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Thabiso Sthembiso Msomi, Master of Accounting, Lecturer, Accounting and Informatics, Management Accounting, Durban University of Technology, South Africa. (Corresponding author)

Odunayo Magret Olarewaju, Ph.D., Senior Lecturer, Faculty of Accounting and Informatics, Department of Management Accounting, Durban University of Technology, South Africa.



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Thabiso Sthembiso Msomi (South Africa), Odunayo Magret Olarewaju (South Africa)

DYNAMIC PANEL INVESTIGATION OF THE DETERMINANTS OF SOUTH AFRICAN COMMERCIAL BANKS' OPERATIONAL EFFICIENCY

Abstract

Like any other business, commercial banks are greatly affected by the micro and macro-environment that operate in, no matter how large they are. Capital adequacy ratio, credit risk, money supply, inflation, the exchange rate, and the national gross domestic product have been noted to be the key determinants of bank operational efficiency. This research study looked at the operational efficiency of four large South African banks, namely, Standard Bank, Absa, Nedbank, and First National Bank. A quantitative, descriptive, correlation design was employed, and the System-Generalized Method of Moments (SYS-GMM) techniques were used and revealed that operational efficiency was positively correlated with capital adequacy ratio, credit risk, inflation, and exchange rate, and negatively correlated with profitability, money supply and GDP. SYS-GMM estimates show that capital adequacy ratio, credit risk, inflation and exchange rate positively influenced operational efficiency, while profitability, money supply (M3) and GDP had a negative influence. Thus, it is concluded that bank management should decrease administrative costs, evaluate customers' creditworthiness before issuing loans, raise bank size as operational conditions require, boost intermediation, and anticipate inflation to operate more efficiently.

Keywords

operational efficiency, system-generalized method of moments, commercial bank, GDP, bank capital adequacy, credit risk, profitability

JEL Classification

C58, F65, G21

INTRODUCTION

Given the significance that the banking sector plays in an economy, there has been a consistent rise in the amount of research attention that is focused on operational efficiency in the banking industry. The goal of banking regulation is to make sure that banks work well and efficiently. Not only are banking operations important to an economy, but they are also a big part of what helps governments set monetary and fiscal policy and keep the economy stable. When considered against the background of the government's ties to the different parts of the economy, this raises the issue of why operational efficiency should be of significant importance to the government. Any type of persistent inefficiency in the sector is bad and could lead to a bank run, which would be bad for depositors, creditors, investors, and other important players in the economy. For this reason, the commercial banks of many nations are placing a greater emphasis on the ongoing effort and tenacity to deepen the development of managerial and regulatory frameworks to come to terms with burgeoning systemic risks to prevent operating inefficiency. These frameworks are meant to keep operations from being inefficient by making sure that systemic risks are dealt with properly. This shows in some ways how important the sector is as a main focus of current economic management for the

growth, improvement, and long-term health of a country's economy through the machinery of using and allocating financial resources. It is impossible to undervalue the importance of the sector's dominance in both domestic and international financial discussions. This is especially true when considering the potential contribution, it can make to national productivity, which in turn helps an economy stay strong and stable in the face of both internal and external shocks.

To attain operational efficiency, banks, like any other company, must be cautious. Changes in the South African market environment continue to cause uncertainty that puts bank operating budgets at risk, so it is important to recognize and understand these changes. To navigate effectively and justify their establishment, businesses must be vigilant and adaptive. In a world where things are always changing, it should be a key strategic goal for bank management to improve operational efficiency. Banks, like any other type of business, should be more careful about how they spend their money, especially when certain business situations come together to make it more important than ever to improve operational efficiency. In a world where things are always changing, improving operational efficiency should be one of the most important strategic goals that bank management should work toward. This puts a huge strain on their abilities, which hurts their net income margins and slows the rate at which deposits are growing.

The research suggests that there aren't enough studies on operational efficiency particularly in the South Africa context, which could be why it's hard to figure out why the sector isn't working well and come up with solutions. Studies have been criticized for overlooking important bank-specific and macroeconomic elements that, when taken together, may have major impact on operational efficiency. This lack of research could make it hard for us to understand the many things that affect how productive the banking industry is. That a disconnect exists is one of the driving forces for the research. So, the goal of the research is to find out what factors, both inside individual commercial banks and in the economy as a whole, make it possible for South African banks to run their daily business so smoothly. To ensure that commercial banks do well, stakeholders and other groups of interest, like the central bank and the government, need to understand how important banks are and figure out what makes the South African banking sector work well.

