COMBINING EFFICIENCY WITH ROA: INDICATOR OF FUTURE RELATIVE PERFORMANCE – SOUTH AFRICAN BANKING GROUPS

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Abstract

Bank financial performance and relative future financial performance are important issues to stakeholders like management, shareholders, investment analysts and portfolio managers. This paper provides evidence that bank financial performance expressed as return on assets (ROA) figures that are adjusted according to relative income and expenditure efficiency provide fundamental measures of performance that have a causal link with future profits and can be utilised in estimating future financial performance. The methodology applied in this research consists of empirically investigating the annual changes in the ROAs of the nine listed South African Banking Groups over the period 2000 to 2008. The study consists of a two stage process. Data envelopment analysis (DEA) is conducted and resultant DEA scores are combined with the calculated ROAs of banks to provide efficiency adjusted ROA. The findings of this research paper shows that combining the CRS efficiency of bank groups with ROA provides a more reliable measure of future financial performance than just conventional ROA figures and efficiency figures.

Keywords: Bank financial performance; return on assets; data envelopment analysis; income efficiency; cost efficiency; efficiency adjusted return on assets.

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1. Introduction

ROA assesses the profitability performance of total assets, and could be treated as measure of bank financial performance (Tarawneh 2006). The ROA of some South African bank groups have fluctuated quite dramatically over the period 2000 to 2008. Major bank groups like Nedcor Group Limited had a 4.96% ROA before taxation in 2000 with a drop to a negative return of 0.238% in 2003, and thereafter recovering to 1.91% in 2007 (Bureau van Dijk Electronic Publishing 2010). Other bank groups like African Bank Limited had a 21.38% ROA before taxation in 2000, with a drop to 12.50% in 2002, and an increase to 23.15% in 2006. During the period 2000 to 2007 the positive and negative fluctuation in the ROA of the bank groups did not occur equivalently simultaneous, thus indicating that it can be ascribed to individual bank efficiency and not macro-environmental factors that affected the banking industry as a whole. This is proved by the fact that in each of the years from 2000 to 2007, the ROA of some bank groups showed increases in ROA whilst others showed slumps. During this same period of time (2000 to 2007) the ROE of banks fluctuated much more due to the multiplication effect of the financial leverage factor resulting from an average equity to total asset ratio of approximately 6% for the major banking groups like Standard Bank Limited, Firstrand Limited, Absa Group Limited, Nedcor Group Limited and Investec Limited (Bureau van Dijk Electronic Publishing 2010). In the case of Nedcor Group Limited this resulted in a ROE of 44.84% in 2000 deteriorating to a negative ROE of 4.15% in 2003 and progressively increasing back to 24.72% in 2007.

The only major macro-environmental factor that affected the total industry since 2000 was the Global Financial Crises that started in 2007. The impact of this detrimental event led to a substantial average decline of 20.26% in the ROAs of all bank groups, but not to negative ROAs (Bureau van Dijk Electronic Publishing 2010). Since some bank groups had negative ROA figures in previous years but all bank groups could avoid negative figures amidst the global financial crises may be an indicator that the efficiency of banks improved compared to previous years.

The objective of this paper is to provide evidence that ROA figures of banks that are adjusted according to relative income and expenditure efficiency provide fundamental measures of performance that have a causal link with future profits and can be utilised in estimating future financial performance.

2. Determining Financial Performance – Overview of Research Conducted

The ROA of a bank can be regarded as a measure of financial performance as indicated by Tarawneh (2006). However, Arnold (2005) states that figures about the return on capital employed that are derived from a company's accounts are virtually useless within the context of corporate financial management. Facts on which he bases his perspective are true in terms of generalisation, but in the banking industry the cash flow timing of accounting figures and relevance of asset figures in the ratio differ from companies in other industries due to distinct operational dissimilarity and regulatory accounting requirements set by central banks. In this regard Beccalli, Casu and Girardone (2006) point out that the literature on accounting information and stock returns typically excludes banking institutions due to their high leverage and other distinguishing characteristics of the industry (e.g. regulations). Furthermore, researchers like Ho and Zhu (2004) acknowledged that ROA is regarded as the bottom line result that shows the combined effects of income, expense and asset management on operating results of banks.

