) is purpose-built to solve the DEA problem and has been used in this paper to generate measures of scale, technical, allocative and cost efficiency for each observation in the data set (i.e. for each branch office in each month). Due to space constraints, monthly results for all the branches cannot be presented. For this reason, the monthly estimates of technical, allocative, cost and scale efficiency for only branch 51, one of the better performing branches, are presented in Table 2. (No returns to scale are reported in Table 2 as branch 51 was fully scale efficient for the entire period.) These estimates are calculated under the assumption of variable returns to scale (VRS). This assumption is, in an economic sense, less restrictive than the assumption of constant returns to scale (CRS).

From the second column in Table 2 it can be seen that branch 51 was fully technical efficient in all but one period, namely period 4. This means that during period 4 branch 51 could reduce its inputs by 1.4 per cent and still produce the same output. During this period branch 51 was also not allocatively nor cost efficient, although the branch was fully scale efficient. It is interesting to note that branch 51 was scale efficient throughout the sample period, which indicates that the branch was of the correct size. The mean cost efficiency for the branch is 97.2 per cent, which indicates that branch 51 could reduce its input costs by 2.8 per cent if it were to become technically and allocatively efficient.

Table 2
VRS efficiency estimates for branch 51 (model 1)

Period (t)	Technical efficiency (te)	Allocative efficiency (ae)	Cost efficiency (ce)	Scale efficiency (se)
1	1.000	1.000	1.000	1.000
2	1.000	0.990	0.990	1.000
3	1.000	0.992	0.992	1.000
4	0.986	0.998	0.983	1.000
5	1.000	1.000	1.000	1.000
6	1.000	0.932	0.932	1.000
7	1.000	0.915	0.915	1.000
8	1.000	0.913	0.913	1.000
9	1.000	0.966	0.966	1.000
10	1.000	1.000	1.000	1.000
11	1.000	1.000	1.000	1.000
Mean	0.999	0.973	0.972	1.000
Maximum	1.000	1.000	1.000	1.000
Minimum	0.986	0.913	0.913	1.000

The VRS efficiency estimates for all the branches, over the sample period, are reported in Table 3. These estimates are the means for each one of the branches as well as a mean efficiency estimate for all the branches. It can be seen that branch 51 is operating at optimal size with a mean scale efficiency estimate of 100 per cent, while the mean allocative efficiency estimate is 97.3 per cent and the mean technical efficiency is 99.9 per cent. It is clear from the second column that a large number of branches can increase their efficiency by decreasing their inputs (e.g purchased funds) without decreasing production. The mean technical efficiency estimate for all the branches is 50.2 per cent. This means that on average, the branches use double the number of inputs needed to produce these specific outputs.

The mean allocative efficiency estimate for all the branches is 73.7 per cent, while the mean scale efficiency is 81.9 per cent. The much higher mean allocative efficiency might be due to the fact that all the branches need a minimum set of inputs to allow them to perform their specific tasks. This includes staff as well as capital inputs. The mean scale efficiency indicates that a large number of branches are either too large or too small, depending on whether they are operating on decreasing or increasing returns to scale.

Table 3
VRS efficiency estimates for all branches (model 1)

Branch	Mean technical efficiency	Mean allocative efficiency	Mean cost efficiency	Mean scale efficiency
1	0.174	0.852	0.148	0.444
2	0.483	0.927	0.449	0.619
3	0.292	0.899	0.262	0.514
4	0.370	0.627	0.221	0.446

5	0.351	0.687	0.238	0.466
6	0.371	0.815	0.299	0.526
7	0.355	0.859	0.305	0.533
8	0.398	0.859	0.342	0.556
9	0.239	0.888	0.212	0.495
10	0.728	0.998	0.726	0.773
11	0.601	0.910	0.547	0.671
12	0.975	0.905	0.882	0.871
13	0.223	0.788	0.174	0.470
14	0.192	0.877	0.169	0.486
15	0.442	0.884	0.390	0.604
16	0.370	0.774	0.280	0.543
17	0.404	0.886	0.358	0.590
18	0.226	0.866	0.195	0.509
19	0.415	0.899	0.373	0.600
20	0.341	0.863	0.294	0.565
21	0.328	0.549	0.178	0.477
22	0.718	0.414	0.288	0.578
23	0.715	0.835	0.591	0.737
24	0.464	0.673	0.309	0.581
25	0.976	0.622	0.606	0.791
26	0.386	0.590	0.218	0.528
27	0.572	0.737	0.417	0.663
28	0.497	0.534	0.260	0.550
29	0.313	0.468	0.145	0.475
30	0.388	0.636	0.245	0.553
31	0.380	0.653	0.246	0.561
32	0.770	0.622	0.478	0.718
33	0.330	0.812	0.267	0.594
34	0.431	0.604	0.232	0.561
35	0.619	0.657	0.397	0.669
36	0.304	0.582	0.176	0.516
37	0.299	0.580	0.171	0.509
38	0.410	0.719	0.292	0.599
39	0.544	0.744	0.398	0.671
40	0.417	0.693	0.287	0.599
41	0.902	0.301	0.271	0.618
42	0.412	0.614	0.248	0.576

