Internal Determinants Of Bank Profitability In South Africa: Does Bank Efficiency Matter?

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ABSTRACT

In a study conducted by Ncube (2009) to evaluate bank cost and profit efficiency, it was established that South African banks were more efficient at managing costs than generating profits. In this paper, the aim is to complement this particular work by exploring the internal determinants of bank profitability but with more focus on the impact of bank efficiency. Applying a two step-methodology framework to a panel of four small banks and four large banks for the period 2005-2011, total factor productivity efficiency (TFPE) scores were generated using the DEA methodology. Within the first stage, the intermediation approach was followed in which bank inputs included total operating expenses, labour, fixed assets, and total deposits while interest income, non-interest income and gross loans were considered as output variables. Each bank`s efficiency score for each of the periods was then evaluated based on its distance from the constructed efficiency frontier.

In the second stage analysis, the Generalised Least Squares Fixed Effects Model was then performed to examine the impact of TFPE among other internal determinant factors on bank profitability indicators, specifically return on average assets (ROAA) and net interest margin (NIM). The obtained empirical findings showed that high total factor productivity efficiency and capital adequacy lead to higher profitability, while high cost inefficiency, diversification activities, large bank size, and high credit risk leads to lower profitability. Of great importance was that both models confirmed the positive role of attaining efficiency as an important driver of profitability among banks.

Keywords: Bank Efficiency; Fixed Effects Model; Interest Margin; Profitability; Return on Average Assets; South Africa

1. INTRODUCTION

It is well documented that economic growth within a country is dependent on the essential intermediary role of the banking sector. Therefore, attaining high profits is crucial for the sustainability of the banking sector and for achieving sustained economic growth. Empirical studies by Olweny and Sipho (2011) and Flamini et al. (2009) have shown that a profitable banking sector is better able to withstand negative shocks and therefore contribute to financial stability. Moreover, bank profits that are re-invested into the business is an important source of capital. In a study conducted by Ncube (2009) to evaluate the efficiency of South African banks, it was established that the banks were more efficient at managing costs compared to generating profit.

In this paper, the aim is to extend this particular work and complement previous South African bank performance studies by exploring the internal determinants of bank profitability, particularly the significance of efficiency. Therefore, the objective of this paper is to measure efficiency using the Hicks-Moorsteen total factor productivity index approach that uses DEA linear programs. The generated efficiency scores are then regressed with other internal determinants on bank profitability indicators.

Various types of efficiencies exist within the banking literature; namely, technical, allocative, productive, profit, and cost efficiency. Technical efficiency implies that a particular bank produces a given set of outputs (such as interest income, loans, non-interest income) using the smallest possible amount of inputs (such as operating cost, employees, capital, and deposits). On the other hand, Ncube (2009) defines allocative efficiency as the extent to which a bank's resources are being allocated toward activities with the highest expected value. Depending on the perspective of analysis of the researcher, one can choose to analyse efficiency from the cost or profit perspective. Cost efficiency provides a measure of how close a bank's actual cost is to what a best-practice bank's cost would be for producing an identical output bundle under similar conditions. A bank is considered inefficient if its costs are higher than a best-practice bank. Similarly, profit efficiency measures the ability of a bank in generating the maximum attainable profit given prices of its inputs and outputs. A bank is categorized as inefficient if its profits are less relative to the profits of the best-practice bank.

In Africa, the banking sector in South Africa is the largest and the most sophisticated. The South African banking system is effectively regulated and categorised with those of advanced countries. The sector is currently composed of 17 locally controlled banks, three mutual banks, 14 branches of foreign banks in South Africa, a co-operative bank, and 41 representative offices (SARB, 2013). However, the banking sector is dominated by four large banks; namely, the Amalgamated Bank of South Africa (ABSA), FirstRand Bank, Nedbank, and Standard Bank. In 2011, the SARB (2011) reported that 84.1 percent of the total balance sheet size of the entire banking sector was dominated by these four largest banks. Hence, the South African banking industry exhibits a high level of concentration. Notwithstanding the challenging environment brought about by the 2007-2008 global financial crisis, South African banks remain stable and profitable. However, the marked disparities between small and large South African banks, in terms of profitability, is a cause for concern. For example, bank-level data for the period under review shows that, on average, net interest margin for large banks is 3.05 percent compared to 23 percent for small banks, while average ROAA for large banks is 1.36 in comparison to 5.03 for small banks.

The rest of the paper is set out as follows: Section 2 reviews the relevant literature pertaining to bank efficiency and profitability. The methodological framework and data analysis are presented in Section 3. The empirical findings are discussed in Section 4. Section 5 concludes the paper.