1. LITERATURE REVIEW

The operational efficiency of banks is crucial as they have a major influence on the stability of financial systems and the economy (Alqahtani & Mayes, 2018). In particular, commercial banks stimulate economic growth by efficiently allocating financial capital (Msomi, 2022). This position is well founded within the economy with financial system stabilization. Banking operational efficiency enhances the health of the financial sector, as well as the growth of the economy (Yahaya & Awen, 2020). Therefore, many researchers around the world have been involved in researching the determinants of operational efficiency of commercial banks (e.g., Ikhide, 2008; Alkhatib & Harasheh, 2012; Taiwo & Agwu, 2017; Nguyen et al., 2018; Alqahtani & Mayes, 2018; Abate & Mesfin, 2019; Afaq et al., 2019; Boateng, 2019; Minh & Thanh, 2020; Chen & Lu, 2021). From the

plethora of studies conducted, there is a paucity of studies looking at operational efficiency in South African commercial banks.

It is generally accepted that the operating efficiency of banks is a determining factor for their success (Chen & Lu, 2021). Banks in developing countries are very concerned about their operational performance (Pelletier, 2018; Doan et al., 2018). Efficiency is characterized as the capacity of an organization to produce a result with minimal effort or capital (Grmanová & Ivanová, 2018). It is a metric of how close a production unit is to its production possibility frontier, which is composed of points on a line that optimally combine inputs in order to generate one quantity of output (Sickles & Zelenyuk, 2019). Operating efficiency is seen as the capacity of the business to minimize operating costs by integrating the qualified employee, procedures and technologies to achieve its goal (Lotto,

Table 1. Overview of the top 5 South African commercial banks

Source: Buzzsouthafrica (2022).

Top and biggest banks in South Africa	Market capitalization, USD	No. of employees	No. of branches	Net asset value, USD
Standard bank	10.5 Billion	50,691	600	2.6 Trillion
First Rand bank	9.1 Billion	+ 48,000	+ 800	122.7 Billion
ABSA bank	7.7 Billion	42,000	1,000	1.339 Trillion
Nedbank	5.7 Billion	+ 29,403	692	1.1 Trillion
Investec	2.1 Billion	+ 8,700	+ 40	60,146 Billion

2018; Buchory, 2021). With the right mix of capital, the business activity of every business would increase the efficiency of its services or products (Saha & Dutta, 2021). Banks operate efficiently by channeling savings from deposits and mobilized those companies with high anticipated social and economic returns. Post lending, banks track these tools to ensure successful and productive usage (Alkhatib & Harasheh, 2012). On the other hand, commercial banks that are unsustainable and inefficient in channeling savings appear to delay economic growth as well as the welfare of the society (Zhu et al., 2019).

The South African financial services sector is highly developed, boasting dozens of domestic and international institutions that provide a full range of services including commercial, retail, and merchant banking, mortgage lending, insurance, and investment. This sector is supported by a robust legal and compliance framework. The banking system in South Africa is highly established and effectively governed. It is made up of a central bank known as the South African Reserve Bank, a few big banks that are financially stable, investment institutions, and a slew of smaller banks. The Absa Group is recognized as one of the leading financial service companies in Africa. The bank prides itself on being an African financial services business with the goal of becoming the continent's source of national pride. As its name implies, First National Bank (FNB) was the very first commercial bank to be established in the country of South Africa. Since its founding in 1838, it has grown to become one of the greatest financial institutions in the nation. The Standard Bank Group Limited, which also does business under the name Stanbic Banks South Africa, is the largest bank in South Africa. It is also the largest company in Africa in terms of assets and earnings. Over 560 locations spread across 20 nations make up the bank's

branch network in sub-Saharan Africa. Both the bank's mortgage lending and card-issuing businesses are the most significant in South Africa (Kinuthia, 2022).

South Africa's financial industry is very centralized. Examining operational effectiveness is required when there is a high level of focus. The table below shows the performance of the top 5 commercial banks in South Africa.

1.1. Concept of operating efficiency

A bank's ability to turn financial inputs through financial goods and services at a lower price than revenue generated from operations is determined by its operating efficiency (Olawajaju & Obalade, 2015). It is associated with the effective use of human and material resources, as well as the effective use of manpower, machine tools and material revenues to increase goods and services at a lower price (Chen, 2001). It is all about tactical operational preparation aimed at maintaining a healthy balance between cost and efficiency. The recognition and elimination of inefficient processes that lead to resource depletion, resulting in higher organizational income is the main objective. It is all about getting the most proportional decline in input consumption for a given output or getting the most proportional increase in output for a given input.

One of several ratios widely used to determine business performance is the operating income to capital expenditure ratio. A high ratio indicates greater productivity and benefit. It denotes that input costs were properly handled and lowered in order to attain higher income, demonstrating bank liquidity risk management performance (Buchory, 2014; Eferakeya & Erhijakpor, 2020; Kustina et al., 2019).

1.2. Prior studies

According to Tu et al. (2020), Taiwan's banks became more efficient after a financial reorganization. The outcome was ascribed to a modification of the banking operations' risk assessment procedure. Financial reform in the banking industry is rumored to boost performance through raising competition (Lotto, 2019). This run opposed to the idea that growing market share generally tends to boost bank efficiency, as suggested by the efficiency market hypothesis.

