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ECONOMETRIC ANALYSIS OF THE DETERMINANTS OF BANK PROFITABILITY IN THREE MAJOR AFRICAN COUNTRIES: KENYA, NIGERIA, AND SOUTH AFRICA

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Abstract

In light of the importance of bank profitability for provision of financial services and for financial stability, this study examines its determinants in three major Sub-Sharan African countries, namely Kenya, Nigeria and South Africa. Our panel econometric approach using bank-level fixed effects seeks to identify the bank-specific, banking-market and macroeconomic determinants of bank profitability in 240 banks across the three countries over 1990-2019. Across a range of estimates, we find that bank liquidity and the non-interest income to total income ratio had a significant positive effect on profitability while credit risk and the cost-to-income ratio had a significant negative effect. In most models, real GDP growth affected bank profitability positively. Small banks and large banks differ in terms of their determinants of profitability. There are important implications for both bank management and regulators, which in turn may affect both financial stability and scope for economic development. [1]

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1. Introduction

In recent years, the African continent has seen the second-fastest economic growth across the globe with, for example, annual GDP growth rate of 3.4% and 3.6% in 2019 and 2020 respectively (African Development Bank 2020). The exceptional economic growth of the African continent has accompanied a rising proportion of the population holding bank accounts over the past decade (Aliana and Miroga 2020). Accordingly, commercial banks in some African countries have witnessed strong profitability performance due to market growth (Ali and Puah 2019). Indeed, recent data indicate that over the past decade, commercial banks in countries such as South Africa, Nigeria and Egypt have reported significantly higher return on assets compared to banks in developed nations (Bolarinwa et al 2019).

In any economy, commercial banks play a fundamental role not only in facilitating financial intermediation but equally in maintaining economic and financial stability (Athanasoglou et al 2008, Noman et al 2015). For example, the most recent global financial crisis, which occurred in 2007-2008 was mostly attributed to commercial banks' irresponsible lending practices in the sub-prime mortgage, which adversely affected global economic stability (Ozili 2021). To avoid such problems in the African continent, regulatory authorities need to encourage the adoption of appropriate risk-management strategies and enforce appropriate regulatory standards that contribute to enhancing banks' solvency, liquidity, and profitability performance. More generally there is a need to adopt the Basel III framework, addressing as it does the main regulatory issues raised by the subprime crisis. But they also need to adopt policies favourable to bank profitability, not least given the role of retained earnings in building up capital strength. Appropriate regulatory policies will not only maintain stability of the financial sector (Borio, Gambacorta and Hofmann 2017) but will also facilitate effective provision of financial services, which will in turn help economic development.

The fact that the rural banking infrastructural network is still underdeveloped in Africa implies that majority of the rural population in the continent have historically not had access to banking services. However, a particular feature of African banking is that commercial banks in Africa are increasingly focused on development of mobile banking platforms as an avenue to reach potential clients located in the rural areas, which account for more than 60% of the continent's population (Ondiege 2010). With a growing number of mobile money users in Africa, the mobile banking platform is a strategic tool to increase financial inclusion as evidenced by experience in countries such as South Africa and Kenya (Nguena 2020).[2] Countries such as Nigeria have set financial inclusion targets (IMF 2021a).

Data show that there has indeed been a considerable growth of mobile banking platforms in sub-Saharan Africa over the past 13 years. For instance, over the period, 2007-2010, the number of customers with mobile banking accounts increased from 0.9 million to 11.89 million (Nguena 2010), and at the end of 2019 the number of customers with mobile banking accounts in Africa is estimated to be more than 100 million (Nguena 2020). The implication is that in Africa, the number of customers with mobile banking accounts has increased tenfold since 2010 alone. The growth in mobile money subscriptions across Africa has contributed in turn to the rise in mobile banking platforms (Nguena 2020). A report by GSMA (2020) indicates that sub-Saharan Africa region experienced an 11.9% growth in mobile money usage in 2019 compared to the Latin America and Caribbean (2.5% growth) and the European region (7.3% growth). The implication is that banks in Africa have a considerable potential to exploit the financial profitability benefits associated with mobile banking platforms (Ondiege 2010; Abel and Roux 2016, Ahamed 2017).

[2] The estimates indicate that >55.2% of the population in sub-Saharan Africa are mobile money users.

The research topic on the determinants of bank profitability has been explored to a considerable depth by previous empirical research studies (such as Davis et al 2022, Petria et al 2015, Altavilla et al 2017 and Kohlscheen et al 2018). However, the majority of such studies have not been focused on African countries[3] and hence there is limited evidence on the specific factors that influence bank profitability there. This is paradoxical since, as noted above, commercial banks that operate in Africa have recorded exceptional return on asset (ROA) performance compared to financial institutions that operate in advanced nations. This is mainly due to the growth of mobile banking platform, which in effect leapfrogs the legacy technology of commercial banks that operate in advanced nations.

In this context, we seek to explore the determinants of bank profitability across a wide range of banks in Kenya, South Africa and Nigeria using extensive and up-to-date data from financial statements that captures banks' financial performance over a long period from 1990 till 2019. We aim to ascertain, based on panel estimates, the factors that influence the profitability of African commercial banks. In doing so we aim to deepen and develop the approach of studies of profitability in individual African country such as Abiodun (2012) on factors that influence bank profitability in Nigeria and Maredza (2014) on predictors of bank profitability in South Africa, while also highlighting the shortcomings of earlier work on African banks.

Our key hypothesis is that internal bank-specific factors (namely credit risk, capital adequacy, asset quality, bank asset-size, liquidity, non-interest-income to total-income and cost-to-income ratio), which in turn reflect management decisions, will be the main factors that significantly determine variation in the ROAA and ROAE profitability of commercial banks. The findings from this study are expected to be robust because it employs market structure and macroeconomic control variables as well as bank-specific factors, thus limiting the risk of omitted variables bias. Besides, the research data are up-to-date given that the dataset includes data up to and including end of year 2019. We include data for 73 banks from Kenya, 101 banks from Nigeria and 66 from South Africa. The findings from this study are also distinct in that besides a baseline regression over 1990-2019, we also assess determination of profitability over different time periods (1990-2019, 1990-2009 and 2010-2019) as well as dividing between large and small banks and undertaking two robustness checks.

Our results have wider implications. Since a profitable and stable banking industry contributes to economic stability, monetary authorities, bank regulators and international institutions such as the World Bank, IMF and Basel Committee have an incentive to identify factors which influence bank profitability (Amidu and Harvey 2014; Caselli 2016; World Bank 2020). Regulators and Central Banks, also advised by the international institutions, can benefit from information on the relative effects of types of risk for bank profitability, including macroeconomic developments, as they seek to attain their output/inflation stabilisation goals and maintain financial stability (Kohlscheen et al. 2018). Furthermore, the identification of internal bank-specific factors that influence bank profitability can inform the adoption of strategic actions by senior bank managers with a view to improve the profitability of the financial institutions under their management.

We note that there remain major challenges to bank regulation in Sub Saharan African countries such as those studied. Summarising the work of the IMF/World Bank Financial Sector Assessment Programs, EIB (2013) note that supervisory capacity is weak in many African countries, reflecting both under-resourcing of supervision activities and deficient legislative arrangements. Also, there is typically a need to give more attention to consolidated supervision of financial conglomerates, covering both bank and non-bank operations. The spread of pan-African banking groups implies a

[3] Besides developed countries, they are mainly focused on emerging markets such as the Organisation of Islamic Corporation (OIC) countries and South Asian countries e.g. Pakistan and India (Yao et al. 2018; Al-Homaidi et al. 2018)

need for home country regulators to give full attention to the foreign operations of these groups and to coordinate actions and share information with host country supervisors. (ibid, p25). Furthermore, most countries have not yet introduced Basel III to their regulatory framework.

The article is structured as follows. Section 2 presents a theoretical and empirical review of the factors that determine bank profitability, with a specific focus on evidence from African countries. Section 3 describes how the study will be conducted using panel regression analysis and Section 4 highlights the data, which is largely collected from Fitch-Connect. The panel regression findings are presented in Section 5 while Section 6 undertakes a discussion on implication of the results and how it compares to previous evidence. Section 7 concludes.

2. Literature Review

The review is organised into two main sections. First, the theoretical section describes how the efficient-structure hypothesis explains the mechanism by which bank efficiency translates to greater bank profitability, market power and in turn exceptional bank performance. Second, the empirical section examines the findings of previous studies on factors that influence commercial bank profitability, with a particular focus on studies of banks in African countries. In Appendix 1 we show a detailed table showing the main African studies and highlighting the shortcomings that we seek to address.

2.1. Theoretical Literature Review

The theoretical underpinning of empirical research studies that examine the determinants of bank profitability is mainly guided by the efficient-structure theory (Maredza 2014; Ebenezer, Omar and Kamil 2017). The ***efficient-structure hypothesis*** describes the mechanism by which bank operational efficiency translates to higher profitability, greater market power/dominance and therefore, exceptional bank performance (Berger 1995). Under the efficient structure hypothesis, commercial banks with exceptional ***operational efficiency*** and ***credit risk management*** strategies tend to have lower operating costs and therefore, higher profitability.

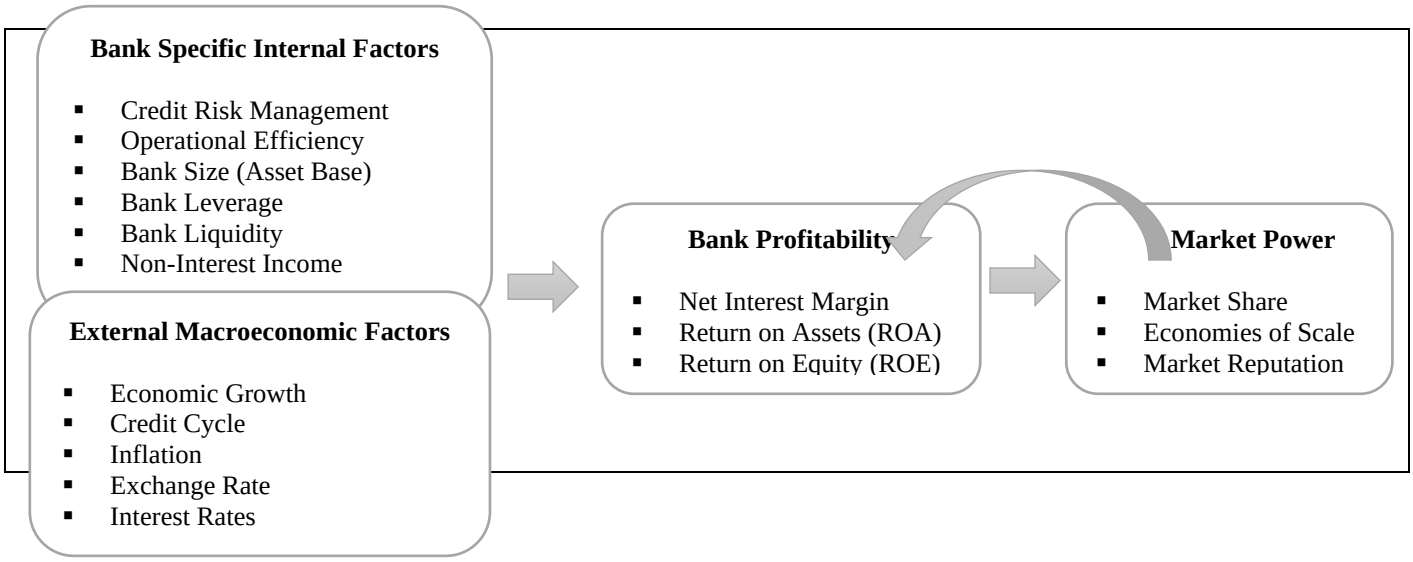
The conceptual framework on the determinants of bank profitability as depicted in Figure 2.1 below indicates that effective ***credit risk management*** and ***operational efficiency*** in terms of lower bank costs improves bank profitability (net interest margin, return on assets and return on equity). As a result of ***scale economies***, large banks with exceptional operating efficiency, and therefore, higher profitability also tend to possess strong market power, thus contributes positively to the strong financial performance of such commercial banks (Gul, Irshad and Zaman 2011; Garcia and Guerreiro 2016). The implication is that economies of scale are important in enhancing the financial profitability of commercial banks. If scale economies are associated with better bank operational efficiency and lower cost, this in turn contributes to strong profitability (Berger and Humphrey 2012; Tiberiu 2015). However, there is also contrary evidence that for the largest banks, diseconomies of scale related to difficulties of management tend to adversely affect profitability (Francis 2013).