Gilbert and Wheelock (2007), Mostafa (2007), and Christian, Moffitt and Suberly (2008) also indicated that in measuring the profitability of a bank, bank regulators and analysts use ROA and ROE to assess industry performance and forecast trends in market structure as inputs in statistical models to predict bank failures and mergers and for a variety of other purposes where a measure of profitability is desired.

DuPont analysis makes a simultaneous analysis of efficiency and profitability possible, and it shows how they interact to determine ROA (Dehning and Stratopoulos 2002). This fundamental method used for assessing profitability was adopted by David Cole in 1972 (Koch and MacDonald 2006:67). This system is properly discussed in the bank management literature of authors like Hempel and Simonson (1999), Fraser, Gup and Kolari (2001), Rose (2002), Rahman, Tan, Hew and Tan (2004), Rose and Hudgins (2005) and Gup, Avram, Beal, Lambert and Kolari (2007).

Researchers applied DEA to compare the efficiency and performance of banks with a combination of variables that consist of financial figures that are ROA elements combined with other non-direct financial figures as indicated in table 1. Non-direct financial figures are all cost or income related, but cannot be regarded as equivalent to accounting figures used in DuPont analysis. It is evident that these researchers supplement accounting based financial information with other company information.

Table 1. Combination of financial and non-direct financial information variables used in DEA to compare the efficiency of banks

Researchers	DEA financial variable inputs	DEA financial variable outputs
Ho (2001)	Assets Interest expenses Employees Fixed assets	Interest income Non-interest income
Mukharjee, Nath and Pal (2002)	Net worth Borrowings Operating expenses Employees Branches	Deposits Net profit Advances Noninterest income Interest income Sales Deposits
Ho and Zhu (2004)	Capital stocks Assets Branches Employees	Sales Deposits
Sakar (2006)	Branches Employees per branch Assets, Loans Deposits	ROA ROE Interest income/assets Interest income/operating income Noninterest income/assets
Wu, Jang and Liang (2006)	Employees Expenses	Deposits Revenues Loans
Howland and Rose (2006)	Non-sales full time employees Sales full time employees Size City employment rate	Loans Deposits Average number of products/customer Customer loyalty

Other researchers like Kao and Liu (2004), Cronje (2007), Mostafa (2007), Muliamal et.al (2008), Ioannidis, Molyneux and Pasiouras (2008) and Thamron (2009) used different components of historical financial information that make up ROA to compare the relevant efficiency of banks within the context that it is acknowledged by researchers like Dehning and Stratopolous (2002) that DuPont analysis enables efficiency analysis. They applied Data Envelopment Analysis (DEA) based on financial ratio figures constituting different elements of ROA by decomposing such financial performance indicators to their efficiency and effectiveness equivalents (refer to table 2).

Table 2. Financial information variables used in DEA to compare the efficiency of banks

Researchers	DEA financial variable inputs	DEA financial variable outputs
Kao and Liu (2004)	Total deposits Interest expense Non-interest expense	Total loans Interest income Non-interest income
Mostafa (2007)	Capital (equity) Assets Profits	ROA ROE
Muliamal et.al (2008)	Total employee expenses Total non-employee expenses Provision for interest earning losses	Net interest income Net trading income Net off-balance sheet income
Ioannidis, Molyneux and Pasiouras (2008)	Cost of borrowed funds Cost of non-financial inputs	Loans Other earning assets Noninterest income
Cronje (2007) and Thamron (2009)	Interest income Interest expense Other income Other expense Bad debt write offs	Total assets

Kirkwood and Nahm (2006) as well as Ioannidis, Molyneux and Pasiouras (2008) indicate that they have examined both cost and income efficiency in the application of DEA to compare the performance of banks. This can be described as an alignment with the principles of the DuPont analysis although Kirkwood and Nahm (2006) used financial figures that are ROA elements combined with other non-direct financial figures. Ioannidis, Molyneux and Pasiouras (2008) also referred to Maudos, Pastor, Perez and Quesada (2002) who argue it provides a more important source of information than the partial view offered by analyzing cost efficiency.