Okuda and Aiba (2020) and Okuda et al. (2014) found that the operational efficiency of big organizations is greater and more resilient than that of smaller companies in their examination into aspects of operating efficiency as well as overall productivity using a sample of Cambodian financial institutions. Institutions with more than 50% of their capital coming from outside the country have much lower capitalization levels than domestic institutions. Institutions with a wide range of offerings are far more productive and stable. Their total productivity and several extrinsic characteristics seem to be improving consistently. Significant gains in productivity changes have also been facilitated by stronger economic growth and an increase in household financial instrument reserves. These results imply that enhanced operational capacity, suitable foreign ownership selection, stronger managerial robustness, and expanded diversity are necessary for any further expansion of Cambodian commercial banks.

Sulaeman et al. (2019) claim that operationally effective banks are substantially more financially sustainable and operating at their peak potential. They also point out that additional elements influencing bank performance are internal ones, specifically the qualities of the bank. Size, kind, and capital are all types of bank – specific factors. Ruslan et al. (2019) performed studies on this topic and found that factors such as bank size, capital, and ownership structure had a substantial favorable impact on economic growth. They also point out that factors affecting banks' efficiency include things like capital and size.

Size has a significant relationship with both system efficacy and scale ineffectiveness. The pattern in output levels over time demonstrates how macroeconomic conditions significantly influenced efficiency measures (Yahya & Awen, 2020).

Jayaraman and Srinivasan (2019) examined the performance of the Indian commercial banking sector from 1992 to 2002, after reform. They studied determining factors using the Tobit model and discovered that moderate banks did ok, banks with greater capital adequacy ratios are probably more effective, and banks with lower non-performing loans are maybe more successful. They looked at ownership as an efficiency predictor as well and discovered that banks with public ownership performed better than their private counterparts in the post-reform period (including foreign banks).

In Lotto (2019), the operational performance of 36 Tanzanian commercial banks is examined from 2000 to 2017. A trustworthy random-effect regression model was employed in the study to roughly estimate the relationship between bank operational efficiency and its components. The results of the study show a positive correlation between bank operational performance and both bank liquidity and capital adequacy. This suggests that capital adequacy and liquidity not only provide a higher capital reserve as well as bank essential liquidity ratio, which strengthen financial sustainability, but also enhance bank operating efficiency by lowering the systemic risk among stockholders and debt holders. The data also show that bank profitability and operating performance are intimately related, indicating that banks should prioritize boosting their revenue in order to enhance operational effectiveness. The results of the study recommended Tanzanian banks to monitor and examine these elements in order to guarantee the long-term sustainability and economic growth of the banks and industry. In order to continue robust financial growth, Tanzanian commercial banks must embrace any potential advancements that might raise their levels of firm profitability. The basic goal of banks is to maximize profits in order to maximize shareholder capital or fortune.

1.3. Hypotheses development

1.3.1. Profitability and banking sector operating efficiency

There is a substantial degree of disagreement over the outcomes of study that was carried out to explore the impact that profitability has on the performance of banks. According to Almaqtari et al. (2019), there is a strong association between

the profitability of the bank and its effectiveness. This would imply that banks with higher levels of profitability have higher levels of operational performance when contrasted to banks with reduced levels of profitability. According to Buchory (2015), there is currently no evidence that can definitively prove that massively lucrative banks are more successful in terms of operational performance than banks with lower profits. In addition, the conclusions of studies conducted by Sanchez et al. (2013), Hadi et al. (2018), Khilyana (2019), and Goswami et al. (2019) on the actual impact of bank efficiency have demonstrated that there is a positive correlation between profitability and bank efficiency.

1.3.2. Capital adequacy and banking sector operating efficiency

The scholarship acknowledges that capital adequacy is a determinant that determines the operational effectiveness of a bank. Altunbas et al. (2007) and Hunjra et al. (2020) conducted the most recent study on European banks, and their findings suggested that there is a detrimental link amongst capital adequacy and operational efficiency. This can be attributed to the fact that European banks have a propensity to hold onto more capital and to deal on fairly low levels of risk. According to the findings of yet another research study conducted by Moudud-Ul-Huq (2019), firms that have access to a greater amount of money operate more effectively than enterprises that have just limited financial resources. Several research studies, including the one conducted by Tecles and Tabak (2010), Batir et al. (2017), Silva et al. (2018), and Al-Harbi (2019), have investigated the factors that determine bank efficiency and found that there is a positive correlation among both bank capital and bank efficiency. The findings indicate that when a bank has an adequate amount of capital, it is able to take advantage of much more possibilities at a lower cost, hence reducing the amount of risk that is connected with the bank's business operations.

1.3.3. Credit risk and banking sector operating efficiency

The percentage of a bank's total credit that is comprised of non-performing loans is a significant indicator of the credit risk that the bank poses to its customers since it shows the possible losses that the

bank might incur (Yin et al., 2021). A loan that is considered to be non-performing contains principal and interest payments that have been overdue for at least ninety days and may raise issues as to whether or not the payments will be repaid in the future. An increasing number of these loans indicates that a bank has a significant credit risk, which eventually undermines the bank's efficacy and its capacity to remain sustainable (Makkasau et al., 2020). A rise in the proportion of non-performing loans will lead to an increase in operating costs and an advancement in the amount of bad debt, neither of which are likely to have a beneficial effect on cost-effectiveness (Odunga et al., 2013).