43	0.497	0.597	0.292	0.606
44	0.855	0.842	0.712	0.845
45	0.534	0.880	0.468	0.717
46	0.532	0.964	0.510	0.740
47	0.721	0.875	0.630	0.808
48	0.901	0.392	0.350	0.661
49	0.658	0.598	0.380	0.657
50	0.281	0.506	0.140	0.496
51	0.999	0.973	0.972	1.000
52	0.996	0.988	0.984	0.950
All	0.502	0.737	0.366	0.819

Table 4

VRS efficiency estimates for branch 51 in respect of loans (model 2)

Period (t)	Technical efficiency (te)	Allocative efficiency (ae)	Cost efficiency (ce)	Scale efficiency (se)	Returns to scale
1	1.000	0.560	0.560	1.000	
2	0.908	0.706	0.641	0.909	drs
3	1.000	0.662	0.662	1.000	
4	0.907	0.662	0.601	0.909	drs
5	0.880	0.641	0.564	0.882	drs
6	0.847	0.919	0.779	0.845	drs
7	0.989	0.725	0.717	0.938	drs
8	1.000	1.000	1.000	1.000	
9	0.989	0.886	0.876	0.851	drs
10	1.000	1.000	1.000	0.963	drs
11	1.000	1.000	1.000	1.000	
Mean	0.956	0.796	0.764	0.936	
Maximum	1.000	1.000	1.000	1.000	
Minimum	0.847	0.560	0.560	0.845	

In Table 4 the VRS efficiency estimates for branch 51 in respect of loans are reported. The mean technical efficiency is 95.6 per cent, while the allocative efficiency is 79.6 per cent. This means that, with regard to the loan activity, the branch can reduce its inputs by 4.4 per cent without decreasing the output, while the mean allocative efficiency estimate of 79.6 per cent indicates that the branch can reduce input costs by 20.4 per cent by altering the input mix. On a number of occasions over the sample period the branch was operating at optimal scale, while in some periods the branch was operating at decreasing returns to scale. This means that this branch was slightly too large with respect to the loan activity and the inefficiency may be caused by too large an amount of purchased funds.

When the results reported in Table 2 are compared to the results reported in Table 4, it can be seen that the mean technical efficiency estimate for branch 51 in the case of the combined (loans and deposits) activities is substantially higher than the similar estimate for loans. This is also the case with allocative, cost and scale efficiency.

Table 5
VRS estimates for all branches in respect of loans (model 2)

Branch	Mean technical efficiency	Mean allocative efficiency	Mean cost efficiency	Mean scale efficiency
1	0.180	0.366	0.058	0.189
2	0.234	0.235	0.071	0.244
3	0.226	0.347	0.081	0.233
4	0.428	0.390	0.190	0.436
5	0.323	0.330	0.121	0.332
6	0.313	0.345	0.121	0.321
7	0.284	0.274	0.104	0.292
8	0.358	0.447	0.162	0.370
9	0.210	0.391	0.069	0.222
10	0.267	0.250	0.081	0.277
11	0.267	0.294	0.084	0.274
12	0.664	0.650	0.510	0.672
13	0.199	0.277	0.056	0.205
14	0.144	0.197	0.029	0.151
15	0.285	0.208	0.072	0.290
16	0.281	0.212	0.069	0.285
17	0.266	0.226	0.070	0.272
18	0.233	0.386	0.083	0.248
19	0.284	0.262	0.084	0.289
20	0.273	0.275	0.086	0.281
21	0.294	0.296	0.096	0.305
22	0.554	0.192	0.168	0.562
23	0.472	0.224	0.145	0.479
24	0.343	0.180	0.083	0.350
25	0.911	0.873	0.850	0.927
26	0.335	0.326	0.132	0.353
27	0.436	0.227	0.128	0.440
28	0.371	0.208	0.101	0.375
29	0.300	0.343	0.108	0.306
30	0.325	0.287	0.110	0.334
31	0.347	0.365	0.139	0.353