The theoretical conceptual framework in Figure 2.1 indicates that the ***size of the bank*** as measured by its asset base, ***leverage***, and ***liquidity*** are other internal factors which have been shown to increase bank profitability (Nalianya and Miroga 2020). According to Abiodun (2012), the liquidity of commercial banks tends to enhance the banks' ability to advance credit facilities, which raises their interest income. In addition, strong liquidity and leverage position also allows banks to effectively manage operations, which in turn leads to improved bank profitability as well as

ensuring solvency (Issn, Ebenezer, Ahmad and Bin 2017). ***Non-interest income*** has also been considered an important internal bank-specific factor that positively influences bank profitability (Tarus, Chekol and Mutwol 2012).

The theoretical conceptual framework presented in Figure 2.1 also depicts the relevance of external macroeconomic factors such as ***economic growth***, the ***inflation rate***, ***interest rates***, and ***real exchange rates*** in determining bank profitability. Favourable macroeconomic conditions tend to improve the asset quality of bank holdings, which in turn enhances the profitability performance of financial institutions (Flamini et al 2009). The article by Altman (2020) also provides evidence on how credit risk, credit cycles and economic cycles influence bank profitability. For instance, prior to the recent stressed credit cycle in 2019, the corporate bond default rates then of 2.87% were considered substantially lower than the historical average default rate of 3.3% and this would also be reflected in loan defaults. On the other hand, adverse cyclical trends may affect bank profitability adversely.

Figure 2.1: Conceptual Framework on the Determinants of Bank Profitability



Source: Al-Homaidi et al. (2018).

2.2. Empirical Literature Review

The determinants of bank profitability can be categorised into ***internal*** and ***external*** factors (Kapaya and Raphael 2016). The internal factors that influence bank profitability consist of bank-specific attributes, which enhance the strategic and operational competitiveness of financial institutions and can be controlled by bank managers (Masood and Ashraf 2012). The external factors include macroeconomic variables and market concentration factors that influence bank profitability and which are not under the control of individual bank managers.

2.2.1. Internal Factors

Internal factors can be seen as related to the banks' business model as in Beck et al (2013). We consider them one by one, while bearing in mind that managers need to simultaneously target each in order to optimize the balance of risk and return for the bank.

The findings from the empirical research studies indicate that ***credit risk management*** is a key internal factor that influences bank profitability. For instance, using a sample of 106 Nigerian banks for the period, 2001-2015 and OLS regression, Akinkunmi (2017) found that effective credit risk management and the capital adequacy ratio are key bank-specific predictors of bank profitability. Effective credit risk management has a considerable impact in enhancing the quality of asset held by banks due to the lower risk of default. Banks with strong credit risk management strategies report lower default rates and provisions for loan loss reserves, which contribute to strong profitability (Rani and Zergaw 2017).

Similarly, ***size of the bank*** as captured by the asset base has been empirically found to affect the profitability of financial institutions in developing countries. Using a panel dataset from 216 commercial banks that operate in 42 sub-Saharan Africa over the period, 1999-2006, the findings by Francis (2013) note the significant positive effect of bank size on profitability. According to the study, large-sized banks with substantial asset base tend to have higher scale economies, which in turn enhance their profitability through lower operating costs.

Bank ***operating efficiency*** as captured by the ***cost-to-income ratio*** has also been identified to have a significant direct effect on profitability of financial institutions (Francis 2013; Roman and Camelia 2017). For instance, using a sample of 216 commercial banks, which were drawn from 42 countries that operated in Sub-Saharan Africa in 1999-2006, Francis (2013) noted that bank operational efficiency had a significant positive effect on the ROA and ROE bank profitability performance. In an empirical study that explored the internal determinants of bank profitability in South Africa using a sample of four small banks and four large banks in 2005-2011, Maredza (2014) also identified total factor productivity efficiency and operational cost efficiency as important factors that influence bank profitability. Furthermore, using a sample population of 244 bank staff in a qualitative-survey study, Nalianya and Miroga (2020) also identified operational expenses as a significant factor that determined the profitability of banks listed on the Nairobi Stock Exchange. These findings are consistent with the efficient structure hypothesis, which shows how banks with strong operational-efficiency and better credit risk management tend to have greater profitability performance (Ebenezer et al. 2017).

The importance of the ***capital adequacy*** ratio is evidenced by the fact that under the Basel III accord, banks need to have a minimum risk-adjusted capital adequacy ratio of 8% (Yuksel, Mukhtarov, Mammadov and Ozsari 2018). The capital adequacy ratio has also been cited as a key internal bank-specific factor that influence the profitability of commercial banks (Chaplin 2010; Olweny 2011). In a study that used financial statement data from 38 Kenyan banks for the period 2002-2008, Olweny (2011) found that the capital adequacy ratio along with other internal bank factors had a statistically-significant positive effect on bank profitability.

Diversification, captured by a higher share of non-interest income to total income, has not been widely assessed in African banking studies apart from Flamini et al (2009) who found a positive effect on profitability. It was found to benefit profitability for European banks by Goddard et al (2013) and Petria et al (2013). However, Saona (2016) suggested that there is a negative relationship between revenue diversification and profitability measured by the net interest margin

for Latin American banks over 1995-2012. The focus of banks on mobile banking suggests that this aspect could be of particular importance in Africa.

There are other internal bank-specific factors, which determine the profitability of commercial banks. These include, ***asset quality***, ***deposit ratio(total-deposit/total-asset)***, ***bank liquidity***, the ***management experience***, and the ***number of branches*** (Holmstrom & Tirole 2010). For instance, using a sample of 216 banks from 42 sub-Saharan Africa region over the period, 1999-2006 and fixed-effects regression, Francis (2013) found that liquidity has a significant positive effect on bank profitability. The study by Olweny (2011) conducted in Kenya also noted based on OLS regression analysis that asset quality was an important factor that influenced bank profitability in Kenya.

A brief review of the findings from research studies conducted in developed countries indicate that almost the same bank-specific factors influence the financial profitability of commercial banks in advanced economies as in Africa. For instance, the study by Birindelli and Ferretti (2015), which relied on data from European banks over the period 2006-2012 found that bank profitability was significantly influenced by operating efficiency and credit risk exposure. The research study by Liu (2013), which used a sample of 8677 U.S. banks over the period, 2007-2012 also found that both capital adequacy ratio and bank asset size had a strong effect on bank profitability.

Pasiouras and Kosmidou (2007) found that large-sized European banks were able to benefit from economies of scale to introduce innovative bank products through diversification. However, based on data from 665 commercial banks (1992-1998) that operate in six EU countries, Goddard et al. (2004) noted that as bank size increase, the scale economy benefits tend to diminish. Goddard et al (2013) found that average profitability was higher over 1999-2007 for European banks that are efficient and diversified, but lower for those that are more highly capitalised. Similarly, in a study to establish the determinants of bank profitability in Turkey using a sample of 10 commercial banks over the period, 2002-2010, Alper and Anbar (2012) found that bank asset size has a strong positive effect on financial profitability of banks in the country.

Finally, a recent study Davis et al (2022) found that profitability across a sample of 7,250 global banks in 92 countries over 1990-2018 was influenced by bank size negatively, while the leverage ratio had a negative and significant effect on the ROAE but a positive impact on the ROAA. There was a negative effect from credit risk (measured by non-performing loans/gross loans) while a higher deposit/liabilities ratio (implying less risk of runs due to deposit insurance), raises profitability. The cost/income ratio had a significant and negative relationship to banks' profitability.

2.2.2. External Factors

The findings from most empirical research studies that examined the determinants of bank profitability conclude that macroeconomic factors (i.e., ***GDP growth***, ***inflation***, ***interest-rates***, ***credit-cycle***, and ***exchange-rate***) also have a strong effect on the profitability of commercial banks (Wilson 2012; Lipunga 2014; Fredrick 2015). For example, using a sample dataset of 686 banks (1989-2008) from all conventional banks that operate in Organisation of Islamic Co-operation (OIC) countries and fixed-effects regression analysis, Al-Harbi (2019) identified real GDP growth rate, real interest rates and bank concentration as important external factors that foster the profitability of commercial banks. However, using data from seven commercial banks in Nigeria for the period, 2005-2011, Aminu (2013) found that GDP growth had a negative effect on bank profitability in the country, which was explained by the government's unstable economic policy reforms.

Market concentration factors are considered key external determinants of commercial banks' profitability (Akinkunmi 2017). Using a panel dataset of 106 Nigerian banks over the period, 2001-2015, Akinkunmi (ibid) noted the important role of market concentration in fostering bank profitability in the country. Ameur and Mhiri (2013) as well as Zampara et al (2017) also identified market share and industry growth as key external market factors that influenced the profitability of commercial banks in Greece. The external market factors such as ***market share***, ***market size*** and ***growth*** are considered important in determining the ability of banks to enjoy scale economies and therefore, attain operational cost efficiency (Liu and Wilson 2010). Other measures of market concentration which have been noted to influence bank profitability include the share of ***total assets held by the top tier banks*** and the ***Herfindahl Index*** (Beck, Robert and Afeikhena 2005; Flamini et al. 2009).[4]

Similar studies, which were conducted in developed countries also provide evidence that the same set of external macroeconomic and structural factors influence bank profitability. Petria et al. (2015), which relied on banking data from the EU-27 over the period, 2004-2011 noted that both market concentration and GDP growth had a substantial influence on the ROAA and the ROAE bank profitability. Alper and Anbar (2012) found that only changes in real interest rates had a strong positive effect on bank profitability in Turkey. Davis et al (2022) using global data over 1990-2018 found an alternative competition measure, the Lerner Index, had a positive and significant effect on both ROAA and ROAE. This suggests that banks were able to exploit their greater market power to increase profitability. They also found that GDP growth boosted banks profitability.