The evidence-based research conducted by Siddique et al. (2020), Salim et al. (2017), and Miah and Uddin (2017) show that there is a meaningful relation between the ratio of non-performing loans and total loans and the ineffectiveness of bank price levels. In addition, the ratio of non-performing loans to total loans is also positively correlated with inefficiency of bank prices. After using Data Envelopment Analysis, Garza-Garcia (2012) found that the data showed that non-performing loans are hindering the performance of banks. In addition, Eferakeya and Erhijakpor (2020) show that credit risk is a factor that decides the level of efficiency achieved by banks operating in highly competitive markets. Using the general moment approach, Sharma et al. (2015) research on the many variables affecting the efficiency of banks in Pacific Island Countries (GMM). The research has revealed that there is a significant beneficial influence that credit risk has on bank efficiency from the perspective of macroeconomic models, and bank-specific models. Both Tadesse (2017) and Gadzo et al. (2019) have shown, using the Tobit model, that credit risk has an influence on operational performance that is less favorable than previously thought. Adusei (2016) conducted research using the binary logit approach, and they found that credit risk has a significant detrimental effect on technical efficiency. This was one of the findings of their research.

1.3.4. Inflation rate and banking sector operating efficiency

It has been shown that the rate of inflation may have an influence, to a certain extent, not only on the profitability of banks but also on their cost-ef-

fectiveness as a macroeconomic indicator. Garcia and Trindade (2019) came to the conclusion that a hyperinflationary climate has a favorable connection with bank efficiency. This is due to the fact that an unsustainable branch network may be connected with a high inflationary climate. According to the findings of Ürmösy (2018), inflation may lead to an increase in bank expenditures. This is due to the fact that increased labor costs are likely to be connected with a larger volume of transactions, which would result in a higher per capita ratio of bank branches. The rise in inflation leads to a rise in interest rates, which in turn almost certainly will contribute to increased bank charges. Mabati and Onserio (2020), on the other hand, contend that the effect of inflation on bank expenses and revenue often relies on the growing rate of operational expenditure rather than the inflation rate itself. In other words, the rate of inflation is not the most important factor. On the other hand, Ebenezer et al. (2017) have come to the conclusion that the effect that inflation has on the profitability of a bank is dependent on the bank's ability to forecast inflation and the capabilities of the bank's managers to keep costs under control while maintaining interest rate stability in order to generate profits. Therefore, it is anticipated that commercial banks would have the capacity to precisely forecast changes in inflation rates, particularly those that would have a beneficial effect on the profitability of banks. signs of inflation that are anticipated based on their study on either the cost inefficiency or benefit inefficiency of banks (Belas et al., 2019). Garza-Garcia (2012), Eferakeya and Erhijakpor (2020), and others provided data that proved that inflation hinders bank output. Garza's findings Garcia's were presented first. According to the findings of a research that was conducted by Olarewaju (2016), inflation has a significant impact on the operational efficiency of banks.

1.3.5. Money supply (M₃) and banking sector operating efficiency

Money has a significant impact on economic activity, since it is utilized in almost all economic transactions. A rise in the money supply has two effects: it lowers interest rates, which encourage investment, and it puts more money in the hands of consumers, which makes them feel wealthier and encourages consumption. Businesses pur-

chase additional raw materials and boost production in response to rising sales. The expansion of commercial activity drives the demand for both capital items and labor (Ntwiga, 2020). However, an increase in the money supply as a result of increased savings suggests that people will consume goods in the future (Wang et al., 2018).

1.3.6. Exchange rate and banking sector operating efficiency

The efficiency of a bank's operations is impacted by currency exchange rates between the investee nation and the investor's home currency (Cumming & Johan, 2007). The real exchange rate is often used as a gauge of global competitive advantage. It is also referred to as an indicator of a nation's currency's competitive nature, and there is an inverse link between these two variables and competitive intensity. Any nation's currency will be more competitive the lower the value of this index is, indicating that country. The widely-held belief is that exchange rate volatility impacts predicted company cash flows and, therefore, its performance through changing home currency-denominated revenues (costs) and the rules of competition for businesses with worldwide operations (Agade, 2014). Exchange rate variations have an impact on the earnings that banks repatriate to their overseas investors, according to Caner and Kontorovich (2004) research on the causal association among exchange rates and operational efficiency in banks.