2. LITERATURE REVIEW

In this section of the paper, empirical literature review relating to bank profitability and efficiency is presented. As stated earlier, the South African banking industry is heavily concentrated with the four largest banks accounting for more than 90 percent of the retail market (CGAP, 2011). It is against this background that most of the empirical studies in South African banking (Mlambo & Ncube, 2011; Greenberg & Simbanegavi, 2009; Okeahalam, 2001) have taken a particular interest on examining the relationship between market structure and bank efficiency. In a closely related study, Ncube (2009) investigated the cost and profit efficiency of banks in South Africa. Their study employed the parametric stochastic frontier approach to determine both cost and profit efficiency of four large and four small South African banks over the period of 2000-2005 and classified according to the number of employees. The average cost and profit efficiencies over the six periods were 92% and 55%, respectively. Their study concluded that South African banks were relatively better at controlling cost than generating profit, as indicated by the lower profit efficiency and higher cost efficiency scores.

Another notable study was undertaken by Oberholzer et al. (2010) who studied the five largest banks in South Africa for the period 1998-2007 to establish the extent to which market value ratios were affected by profitability changes and DEA efficiency measures. Two DEA models were employed based on the definition of outputs included. Model 1 used only income statement data as outputs; namely, the value of interest income and non-interest income. Under model 2, only balance sheet data outputs were considered; that is, the value of deposits, loans and equity. The empirical findings from DEA analysis revealed that the average technical efficiency of all the banks was 89.5% and 79% for Model 1 and Model 2, respectively. Particularly important to their study, they found profitability ratios to be stronger drivers of market value ratios in comparison to DEA efficiency measures.

Various other empirical studies of efficiency and profitability tend to produce mixed results. For instance, Frimpong (2010) undertook a study to investigate the state of efficiency of Ghanaian banks in 2007 and to explore its linkage with profitability. The study employed the intermediation approach with deposits and total expenditures representing inputs, whereas outputs comprised advances and investments. The sample of banks used in the study consisted of eleven foreign banks, eight private local banks, and three government-owned banks. In a two-step procedure, the DEA technique was employed to estimate efficiency scores. Their first stage findings reported an average TE score of 74% and that 18% of the banks were efficient, while the rest (82%) had efficient scores ranging from 33% to 89%. In the second step, the efficiency-profitability matrix applied in the original work of Boussofiane et al. (1991) was utilised to explore the relationship between efficiency and profitability. Four quadrants were identified; namely, *star, sleeper, question,* and *dog*. *Star* banks were those that achieved both superior TE and profitability; *sleeper* banks consisted of those that were highly profitable yet inefficient; *Question mark* banks were those lagging in profits by reason of their technical inefficiency; and *Dog banks* consisted of those that operated at high efficiency but low profitability. Second-stage analysis indicated that (6) 27%, (7) 32%, (7) 32%, and (2) 9% of 22 banks included in the study were located within the star, dog, question, and sleeper categories, respectively. The author found that 32% of the banks were highly profitable, yet inefficient, and that 9% generated low profitability despite being highly efficient.

Another study undertaken by Tregenna (2009) to evaluate the determinants of bank profitability in the US concluded that bank efficiency does not strongly affect profitability. The author found that high profits among American banks were a result of concentration rather than efficient performance. He then highlighted the importance of attaining efficiency, arguing that high profits derived from market share, rather than efficient operations, cannot prevent banks from bankruptcy in the event of a crisis. In contrast, Demirguc-Kunt and Huizinga (2000) argue that lower profitability should be a reflection of increased efficiency due to greater competition among banks. In other words, the author suggests that high profits in the sector indicate inefficiency. Thus, there are mixed findings from previous studies with some confirming either positive, negative, or no impact on bank profitability. To the best knowledge of the researcher, this study will be a first attempt in South Africa to investigate the impact of bank efficiency on profitability.

3. METHODOLOGY AND DATA ANALYSIS

3.1 Data Envelopment Analysis

DEA is a non-stochastic technique that is used to provide an overall evaluation of technical and allocative[1] efficiency for a multiple-input-output firm (Coelli, 1996). The intermediation approach, as opposed to the production approach, was followed in defining bank inputs and outputs. Bank inputs included total operating expenses, labour, fixed assets, and total deposits while interest income, non-interest income, and gross loans were considered as output variables. The non-parametric DEA technique constructs an efficiency frontier where each firm`s efficiency is then evaluated based on the distance from this frontier. Since DEA is affected by extreme values, the sample was categorised into four large and four small banks. The DPIN 3.0 program for decomposing total factor productivity was then run for each size category. Efficiency scores range from zero to one. A score below one represents an inefficient bank, which is located below the efficiency frontier, while a score of one implies that the bank is fully efficient and lies on the frontier. There are two basic DEA models; namely, the constant returns to scale (CRS) model, also known as the CCR model (after Charnes Cooper & Rhodes, 1978), and the variable returns to scale (VRS) model, also known as the BCC model (after Banker Charnes & Cooper, 1984). The empirical model adopted in this paper was the BCC. The major distinction between these two models is the handling of returns to scale with the BCC model allowing for a more realistic concept of variable returns to scale. The assumption of the CRS DEA model is only suitable for situations where all the banks are operating at an optimal scale. Since banking in South Africa is heavily concentrated among the four largest banks, the CRS assumption may not be realistic for a panel of large and small banks.