In sum, this section of the paper suggests that the efficient structure hypothesis is central in explaining the mechanism through which bank efficiency translates to greater scale economies and profitability. The empirical literature also identifies both bank-specific and macroeconomic factors as well as market concentration as important determinants of bank profitability. In Appendix 1 Table A.1.1, we provide a summary of key findings of the main African studies we have cited, as well as gaps in knowledge that we shall seek to fill. We shall seek to advance on existing work by a comprehensive set of control variables covering bank-specific, banking-market and macroeconomic determinants of bank profitability, by using a much longer and more up to date dataset from 1990-2019, by covering several countries rather than just one and a full range of bank sizes rather than just a few large ones.

3. Methodology

3.1. Empirical Models

This study employs a linear panel OLS regression econometric model to establish the bank-specific, macroeconomic and market structure determinants of bank profitability in the three African countries. The linear panel regression model that was used to estimate the determinants of bank profitability is generally specified where profitability (measured by the return on average assets (ROAA) and return on average equity (ROAE)) is captured as the model's dependent variable while bank-specific, macroeconomic and market concentration factors were incorporated as the model's independent variables (as in Davis, Karim, and Noel 2022), chosen in light of the discussion in Section 2.2 above.

[4] The Herfindahl index is calculated by squaring the market share of each firm competing in a market and then summing the resulting numbers. It can range from close to zero to 10,000.

Profitability = *f* (Bank-specific factors, macroeconomic factors, market factors).

The fact that the study captures profitability in terms of the ROAA and ROAE implies that there are two econometric models, which were estimated. The two econometric models, which are based on the conceptualization from a similar study by Al-Homaidi et al. (2018) are specified as follows:

$$ROAA_{it} = \alpha_0 + \alpha_1 CR_{it} + \alpha_2 AQ_{it} + \alpha_3 CAD_{it} + \alpha_4 LNAS_{it} + \alpha_5 LIQ_{it} + \alpha_6 NIMTI_{it} + \alpha_7 CI_{it} + \alpha_8 MC_{it} + \alpha_9 GDP_{it} + \alpha_{10} INF_{it} + \alpha_{11} INT_{it} + \alpha_{12} EXCH_{it} + \varepsilon_{it} \quad \textbf{(Model1)}$$

$$ROAE_{it} = \alpha_0 + \alpha_1 CR_{it} + \alpha_2 AQ_{it} + \alpha_3 CAD_{it} + \alpha_4 LNAS_{it} + \alpha_5 LIQ_{it} + \alpha_6 NIMTI_{it} + \alpha_7 CI_{it} + \alpha_8 MC_{it} + \alpha_9 GDP_{it} + \alpha_{10} INF_{it} + \alpha_{11} INT_{it} + \alpha_{12} EXCH_{it} + \varepsilon_{it} \quad \textbf{(Model2)}$$

3.2. Definition and Measurement of the Research Variables

Dependent Variables

Return-on-Average-Assets (ROAA): The ROAA is a profitability ratio, which is measured as the proportion(percentage) of total net income to average total assets (Ahamed 2017). ROAA reflects how a bank uses its assets to generate profits. The ROAA is expected to be influenced by internal bank-specific factors, market factors and external macroeconomic factor variables.

Return-on-Average-Equity (ROAE): The ROAE is defined as a profitability measure that captures the percentage of bank net income to average total equity (Abel et al. 2016). ROAE measures the performance of a bank based on its average shareholders' equity, equivalent to the return to shareholders on their equity. As for the ROAA, the expectation is that variation in ROAE would be influenced by bank-specific and market factors and the external macroeconomic variables.

Independent Variables

Credit Risk (CR): Credit risk is a bank-specific factor variable that was measured as a percentage of total loan loss reserves to gross loans. A higher credit risk is projected to negatively affect bank profitability (Kumbirai and Webb 2010).

Asset Quality (AQ): Asset quality (AQ) is an internal bank-specific factor that is measured as a percentage of total loans to total assets. A positive effect of AQ might indicate that loan yields net of losses are more than those of other assets such as liquid assets. (Nalianya and Miroga 2020).

Capital Adequacy Ratio (CAD): The capital adequacy ratio is a measure of the solvency of commercial banks. It is measured as the percentage of total equity to total assets. There is mixed evidence on the effect of capital adequacy ratio on bank profitability (Abel and Roux 2016).

Asset Size (LnAS): The natural logarithm of total assets is usually applied as a proxy for bank asset size (Lawa et al. 2017). It is expected to have a positive effect on profitability whereby economies of scale contribute to bank operational efficiency (Francis, 2013). On the other hand, for large banks, problems in management may which reduce operational efficiency and result in lower profitability (Al-Homaidi et al. 2018).

Liquidity Ratio (LIQ): The liquidity ratio is measured as the ratio of total liquid assets to total bank assets. As a short-term working capital measure with lower returns than loans, liquidity is expected to have a negative effect on bank profitability (Kapaya and Raphael 2016).

Non-Interest-Income to Total-Income (NIMTI): This ratio measures the percentage of non-interest-income to total-income of the banks. NIMTI is expected to positively affect bank profitability (Nessibi 2016).

Cost-to-Income (CI): The cost to income ratio measures the operating efficiency of banks. It is predicted to have a negative effect on bank profitability (Ongore and Kusa, 2013).

Market Concentration (MC): Market concentration measures the percentage of top 3 bank assets to total assets of the banking sector, derived from the World Bank Global Financial Development Database (World Bank 2019). Market concentration is predicted to positively affect bank profitability (Akinkunmi, 2017).

Real Gross Domestic Product Growth (GDP): Annual real GDP growth is used to measure the rate of growth in economic activity (Aminu, 2013) and is expected to be positively related to profitability (Lawa, Zogli and Dlamini 2017).

Inflation Rate (INF): The annual inflation rate (CPI) is measured as the change in general prices of a basket of consumer goods over a one-year period. The inflation rate is predicted to positively influence bank profitability (Al-Homaidi et al. 2018), inter alia as loan rates may be raised during inflation relative to deposit rates.

Interest Rate Spread (INT): The interest rate spread captures the prevailing lending rate that is used by banks offering loans and credit facilities less the deposit rate. The expectation is that interest rate spreads would have a positive effect on bank profitability, by boosting the net interest margin (Nalianya and Miroga 2020).

Real Exchange Rate (EXCH): The real effective exchange rate over a one-year period captures the nominal trade-weighted exchange rate adjusted for relative prices. Variation in real exchange rates is expected to have a positive effect on bank profitability (Al-Harbi, 2019).

Table 3.1 presents a summary of the specific definitions and formula that were used to measure the model's dependent and independent variables.

Table 3.1: Definitions and Measurement of the Dependent and Independent Variables

Dependent Variables	**Acronym**	**Formula**	**Expected Effect**
Return on Average Assets	ROAA	$ROAA_{it} = \frac{Net\ Income_{it}}{Average\ Assets_{it}}$	
Return on Average Equity	ROAE	$ROAE_{it} = \frac{Net\ Income_{it}}{Average\ Equity_{it}}$	
IV: Bank-Specific Variables	**Acronym**	**Formula**	**Expected Effect**
Credit Risk	CR	$CR_{it} = \frac{Total\ Loan\ Loss\ Reserve_{it}}{Gross\ Loans_{it}}$	Negative (-)
Asset Quality	AQ	$AQ_{it} = \frac{Loans_{it}}{Total\ Assets_{it}}$	Positive (+)
Capital Adequacy Ratio	CAD	$CAD_{it} = \frac{Total\ Equity_{it}}{Total\ Assets_{it}}$	$\pm$
Asset Size	LnAS	$LnAS_{it}$ = Ln (Total Assets)	$\pm$
Liquidity Ratio	LIQ	$LIQ_{it} = \frac{Liquid\ Assets_{it}}{Total\ Assets_{it}}$	Negative (-)
Non-Interest Income to Total Income	NIMTI	$NIMTI_{it} = \frac{Non{-}Interest\ Income}{Total\ Income_{it}}$	Positive (+)

Cost to Total Income	CI	$CI_{it} = \frac{Total\ Cost}{Total\ Income_{it}}$	Negative (-)
IV: Market Variables	**Acronym**	**Formula**	**Expected Effect**
Market Concentration	MC	MC_{it} =Share of top 3 banks in banking sector assets	+
IV: Macroeconomic Variables	**Acronym**	**Formula**	**Expected Effect**
Real Gross Domestic Product Growth	GDP	Annual Real GDP Growth	$\pm$
Inflation Rate	INF	Annual Inflation Rate	+
Interest Rate Spread	INT	Lending rate less deposit rate	+
Real Exchange Rate	EXCH	Average Real Exchange Rate (2010=100)	+

4. Data

Bank data derived from financial statements were collected from Fitch-Connect.[5] A panel dataset of 240 commercial banks from the three African countries was collected over the period from 1990 to 2019 (73 banks from Kenya, 101 banks from Nigeria and 66 banks from South Africa). These banks were selected from the retail consumer bank and universal commercial bank categories. Data on real GDP, real exchange rate, real interest rate and inflation rate were collected from World Bank WDI (2020) database and concentration from the World Bank GFDD (2019) database.[6]

4.1. Data Analysis

The data were first winsorised at 1%. The winsorisation increases the accuracy of the statistical analysis because it limits the effect of extreme values (Peck, Olsen and Short 2019). A preliminary statistical analysis using the Hausman test was conducted to establish whether to use random or fixed-effects panel regression analysis. According to Al-Homaidi et al. (2018), the Hausman test is a useful tool in econometrics analysis that facilitates evaluation on the model misspecification tests based on a comparative analysis of two different estimator variables. At a 5% significance-level, a random-effects panel regression model would only be statistically appropriate if the results of the Hausman test indicate that the estimated Chi-square (χ^2) statistics has a significance value (ρ-value > 0.05). A fixed-effects regression model would be run if the estimated Chi-square statistics has a significance value (ρ-value < 0.05).

The two ROAA and ROAE econometric models were estimated using OLS panel regression analysis in Eviews. The panel regression models were estimated by sub-periods (1990-2019, 1990-2009 and 2010-2019), by size of the commercial banks (large and small) and by country of operation (Kenya, Nigeria and South Africa). The main justification for adopting the stated regression model classifications was to ascertain whether the determinants of bank profitability vary by time period, size of the banks and country of operation. Finally we also undertook robustness checks, namely with country dummies instead of bank dummies, and with both bank and time dummies.

4.2. Descriptive Statistics

Table 4.1 shows descriptive statistics for the regression variables. Further detail on the sample and the subsamples are provided in Appendix 2.

[5] The Fitch-Connect is considered as the most authentic and reliable databases for financial information of banks across the globe. The database provides up-to-date information on banks' financial performance for over 30,000 private and public financial institutions, which are spread across the globe.