1.3.7. Gross domestic product and banking sector operating efficiency

Numerous research papers have shown that a key element in enhancing bank operations is the rise in the gross domestic product (GDP). Stronger GDP growth, according to Gompers and Lerner (1998), encourages entrepreneurship, which raises the need for investment capital. There are contradictory findings on the effect of GDP growth on the operational efficiency of commercial banks. Jeng and Wells (2000) claim that there is a negligible effect of GDP growth on operational efficiency of commercial banks, whereas Bernoth et al. (2010) claim that there is a positive correlation between operational efficiency of commercial banks and GDP growth. Commercial banks often do

well when the GDP is growing quickly and when demand is rising overall. You may easily acquire money to finance purchases. Commercial banks are more likely to report profitable periods when their portfolios are larger and more varied. It is hardly unexpected that foundational investors in commercial banks, such as hedge funds, mutual fund managers, insurance companies, and pension funds, have pushed to increase access to this growing asset class in their fund portfolios, particularly during periods of strong liquidity. It is anticipated that commercial bank operating productivity and GDP would be positively correlated (Dinson, 2017; Mehta & Bhavani, 2017).

This study aimed to evaluate the determinants of the operational efficiency of the commercial banking system in South Africa. As a direct consequence of this, the following hypotheses are put forward:

- H1: There is a positive relationship between profitability and operating efficiency.*
- H2: Bank capital adequacy is positively related to bank operating efficiency.*
- H3: Credit risk significantly determines the banking sector's operating efficiency.*
- H4: Inflation rate does not significantly determine banking sector operating efficiency.*
- H5: Money supply (M3) does not significantly determine the banking sector's operating efficiency.*
- H6: Exchange rate does not significantly determine the banking sector's operating efficiency.*

H7: Gross Domestic Product significantly determines the banking sector's operating efficiency.

1.4. Conceptual framework

The conceptual framework used in this study is depicted in Figure 1. The link between independent and dependent variables is displayed by the framework.

1.5. Theoretical underpinning

Berger and Humphrey (1997) assert that the 'intermediation principle' is best suited to evaluating commercial banks due to the inclusion of interest expenses, which account for about half to two-thirds of overall costs. Since there is no comprehensive theory on banking operations, as well as no clear consensus on the description and estimation of banks' outputs and inputs, this study is based on the intermediation theory. The intermediation theory continues to be useful in conjunction with an egalitarian theory of banking activities. As a result, it is thought to be more suitable for evaluating the boundary of the operational efficiency performance of banks (Ladime & Brahmana, 2021).

This research is based on the resource-based value framework created by Welnerfelt (1984). This idea proposes that businesses who invest in developing their strategic competencies and resources would be able to gain an economic edge over their competitors (Olaewaju & Msomi, 2021). According to the principle, viable financial institutions have an edge over their rivals. The hypotheses considered, the level of existing empirical review, and the availability of data all played roles in the selec-

Source: Authors design (2022).

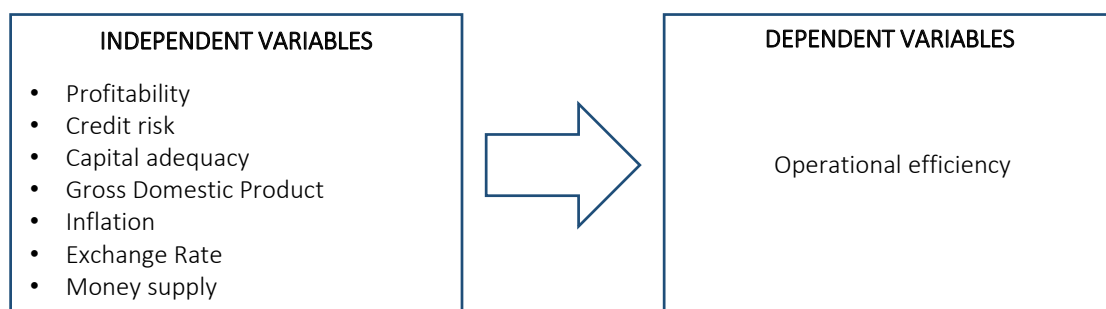


Figure 1. Conceptual model

tion of the factors used in this study. Each of the study’s variables, and the theoretical justifications for their inclusion, are detailed above.

2. METHOD

Secondary data were gathered manually from annual-audited accounts of four major commercial banks in the South African banking industry while the data of macro-economic factors were pulled from the International Financial Statistics for this analysis. Data from the year 2000 to 2019 were collected from the McGregor Archive. Standard Bank, Absa, Nedbank and FNB were the selected commercial banks for this research study. Out of the five biggest banks in South Africa, these four selected banks are commercial banks. Their disclosure of information and reporting are accurate and most needed information can be collected rapidly. This observational study used unbalanced panel results because some of the findings in the survey were absent due to the emergence of new banks. The two-step SYS-GMM is used to estimate the model of the study because it controls for the endogeneity of the lagged dependent variable in the dynamic panel. More so, the SYS-GMM

estimator has a low bias and higher efficiency (Soto, 2009). Hence the model is specified as below:

$$\begin{aligned}
 OPE_{it} = & \beta_0 + \beta_1 OPE_{it-1} + \beta_2 PRO_{it} + \\
 & + \beta_3 CAR_{it} + \beta_4 CRE_{it} + \beta_5 MON_{it} + \\
 & + \beta_6 INF_{it-1} + \beta_7 EXR_{it} + \beta_8 GDP_{it} + \mu_{it},
 \end{aligned}
 \tag{1}$$

where β_0 is the constant term; $\beta_1 - \beta_8$ are the estimated coefficients of the independent variables; μ_{it} is the error term; it is the notation of a panel study; i denotes the commercial banks and t denotes the time period. Both descriptive and inferential statistics are being used to estimate the model. Specifically, SYS-GMM was used to examine the determinants of the operational efficiency of the selected banks. The variables are explained in Table 2.