Thamron (2009) used DEA to calculate the efficiency scores of banks based on the research model of Cronje (2007) and combined these scores with ROA. He states that the combination of ROA and DEA scores provide a good profitability measure that incorporates the efficiency of banks in attaining their profits and can be referred to as the ROA efficiency of banks. This statement is also confirmed by the opinion of Murthy, Nandakumar and Wague (2008) that efficiency contributes to improved profitability but banks are more interested in ensuring continued profitability of their banks than in achieving efficiency.

3. Methodology Applied In This Study

The methodology applied in this research consists of empirically investigating the annual changes in the ROAs of the nine listed South African Bank Groups over the period 2000 to 2008 by using the listed company financial information database of Bureau van Dijk Electronic Publishing (2010) available on their Osiris system.

The study consists of a two stage process. DEA is conducted and resultant DEA scores are combined with the calculated ROAs of banks to provide efficiency adjusted ROA.

3.1 Stage 1 – DEA analysis

DEA is used to compute a comparative ratio of outputs to inputs for each bank group to obtain their relative efficiency scores. The DEAP 2.1 software of Coelli (1996) is used for the DEA analysis. The efficiency score is usually expressed as either a number between zero and one or 0% and 100%. A decision making unit (DMU) with a score less than one is deemed inefficient relative to other DMUs (Avkiran, 1999).

The following formulation, also known as the input-oriented Charnes, Cooper and Rhodes (CCR) Model, is applied in this study to determine the relative cost efficiency of the bank groups:

$$\text{Minimize } H_A - \varepsilon\left(\sum_{r=1}^{R} s_r^+ + \sum_{i=1}^{I} s_i^-\right)$$

$$\text{subject to: } H_A x_{iA} - \sum_{j=1}^{n} \lambda_{Aj} y_{ij} - s_i^- = 0, \text{ for all } i = 1,2,...,I,$$

$$\sum_{j=1}^{n} \lambda_{Aj} y_{rj} - s_r^+ = y_{rA}, \text{ for all } r = 1,2,....,R,$$

$$\lambda_{Aj}, s_r^+, s_i^- \geq 0, \text{ for all } j, r, i.$$

where:

H_A = the minimum proportion such that for each input, the weighted combination of input of all bank groups does not exceed the proportion H_A of the input of bank group A. At the same time the weighted combination of output of all bank groups is at least as great as that of bank group A.

s^+_r = slack variables corresponding to the outputs.

s^-_i = slack variables corresponding to the inputs.

R = the number of outputs.

I = the number of inputs.

λ_{Aj} = the optimal weights calculated by the linear programme for the outputs of bank group A.

The formulation for the output-oriented CCR model that is applied in this study to determine the relative income efficiency of the banking groups is:

$$\text{Maximise } -H_A + \varepsilon\left(\sum_{r=1}^{R} s_r^+ + \sum_{i=1}^{I} s_i^-\right)$$

In the application of DEA the inputs and outputs that apply to the type of efficiency that is being assessed should be determined (Sherman and Rupert, 2006). Manandhar and Tang, (2002) states that the efficiency that can be determined by applying DEA is not confined to a traditional sense of operating efficiency; the inputs and outputs used will determine the relative evaluation of performance in a specific performance dimension. Since the objective of the research is to determine the efficiency of the ROA of bank groups and the principles of DuPont analysis is applied in this regard, the following financial statement figures are regarded as relevant elements of ROA: Interest income, non-interest income, other income, interest expenses, non-interest expenses, loan losses and other expenses (Cronje, 2007). These figures represent the assemblage of the net profit before tax figure (numerator) in the ROA ratio. The other financial statement figure that is relevant and also forms part of the ROA ratio is total assets (denominator).

Another aspect that is relevant to the inputs and outputs that have to be selected for efficiency analysis is that the measured DEA efficiency in small samples is sensitive to the difference between the number of DMUs and the sum of inputs and outputs used (Button and Weyman-Jones, 1992). In a typical analysis each ratio may be associated with a different DMU and the number of such ratios will be the product of the number of inputs and the number of outputs. In general if there are t outputs and m inputs we would expect the order of tm efficient DMUs, suggesting that the number of units in the set should be substantially greater than tm, in order for there to be suitable discrimination between the DMUs. Raab and Lichty (2002) suggest a general rule of thumb – the minimum number of DMUs should be greater than three times the number of inputs plus outputs.