[6] Date for real exchange rates for Kenya came from Darvas (2021)

Table 4.1 Descriptive statistics for the full sample

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
ROAA	1.906	1.730	11.590	-14.460	3.141	2450
ROAE	15.149	15.590	66.600	-80.896	19.492	2411
CR	8.623	4.245	66.279	0.230	11.373	2532
AQ	0.532	0.532	1.036	0.011	0.215	2749
CAD	16.079	12.720	81.760	-14.734	14.398	2813
LNAS	19.842	19.433	25.380	15.499	2.232	2813
LIQ	30.484	25.780	83.072	0.814	20.860	2809
NIMTI	0.396	0.377	1.034	0.007	0.208	2709
CI	67.720	62.430	261.781	17.963	32.868	2715
MC	61.208	62.638	98.885	22.281	22.341	7200
GDP	3.710	3.307	15.329	-2.035	3.184	7200
INF	13.199	9.378	72.836	1.554	13.002	7200
INT	7.287	7.140	18.360	3.120	3.248	7200
EXCH	101.318	94.652	273.013	49.750	37.172	7200

Note: ROAA is the return on average assets, ROAE is the return on average equity, CR is Credit Risk (loan loss reserves/gross loans), AQ is Asset Quality (loans/total assets), CAD is the Capital Adequacy Ratio (total equity/total assets), LnAS is Asset Size (log of total assets), LIQ is the Liquidity Ratio (liquid assets/total assets), NIMTI is Non-Interest Income to Total Income, CI is the Cost to Total Income ratio, MC is market concentration, GDP is growth in real GDP, INF is annual inflation, INT is the interest rate spread and EXCH the real exchange rate. Variables are winsorised at 99% and in level (not lagged).

It can be seen that the mean level of bank ROAA is 1.9% while the ROAE is 15.2%. This compares to 0.9% and 8.6% in a global sample over a similar period from Davis et al (2022), showing the high profitability that African banks have experienced. African banks hold reserves of 8.6% over gross loans, while loans are 53.2% of total assets and liquidity is 30.5% of assets (most of which is typically in the form of government securities). The average leverage ratio (unadjusted capital adequacy) is 16.1%, higher that the 13.2% found globally in Davis et al (ibid). Non-interest income accounts for an average of 39.6% of total income, much higher than the global average of 20% that Davis et al (2022) found. Correspondingly, the cost to income ratio is 67.7% (Davis et al (ibid) found a global average of 63.7%). Growth and inflation in Africa also exceed global averages.

We now go on to analyse the profitability data in more detail for the subsamples.

Table 4.2: Descriptive Statistics: Mean ROAA and ROAE by country (percent)

Profitability Measure: ROAA	**Kenya**	**Nigeria**	**South Africa**
Mean	1.58	2.60	1.58
Median	1.83	2.54	1.29
Standard Deviation	2.92	3.25	3.18
Profitability Measure: ROAE	**Kenya**	**Nigeria**	**South Africa**
Mean	11.28	20.94	13.93
Median	11.95	20.50	15.48
Standard Deviation	18.21	21.54	17.26

The descriptive results indicate that when compared in terms of the ROAA profitability, Nigerian banks recorded higher profitability performance compared to South African and Kenyan banks. A similar pattern is apparent when the banks are assessed in terms of the ROAE profitability performance, the descriptives indicate that the Nigerian banks again had a better profitability performance compared to South African banks, while Kenyan banks had the lowest ROAE.

The analysis of bank profitability performance indicates that commercial banks in the three African countries had a positive ROAA and ROAE profitability performance, although as shown in Table 4.2, there are some outliers with very low returns in individual years, even allowing for winsorisation. No doubt party due to a different sample, the findings based on the descriptives are slightly different from the outcome based on the study by Obamuyi (2013) who notes that partly due to their low asset base, non-diversified income sources and poor credit risk management, Nigerian banks have recorded unimpressive profitability performance over the past two decades. It also contrasts with the African Development Bank (2020), who suggested that South African banks have continued to record better profitability performance compared to other banks in the sub-Saharan Africa region.

The average ROAA and ROAE by size of the bank is depicted in Table 4.3.

Table 4.3: Descriptive Statistics: Mean ROAA and ROAE by Size of the Bank (percent)

Profitability Measure: ROAA	**Small-Sized Banks**	**Large-Sized Banks**
Mean	1.72	2.07
Median	1.65	1.83
Standard Deviation	3.79	2.42
Profitability Measure: ROAE	**Small-Sized Banks**	**Large-Sized Banks**
Mean	11.98	17.93
Median	11.64	17.85
Standard Deviation	21.88	16.64

The classification of banks by size was undertaken by comparing the total assets of commercial banks that operate in the three African countries. The large-sized banks were classified as those financial institutions with total assets greater than median total asset size (in natural logs) of 19.43 (Table 4.1) while the small-sized banks were categorized as those financial institutions with total assets less than the median.

The large-sized commercial banks in the three African countries reported significantly higher mean returns on average asset compared to the mean return on average assets for small-sized banks. Similarly, in terms of the ROAE, large-sized banks reported significantly higher mean ROAE compared to the small-sized banks. The implication is that large-sized banks outperformed the small-sized banks in terms of both the ROAA and the ROAE profitability performance. These findings are fairly consistent to the insight based on the study by Adusei and Elliot (2015) who noted that large commercial banks in Ghana had better financial performance and stronger financial stability compared to the small banks.

As shown in Appendix 2 Table A.2.6, generally there is a fairly low correlation between ROAA and ROAE and other independent variables with the $r < 0.5$ in virtually all cases, which suggests that there is no multicollinearity and therefore, the results of the panel regression analysis are feasible.

The strongest correlations are between banks' ROAA/ROAE and the cost income ratio, which is 0.4 and 0.5 respectively.

5. Results

The Hausman test (Table 5.1) indicates that the Chi-square statistics in the two panel regression models (ROAA;χ^2 =91.02, ρ< .05) and (ROAE;χ^2 =51.43, ρ< .05) are statistically significant when assessed at the 5% significance level. This means that based on the Hausman test, the analysis rejects the null hypothesis that the random effects panel regression model estimation is appropriate and concludes that fixed-effects panel regression should be used to estimate the determinants of banks' ROAA and ROAE profitability.

Table 5.1: Summary of the Hausman Test

Test Summary	χ^2 Statistics	D.F	ρ-value
Model 1: ROAA Model	91.02	12	0.000
Model 2: ROAE Model	51.43	12	0.000

5.1. Panel Regression Results by Period of Analysis

Table 5.2 presents a summary of the results of the bank fixed-effects regression analysis for the entire period of analysis, 1990-2019 and by sub-periods (1990-2009 and 2010-2019)

Table 5.2: Fixed-Effects Regression Analysis Summary: Period of Analysis

Variables	ROAA Model			ROAE Model		
	1990-2019	1990-2009	2010-2019	1990-2019	1990-2009	2010-2019
Intercept	8.559*** (5.4)	13.604*** (6.4)	-18.071*** (3.3)	61.638*** (5.4)	120.942*** (8.1)	-211.85*** (4.6)
CR	-0.0405*** (6.2)	-0.031*** (4.0)	-0.0277* (1.9)	-0.222*** (4.5)	-0.207*** (3.6)	-0.0605 (0.5)
AQ	-1.32*** (2.6)	-0.968 (1.4)	-0.965 (1.2)	-7.843** (2.1)	-20.542*** (4.0)	6.956 (1.0)
CAD	0.0951*** (14.0)	0.0552*** (6.4)	0.19*** (13.4)	0.0366 (0.7)	-0.254*** (3.2)	1.05*** (8.8)
LNAS	-0.245*** (3.9)	-0.43*** (4.9)	1.037*** (4.1)	-1.517*** (3.4)	-3.364*** (5.4)	11.829*** (5.6)
LIQ	0.0077 (1.6)	0.0204*** (2.8)	-0.00005 (0.1)	0.118*** (3.4)	0.041 (0.8)	0.0267 (0.4)
NIMTI	1.116*** (3.0)	2.002*** (4.2)	0.187 (0.3)	8.618*** (3.1)	7.363** (2.1)	11.138** (2.3)
CI	-0.0508*** (24.1)	-0.075*** (24.8)	-0.0345*** (11.2)	-0.403*** (25.4)	-0.516*** (22.7)	-0.304*** (12.2)
MC	-0.0049* (1.7)	0.001 (0.3)	-0.0088** (2.0)	0.0048 (0.2)	0.0336 (1.3)	-0.081** (2.4)
GDP	0.0197 (1.2)	-0.0124 (0.7)	0.086* (1.9)	0.289** (2.4)	0.187 (1.5)	0.313 (0.9)
INF	0.0107* (1.8)	-0.0005 (0.1)	0.0232 (0.7)	0.192*** (4.6)	0.125*** (3.1)	-0.109 (0.4)
INT	-0.0032 (0.1)	-0.0425 (1.2)	-0.0004 (0.1)	0.0154 (0.1)	-0.165 (0.6)	-0.0677 (0.1)
EXCH	0.007*** (5.7)	0.0062*** (4.9)	-0.0186** (2.3)	0.0506*** (5.8)	0.0484*** (5.5)	-0.222*** (3.5)
Standard Errors	1.845	1.71	1.578	13.03	11.83	12.39
F-statistics	16.23	14.36	17.47	11.716	10.54	9.885
Prob (F-statistics)	0	0	0	0	0	0
Adjusted R^2	0.614	0.658	0.721	0.529	0.581	0.588
Periods	30	20	10	30	20	10
Number of Banks	221	181	129	218	180	124
Observations	2224	1332	892	2187	1313	874

Notes: ROAA is the return on average assets, ROAE is the return on average equity, CR is Credit Risk (loan loss reserves/gross loans), AQ is Asset Quality (loans/total assets), CAD is the Capital Adequacy Ratio (total equity/total assets), LnAS is Asset Size (log of total assets), LIQ is the Liquidity Ratio (liquid assets/total assets), NIMTI is Non-Interest Income to Total Income, CI is the Cost to Total Income ratio, MC is market concentration, GDP is growth in real GDP, INF is annual inflation, INT is the real interest rate and EXCH the current exchange rate. Independent variable coefficient values and t-statistics values (in parenthesis) are reported below each estimated coefficient. Significance ρ*, 10%; ρ**, 5%; ρ***, 1%. All variables were winsorised at 1% and 99%.

The panel regression results for the full sample indicate that credit risk, asset quality, the capital adequacy ratio, asset size, the ratio of non-interest-income to total income and the cost-to-income ratio were the bank-specific factors that had a significant effect on the ROAA measure of bank profitability in the three African countries. Profitability is boosted by a higher level of capital

adequacy, and bigger non-interest share, while it is reduced following increases in credit risk (reserves/loans), asset quality (the loan-asset ratio), asset size and the cost-income ratio. We find that increased concentration has a negative effect on the ROAA. The inflation rate had a significant positive effect on the banks' profitability as did the real exchange rate.

The ROAE estimated model has similar results to ROAA except that liquidity has a significant positive effect and capital adequacy did not have significant effects. GDP growth has a favourable effect on ROAE whereas market concentration is not significant.