32	0.669	0.541	0.416	0.678
33	0.260	0.216	0.071	0.265
34	0.353	0.342	0.121	0.361
35	0.489	0.331	0.206	0.471
36	0.228	0.169	0.051	0.231
37	0.310	0.449	0.134	0.316
38	0.395	0.488	0.199	0.402
39	0.485	0.531	0.286	0.504
40	0.379	0.435	0.183	0.387
41	0.804	0.738	0.667	0.822
42	0.376	0.431	0.175	0.376
43	0.477	0.549	0.271	0.473
44	0.605	0.610	0.418	0.618
45	0.410	0.407	0.207	0.424
46	0.439	0.543	0.267	0.456
47	0.638	0.624	0.450	0.652
48	0.797	0.726	0.664	0.795
49	0.550	0.582	0.384	0.566
50	0.252	0.348	0.097	0.255
51	0.853	0.796	0.764	0.936
52	0.864	0.893	0.881	0.864
All	0.468	0.397	0.215	0.550

The VRS estimates for all the branches in respect of loans are reported in Table 5. A comparison between the results from Table 3 and those reported in Table 5 shows the branches are to a large extent less allocatively efficient (39.7 per cent – Table 5) with regard to loans than they are with regard to the combined activities (73.7 per cent – Table 3). In the case of branch 51, the mean allocative efficiency is 79.6 per cent (Table 5) in respect of loans and 97.3 per cent (Table 3) in respect of the combined activities. In respect of loans this means that branch 51 can reduce its input costs by 20.4 per cent by altering the input mix. A similar situation is found in the case of technical, cost and scale efficiency.

In Table 6 the VRS efficiency estimates for branch 51 in respect of deposits are reported. The mean technical efficiency estimate for the branch is 99.5 per cent. For 8 out of the 11 time periods (observations) the branch can be regarded as being fully technical efficient. In respect of loans (Table 4), this branch has a mean technical efficiency of 95.6 per cent and for 5 out of the 11 time periods it can be regarded as being fully technical efficient

The mean allocative efficiency of branch 51 in respect of deposits is 97.7 per cent compared to a mean allocative efficiency in respect of loans of 79.6 per cent. This indicates that the input mix for deposits is utilised more efficiently than the input mix for loans. This again indicates that the inefficiency in the case of loans may be caused by the large amount of purchased funds not being properly utilised.

In the case of deposits, branch 51 was also more cost efficient (97.2 per cent) than was the case with loans (76.4 per cent). With regard to scale efficiency for deposits, branch 51 operated at the optimal scale for 8 out of the 11 time periods compared to loans where the branch only operated 4 out of the 11 time periods at the optimal scale. In time period 2, 4 and 7 the branch operated at decreasing returns to scale and this corresponds with the time periods in the case of loans, but in the latter case the branch also operated at decreasing returns to scale in time period 5, 6, 9 and 10.

Table 6

VRS efficiency estimates for branch 51 in respect of deposits (model 3)

Period (t)	Technical efficiency (te)	Allocative efficiency (ae)	Cost efficiency (ce)	Scale efficiency (se)	Returns to scale
1	1.000	1.000	1.000	1.000	
2	0.998	0.993	0.990	0.998	drs
3	1.000	0.992	0.992	1.000	
4	0.994	0.990	0.984	0.994	drs
5	1.000	1.000	1.000	1.000	
6	1.000	0.933	0.933	1.000	
7	0.950	0.963	0.915	0.952	drs
8	1.000	0.913	0.913	1.000	
9	1.000	0.966	0.966	1.000	
10	1.000	1.000	1.000	1.000	
11	1.000	1.000	1.000	1.000	
Mean	0.995	0.977	0.972	0.995	
Maximum	1.000	1.000	1.000	1.000	
Minimum	0.950	0.913	0.913	0.952	

In Table 7 the VRS estimates for all branches in respect of deposits are reported. The mean technical efficiency estimate for deposits is 49.8 per cent compared to the mean technical efficiency estimate for loans that is 46.8 per cent (Table 5) and 50.2 per cent for the combined activities (Table 3). The mean technical efficiency indicates that the inputs are not utilised efficiently.

The mean allocative efficiency estimate for deposits is (74.0 per cent) is marginally higher than the corresponding estimate for the combined activities (73.7 per cent – Table 3), but substantially higher than the mean allocative efficiency estimate for loans (39.7 per cent – Table 5). This is clearly an indication that the input mix for loans should be investigated.