3.2 Determinants of Profitability

In line with empirical studies (Mirzaei et al., 2011; Demirguc-Kunt & Huizinga, 2000) on bank profitability, return on average assets (ROAA) and net interest margin (NIM) were chosen as indicators of

[1] If price data on inputs and outputs is available, one can compute allocative efficiency measures using the DEA approach.

profitability. ROAA is found by expressing a bank's net income as a proportion of its total average assets. NIM, on the other hand, represents the percentage share of net interest income to average interesting-earning assets. Following Flamini et al. (2009), a translog model of the general form below was estimated:

$$\ln ROAA_{it} = \alpha_{it} + \beta_1 \ln TFPE_{it} + \beta_2 \ln Z_{it} + \mu_{it} \qquad \textbf{(Model 1)}$$

To check the robustness of Model 1 results, regressions are performed again, but this time with net interest margin as the profitability indicator variable by following the model:

$$\ln NIM_{it} = \alpha_{it} + \beta_1 \ln TFPE_{it} + \beta_2 \ln Z_{it} + \mu_{it} \qquad \textbf{(Model 2)}$$

where profitability indicators - ROAA of bank *i* in period *t* ($ROAA_{it}$) and NIM of bank *i* in period *t* (NIM_{it}) - are written as a function of total factor productivity efficiency for bank *i* in period *t* ($TFPE_{it}$) and Z_{it} a vector of other internal bank specific factors representing expenses management, diversification, capitalization, risk and bank size.

3.2.1 Total Factor Productivity Efficiency (TFPE)

This particular measure of bank efficiency is generated in the first stage by using the non-parametric DEA technique. The study hypothesizes that efficient banks are more profitable relative to inefficient ones. Hence, this variable is expected to exhibit a positive relationship with bank profits.

3.2.2 Expenses Management

A bank`s cost-to-income ratio (CIR) was used to capture operational efficiency or efficiency in expenses management. This efficiency indicator expresses a bank's total operating cost (non-interest expenses) as a proportion of its total operating income. An increase in this ratio is interpreted as cost inefficiency and is expected to be negatively related with bank profitability.

3.2.3 Capital Adequacy

In line with empirical studies, the ratio of equity to total assets (ER) was used as a proxy for bank capital adequacy. In recent years, particularly in the wake of the global financial crisis, adequate capital represents an important determinant of bank profitability. Flamini et al. (2009) states that well capitalized banks need to borrow less to fund a given level of assets and so face less costs of funding. Thus, a positive relationship between capital adequacy ratio and bank profits is expected.

3.2.4 Risk Management

Credit risk was measured using the ratio of impaired loans to gross loans (ILGL). ILGL is an important variable that reflects the quality of loans. Higher figures indicate inefficiency in lending and a lack by the management to manage risk. Therefore, an increase in this variable is expected to decrease bank profitability.

3.2.5 Diversification

Non-interest revenue to gross revenue (NRGR) constitutes an essential proxy variable for a bank`s non-traditional activities. Banks diversify in order to reduce their exposure to interest sensitive income and so decrease exposure to risk. However, if diversification is associated with riskier activities, bank profitability may decrease. Hence, the variable is expected to exhibit either a negative or positive sign.

3.2.6 Bank Size

The total amount of assets (TA) of each bank is specified in the regression to capture the possible economies of scale advantages associated with size. In empirical research, inconclusive results have been found between bank size and profitability. The variable is expected to exhibit either a negative or a positive sign.

3.3 Data Analysis

A panel of eight South African banks, classified as four large and four small, were analysed for the period 2005-2011. The criteria of grouping were based on the total assets of the balance sheet of each bank as of 31 December, 2011 (see Table 1). Bank input and output data for computation of bank efficiency scores within the first stage DEA analysis, as well as bank-level regressor variables for second-stage examination, were obtained from the Bankscope database. The sample in this study is a fair representation of the entire banking sector and is particularly so given that the sample includes the four largest banks in South Africa.

Table 1: The Number and Classification of Banks in the Sample

Large Banks	Total Assets (R Millions)	Small Banks	Total Assets (R Millions)
STANDARD	889 250	AFRICAN BANK	49 236
ABSA	725 679	CAPITEC	22 230
FRB	665 525	UBANK	3 586
NEDBANK	585 033	SASFIN	2 767

Source: SARB Supervision Department, Annual Report, 2011

The first-step variables and their descriptive statistics are presented in Table 2. As stated earlier, due to wide variation indicated by the descriptive statistics, the DEA program is run for each size category since DEA is affected by extreme values.