The results of the panel regression analysis for the sub-period, 1990-2009 are similar to the baseline for the ROAA except that asset quality, concentration and inflation are not significant while liquidity is significant. In the case of the ROAE, capital ratios are now significant with a negative sign as in Davis et al (2022), and liquidity and GDP growth are not significant. As regards the results for the second subperiod 2010-2019, most results are again similar to the baseline. There is a sign reversal over the earlier period for ROAA in the case of asset size with a positive sign, which is also present for the ROAE. This suggests benefits of size have become more apparent since 2010. Capital adequacy is now positive for both ROAA and ROAE, which may indicate the favorable effect of regulatory tightening since Basel III. Market concentration is significant and negative for both measures. Also the GDP effects are insignificant for ROAE but significant for ROAA and inflation is not significant.

Overall, the results in Table 5.2 indicates that there is considerable stability in the determinants of profitability within the sample. Specifically, in virtually all the estimated fixed-effects regression models, credit risk and the cost to income ratio had a significant negative effect on the ROAA and ROAE. These results match the findings by Akinkunmi (2017) who also found that credit risk and operational costs have a negative effect on bank profitability. The findings also align with the efficient structure hypothesis, which is based on the premise that banks with stronger operational efficiency (lower credit-risk and operational-cost) tend to benefit from increased profitability (Berger 1995). Similarly, in all the estimated regression models, the non-interest share had a significant positive effect on ROAA and ROAE over the analysis periods. These results show the beneficial effect of income diversification for banks.

One contrast within the sample is that the capital adequacy ratio had a significant positive effect on the ROAA and ROAE in 2010-2019, but a negative one for ROAE in 1990-2009 – a similar result was found by Davis et al (2022) with a global sample. Furthermore, the full period suggests that there are diseconomies of scale for large banks in these African countries as in Al-Homaidi et al. (2018) although the positive sign in 2010-19 suggests that these diseconomies of scale may have eased in the most recent period.

5.2. Panel Regression Results by Size of the Bank

The results of the fixed-effects panel regression analysis in terms of bank size are presented in Table 5.3. As a memo item we also show the full sample results from Table 5.2.

Table 5.3: Fixed-Effects Regression Analysis Summary: Size of Banks

Variables	ROAA Model		ROAE Model		Memo: full sample	
	Small Banks	Large Banks	Small Banks	Large Banks	ROAA	ROAE
Intercept	-11.46*** (2.9)	13.216*** (6.6)	-71.44*** (2.7)	105.16*** (6.6)	8.559*** (5.4)	61.638*** (5.4)
CR	-0.0116 (1.0)	-0.0704*** (8.7)	-0.0584 (0.7)	-0.506*** (7.5)	-0.0405*** (6.2)	-0.222*** (4.5)
AQ	0.239 (0.2)	-1.654*** (3.1)	-4.534 (0.7)	0.997 (0.2)	-1.32*** (2.6)	-7.843** (2.1)
CAD	0.111*** (9.7)	0.108*** (11.3)	0.336*** (4.2)	-0.168** (2.0)	0.0951*** (14.0)	0.0366 (0.7)
LNAS	0.764*** (4.1)	-0.478*** (6.2)	5.258*** (4.2)	-3.534*** (5.8)	-0.245*** (3.9)	-1.517*** (3.4)
LIQ	0.0285*** (2.9)	0.00362 (0.7)	0.205*** (3.1)	0.149*** (3.7)	0.0077 (1.6)	0.118*** (3.4)
NIMTI	1.076* (1.9)	1.458*** (3.0)	8.053* (1.9)	13.051*** (3.4)	1.116*** (3.0)	8.618*** (3.1)
CI	-0.0538*** (16.1)	-0.0489*** (16.1)	-0.381*** (16.6)	-0.515*** (19.2)	-0.0508*** (24.1)	-0.403*** (25.4)
MC	-0.0077 (1.3)	-0.00278 (0.9)	-0.0542 (1.4)	0.0428* (1.9)	-0.0049* (1.7)	0.0048 (0.2)
GDP	-0.0617** (2.2)	0.0467** (2.3)	-0.149 (0.8)	0.329** (2.1)	0.0197 (1.2)	0.289** (2.4)
INF	0.00316 (0.3)	0.169** (2.2)	0.135** (2.2)	0.222*** (3.7)	0.0107* (1.8)	0.192*** (4.6)
INT	0.0277 (0.6)	0.0918*** (2.8)	0.376 (1.1)	0.536** (2.1)	-0.0032 (0.1)	0.0154 (0.1)
EXCH	0.0028 (1.3)	0.00694*** (4.8)	0.00411 (0.3)	0.0636*** (5.7)	0.007*** (5.7)	0.0506*** (5.8)
Standard Errors	2.077	1.471	13.624	11.277	1.845	13.03
F-statistics	11.93	15.84	8.809	11.631	16.23	11.716
Prob (F-statistic)	0	0	0	0	0	0
Adjusted R^2	0.66	0.612	0.58	0.534	0.614	0.529
Periods	30	30	30	30	30	30
Number of Banks	168	118	164	118	221	218
Observations	1010	1214	989	1198	2224	2187

Notes: ROAA is the return on average assets, ROAE is the return on average equity, CR is Credit Risk (loan loss reserves/gross loans), AQ is Asset Quality (loans/total assets), CAD is the Capital Adequacy Ratio (total equity/total assets), LnAS is Asset Size (log of total assets), LIQ is the Liquidity Ratio (liquid assets/total assets), NIMTI is Non-Interest Income to Total Income, CI is the Cost to Total Income ratio, MC is market concentration, GDP is growth in real GDP, INF is annual inflation, INT is the real interest rate and EXCH the current exchange rate. Independent variable coefficient values and t-statistics values (in parenthesis) are reported below each estimated coefficient. Significance ρ*, 10%; ρ**, 5%; ρ***, 1%. All variables were winsorised at 1% and 99%.

As a starting point it is worth noting from Table 4.3 that profitability of large banks is on average higher than for small banks, suggesting more scope for improvement in the latter group. One underlying factor (Appendix 2 Tables A.2.1 and A.2.2) may be the higher cost-income ratio for smaller banks (73% compared with 62%). Most other bank-specific aspects are broadly comparable, for example non-interest income is 39% for the small banks and 40% for the large ones.

In Table 5.3, we find a number of results that are similar for both small and large banks, and for the full sample. These include the negative effect of the cost-income ratio on both measures of profitability and the positive effect of non-interest income. The cost to income ratio result is consistent with the findings by Nalianya and Miroga (2020). The non-interest effect suggests all banks record better ROAA and ROAE profitability performance by diversifying their income to other non-interest income sources such as mobile banking and internet banking (Akinkunmi 2017). Capital adequacy is positive for the ROAA for both subsamples and for the ROAE for small banks but negative for the ROAE for large banks. Liquidity is positive and significant for all the samples except for ROAA for large banks. Meanwhile credit risk and asset quality are only significant profit determinants for large banks. The outcome for credit risk in large banks is consistent with the findings by Akinkunmi (2017) who noted that a higher credit risk has a negative effect on bank profitability.

As regards the external effects, we find that GDP growth has a positive effect for large banks but negative for small banks' ROAA. Inflation is positive in all cases except for small banks ROAA. Large banks benefit from a wider in a wider interest rate spread and higher real exchange rate which is not the case for small banks. Concentration is only significant and positive for the ROAE for large banks.

There is one factor where results differ markedly between small and large banks, which is asset size. There is a pattern of positive effects for small banks and negative for large ones. This suggests that whereas for the small banks there is a benefit to growth in size for profitability, for the large-sized banks, investment in additional capacity tends to have a negative effect on bank profitability performance. The relationship suggests that economies of scale are only effective up to a certain limit, which suits the performance of small-sized banks compared to the large-sized commercial banks, and may imply there is an optimal size of banks in Africa.

We note also that small bank profitability is driven more by internal factors than large banks in that the latter is strongly influenced by GDP growth, inflation, interest rate spreads and the real exchange rate. Large banks may be more geared to the economy as a whole than small ones as well as being more active in wholesale markets such as foreign exchange.

5.3. Panel Regression Results by Country of Operation

Table 5.4 summarises the results of the fixed-effects panel regression results by country of operation (Kenya, Nigeria and South Africa).

Table 5.4: Fixed-Effects Regression Analysis Summary: Country of Operation

Variables	ROAA Model			ROAE Model		
	Kenya	Nigeria	South Africa	Kenya	Nigeria	South Africa
Intercept	-9.606*** (3.1)	10.474*** (3.9)	12.57** (2.6)	-77.847*** (4.0)	74.077*** (3.7)	79.168** (2.2)
CR	-0.029** (2.8)	-0.346*** (3.4)	-0.143*** (7.2)	-0.103 (1.5)	-0.361*** (4.6)	-0.359** (2.1)
AQ	-1.194 (1.5)	-0.609 (0.6)	-0.011 (0.1)	-3.276 (0.6)	-0.301 (0.1)	1.952 (0.3)
CAD	0.136*** (13.7)	0.0405*** (3.1)	0.121*** (8.2)	0.543*** (8.2)	-0.38*** (3.6)	-0.022 (0.2)
LNAS	0.646*** (4.3)	-0.324*** (3.1)	-0.546*** (3.2)	6.125*** (6.4)	-1.816** (2.3)	-2.777** (2.2)
LIQ	0.0166** (2.2)	0.0163* (1.8)	0.0144* (1.6)	0.155*** (3.2)	0.259*** (3.8)	0.021 (0.3)
NIMTI	-0.199 (0.3)	1.445** (2.2)	0.964 (1.5)	-12.349*** (3.2)	9.737** (2.0)	13.5** (2.4)
CI	-0.043*** (15.2)	-0.0628*** (15.1)	-0.037*** (7.4)	-0.275*** (15.5)	-0.575*** (16.4)	-0.357*** (9.0)
MC	-0.014** (2.1)	0.002 (0.5)	0.0154 (1.5)	-0.098** (2.3)	0.064** (2.3)	0.101 (1.3)
GDP	0.0931** (2.2)	-0.0366 (1.6)	0.160*** (3.3)	0.742** (2.7)	-0.122 (0.7)	1.205*** (3.4)
INF	0.0183 (1.1)	-0.00117 (0.2)	0.068 (1.5)	0.196* (1.9)	0.103** (2.0)	0.728** (2.1)
INT	0.0878 (1.6)	0.17*** (3.1)	-0.2 (1.0)	0.283 (0.8)	0.855** (2.1)	-2.142 (1.4)
EXCH	-0.0067 (0.8)	0.00417*** (2.8)	-0.0007 (0.1)	-0.183*** (3.3)	0.0418*** (3.8)	0.0478 (0.9)
Standard Error	1.649	1.963	1.682	10.323	14.211	12.551
F-statistics	20.590	11.76	18.429	19.87	10.003	7.096
Prob. (F-statistic)	0	0	0	0	0	0
Adjusted R^2	0.657	0.61	0.638	0.651	0.569	0.378
Periods	27	30	28	27	30	28
Number of Banks	70	95	56	70	94	54
Observations	829	732	663	820	715	652

Notes: ROAA is the return on average assets, ROAE is the return on average equity, CR is Credit Risk (loan loss reserves/gross loans), AQ is Asset Quality (loans/total assets), CAD is the Capital Adequacy Ratio (total equity/total assets), LnAS is Asset Size (log of total assets), LIQ is the Liquidity Ratio (liquid assets/total assets), NIMTI is Non-Interest Income to Total Income, CI is the Cost to Total Income ratio, MC is market concentration, GDP is growth in real GDP, INF is annual inflation, INT is the interest rate spread and EXCH the real exchange rate. Independent variable coefficient values and t-statistics values (in parenthesis) are reported below each estimated coefficient. Significance ρ*, 10%; ρ**, 5%; ρ***, 1%. All variables were winsorised at 1% and 99%.