3. RESULTS AND DISCUSSION

Table 3 showed the descriptive analysis for the determinants of operational efficiency of South African commercial banks for the period 2000 to 2019. The determinants of operational include profitability, capital adequacy ratio, credit risk, money supply, inflation rate, exchange rate and GDP. The

Table 2. Variable description

Variable	Notation	Measurement	A-priori
Operational efficiency	OPE	Total operating costs/ Total operating Income	+
Lagged operational efficiency	OPE _{t-1}	Total operating costs/ Total operating Income	+
Profitability	PRO	Profit after tax/ Total asset	+
Capital adequacy ratio	CAR	Total equity/ Total assets	+
Credit risk	CRE	Non-performing loans/ Total loans	-
Money supply	MON	M3	+
Inflation rate	INF	The consumer price index of the countries	-
Exchange rate	EXR	Exchange rate to USD	+
Gross Domestic Product	GDP	GDP Growth rate	+

Table 3. Summary statistics

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
OPE	80	.0175873	.0358789	-.2930973	.2954892
PRO	80	.8967802	.2826924	.2052155	5.572873
CAR	80	.1204737	.1324367	-.4447174	.8091629
CRE	80	.2008674	1.014675	-.9912991	18.18689
MON	76	1.871059	19.93593	-2.000	466.069
INF	74	.0109484	.0265938	-.1590017	.2635914
EXR	74	.2822329	1.500507	-19.6535	21.48262
GDP	76	52.28115	31.76851	-60.875	356.54

Note: OPE is the operational efficiency ratio; PRO is the profitability; CAR is the capital adequacy ratio; CRE is the credit risk; MON is the M3 money supply; INF is the inflation rate; EXR is the exchange rate, and GDP is the Gross Domestic Product.

mean value for operational efficiency, profitability, capital adequacy ratio, credit risk, money supply, inflation rate, exchange rate and GDP were: 0.018, 0.897, 0.120, 0.201, 1.871, 0.011, 0.282 and 52.281, respectively. These findings imply that the need to enhance the operational efficiency of commercial banks in South Africa is through improvement in profitability, capital adequacy ratio, credit risk, money supply, inflation rate and exchange rate for the commercial banks under consideration. The maximum and minimum value for the operational efficiency, profitability, capital adequacy ratio, credit risk, money supply, inflation rate, exchange rate and GDP were: 0.295 & -0.293, 5.573 & 0.205, 0.809 & -0.445, 18.187 & -0.991, 466.069 & -2.000, 0.264 & -0.159, 21.483 & -19.654 and 356.54 & -60.875, respectively. The standard deviation value of 0.036, 0.283, 0.132, 1.015, 19.936, 0.027, 1.501 and 31.769 showed the values at which operational efficiency, profitability, capital adequacy ratio, credit risk, money supply, inflation rate, exchange rate and GDP were been deviated from their respective expected value.

The correlation coefficients presented in Table 4 showed the extent of operational efficiency of the commercial banks and determinants such as profitability, capital adequacy ratio, credit risk, money supply, inflation rate, exchange rate and GDP which were correlated. From Table 4, it was discovered that operational efficiency was positively correlated with capital adequacy ratio, credit risk,

inflation rate and exchange rate with correlation coefficient of 0.40, 0.02, 0.52 and 0.01 respectively while it was discovered that operational efficiency was negatively correlated with profitability, money supply and GDP with correlation coefficient of -0.21, -0.03 and -0.13, respectively. Thus, as the profitability, money supply and GDP increased, the operational efficiency continued to decrease. Also, profitability was found to be positively correlated with money supply, exchange rate and GDP with correlation coefficient of 0.01, 0.05 and 0.04, respectively, while profitability was discovered to be negatively correlated with capital adequacy ratio, credit risk and inflation rate with correlation coefficient of -0.28, -0.03 and -0.29, respectively. Capital adequacy ratio also has a positive correlation with inflation and exchange rate with 0.56 and 0.04 as the respective correlation coefficient while it was found that capital adequacy ratio has a negative correlation with credit risk, money supply and GDP with the correlation coefficient of -0.05, -0.02 and -0.14, respectively. Thus, as the profitability, money supply and GDP of the commercial banks in South Africa increased, their operational efficiency continued to decrease.