Based on the aforementioned criteria regarding performance dimension and the limitations relating to the number of inputs and outputs that are used, two DEA input and output datasets were set up for this research. This created a profit efficiency dataset consisting of one input, namely average total assets and three outputs - interest income, non-interest income and other income. For the cost efficiency dataset four inputs were considered – interest expense, non-interest expense, loan losses and other expenses with average total assets as output. The general rule of thumb criteria of Raab and Lichty (2002) in terms of the number of inputs cannot be attained completely but the non-interest expenses and loan losses are combined in the cost efficiency dataset (because loan losses are generally reported as part of non-interest expenses in financial statements).

DEA is conducted with both constant returns to scale (CRS) and variable returns to scale (VRS). This procedure makes it possible to decompose technical efficiency (TE) into pure technical efficiency (PTE) and scale efficiency (SE). The CRS efficiency score represents technical efficiency that measures the inefficiencies due to the input/output configuration as well as the size of operations while the VRS efficiency score only represents pure technical efficiency without scale efficiency. Coelli (1996) indicates that the scale inefficiency of a DMU can be calculated from the difference between the VRS TE score and the CRS TE score by applying the following calculation:

$$Scale - efficiency = \frac{\theta^*_{VRS}}{\theta^*_{VRS}}$$

Scale efficiency is also calculated to analyse the combination of it with ROA.

3.2 Stage 2 – Comparison of combining efficiency with ROA and conventional ROA as future performance indicators

The ROA efficiency combinations that are evaluated in terms of their causal link with future profits and ability to serve as profound indicators of financial performance (ROA) in the next financial period

represent configurations of the CRS, VRS and Scale efficiency scores with ROAs as well as the combination of DEA scores according to the methodology of Thamron (2009) to create single CRS, VRS and scale efficiency ROA figures. Subsets of all independent variable combinations are analysed to find the combination that maximises the adjusted R^2.

All ROA efficiency combinations are evaluated by applying linear regression analysis with Statgraphics Centurion XVI software. The following model applies:

$$\gamma_t = \chi_{t-1} + \beta$$

Where: Y_t = the ROA in year t.
X_t = a vector of independent variables.

All CRS, VRS and Scale efficiency variables used in the analysis are calculated as follows:

$$\text{DEA score} = \frac{\text{Cost efficiency score} + \text{income efficiency score}}{2}$$

CRS, VRS and scale efficiency ROA figures are calculated as follows:

$$\text{Effeciency adjusted ROA} = \text{ROA}\left(\frac{(\text{DEA ce score x ROA}) + (\text{DEA ie score x ROA}}{2}\right)$$

Where: ce score = cost efficiency score.
ie score = income efficiency score.

In the case of negative ROAs the following adjustment is applied to retain difference equivalence compared to positive ROAs for all CRS, VRS and scale efficiency ROAs:

$$\text{Efficiency adjusted negative ROA} = \text{ROA} + \left(\text{ROA} - \left(\frac{(\text{DEA ce score x ROA}) + (\text{DEA ie score x ROA})}{2}\right)\right)$$

4. Empirical Findings

The mean DEA income efficiency scores of bank groups for the period 2000 to 2008 are contained in table 3. The mean CRS scores that measure the gross efficiency of banks comprise technical efficiency and scale efficiency. Technical efficiency describes the ability to convert inputs to outputs. Scale efficiency recognises that scale of efficiency cannot be attained at all levels of operation and that there is only one most productive scale size where scale efficiency is maximum at 100 % (Ramanathan, 2003). Within this context the CRS (technical) efficiency of the bank groups are in the total period of time (2000 to 2008) much less than the VRS (pure technical) efficiency. Equality only holds when the scale efficiency is unity or the bank operates at the most productive scale size. The resultant mean scale efficiency scores (ratio of the CRS efficiency to the VRS efficiency) are indicative of the fact that scale inefficiency contributes extensively to bank group profit inefficiency in general.