There are some major underlying differences in bank-specific factors for the banks in the three different countries. As shown in Section 4.6 above, Kenyan banks have lower profitability by both measures, followed by South African banks while Nigerian banks have the highest ROAA and

ROAE. As shown in Appendix 2 Table A.2.3-A.2.5, credit risk is higher and the loan-assets ratio lower in Nigeria than in the other two countries, that are more comparable. Kenyan banks have the highest capital adequacy while South African banks have lower liquidity than in the other countries. Non-interest income is highest in Nigeria and lowest in Kenya, while the ordering of cost-income ratios is also highest in Nigeria – in contrast to the better profitability performance.

Comparing across the three countries, there are several major similarities in results, notably the negative effect of the cost-income ratio and credit risk on profitability, positive effects of liquidity and the fact that capital adequacy boosts the ROAA and is insignificant or reduces the ROAE (except for Kenya where the ROAE effect is positive). Asset quality is not significant in any case. Other effects are more diverse. Asset size is positive for Kenya but negative for Nigeria and South Africa. Non-interest income boosts profitability except for the ROAE in Kenya.

There are also some diverse results for the external effects. Higher growth and inflation tend to boost profitability in South Africa and Kenya but GDP growth is insignificant in Nigeria. Inflation boosts the ROAE in all three countries but is not significant for the ROAA. As regards the exchange rate, there is a negative effect in Kenya and positive in Nigeria. Finally, market concentration boosts the ROAE in Nigeria but reduces both measures in Kenya.

The differences across countries are likely to reflect factors such as income levels, market structure and regulation as well as differing macroeconomic developments. For example, the differences in the effect of bank asset size on profitability across the three African countries could be attributed to the fact that Kenya might have different bank regulations compared to those that apply in Nigeria and South Africa. It may also be at an earlier stage in financial development.

5.4. Robustness Checks

We undertook two robustness checks to test the stability of the estimated baseline fixed effects regression model. The first robustness check was assessed with country fixed effects only. The second robustness check was undertaken with bank fixed effects and time fixed affects. As pointed out by Meuleman and Vander Vennet (2020), the subsamples and variants depicted above also provide tests of the robustness of our approach. In general, the results were robust to inclusion of country-specific, bank-specific and time fixed effects, as shown in Appendix 3.

6. Discussion of Results

The results show that liquidity, capital adequacy and the ratio of non-interest income to total income generally had a significant positive effect on bank profitability. Credit risk, asset quality, asset size and the cost to income ratio had a significant negative effect on the ROAA and ROAE in most of the estimated fixed-effects regression models. In most cases, real GDP growth had a significant positive effect on bank profitability while interest rate spreads are negative. The subsample variants and robustness check indicate that the baseline ROAA and the ROAE models are stable across countries, banks and over time and when the fixed effects are varied from bank fixed effects only. The main exceptions are changes in the size coefficients.

This section interprets the findings in terms of the extent to which they generate concrete solution to the main hypothesis. The section also interprets the findings in terms of the extent to which the results are consistent with similar prior studies. The implication of the study for practice by

managers and regulators, recommendations, suggestions for future research, and conclusion are presented in the following Section 7. As background, we provide in Table 6.1 a summary of the main results of the paper.

Table 6.1 Summary of regression results

	1990-2019		1990-2009		2010-19		Small		Large		Kenya		Nigeria		South Africa	
	ROAA	ROAE	ROAA	ROAE	ROAA	ROAE	ROAA	ROAE	ROAA	ROAE	ROAA	ROAE	ROAA	ROAE	ROAA	ROAE
CR	-***	-***	-***	-***	-*				-***	-***	-**		-***	-***	-***	-**
AQ	-***	-**		-***					-***							
CAD	+***		+***	-***	+***	+***	+***	+***	+***	-**	+***	+***	+**	-***	+***	
LNAS	-***	-***	-***	-***	+***	+***	+***	+***	-***	-***	+***	+***	-***	-**	-***	-**
LIQ		+***	+***				+***	+***		+***	+**	+***	+*	+***	+*	
NIMTI	+***	+***	+***	+**		+**	+*	+*	+***	+***		-***	+**	+**		+**
CI	-***	-***	-***	-***	-***	-***	-***	-***	-***	-***	-***	-***	-***	-***	-***	-***
MC	-*				-**	-**				+*	-**	-**		+**		
GDP		+**			+*		-**		+**	+**	+**	+**			+***	+***
INF	+*	+***		+***				+**	+**	+***		+*		+**		+**
INT									+***	+**			+***	+**		
EXCH	+***	+***	+***	+***	-**	-***			+***	+***		-***	+***	+***		

Notes: ROAA is the return on average assets, ROAE is the return on average equity, CR is Credit Risk (loan loss reserves/gross loans), AQ is Asset Quality (loans/total assets), CAD is the Capital Adequacy Ratio (total equity/total assets), LnAS is Asset Size (log of total assets), LIQ is the Liquidity Ratio (liquid assets/total assets), NIMTI is Non-Interest Income to Total Income, CI is the Cost to Total Income ratio, MC is market concentration, GDP is growth in real GDP, INF is annual inflation, INT is the interest rate spread and EXCH the real exchange rate.

The findings from the econometric analysis indicate that one internal bank-specific determinant which had a strong positive effect on bank profitability in the three African countries was the non-interest-income to total-income ratio (nimti). The results indicate that banks are likely to profit from diversification of their income sources besides the interest income. Commercial banks need to acknowledge the importance of other non-interest income sources such as bank fees and commission from the mobile banking platform, which can be effectively exploited by all banks. This is in line with Flamini et al (2009) whose results highlighted the importance of non-interest income.

The importance of asset size (lnas) for bank profitability was highlighted in the ROAA and the ROAE models for small-sized banks where its effect was significantly large and positive. The implication is that small-sized financial institutions are likely to benefit from expanding their economies of scale in operations. However, for large banks, investment in assets beyond the optimal level was associated with diseconomies of scale, which had an adverse effect on bank profitability and this carries across to the full sample. These results are not consistent with the findings from a similar study conducted by Francis (2013) who noted that based on a sample of commercial banks from the sub-Saharan Africa region that asset size had a significant positive effect on bank profitability across the size range, but are in line with Al-Homaidi et al (2018).

We note that liquidity ratios (LIQ) are often positive and significant as a determinant of profitability. This is contrary to usual expectations, whereby as a short-term working capital measure with lower returns than loans, liquidity is expected to have a negative effect on bank profitability (Kapaya and Raphael 2016). It is likely to reflect the high returns on government debt that comprise a large proportion of liquidity in African countries,

Consistent with the outcome from previous studies, the findings in this research project also confirm the negative effect of credit risk (CR) and the cost-to-income ratio (CI) on bank profitability. The findings indicate that operational efficiency and effective credit risk management are important strategic options for banks, which can enhance their financial profitability. These results match the insight based on the study by Akinkunmi (2017) who observes that from a sample of Nigerian banks (2001-2015), credit risk is likely to have a negative effect on bank profitability. Akinkunmi (2017) also notes that effective credit risk management has a considerable influence in enhancing the quality of bank assets. Ongoreb and Kusa (2013) highlight the role of the cost-income ratio.

In several of the samples, market concentration (MC) had a significant negative effect on bank profitability. The implication is that in contrast to previous findings by Akinkunmi (2017) and Zampara et al. (2017), banks in sectors with strong market concentration tend to experience low profitability. In contrast, the large banks and Nigerian ROAE fixed-effects regression models showed that market concentration factor had a significant positive effect on bank profitability when assessed at the 10% significance level. These findings match the prior outcome based on the study by Akinkunmi (2017) who found that market share had a significant positive effect on bank profitability. Similarly, Zampara et al. (2017) also identified that banks with a strong market share tend to outperform financial institutions with low market share.

The external macroeconomic factors have a significant effect on bank profitability, underlining the role of external factors in maintaining financial sector stability (Demirguc-Kunt and Huizinga 2000, Aburime and Uche, 2008). In many of our estimates, variation in real GDP growth (GDP), inflation (INF), interest rate spreads (INT) and the real exchange rate (EXCH) had a positive effect on bank profitability. The positive effect of real GDP on bank profitability is consistent with the previous findings by Al-Harbi (2019) who acknowledged the important role of real GDP growth on bank profitability in OIC countries. In contrast, Aminu (2013) contradicts the outcome of this study because he found that real GDP had a significant negative effect on bank profitability. The positive effect of interest rate spread variation on bank profitability is in line with the previous findings by Rossouw (2011) as well as Olson and Zoubi (2011) who note that banks tend to raise their interest on loans during periods when real interest rates have risen.

Furthermore, in contrast to the findings in this study with a positive inflation effect in a number of the samples, Francis (2013) noted that inflation had a negative effect on bank profitability in Nigeria. Nalianya and Miroga (2020) also contrast the findings in this study by observing that inflation rate has a substantial negative effect on bank profitability in Kenya.

The findings that fluctuation in real exchange rates have a strong positive effect on bank profitability are consistent are consistent with Akinkunmi (2017) who observed that currency depreciation tend to decrease profits of financial institutions engaged in foreign currency trading. On the other hand, there may be risks in that IMF (2019) noted the sizeable exposure of Nigerian banks to the exchange rate for example, where relatively banks have limited short-term net FX liquidity position and lending to borrowers with incomplete currency hedges.

7. Conclusions

We have found that bank-specific factors and external macroeconomic factors are important predictors of bank profitability in the three African countries, namely Kenya, Nigeria and South Africa. Specifically, asset size, credit risk, non-interest-income to total-income and the cost to income ratio are the main predictors of bank profitability in the three African countries. Liquidity and asset quality are also significant in a number of samples. External macroeconomic factors also

have an important role in enhancing bank profitability in the three African countries, especially for large banks. Finally, market concentration was found to generally have a negative effect on bank profitability except for the ROAE in Nigeria.

The findings in this study have important implications for commercial banks and the central bank policies to enhance the stability of the financial sector. Firstly, the strong positive effect of asset size on small bank profitability implies that small commercial banks in the three African countries need to invest in productive asset resources to strengthen their profitability, which suggests that more mergers might be required to enhance bank profitability performance and maintain stability of the financial sector. Petria et al. (2015) suggests that growth through merger and acquisition is an important factor that not only enhances banks' profitability but also maintains their financial stability. On the other hand the negative results for asset size in the case of large banks suggests that there is an optimal size of banks beyond which diseconomies of scale prevail.

Secondly, the results in this study also imply that banks need to put in place effective credit risk management strategies to lower credit risk, improve asset quality and therefore enhance profitability performance (Chirwa, 2003).

Thirdly, banks also need to place considerable focus on their operational efficiency and consider expanding their income sources to other non-interest income, which were found to have a strong positive effect on profitability of banks. This could include further development of mobile banking.