Table 2: Descriptive Statistics for First Stage Variables

	Gross Loans	Interest Income	Non-interest Income	Number of Employees	Fixed Assets	Total Customer Deposits	Operating Expenditure
Mean	195072	22008	8078	16581	2766	179537	22908
Median	114158	14957	6805	14149	1461	78943	15763
Maximum	561552	82797	37665	39738	12026	623295	79746
Minimum	164	135	4	435	39	49	281
Std. Dev.	207069	23148	8563	15145	3178	195640	23684
Obs.	56	56	56	56	56	56	56
Cross-Sections	8	8	8	8	8	8	8

4. DISCUSSION OF RESULTS

4.1 First-Stage Analysis

Running the DPIN program with VRS specification, total factor productivity efficiency (TFPE) averages were generated for each size category and for all banks in each year of the study, as reported in Table 3. An examination of the results confirmed large banks to exhibit a higher TFP efficiency score of 62 (0.62) percent compared to small banks with an average score of 47 (0.47) percent. TFPE score represents the main performance indicator of particular interest in this study. TFPE is a measure of overall productivity performance. It actually measures the difference between observed (actual) TFP and the maximum TFP* attainable using the available technology. This measure was an average of 55 percent for all the banks, which means that for the seven year period (2005-2011), banks fell short by 45 percent to realise the maximum productivity that was achievable with their technology. Another way of putting it is that all banks needed 55 percent of the resources actually consumed in generating banking output. The standard deviation figures suggest that dispersion or variability of both performance indicators is marginally wider for small banks compared to large banks indicating more scope for improvement, particularly among the small banks. It was postulated that the disparity in efficiency was due to the fact that large and small banks operate different business models and hence emphasise different focus areas. For instance, the business model of retail banking is mainly associated with small banks while large banks mostly operate in the wholesale corporate market. Akhigbe and McNulty (2005) argue that the business model of small banks generally requires relatively high cost whereas larger banks preserve low costs. Studies (Vittas, 1991; Casu et al., 2006) in banking literature have confirmed that, in general, the cost to income ratio is relatively higher for a small bank compared to a large bank.

Table 3: Summary Statistics of TFP Efficiency, 2003 – 2011

		LARGE BANKS	SMALL BANKS	ALL BANKS
		TFPE	**TFPE**	**TFPE**
2005	*MEAN*	0.471	0.366	0.419
	MAX	0.804	0.902	0.853
	MIN	0.242	0.136	0.189
	STDEV	0.244	0.359	0.302
2006	*MEAN*	0.737	0.326	0.532
	MAX	0.873	0.704	0.789
	MIN	0.578	0.070	0.324
	STDEV	0.122	0.310	0.216
2007	*MEAN*	0.734	0.468	0.601
	MAX	0.777	0.705	0.741
	MIN	0.662	0.092	0.377
	STDEV	0.053	0.277	0.165
2008	*MEAN*	0.607	0.604	0.606
	MAX	0.696	1.000	0.848
	MIN	0.528	0.271	0.400
	STDEV	0.069	0.347	0.208
2009	*MEAN*	0.512	0.526	0.519
	MAX	0.650	0.867	0.7585
	MIN	0.431	0.156	0.2935
	STDEV	0.095	0.346	0.2205
2010	*MEAN*	0.601	0.436	0.5185
	MAX	0.774	0.808	0.791
	MIN	0.469	0.154	0.3115
	STDEV	0.138	0.323	0.2305
2011	*MEAN*	0.686	0.565	0.6255
	MAX	0.910	1.000	0.955
	MIN	0.570	0.222	0.396
	STDEV	0.160	0.368	0.264
OVERALL	***MEAN***	**0.621**	**0.470**	**0.546**
	STDEV	0.104	0.102	0.072
	MIN	0.471	0.326	0.419
	MAX	0.737	0.604	0.626

The rest of the findings are shown in Appendix 1 and Appendix 2. The TFPE scores for each bank in the sample were later used in the second-stage analysis among other internal determinants of bank profitability.

4.2 Second-Stage Analysis

This section presents empirical results on the impact of bank efficiency on profitability of banks using the appropriate panel data estimation technique. Unit root tests are first performed on the data series to establish whether the series is stationary. A crucial preliminary step in the process of building a robust econometric model is to understand the properties and characteristics of the data involved. It is therefore crucial to test for stationarity of each panel series to be used in the estimation. A series is said to be stationary if it's mean, variance, and covariance structure do not change over time. Disregarding the problem of non-stationarity when it is actually present leads to spurious or nonsensical results. Several panel data unit root tests were performed on the pooled data and the results are presented in Appendix 3. All tests produced stationary variables in levels.