Table 3. Mean DEA income efficiency scores of South African bank groups for the period 2000 to 2008

Year	Mean CRS score	Mean VRS score	Mean Scale score
2000	0.483	0.877	0.532
2001	0.506	0.929	0.528
2002	0.536	0.893	0.563
2003	0.611	0.882	0.691
2004	0.553	1.000	0.533
2005	0.634	0.952	0.653
2006	0.518	0.868	0.611
2007	0.585	0.919	0.659
2008	0.514	0.905	0.582

The mean CRS cost efficiency scores for both DEA datasets are, for all the 2000 to 2008 periods, high compared to the mean CRS income efficiency scores of bank groups (refer to table 4). The mean VRS cost efficiency scores are slightly higher than the mean VRS income efficiency scores. This indicates that banks experience less relative cost inefficiency. The mean CRS cost efficiency score is slightly lower than the mean VRS cost efficiency score and therefore implicates scale inefficiency although by far not as significant as the scale inefficiency of income management.

Table 4. Mean DEA cost efficiency scores of South African bank groups for the period 2000 to 2008

Year	Mean CRS score	Mean VRS score	Mean Scale score
2000	0.898	0.945	0.952
2001	0.772	0.870	0.896
2002	0.868	0.957	0.907
2003	0.891	0.965	0.926
2004	0.884	0.942	0.941
2005	0.893	1.000	0.893
2006	0.851	1.000	0.851
2007	0.850	1.000	0.850
2008	0.832	1.000	0.832

The means of original ROAs of bank groups show that 2000 was the year when the average financial performance was the best, followed by a plunge in 2001 (refer to table 5). The average financial performance thereafter improved steadily to 2006 with the effect of the global financial crises showing a start-off in 2007 and intensifying in 2008. The means of the CRS efficiency adjusted ROAs differ significantly from original ROAs due to the low CRS income and cost efficiency scores contained in tables 3 and 4.

Table 5. Means of original ROAs and efficiency adjusted ROAs of South African bank groups for the period 2000 to 2008

Year	Original ROA %	CRS efficiency adjusted ROA %	VRS efficiency adjusted ROA %	Scale efficiency adjusted ROA %
2000	6.934	5.745	6.456	5.796
2001	3.294	1.332	2.291	2.072
2002	4.611	4.111	4.553	4.150
2003	4.028	3.672	3.992	3.683
2004	4.515	3.659	4.124	3.969
2005	6.355	5.244	6.307	5.263
2006	6.856	5.409	6.707	5.522
2007	6.315	4.882	6.174	5.014
2008	4.882	3.428	4.704	3.574

Linear regression analysis results for all the ROA adjustment combinations are reflected in table 6.

The combination of CRS, the percentage change thereof compared to the CRS score in the previous year, ROA, and the percentage change of it from the previous year provides the equation that shows the best prediction relationship with the relative ROA that can be expected from banks in the next financial year. Although there are other ROA efficiency combinations with higher R^2 and adjusted R^2 means, this is the only one complying for all periods analysed with 95.0% analysis of variance confidence levels and has no indication of serial autocorrelation in the residuals at a 95.0% confidence level. This ROA efficiency combination can be depicted as follows:

ROA next year = Constant + Coefficient*CRS score + Coefficient*% change in CRS score + Coefficient*ROA + Coefficient*% change in ROA

Table 6. Linear regression relationship between different ROA efficiency adjustments and ROA in the nest financial year over the period 2001 to 2008

Independent variable/combination of independent variables	Dependent variable	R^2 mean %	Adjusted R^2 mean %	Highest P-Value	Lowest DW (p value)
CRS ROA	ROA next financial year	85.70486	80.9398	0.0466	0.0368
CRS % change CRS ROA	ROA next financial year	91.49036	86.3846	0.081	0.1364
CRS % change CRS ROA % change ROA	ROA next financial year	95.69157	91.38313	0.0233	0.2051
VRS ROA	ROA next financial year	79.62983	73.17053	0.0354	0.0272
VRS % change VRS ROA	ROA next financial year	88.52607	81.64173	0.0043	0.0573
VRS % change VRS ROA % change ROA	ROA next financial year	90.71283	83.99111	0.2262	0.1124
Scale ROA	ROA next financial year	88.84617	85.12996	0.0404	0.0103
Scale	ROA next financial	91.4172	86.2675	0.0634	0.0778