Finally, the results also imply that central banks and governments in African countries need to put in place appropriate monetary and fiscal policies to ensure that macroeconomic factors such as real GDP, inflation, interest rates and exchange rates have a favourable impact on bank profitability (Dhouibi 2016).

The findings in this study also highlight the effect of a number of issues that African banks have faced over the past three decades. Firstly, the significant effect of credit risk on bank profitability for financial institutions that operate in the three countries highlight the issues associated with low financial penetration in the SSA region. The study by Nyantakyi and Sy (2015) as well as Nessibi (2016) report that less than 25% of the sub-Saharan population has a formal bank account. The low financial inclusion, especially among the low-income communities indicate that few individuals can qualify for credit facilities while those who access such loans tend to default leading to low asset quality held by banks.

A second issue pertains to inadequate central bank supervision and/or the over-regulation of the banking sector (Kumbirai and Webb 2010). For instance, African banks in some countries have been subjected to very high capital reserve requirements by their regulatory authorities (Nyantakyi and Sy 2015), which tends to limit their interest earning potential and therefore, resulting in low ROAE profitability, which was noted in this study. Thirdly, as noted based on the insight from the study by Nyantakyi and Sy (2015), a number of the Basel III regulations such as the capital adequacy and liquidity requirements do not yet apply for African banks. For instance, while most countries in Europe implemented Basel III in 2014, only Mauritius and South Africa have implemented Basel II and are currently considering the adoption of Basel III regulations. Failure to do so may enhance risks, not least since it is only with Basel III that liquidity requirements are mandated, and also capital requirements increased. Other external factors such as macroeconomic and political instability have also been noted as major issues faced by African banks, consistent with the negative effect of real exchange rate on the ROAA and ROAE as found in this study (Sufian and Habibullah 2009; Kanwal and Nadeem 2013).

Therefore, based on the stated issues, there is need for the African governments to create conducive environments to promote financial inclusion, especially among the low-income communities (Nyantakyi and Sy 2015). In addition, monetary authorities should also engage in effective supervision and minimise the adoption of unfavorable banking regulations such as the use of excessive reserve requirements (Beck et al. 2005). It may be desirable to reduce exposures of banks to the public sector as in Kenya where holdings of government securities are 30 percent of assets (IMF 2021b) not least to reduce crowding out of private sector loans. Furthermore, to ensure that African banks are stable and able to participate effectively in the international financial markets, then BCBS should also review the relevance of the current Basel III regulations to African banks. Finally, central banks and governments in African countries can enhance stability for African banks by adopting appropriate macroprudential regulations to maintain macroeconomic stability (Ozili 2017).

High levels of liquidity and the result that liquidity has a frequently positive effect on profitability may reflect the high dependence of African banks on government debt as an asset - banks lend considerably to their respective governments. This situation leads to constrained bank liquidity that could affect the credit and liquidity risks of financial institutions in the region (Nyantakyi & Syi 2015). It also crowds out lending to private firms and individuals. This may give rise to risks of adverse spirals if fiscal policy is too loose, as in the European debt crises of 2010-15.

The primary shortcoming of this study is that it examines the determinants of bank profitability in only three African countries. Therefore, future research should examine the determinants of bank profitability using a wider range of countries from Africa. Secondly, this study computed the market concentration factor based on the proportion of top 3 bank assets to total industry assets, which might not provide an accurate measure of bank competition. A suggestion for future study is to consider using the Lerner Index, which is a better measure of bank competition and market power (Flamini et al. 2009, Davis et al 2022). A quadratic in terms of bank size and non-interest income could be used to test whether an optimal size of African banks can be found. Furthermore, future research should also examine and compare the determinants of bank profitability in African retail banks versus universal banks. It could use the risk-adjusted measure of capital adequacy rather than the leverage ratio. Finally, there is evidence that business model of the banks has considerable effect on bank profitability. Mergaerts and Vander Vennet (2016) note that retail-oriented banks and those that rely on a diversified business model tend to report greater profitability. Therefore, future studies should consider how the business model influences the bank profitability in Africa.

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Appendix 1: Literature summary

Table A.1.1: Summary of the Empirical Literature for African Banks

Author	Findings	Knowledge Gaps
1. Tarus, Chekol and Mutwol (2012)	The study relies on data from 44 Kenyan banks for the period, 2000-2009 and fixed-effects regression to establish the determinants of bank profitability in Kenya. It finds that operating expenses and credit risk are the main internal bank-specific determinants of profitability. However, inflation had a negative effect on bank profitability in Kenya.	The study fails to capture the effect of business model and bank concentration on profitability and the dataset ends in 2009.
2. Aminu (2013)	On the basis of a regression analysis using a sample of seven Nigerian banks, Aminu (2013) found that only management efficiency was a significant internal bank-specific determinant of bank profitability in the country. However, the GDP growth rate negatively affected bank profitability.	The study fails to incorporate the effect of market structure on bank profitability. The data periods was short (2005-11) and only large banks were assessed.
3. Francis (2013)	The study, which relied on a panel data of 216 banks from 42 SSA countries, found that internal bank-specific factors (capital adequacy, asset size and liquidity) as well as macroeconomic factors significantly influenced bank profitability in the region.	Does not consider how market structure and bank concentration would affect the profitability of commercial banks, and also does not include non-interest income ratio. The dataset concludes in 2006.
4. Ongore and Kusa (2013)	This study finds that with the exception of liquidity, all bank-specific factors had a significant effect on bank profitability in Kenya. However, the effect of macroeconomic variables on bank profitability was inconclusive.	The study fails to capture the effect of market factors and business model on bank profitability in Kenya.
5. Osuagwu (2014)	The study relies on a panel dataset that covers 60% of banks in Nigeria and finds that credit risk and market concentration factors were the main determinants of profitability performance in Nigeria.	The study fails to assess the role of business model and the external macroeconomic factors on bank profitability. The dataset concludes in 2010.
6. Zouari-Ghorbel (2014)	Using a panel dataset of 16 Tunisian banks over the period, 2003-2012, this study only shows the effect of the external macroeconomic factors (GDP,	The study fails to capture the effect of internal bank-specific factors and business model on profitability of banks in Tunisia.

	inflation, and interest rates) on bank profitability.	
7. Akinkunmi (2017)	The study finds that long-run profitability of commercial banks in Nigeria is mostly influenced by the capital adequacy ratio and credit risk management efficiency.	The study fails to incorporate the effect of external factors such as market concentration and macroeconomic factors on bank profitability.
8. Issn, Ebenezer, Ahmad & Bin (2017)	The findings from the study indicate that capital adequacy and liquidity ratio have a significant positive effect on Nigerian bank profitability while bank operational efficiency had a significant negative effect on bank profitability.	There is a gap on how market concentration factors and the nature of the business model would affect bank profitability.
9. Nalianya and Miroga (2020)	The study relies on the qualitative insight from 244 bank staff in Kenya to analyse the determinants of bank profitability. Only leverage, capital adequacy, liquidity, and operational expenses were identified as having a significant effect on bank profitability in Kenya.	The study fails to incorporate and assess the effect of external factors (macroeconomic variables and market concentration factors) on bank profitability.
10 Flamini et al (2009)	Using a sample of 389 banks from 41 Sub-Saharan-African countries for the period 1998-2006, profitability is mostly affected by credit risk, operating efficiency and bank size as well as non-interest income. Fluctuation in external macroeconomic factors, such as economic growth, inflation, interest rates, and exchange rates also have a significant influence.	There is a gap on how market concentration factors and the nature of the business model would affect bank profitability. The dataset finishes in 2006.
11 Lawa, Zogli and Dlamini (2017)	Using data from the “big four” banks (N = 4 banks) in South Africa (1995-2013), this empirical research study found non-performing loans, capital adequacy, and GDP market price are the main determinants of bank performance in South Africa	There is a gap in the sample which excludes smaller banks in South Africa.
12 Nessibi (2016)	Over 1990–2008 the more profitable of 10 Tunisian banks are those with higher amount of capital and lower operating costs. Private banks tend to perform better than state owned ones. The real interest rate has a positive effect on bank profitability.	Study ends in 2008 and only the top 10 banks are covered.

Appendix 2: Data for subsets and for correlations

Table A.2.1: Descriptive statistics for small banks

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
ROAA	1.719	1.650	11.590	-14.460	3.791	1149
ROAE	11.982	11.640	66.600	-80.896	21.880	1127
CR	10.234	5.725	66.279	0.230	12.760	1212
AQ	0.530	0.532	1.036	0.011	0.208	1356
CAD	18.937	14.300	81.760	-14.734	16.613	1405
LNAS	18.093	18.242	19.429	15.499	0.907	1405
LIQ	35.099	33.575	83.072	0.814	20.777	1404
NIMTI	0.392	0.343	1.034	0.007	0.238	1334
CI	73.919	66.310	261.781	17.963	39.283	1337
MC	59.266	57.288	98.885	22.281	20.390	1405
GDP	3.949	3.780	15.329	-2.035	3.160	1405
INF	11.402	8.864	72.836	1.554	10.834	1405
INT	8.493	8.140	18.360	3.120	3.611	1405
EXCH	99.820	85.159	273.013	49.750	40.626	1405

Note: ROAA is the return on average assets, ROAE is the return on average equity, CR is Credit Risk (loan loss reserves/gross loans), AQ is Asset Quality (loans/total assets), CAD is the Capital Adequacy Ratio (total equity/total assets), LnAS is Asset Size (log of total assets), LIQ is the Liquidity Ratio (liquid assets/total assets), NIMTI is Non-Interest Income to Total Income, CI is the Cost to Total Income ratio, MC is market concentration, GDP is growth in real GDP, INF is annual inflation, INT is the interest rate spread and EXCH the current real exchange rate. Variables are winsorised at 99% and in level (not lagged).