4.3 Diagnostic Tests: Pooled vs Fixed Effects

Having performed the necessary unit root test and confirmed that there is no unit root present in the data, the estimation procedure is taken to the next step which is to choose the appropriate estimation technique among the three panel data estimation models; namely, pooled OLS regression model, fixed effects model (FEM), and random effects model (REM). Both the FEM and REM take into account the bank-specific features, while the pooled OLS model pools all cross sections together and estimates a common regression model disregarding the heterogeneity or distinctiveness of the cross-sections. Baltagi, (2008, p. 17) states that the random effects model is appropriate for very large populations where *N* is generally large relative to *T*. However, the panel sample in this study - $N = 8 = T$ - is not sufficiently large to permit the use of the random effects model. As such, the random effects model was not considered. To decide between a pooled regression model (restricted) and a fixed effects model (unrestricted), the F-test of pooled regression model (restricted) versus individual fixed effects model (unrestricted) was constructed and confirmed the fixed effects model as the robust and representative model. Under the null hypothesis that cross-sections are homogeneous, the F-test constructed was as follows:

$$F\ statistic = \frac{(RSS - URSS)/(n-1)}{URSS/(nt-n-k)} \sim F_{(n-1),(nt-n-k)}$$

$$F\ statistic = \frac{(1.555364 - 1.055007)/7}{1.055007/37} = 2.5069 \ \sim F_{7,37,0.05} = 2.2695$$

The decision is to reject the null hypothesis if the F-statistic exceeds the F-critical value. Since F-statistic = 2.51 > F-critical = 2.27, the null hypothesis that the sample of banks are homogeneous is rejected, implying that the FEM is appropriate. EViews redundant fixed effects likelihood ratio test confirmed the same results and conclusion (see Appendix 4). Mizraei et al. (2011) applied the same fixed effects model to investigate, among other factors, the effects of market structure on bank profitability and risk. In line with the suggestion by Baltagi (2008), the White-diagonal standard errors and covariances were used to correct for the presence of possible heteroscedasticity. The problem of heteroscedasticity occurs often with cross-sectional data as opposed to time series data. Baltagi (2008) argues that in panel data analysis, the assumption of homoscedasticity may not be plausible due to the different variation in sizes of the cross-sections. Three White coefficient covariance methods are considered; namely, White-cross-section, White-period, and White-diagonal. The rule of thumb is to use the White diagonal method if the values for *N* and *T* satisfy $\frac{1}{2}N < T < 2N$. Recall that $N = T = 8$. Classical linear regression modelling requires that the variance of the residuals be homoscedastic or constant, irrespective of the values of the independent variables. Heteroscedasticity, therefore, arises when the variance or spread of the residuals is not constant. The need for equal spread of residuals comes about because in the estimation of a regression function; OLS assigns equal weight (importance) to every observation when minimizing the residual sum of squares (RSS). Ideally, in order to accurately estimate a regression function, observations that are closer to their respective mean values should be given more weight relative to those that are scattered about (Gujarati & Porter, 2010). Hence, the use of robust standard errors to correct for the presence of heteroscedasticity is recommended.

The problem of serial correlation was also tested in the model. One important assumption underlying classical linear regression is that the residuals be uncorrelated with one another. The problem of serial correlation is mainly common with time series data and so requires attention in panel data estimation. The original unweighted FEM showed evidence of positive correlation with a D-W statistic of 0.91 in the primary model. The necessary corrective procedures were performed to transform the original data using the Generalised Least Squares (GLS) weights. Studenmund (2011) defines the GLS as a method of eliminating pure first-order correlation from an equation, thereby restoring the minimum variance property to its estimation. Therefore, GLS is simply "OLS applied to the transformed model that satisfies the classical assumptions" (Gujarati & Porter, 2010, p. 442). The problem of serial correlation was not expected to be persistent due to the short time dimension of the panel. Based on the noted improvement of a change in the D-W statistic from 0.91 to 1.91 in Model 1, it was then concluded that the GLS remedial procedure did remove serial correlation. The final results of GLS-FEM for Models 1 and 2 are shown in

Table 4. Model 1, specified with ROAA as the dependent variable, constitutes the primary model while Model 2, with NIM as the dependent variable, was specified for robustness check.

Table 4: Determinants of Bank Profitability in South Africa (2005 – 2011)

	Fixed Effects (GLS) Model 1	**Fixed Effects (GLS) Model 2**
Dependant Variable	**ROAA**	**NIM**
Constant	3.920*** *(0.0000)*	2.532*** *(0.0000)*
Efficiency (TFPE)	0.170*** *(0.0216)*	0.072*** *(0.0087)*
Capital (ER)	0.303*** *(0.0054)*	0.267*** *(0.0094)*
Expenses (CIR)	-0.789*** *(0.0021)*	-0.388*** *(0.0004)*
Credit risk (ILGL)	-0.215*** *(0.0000)*	-0.004 *(0.8799)*
Size (TA)	-0.384*** *(0.0011)*	-0.015 *(0.8510)*
Diversification (NRGR)	-0.118 *(0.2685)*	-0.341*** *(0.0000)*
Adjusted R^2	**95.6**	**98.9**
D-Watson statistic	**1.91**	**1.87**

4.4 Second-Stage Results: Determinants of Profitability

4.4.1 Total Factor Productivity Efficiency

Of paramount value to the present study was to establish the significance and magnitude of the impact of bank efficiency (TFPE) on profitability. Results in Table 4 show evidence of a positive and significant coefficient, implying that bank profits are influenced by the efficiency with which banks operate. On average, a one percent increase in bank efficiency improves ROAA by 0.17 percent. SARB (2011) reported that ROAA for the banking sector increased from one percent in December 2010 to1.2 percent in December 2011, representing an increase of 0.2 percentage points. Model 2 also confirmed the positive role of bank efficiency on net interest margin. However, the marginal impact of TFPE on ROAA is much larger compared to its impact on NIM.