% change scale ROA	year				
Scale % change Scale ROA % change ROA	ROA next financial year	93.30104	86.6021	0.1372	0.0952
VRS Scale ROA	ROA next financial year	90.667	85.09006	0.0704	0.0171
VRS Scale % change VRS % change Scale ROA	ROA next financial year	96.66504	91.10679	0.1333	0.1033
VRS Scale % change VRS % change Scale ROA % change ROA	ROA next financial year	98.40264	93.61059	0.0927	0.1212
CRS efficiency ROA	ROA next financial year	74.38553	70.72633	0.4253	0.0212
CRS efficiency ROA % change CRS efficiency ROA	ROA next financial year	89.11783	85.49043	0.0229	0.0401
VRS efficiency ROA Scale efficiency ROA	ROA next financial year	84.51603	79.3547	0.2578	0.0273
VRS efficiency ROA Scale efficiency ROA % change VRS efficiency ROA % change Scale efficiency ROA	ROA next financial year	94.72577	89.4515	0.0668	0.2149

The R^2 mean indicates that the model as fitted explains 95.69157% of the variability in ROA in the next financial year. The adjusted R^2 which is more suitable for comparing models with different numbers of independent variables is 91.38313%. The one way analysis of variance P-value is less than 0.05 in regression applied for all of the years 2001 to 2008. Therefore there is a statistically significant relationship between the variables at the 95.0% confidence level. The Durbin-Watson (DW) statistic tests the residuals to determine if there is any significant correlation based on the order in which they occur in the data file. Since the P-value is greater than 0.05, there is no indication of serial autocorrelation in the residuals at the 95.0% confidence level.

All other ROA efficiency combinations with higher R^2 and adjusted R^2 percentages do not comply in terms of analysis of variance P-values and/or DW statistic tests, as they have all exceeded the 95.0% confidence level requirement in at least one of the periods of time where linear regression was applied to it to find its relationship with ROA in the next financial year. The methodology of Thamron (2009) to create single CRS, VRS and scale efficiency ROA figures also did not provide the best combinations, as only one of the subsets constructed according to his methodology complied in terms of analysis of variance P-values and/or DW statistic tests, but provided lower R^2 and adjusted R^2 percentages.

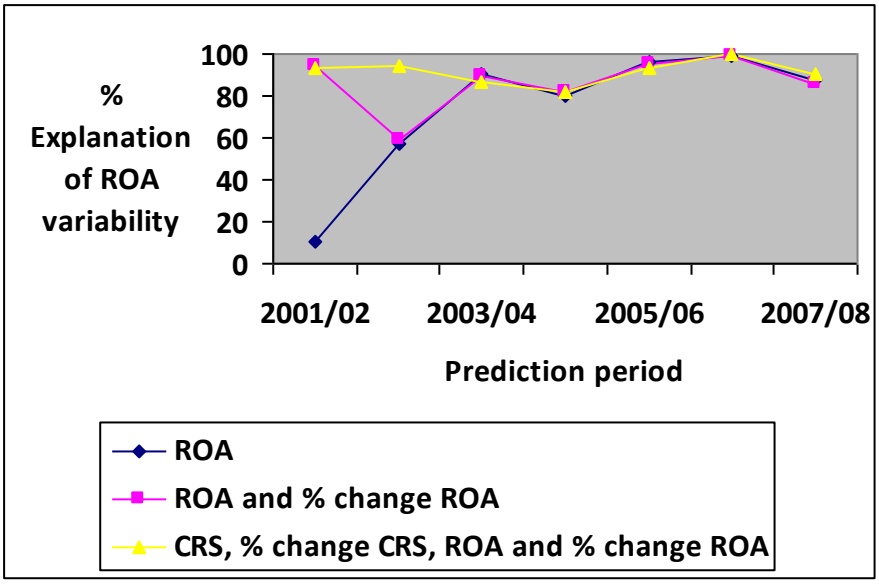
Evidence that the combined CRS efficiency and ROA model provides fundamental measures of performance that have a causal link with future profits are reflected in the information contained in table 7 and figure 1.