Table A.2.2: Descriptive statistics for large banks

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
ROAA	2.071	1.830	11.590	-14.460	2.417	1301
ROAE	17.929	17.850	66.600	-80.896	16.643	1284
CR	7.143	3.340	66.279	0.230	9.701	1320
AQ	0.534	0.532	1.036	0.011	0.221	1393
CAD	13.228	10.985	81.760	-14.734	11.072	1408
LNAS	21.588	21.178	25.380	19.432	1.742	1408
LIQ	25.873	18.890	83.072	0.814	19.909	1405
NIMTI	0.401	0.396	1.034	0.007	0.175	1375
CI	61.705	58.710	261.781	17.963	23.631	1378
MC	65.698	75.590	98.885	22.281	22.832	1408
GDP	3.982	4.200	15.329	-2.035	2.816	1408
INF	9.783	8.062	72.836	1.554	8.219	1408
INT	6.309	6.030	18.360	3.120	2.630	1408
EXCH	107.082	100.000	273.013	49.750	35.182	1408

Notes: See Table A.2.1

Table A.2.3: Descriptive statistics for Kenyan banks

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
ROAA	1.584	1.830	11.590	-14.460	2.920	922
ROAE	11.275	11.950	66.600	-80.896	18.212	913
CR	6.959	4.130	66.279	0.230	8.513	929
AQ	0.579	0.581	1.036	0.011	0.152	1020
CAD	16.940	14.615	81.760	-14.734	11.662	1040
LNAS	18.869	18.694	22.619	15.499	1.554	1040
LIQ	26.646	24.220	81.940	0.814	16.687	1039
NIMTI	0.325	0.305	1.034	0.007	0.161	982
CI	67.912	61.940	261.781	17.963	34.982	978
MC	54.154	54.470	71.164	33.481	9.710	2160
GDP	3.886	4.299	8.406	-0.799	2.330	2160
INF	11.804	9.306	45.979	1.554	9.397	2160
INT	10.042	9.130	18.360	4.500	3.578	2160
EXCH	94.046	85.942	149.768	55.330	24.657	2160

Notes: See Table A.2.1

Table A.2.4: Descriptive statistics for Nigerian banks

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
ROAA	2.599	2.540	11.590	-14.460	3.248	783
ROAE	20.943	20.500	66.600	-80.896	21.546	765
CR	13.987	8.810	66.279	0.230	14.435	865
AQ	0.388	0.383	1.036	0.011	0.159	904
CAD	15.082	12.430	81.760	-14.734	13.118	930
LNAS	19.918	19.623	23.916	15.499	1.849	930
LIQ	43.336	47.215	83.072	0.814	20.689	930
NIMTI	0.449	0.429	1.034	0.007	0.198	897
CI	68.784	63.000	261.781	17.963	32.291	911
MC	50.544	39.101	91.616	22.281	23.182	3060
GDP	4.546	4.824	15.329	-2.035	3.920	3060
INF	18.258	12.386	72.836	5.388	16.613	3060
INT	7.524	7.405	11.060	3.270	1.649	3060
EXCH	107.771	99.783	273.013	49.750	50.147	3060

Notes: See Table A.2.1

Table A.2.5: Descriptive statistics for South African banks

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
ROAA	1.576	1.290	11.590	-14.460	3.177	745
ROAE	13.928	15.480	66.600	-80.896	17.257	733
CR	4.429	2.250	66.279	0.230	7.332	738
AQ	0.631	0.698	1.036	0.011	0.250	825
CAD	16.118	8.230	81.760	-14.734	18.237	843
LNAS	20.959	20.105	25.380	15.499	2.732	843
LIQ	21.003	15.055	83.072	0.814	18.618	840
NIMTI	0.425	0.407	1.034	0.007	0.243	830
CI	66.320	62.270	261.781	17.963	30.842	826
MC	85.384	82.030	98.885	75.147	8.194	1980
GDP	2.226	2.543	5.604	-2.035	1.972	1980
INF	6.903	5.956	15.335	1.554	3.273	1980
INT	3.915	3.740	5.260	3.120	0.686	1980
EXCH	99.278	98.594	134.098	70.428	18.699	1980

Notes: See Table A.2.1

Table A.2.6: Correlation matrix

	ROAA	ROAE	CR	AQ	CAD	LNAS	LIQ	NIMTI	CI	MC	GDP	INF	INT	EXCH
ROAA	1.00	0.81	-0.14	-0.17	0.23	-0.01	0.18	0.07	-0.58	-0.10	0.06	0.09	0.04	0.02
ROAE	0.81	1.00	-0.11	-0.16	-0.08	0.15	0.24	0.07	-0.58	-0.06	0.04	0.16	0.01	0.06
CR	-0.14	-0.11	1.00	-0.14	0.10	-0.21	0.32	0.13	0.21	-0.16	0.04	0.30	0.13	0.06
AQ	-0.17	-0.16	-0.14	1.00	-0.04	0.08	-0.67	-0.28	-0.03	0.25	-0.12	-0.27	-0.13	-0.05
CAD	0.23	-0.08	0.10	-0.04	1.00	-0.34	-0.06	-0.05	-0.04	-0.02	0.00	-0.05	0.05	-0.04
LNAS	-0.01	0.15	-0.21	0.08	-0.34	1.00	-0.29	0.15	-0.17	0.25	-0.06	-0.12	-0.46	0.05
LIQ	0.18	0.24	0.32	-0.67	-0.06	-0.29	1.00	0.22	-0.03	-0.19	0.11	0.32	0.22	-0.05
NIMTI	0.07	0.07	0.13	-0.28	-0.05	0.15	0.22	1.00	0.16	0.00	-0.02	0.18	-0.16	-0.01
CI	-0.58	-0.58	0.21	-0.03	-0.04	-0.17	-0.03	0.16	1.00	0.04	0.00	-0.01	-0.04	0.06
MC	-0.10	-0.06	-0.16	0.25	-0.02	0.25	-0.19	0.00	0.04	1.00	-0.25	-0.27	-0.49	-0.17
GDP	0.06	0.04	0.04	-0.12	0.00	-0.06	0.11	-0.02	0.00	-0.25	1.00	-0.11	0.05	-0.03
INF	0.09	0.16	0.30	-0.27	-0.05	-0.12	0.32	0.18	-0.01	-0.27	-0.11	1.00	0.11	0.07
INT	0.04	0.01	0.13	-0.13	0.05	-0.46	0.22	-0.16	-0.04	-0.49	0.05	0.11	1.00	-0.02
EXCH	0.02	0.06	0.06	-0.05	-0.04	0.05	-0.05	-0.01	0.06	-0.17	-0.03	0.07	-0.02	1.00

Appendix 3: Robustness checks

1 Country Fixed-Effects

The ROAA and the ROAE models for the entire period (1990-2019) were first rerun using country fixed effects. This robustness check was based on the premise that financial institutions are subjected to different country risk characteristics, which include regulatory, political, and economic risks. The robustness check was conducted to facilitate evaluation on whether the estimated baseline ROAA and ROAE fixed effects regression models would be affected by controlling for country risk factors (Xun and Halbert, 2014). A summary of results of the country fixed effects panel regression analysis for both the ROAA and the ROAE models are presented in Table A.3.1.

These results are similar to the baseline ROAA and ROAE fixed effects regression analysis outcome in Table 5.2. The main exceptions are that asset quality is not significant, while capital adequacy is now negative for the ROAE and asset size is now positive. There are less macro effects for the ROAA while all of the macro effects are significant for the ROAE. Nevertheless, overall, the analysis suggests that the estimated fixed-effects panel regression models for the banks' ROAA and ROAE are stable, even when controlling for country characteristics instead of those of individual banks.

Table A.3.1: Country Fixed-Effects Regression Analysis Summary: ROAA and ROAE

	ROAA	ROAE
Variables	**Panel OLS with Country Fixed-Effects**	**Panel OLS with Country Fixed-Effects**
Intercept	12.57**	11.31*
	(2.6)	(1.9)
CR	-0.143***	-0.208***
	(7.2)	(5.4)
AQ	-0.0112	2.222
	(0.1)	(1.0)
CAD	0.121***	-0.0622**
	(8.2)	(2.1)
LNAS	-0.546***	0.518***
	(3.3)	(2.7)
LIQ	0.0145*	0.183***
	(1.6)	(7.0)
NIMTI	0.964	9.925***
	(1.5)	(5.1)
CI	-0.037***	-0.397***
	(7.4)	(31.3)
MC	0.0154	0.0159
	(1.5)	(0.8)
GDP	0.16***	0.343***
	(3.3)	(2.8)
INF	0.0675	0.202***
	(1.5)	(4.8)
INT	-0.2	0.363**
	(1.0)	(2.1)
EXCH	-0.00068	0.0535***
	(0.1)	(6.1)
Standard Errors	1.682	14.264
F-statistics	18.43	121.77
Prob (F-statistic)	0	0
Country Fixed Effects	Yes	Yes
Adjusted R^2	0.638	0.436
Periods	30	30
Number of Banks	221	218
Observations	2224	2187

Notes: ROAA is the return on average assets, ROAE is the return on average equity, CR is Credit Risk (loan loss reserves/gross loans), AQ is Asset Quality (loans/total assets), CAD is the Capital Adequacy Ratio (total equity/total assets), LnAS is Asset Size (log of total assets), LIQ is the Liquidity Ratio (liquid assets/total assets), NIMTI is Non-Interest Income to Total Income, CI is the Cost to Total Income ratio, MC is market concentration, GDP is growth in real GDP, INF is annual inflation, INT is the interest rate spread and EXCH the real exchange rate. Independent variable coefficient values and t-statistics values (in parenthesis) are reported below each estimated coefficient. Significance ρ*, 10%; ρ**, 5%; ρ***, 1%. All variables were winsorised at 1% and 99%.

2 Bank and Time Fixed Effects

For the second robustness check, panel regression analysis was run using estimates of the baseline ROAA and ROAE regression model while controlling for the bank and time fixed effects, thus controlling for unobservable factors that vary over time as well as across banks.

Table A.3.2: Bank and Time Fixed-Effects Regression Analysis Summary: ROAA and ROAE

	ROAA	ROAE
Variables	**Panel OLS with Bank and Time Fixed-Effects**	**Panel OLS with Bank and Time Fixed-Effects**
Intercept	8.453*** (4.3)	54.064*** (3.8)
CR	-0.0414*** (6.3)	-0.214*** (4.2)
AQ	-1.173** (2.3)	-8.515** (2.2)
CAD	0.097*** (14.0)	0.0633 (1.2)
LNAS	-0.226** (2.5)	-0.95 (1.5)
LIQ	0.0076 (1.5)	0.1*** (2.8)
NIMTI	0.925** (2.4)	9.078*** (3.2)
CI	-0.0506*** (23.6)	-0.4*** (24.8)
MC	-0.0033 (1.0)	0.0203 (0.9)
GDP	-0.0234 (1.0)	0.0695 (0.4)
INF	0.0027 (0.3)	0.104* (1.8)
INT	-0.0407 (1.1)	-0.347 (1.2)
EXCH	0.00812*** (5.0)	0.047*** (4.0)
Standard Errors	1.84	13.00
F-statistics	14.65	10.605
Prob (F-statistic)	0	0
Bank and Time Fixed Effects	Yes	Yes
Adjusted R^2	0.615	0.531
Periods	30	30
Number of Banks	221	218
Observations	2224	2167

Notes: ROAA is the return on average assets, ROAE is the return on average equity, CR is Credit Risk (loan loss reserves/gross loans), AQ is Asset Quality (loans/total assets), CAD is the Capital Adequacy Ratio (total equity/total assets), LnAS is Asset Size (log of total assets), LIQ is the Liquidity Ratio (liquid assets/total assets),

NIMTI is Non-Interest Income to Total Income, CI is the Cost to Total Income ratio, MC is market concentration, GDP is growth in real GDP, INF is annual inflation, INT is the interest rate spread and EXCH the real exchange rate. Independent variable coefficient values and t-statistics values (in parenthesis) are reported below each estimated coefficient. Significance ρ*, 10%; ρ**, 5%; ρ***, 1%. All variables were winsorised at 1% and 99%.

The results match the baseline findings in Table 5.2, with the exception of a few insignificant variables (such as capital adequacy, asset size and GDP growth for the ROAE and concentration and inflation for the ROAA). Therefore, including unobservable risk factors that vary across time does not affect the results.

On balance we can conclude that the robustness checks underline the validity of the main results of the paper.