Table 7

VRS estimates for all branches in respect of deposits (model 3)

Branch	Mean technical efficiency	Mean allocative efficiency	Mean cost efficiency	Mean scale efficiency
1	0.173	0.853	0.148	0.148
2	0.483	0.914	0.442	0.442
3	0.290	0.905	0.263	0.263
4	0.370	0.627	0.221	0.221
5	0.351	0.687	0.238	0.238

6	0.371	0.814	0.299	0.299
7	0.355	0.861	0.306	0.306
8	0.398	0.861	0.342	0.342
9	0.239	0.886	0.212	0.212
10	0.728	0.987	0.720	0.720
11	0.598	0.914	0.547	0.547
12	0.979	0.868	0.849	0.849
13	0.224	0.787	0.174	0.174
14	0.192	0.877	0.169	0.169
15	0.442	0.882	0.389	0.389
16	0.370	0.774	0.280	0.280
17	0.404	0.877	0.354	0.354
18	0.226	0.867	0.196	0.196
19	0.415	0.901	0.374	0.374
20	0.341	0.864	0.294	0.294
21	0.327	0.552	0.178	0.178
22	0.720	0.404	0.283	0.283
23	0.714	0.836	0.591	0.591
24	0.463	0.674	0.310	0.310
25	0.960	0.605	0.580	0.580
26	0.382	0.597	0.218	0.218
27	0.569	0.739	0.416	0.416
28	0.491	0.541	0.260	0.260
29	0.320	0.458	0.145	0.145
30	0.381	0.650	0.245	0.245
31	0.365	0.680	0.246	0.246
32	0.741	0.645	0.478	0.478
33	0.336	0.798	0.268	0.268
34	0.428	0.613	0.232	0.232
35	0.619	0.660	0.397	0.397
36	0.304	0.584	0.176	0.176
37	0.296	0.586	0.172	0.172
38	0.402	0.733	0.292	0.292
39	0.528	0.770	0.398	0.398
40	0.415	0.698	0.288	0.288
41	0.888	0.306	0.270	0.270
42	0.412	0.615	0.248	0.248
43	0.488	0.612	0.292	0.292

44	0.791	0.904	0.712	0.712
45	0.545	0.866	0.468	0.468
46	0.522	0.977	0.510	0.510
47	0.708	0.892	0.631	0.631
48	0.929	0.378	0.350	0.350
49	0.630	0.616	0.381	0.381
50	0.281	0.508	0.140	0.140
51	0.995	0.977	0.972	0.995
52	0.992	0.992	0.984	0.984
All	0.498	0.740	0.364	0.577

As cost efficiency is the product of technical and allocative efficiency, the relatively poor technical efficiency is partially the reason for the poor cost efficiency. An improvement in technical efficiency together with an improvement in allocative efficiency will definitely lead to an improvement in cost efficiency.

The mean scale efficiency estimate for deposits is 57.7 per cent compared to the estimate for loans, that is 55.0 per cent (Table 5). This is substantially lower than the mean scale efficiency estimate for the combined activities (Table 3) that is 81.9 per cent. It is clear that in the case of the combined activities, the branches, on average, operated more efficiently.

5 Conclusion

An analysis of the 52 branches of a small South African bank reveals that the majority of the branches are, on average, not fully technically efficient. The mean technical efficiency for all the branches indicates that, on average, inputs can be reduced by 49.8 per cent without reducing outputs. The largest input is purchased funds and if this input can be properly utilised, e.g. made available as loans, it could improve the overall efficiency of the branches and the bank in general. Altering the input mix can lead to a 26.3 per cent reduction in input costs. With regard to cost efficiency, there can be a reduction of 63,4 per cent in input costs if all the branches were to become fully technically and allocatively efficient. Only one branch operated at the optimal scale, while the others operated at decreasing returns to scale, indicating that these branches were too large.

In the case of the efficiency estimates for loans and deposits, the indications are that the branches were more efficient in deposits than in loans. In the case of technical efficiency 48 branches had higher mean efficiency estimates for deposits than for loans. In the case of allocative efficiency 49 branches also had higher mean efficiency estimates for deposits. The mean allocative efficiency estimate for deposits was substantially higher than that for loans. This indicates that some branches were more efficient in collecting deposits, but did not use the opportunity to make it available as loans, resulting in lower profits.

The bank should attempt to balance the efficiency of loans and deposits at the branches in order to improve the efficiency of the bank in general. The fund transfer pricing system used by the bank's ALCO can contribute towards this goal. In the more mature areas where the branches experience stable deposits but a lack of lending activities, excess funds can be transferred to branches in need of funds. Fund transfer prices can then be applied to compensate for the lack of efficiency in loans. It appears that this bank concentrated on the collection of deposits by paying higher interest than its competitors, but neglected the lending function of the bank.

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