4.4.2 Operational Efficiency

The coefficient on operational/cost efficiency (CIR) was significant and negative, as expected, indicating that, on average, increases in cost-to-income ratio are associated with lower level of profitability. Operational efficiency bears the greatest impact on profitability in comparison to all determinants included in both models.

4.4.3 Capital Adequacy

The variable ER, which is a proxy variable for bank capitalization, is also reported as statistically significant and bears the expected positive sign. This finding supports the view that adequately capitalized banks, on average, are more profitable. Mizraei et al. (2011) also found the same result, arguing that banks with more capital are better able to deal with risks since they can cover loan losses from their capitalization.

4.4.4 Risk Management

ILGL, which is a measure of impaired loans to gross loans, is reported negative and statistically significant confirming a detrimental effect on ROAA. However, this credit risk variable was negative, but insignificant, in Model 2, implying that net interest margins, at least for the period covered, were not influenced by impaired loans. Perhaps this reflects the fact that small banks, whose average ROAA was higher than large banks, also had a greater share of impaired loans.

4.4.5 Diversification

The coefficient on the bank diversification variable was negative, but insignificant, in Model 1. However, the variable was found to be negative and statistically significant within Model 2. Hence, non-traditional activities by banks exert a detrimental impact on profitability. This finding is consistent with that of Mizraei et al. (2011) who found off-balance sheet activities, a proxy for diversification, to be negative and insignificant for emerging economies but significant for advanced economies.

4.4.6 Bank Size

In order to control for the impact of bank size on profitability, an asset size variable was entered into the model. Ideally, banks should operate at their optimal scale at the lowest of their long-run average cost curves. However, obtained results have shown evidence of scale inefficiencies among large banks, as indicated by a negative and significant bank size coefficient. Perhaps this finding may also be indicative of the fact that large banks in South Africa do not use market power to reap profits.

5. CONCLUSION

In this paper, a two-stage methodological procedure was followed to determine the impact of bank-specific factors, particularly bank efficiency on profitability. In the first stage, the DEA Hicks-Moorsteen index approach was used to generate and decompose total factor productivity (TFP) into several efficiency measures for a panel of eight banks. First-stage results revealed that the average banking sector total factor productivity efficiency (TFPE) was 55 percent. A further comparison of performance revealed that large banks were better performing than small banks in terms of TFPE. Large banks exhibited a higher score of 62 percent compared to small banks, with an average score of 47 percent. In view of the fact that large banks outperformed smaller banks in terms of efficiency, the author recommended that smaller banks relook at their business models in light of the changing economic and financial landscape. It was postulated that this disparity in efficiency could be due to the fact that large and small banks operate different business models and hence emphasise different focus areas. Therefore, the author suggests an optimal blend of retail and wholesale activities to diversify business operations of small banks in order to improve their efficiency. The empirical findings have also cast light on the link between bank efficiency and profitability. This paper suggests that total factor productivity efficiency and cost efficiency play crucial roles in generating higher profits. Therefore, the author underscores the need for bank managers to attain and maintain high efficiency in order to improve their level of profitability. Adequate capitalization, risk management, bank size, and non-traditional activities were also found to be important drivers of bank profitability in South Africa.

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Appendix 1: Large Banks: *Levels* Computed Using Hicks-Moorsteen Aggregator Functions