Table 5, which contains the two-step SYS-GMM estimates, showed that lagged operational efficiency, capital adequacy, credit risk, inflation rate and exchange rate positively influence the operational efficiency of South African commercial bank to the tune of 0.290, 0.018, 0.003, 0.517 and 0.004

Table 4. Correlation analysis

Variables	OPE	PRO	CAR	CRE	MON	INF	EXR	GDP
OPE	1.0000	-	-	-	-	-	-	-
PRO	-0.2102	1.0000	-	-	-	-	-	-
p-value	0.0000	-	-	-	-	-	-	-
CAR	0.4024	-0.2770	1.0000	-	-	-	-	-
p-value	0.0000	0.0000	-	-	-	-	-	-
CRE	0.0209	-0.0313	-0.0536	1.0000	-	-	-	-
p-value	0.6198	0.4580	0.2034	-	-	-	-	-
MON	-0.0256	0.0072	-0.0185	-0.0440	1.0000	-	-	-
p-value	0.5438	0.8636	0.6614	0.2973	-	-	-	-
INF	0.5233	-0.2896	0.5566	-0.0277	-0.0186	1.0000	-	-
p-value	0.0000	0.0000	0.0000	0.5116	0.6588	-	-	-
EXR	0.0138	0.0486	0.0379	0.0625	0.0090	-0.0011	1.0000	-
p-value	0.7445	0.2496	0.3691	0.1384	0.8302	0.9785	-	-
GDP	-0.1277	0.0382	-0.1354	0.0926	0.0808	-0.1172	0.0012	1.0000
p-value	0.0050	0.4028	0.0029	0.0424	0.0766	0.0101	0.9794	-

Note: OPE is the operational efficiency ratio; PRO is the profitability; CAR is the capital adequacy ratio; CRE is the credit risk; MON is the M3 money supply; INF is the inflation rate; EXR is the exchange rate, and GDP is the Gross Domestic Product.

Table 5. Dynamic panel-data estimation, two-step SYS-GMM

Variables	Coefficients	Standard error	Z	P > z	95% Conf.	Interval
OPE L1.	.2903827	.0899346	3.23	0.001***	.1141141	.4666514
PRO	-.0083002	.006577	-1.26	0.207	-.0211909	.0045906
CAR	.0175409	.0298239	0.59	0.556	-.0409128	.0759946
CRE	.0030872	.0027162	1.14	0.256	-.0022363	.0084108
MON	-.0002506	.0000561	-4.47	0.000***	-.0003605	-.0001406
INF	.5172594	.1420737	3.64	0.000***	.2388	.7957188
EXR	.0037409	.0007114	5.26	0.000***	.0023466	.0051353
GDP	-.0000467	.0000413	-1.13	0.257	-.0001276	.0000341
_cons	.0130873	.0063445	2.06	0.039**	.0006523	.0255223
Group variable: ID		Number of observations		78		
Time variable: YEAR		Number of groups		4		
Number of instruments = 3		Observation per group: minimum		2		
Wald chi2(4) = 175.99		Average		4.32		
Prob > chi2 = 0.000		Maximum		6		

Note: OPE is the operational efficiency ratio; PRO is the profitability; CAR is the capital adequacy ratio; CRE is the credit risk; MON is the M3 money supply; INF is the inflation rate; EXR is the exchange rate, and GDP is the Gross Domestic Product. Also, ** and *** denote 5% and 1%, respectively.

percent, respectively, on one hand. On the other hand, profitability, money supply and GDP have a negative influence on the operational efficiency in South African commercial banks to the tune of 0.0083, 0.0003 and 0.0001, respectively. The statistical significance of the variables revealed that lagged operational efficiency, money supply, inflation rate and exchange rate were significantly affecting the operational efficiency in South African commercial banks at 1 and 5 % respectively. Other variables such as profitability, capital adequacy ratio, credit risk and GDP were statistically insignificant in determining the operational efficiency in South African commercial banks during the period under study. The Wald Chi-square value and the probability of Chi-Square of 175.99 and 0.000, respectively, established the statistical significance and the robustness of the two-step SYS-GMM as a dynamic panel estimation technique to examine the determinants of operational efficiency of South African commercial banks during the period under study.

Thus, this study confirmed the earlier results obtained by Eferakeya and Erhijakpor (2020) and Sharma et al. (2015) that posited credit risk as a determinant of efficiency, and that this has a substantial positive impact on bank efficiency from macro-economic, industrial and bank-specific models. However, Mabati and Onserio (2020) also argued that the impact of inflation on bank costs and income usually depends on the rising rate of

operating expenditures as opposed to the inflation rate. This was further emphasized by Ebenezer et al. (2017) who stated that the identified banks have been able to successfully predict the inflation coupled with the management capacity to control expenses as well as interest rates for generating profits, thus enhance their operational efficiency. This study also affirmed the position of Tecles and Tabak (2010), Batir et al. (2017), Silva et al. (2018), Al-Harbi (2019) and Moudud-Ul-Huq (2019) that the adequacy of capital enables banks to take the opportunities available at a lower cost to minimize the risk associated with bank operations thus enhance their efficiency. The statistical significance of the variables revealed that lagged operational efficiency, money supply, inflation rate and exchange rate significantly affected the operational efficiency in South African commercial banks.