Table 7. Comparison of linear regression links with future performance for ROA and the combined CRS and ROA model

Independent variable/combination of independent variables	Dependent variable	R^2 mean %	Adjusted R^2 mean %	Highest P-Value	Lowest DW (p value)
ROA	ROA next financial year	77.60053	74.40061	0.2066	0.0215
ROA % change ROA	ROA next financial year	89.74481	86.32641	0.0286	0.0134
CRS % change CRS ROA % change ROA	ROA next financial year	95.69157	91.38313	0.0233	0.2051

ROA itself does not serve as an ultimate good predictor of future ROA performance of the bank groups since it does not conform to 95.0% confidence levels over the total period of time (2001 to 2008) that this research has been conducted. However, the prediction value of ROA is improved substantially by also considering the % one-year historical change in ROA that occurred. This combination of ROA with the change in it provides an average 86.32641% explanation of ROA variability in the next financial year based on the adjusted R^2 statistic whilst complying to 95.0% analysis of variance criteria and no indication of serial autocorrelation in the residuals at the 95.0% confidence level. The graphical depiction of the adjusted R^2 for each of the periods of time that the linear regression has been conducted (refer to figure 1) shows that combining the CRS efficiency of bank groups with ROA provides a more reliable measure of future performance as the adjusted R^2 of it remained fairly constant whilst the adjusted R^2 of ROA as predictor of financial performance of bank groups was only 10.4868% in 2001 and 57.5021% in 2002. ROA and the combination thereof with the percentage change in ROA also only provided a 59.4216% explanation of the ROA variability in 2003. The combination of CRS efficiency with ROA, however, retained a high level of ROA prediction over the total period of time.

Figure 1. ROA and CRS efficiency combined with ROA constance in the explanation of ROA variability in next financial year – 2001 to 2008



5. SUMMARY AND CONCLUSION

The ROAs of some major South African bank groups have individually fluctuated quite extensively during the period 2000 to 2007 irrespective of macro-environmental factors that affected the banking industry as a whole. As such some showed increases in ROAs whilst others showed decreases. It was only in 2008 that all the bank groups experienced a decline in ROAs due the impact of the global financial crises.

Researchers like Ho and Zhu (2004) indicated that ROA is the bottom line result that shows the combined effects of income, expense and asset management on operating results of banks. Dehning

and Stratopolous (2002) state that DuPont analysis makes a simultaneous analysis of efficiency and profitability possible and it shows how they interact to determine ROA. It is within this context that researchers like Kirkwood and Nahm (2006), Iounidis, Molyneux and Pasiourus (2008) have examined both cost and income efficiency by way of DEA to compare the performance of banks. The focus of the aforementioned research and the statement of Murthy, Nandakumar and Wague (2008) that banks are more interested in ensuring continued profitability than in achieving efficiency can be regarded as an indication that ROA can be supplemented by income and cost efficiency measures as performance indicators. The expectation is therefore that the combination of the relative performance efficiency of banks and operating bottom line results (ROA) may have a causal link with future profits and can be utilised in estimating future financial performance.

The study consists of a two stage process. DEA is conducted and resultant DEA scores are combined with the calculated ROAs of banks to provide efficiency adjusted ROAs. The findings of this research paper show that combining the CRS efficiency of bank groups with ROA provides a more reliable measure of future financial performance than just conventional ROA figures. The model constructed from the analysis also provides better predictions of future financial performance than ROA efficiency adjusted figures of Thamron (2009). The model can therefore be useful to management, shareholders, investment analysts and portfolio managers.

The findings of the research are subject to certain limitations. The fact that there are only nine listed bank groups in South Africa whose financial statements could be analysed, and the fact that sufficient available information could only be retrieved from 2000 implicates the validity of the findings within a broader context. Furthermore, the number of inputs and outputs used in DEA had to be reduced to obtain suitable discrimination between the bank groups.

Findings of the research should be interpreted with cognisance of the fact that, notwithstanding the limitations of the research, further analysis can be conducted in other environments with the inclusion of more bank groups over longer periods of time to verify the causal links between relative income and expenditure efficiency and future profits and how it can be utilised in estimating future financial performance. It is therefore recommended that future research be conducted in this regard.

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