Period	Firm	TFP	TFP*	TFPE	OTE	OSE	OME	ROSE	OSME	ITE	ISE	IME	RISE	ISME	RME
2005	*ABSA*	1.660	6.866	0.242	1.000	1.000	1.000	0.242	0.242	1.000	1.000	1.000	0.242	0.242	0.242
2005	*FRB*	1.966	2.445	0.804	1.000	1.000	1.000	0.804	0.804	1.000	1.000	1.000	0.804	0.804	0.804
2005	*NEDBANK*	1.198	3.411	0.351	1.000	1.000	1.000	0.351	0.351	1.000	1.000	1.000	0.351	0.351	0.351
2005	*STANDARD*	1.301	2.681	0.485	1.000	1.000	1.000	0.485	0.485	1.000	1.000	1.000	0.485	0.485	0.485
2006	*ABSA*	1.410	1.939	0.727	1.000	1.000	1.000	0.727	0.727	1.000	1.000	1.000	0.727	0.727	0.727
2006	*FRB*	1.889	2.457	0.769	1.000	1.000	1.000	0.769	0.769	1.000	1.000	1.000	0.769	0.769	0.769
2006	*NEDBANK*	1.163	2.012	0.578	1.000	1.000	1.000	0.578	0.578	1.000	1.000	1.000	0.578	0.578	0.578
2006	*STANDARD*	1.102	1.263	0.873	1.000	1.000	1.000	0.873	0.873	1.000	1.000	1.000	0.873	0.873	0.873
2007	*ABSA*	1.402	1.820	0.771	1.000	1.000	1.000	0.771	0.771	1.000	1.000	1.000	0.771	0.771	0.771
2007	*FRB*	1.297	1.958	0.662	1.000	1.000	1.000	0.662	0.662	1.000	1.000	1.000	0.662	0.662	0.662
2007	*NEDBANK*	1.364	1.882	0.725	1.000	1.000	1.000	0.725	0.725	1.000	1.000	1.000	0.725	0.725	0.725
2007	*STANDARD*	1.322	1.700	0.777	1.000	1.000	1.000	0.777	0.777	1.000	1.000	1.000	0.777	0.777	0.777
2008	*ABSA*	1.372	1.972	0.696	1.000	1.000	1.000	0.696	0.696	1.000	1.000	1.000	0.696	0.696	0.696
2008	*FRB*	1.234	2.028	0.609	1.000	1.000	1.000	0.609	0.609	1.000	1.000	1.000	0.609	0.609	0.609
2008	*NEDBANK*	1.336	2.530	0.528	1.000	1.000	1.000	0.528	0.528	1.000	1.000	1.000	0.528	0.528	0.528
2008	*STANDARD*	1.504	2.529	0.595	1.000	1.000	1.000	0.595	0.595	1.000	1.000	1.000	0.595	0.595	0.595
2009	*ABSA*	1.247	2.616	0.477	1.000	1.000	1.000	0.477	0.477	1.000	1.000	1.000	0.477	0.477	0.477
2009	*FRB*	1.540	2.368	0.650	1.000	1.000	1.000	0.650	0.650	1.000	1.000	1.000	0.650	0.650	0.650
2009	*NEDBANK*	1.309	3.035	0.431	1.000	1.000	1.000	0.431	0.431	1.000	1.000	1.000	0.431	0.431	0.431
2009	*STANDARD*	1.408	2.867	0.491	1.000	1.000	1.000	0.491	0.491	1.000	1.000	1.000	0.491	0.491	0.491
2010	*ABSA*	1.282	1.657	0.774	1.000	1.000	1.000	0.774	0.774	1.000	1.000	1.000	0.774	0.774	0.774
2010	*FRB*	1.087	2.319	0.469	1.000	1.000	1.000	0.469	0.469	1.000	1.000	1.000	0.469	0.469	0.469
2010	*NEDBANK*	1.260	2.451	0.514	1.000	1.000	1.000	0.514	0.514	1.000	1.000	1.000	0.514	0.514	0.514
2010	*STANDARD*	1.615	2.490	0.649	1.000	1.000	0.959	0.676	0.649	1.000	1.000	1.000	0.649	0.649	0.649
2011	*ABSA*	1.207	2.120	0.570	1.000	1.000	1.000	0.570	0.570	1.000	1.000	1.000	0.570	0.570	0.570
2011	*FRB*	1.252	1.376	0.910	1.000	1.000	1.000	0.910	0.910	1.000	1.000	1.000	0.910	0.910	0.910
2011	*NEDBANK*	1.160	2.031	0.571	1.000	1.000	1.000	0.571	0.571	1.000	1.000	1.000	0.571	0.571	0.571
2011	*STANDARD*	1.203	1.732	0.694	1.000	1.000	1.000	0.694	0.694	1.000	1.000	1.000	0.694	0.694	0.694

Appendix 2: Small Banks: *Levels* Computed Using Hicks-Moorsteen Aggregator Functions