The Hansen test and the Sargan J-test, which are the tests that are generally recognized as the most reliable, were utilized in the diagnostics test for two-step SYS-GMM. Additionally, the Arellano and Bond order one and two tests were utilized in the diagnostics test for serial correlation. As a result, the Hansen and Sagan test for over-identification of the instrument as well as the AR (1) and AR (2) tests for autocorrelation were utilized as the post-estimation check to justify the utilization of the dynamic panel estimation method in the investigation of the factors that determine the level of operational efficiency of South African

Table 6. Diagnostics test for two-step SYS-GMM

Arellano-Bond test for AR(1) in first differences	$z = -1.31, Pr > z = 0.019^{**}$
Arellano-Bond test for AR(2) in first differences	$z = 0.86, Pr > z = 0.388$
Sargan test of overidentifying restrictions	$chi2(48) = 69.16, Prob > chi2 = 0.024$
Hansen test of overidentifying restrictions	$chi2(48) = 41.43, Prob > chi2 = 0.737$

Note: ** denotes a 5% significance level, AR: Arellano and Bond.

commercial banks. The data shown in Table 6 led to the conclusion that the null hypothesis should be accepted with regard to the AR (1) and AR (2) that were utilized to estimate the SYS-GMM. If the null hypothesis is accepted, then it may be inferred that there was no evidence of a serial correlation at the lag length that was chosen. As a result, it created an efficient, continuous, and trustworthy estimate on the drivers of operational efficiency of South African commercial banks throughout the period of time that was the subject of the study. In addition, the result demon-

strated that the probability value of the Hansen test, which was 0.737, was larger than 5%, which demonstrated that the over-identification of the instruments did not have a significant impact. As a result, it is possible to emphasize that the SYS-GMM estimation was both efficient and trustworthy with the valid instrument, and as a consequence, there was no over-specification of the instruments that were utilized in the operational efficiency of South African commercial banks. The result for the study leads to rejection of the null hypothesis.

CONCLUSION

The objective of the paper was to assess the determinants of the operational efficiency of the commercial banking system in South Africa. An examination of the determinants of operational efficiency of South African commercial banks, including profitability, capital adequacy ratio, credit risk, money supply, inflation rate, exchange rate and GDP, revealed that there is a need to enhance the operational efficiency of commercial banks in South Africa through improved profitability, capital adequacy ratio, credit risk, money supply, inflation rate and exchange rate for the commercial banks under consideration. It was found that as the profitability, money supply, and Gross Domestic Product, their operational efficiency continued to decrease. The SYS-GMM estimates revealed that the lagged operational efficiency, capital adequacy ratio, credit risk, inflation rate and exchange rate positively influenced the operational efficiency, while profitability, money supply and Gross Domestic Product have a negative influence on the operational efficiency in South African commercial banks.

Thus, it can be concluded that the management of commercial banks should pay proper and adequate attention to the identified factors in this study to improve their operational efficiency. The regulatory framework of the commercial banks should be enhanced to be more dynamic and effective in order to have a positive impact and improve operational efficiency. To enhance market share (net loans) and lower interest expenditures and administrative costs, bank administration must evaluate operational efficiency to gain a strategic advantage. Bank strategy must take into account the fact that the usage of available money has a substantial impact on bank competitiveness. When a bank is unable to increase its lending market, accepting a large amount of deposit decreases its competitiveness. The costs of credit risk must also be taken into account while expanding the lending market.

Further research is needed to ascertain the nature of the relationship between electronic banking and the operational efficacy of commercial banks in South Africa in this era of progressive digitalization. It is also proposed to conduct comparative studies to assess the correlation between determinants of operational efficiency in other nations and banks of different sizes.

AUTHOR CONTRIBUTIONS

Conceptualization: Thabiso Sthembiso Msomi, Odunayo Magret Olarewaju.

Data curation: Thabiso Sthembiso Msomi, Odunayo Magret Olarewaju.

Formal analysis: Thabiso Sthembiso Msomi, Odunayo Magret Olarewaju.

Investigation: Thabiso Sthembiso Msomi, Odunayo Magret Olarewaju.

Methodology: Odunayo Magret Olarewaju.

Project administration: Thabiso Sthembiso Msomi.

Resources: Thabiso Sthembiso Msomi.

Software: Thabiso Sthembiso Msomi, Odunayo Magret Olarewaju.

Supervision: Thabiso Sthembiso Msomi, Odunayo Magret Olarewaju.

Validation: Thabiso Sthembiso Msomi, Odunayo Magret Olarewaju.

Visualization: Thabiso Sthembiso Msomi.

Writing – original draft: Thabiso Sthembiso Msomi.

Writing – reviewing & editing: Odunayo Magret Olarewaju.

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