Period	Firm	TFP	TFP*	TFPE	OTE	OSE	OME	ROSE	OSME	ITE	ISE	IME	RISE	ISME	RME
2005	*CAPITEC*	1.770	8.411	0.210	1.000	0.747	1.000	0.210	0.210	1.000	0.747	0.992	0.212	0.210	0.282
2005	*SASFIN*	1.514	11.101	0.136	1.000	1.000	1.000	0.136	0.136	1.000	1.000	1.000	0.136	0.136	0.136
2005	*TEBA*	1.009	4.669	0.216	1.000	0.530	1.000	0.216	0.216	1.000	0.530	1.000	0.216	0.216	0.408
2005	*AFRICAN*	1.257	1.394	0.902	1.000	1.000	1.000	0.902	0.902	1.000	1.000	1.000	0.902	0.902	0.902
2006	*CAPITEC*	2.372	31.605	0.075	1.000	0.724	0.479	0.157	0.075	1.000	0.724	0.965	0.078	0.075	0.104
2006	*SASFIN*	1.224	2.687	0.456	1.000	1.000	1.000	0.456	0.456	1.000	1.000	1.000	0.456	0.456	0.456
2006	*TEBA*	1.223	17.361	0.070	1.000	0.579	1.000	0.070	0.070	1.000	0.579	1.000	0.070	0.070	0.122
2006	*AFRICAN*	1.398	1.986	0.704	1.000	1.000	1.000	0.704	0.704	1.000	1.000	1.000	0.704	0.704	0.704
2007	*CAPITEC*	0.963	1.496	0.644	0.988	0.947	0.736	0.885	0.652	0.989	0.946	0.991	0.657	0.651	0.688
2007	*SASFIN*	1.309	3.024	0.433	1.000	1.000	1.000	0.433	0.433	1.000	1.000	1.000	0.433	0.433	0.433
2007	*TEBA*	1.233	13.462	0.092	1.000	0.515	1.000	0.092	0.092	1.000	0.515	1.000	0.092	0.092	0.178
2007	*AFRICAN*	1.605	2.276	0.705	1.000	1.000	1.000	0.705	0.705	1.000	1.000	1.000	0.705	0.705	0.705
2008	*CAPITEC*	1.014	1.291	0.786	1.000	1.000	0.946	0.831	0.786	1.000	1.000	1.000	0.786	0.786	0.786
2008	*SASFIN*	1.461	4.075	0.358	1.000	0.793	1.000	0.358	0.358	1.000	0.793	1.000	0.358	0.358	0.452
2008	*TEBA*	1.302	4.797	0.271	1.000	0.952	1.000	0.271	0.271	1.000	0.952	0.996	0.273	0.271	0.285
2008	*AFRICAN*	3.205	3.205	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2009	*CAPITEC*	1.089	1.255	0.867	1.000	1.000	1.000	0.867	0.867	1.000	1.000	1.000	0.867	0.867	0.867
2009	*SASFIN*	1.094	3.528	0.310	1.000	0.823	1.000	0.310	0.310	1.000	0.823	1.000	0.310	0.310	0.377
2009	*TEBA*	1.610	10.320	0.156	1.000	0.667	1.000	0.156	0.156	1.000	0.667	0.974	0.160	0.156	0.234
2009	*AFRICAN*	1.327	1.720	0.771	1.000	1.000	1.000	0.771	0.771	1.000	1.000	1.000	0.771	0.771	0.771
2010	*CAPITEC*	1.098	1.358	0.808	1.000	1.000	1.000	0.808	0.808	1.000	1.000	1.000	0.808	0.808	0.808
2010	*SASFIN*	1.299	8.412	0.154	1.000	0.864	1.000	0.154	0.154	1.000	0.864	0.944	0.164	0.154	0.179
2010	*TEBA*	1.745	9.796	0.178	1.000	0.602	1.000	0.178	0.178	1.000	0.602	1.000	0.178	0.178	0.296
2010	*AFRICAN*	1.897	3.147	0.603	1.000	1.000	1.000	0.603	0.603	1.000	1.000	1.000	0.603	0.603	0.603
2011	*CAPITEC*	1.104	1.496	0.738	1.000	1.000	1.000	0.738	0.738	1.000	1.000	1.000	0.738	0.738	0.738
2011	*SASFIN*	1.751	7.901	0.222	1.000	1.000	1.000	0.222	0.222	1.000	1.000	1.000	0.222	0.222	0.222
2011	*TEBA*	1.355	4.486	0.302	1.000	0.857	1.000	0.302	0.302	1.000	0.857	1.000	0.302	0.302	0.353
2011	*AFRICAN*	1.257	1.257	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix 3: Pooled Panel Data Unit Root Tests

Tests	***Statistic***	***P-value***
Null Hypothesis	**Each individual series contains a unit root.**	
ADF - Fisher Chi-square	134.097	*0.0062****
PP - Fisher Chi-square	203.867	*0.0000****
Null Hypothesis	**Assumes common unit root process**	
Levin, Lin & Chu (LLC)	-9.41185	*0.0000****

*/**/*** denotes significance at 10%, 5%, and 1% levels of significance, respectively.

Appendix 4: Diagnostics Tests

Test	**Test Statistic**	**Critical Value**	**Inference**
Redundant Fixed Effects Test H_0: Cross-sections are homogenous H_1: Cross-sections are heterogeneous	F = 5.208	P-value = 0.0003	*Reject H_0 and conclude that bank specific features should be accounted for using the FEM.*
Pooled vs. Fixed Effects: $H_0 : \mu_1 = \mu_2 = ... = \mu_{N-1} = 0$ H_A : *Not all equal to 0*	F = 2.5069	$F_{7,37,0.05} = 2.2695$	*Reject H_0 implying that the FEM is a better model to allow for bank heterogeneity.*
Test for Serial Correlation: $H_0 : \rho = 0$ (no serial correlation) $H_A : \rho \neq 0$ (serial correlation)	DW = 1.91	No correlation if: $D_U < D_W < 4 - D_U$ $1.822 < D_w < 2.178$	*The iterative procedure was successful in correcting negative serial correlation.*
Heteroscedasticity: $H_0 : \sigma_i^2 = \sigma$ (homoscedastic errors) H_A : *Not equal for all i* (heteroscedastic errors)	White diagonal standard errors and covariances were used to correct the problem of heteroscedasticity.		

NOTES