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The potential impact of Basel IV requirements on performance and resilience of commercial banks in Africa

By

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DECLARATION

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ABSTRACT

Capital adequacy is considered an important determinant for the performance and resilience of banks because the banking sector plays a substantial role in the stability and growth of the economy. Literature shows that well-capitalised banks are associated with higher profits. Banks in Africa have revenue growth opportunities, but fragility and vulnerability to bank failures arising from capital inadequacy, non-performing loans and weak banking regulatory requirements restrict their lending capacities to support economic growth. The Basel Committee's aim for introducing higher Basel capital requirements is to strengthen the resilience of the banking system; however, most of the African countries are slow in embracing changes in Basel regulatory requirements. Nevertheless, the implementation of higher Basel capital may affect the performance and lending ability of banks. This study examines the potential impact of Basel IV capital requirements on performance, lending, securitisation, and resilience of commercial banks from selected African countries.

To achieve the set objectives, the study simulates Basel IV capital ratio using historical data from 2000 and 2018 because the implementation of Basel IV capital requirements has not commenced. In this context, the study created sample-representative banks and employed static and dynamic panel regression analyses as the estimation techniques. The results suggest that Basel IV capital requirements portend short-term negative impacts on bank performance and lending, while the long-term impact on bank performance is favourable. In addition, the findings show that higher capital requirements have a significant impact on the volume of securitisation and protect the banks from securitisation exposures; however, increasing volume of securitisation does not impact performance. Finally, capital adequacy positively impacts bank resilience and suggests that banks with a low level of capital are prone to banking distress, while banks with high capital improves resilience.

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LIST OF ABBREVIATION

ABS	Asset Backed Securities
ADF	Augmented Dicker Fuller
ANOVA	Analysis of Variance
ARDL	Autoregressive Distributed Lag
BAM	Bank Al-Maghrib
BCBS	The Basel Committee on Banking Supervision
BIIcap	Basel II capital ratio
BIIIcap	Basel III capital ratio
BIVcap	Basel IV capital ratio
BoB	Bank of Botswana
BoG	Bank of Ghana
BoT	Bank of Tanzania
BoU	Bank of Uganda
CAMELS	Capital, asset quality, management, earnings, liquidity, and sensitivity to market risk
Cap	Capital ratio
CAR	Capital requirements
CBE	Central Bank of Egypt
CBK	Central Bank of Kenya
CBN	Central Bank of Nigeria
cons	Constant
DFE	Dynamic fixed effect
DOF	Degree of freedom
EBA	European Banking Authority
ECT	Error correction term
EU	European Union
FE	Fixed effect
FINSAP	Financial Sector Assessment Program
GMM	Generalised Method of Moment
G-SIB	Global systemically important banks
Gdpgrowth	Gross domestic product growth rate
inflati	Inflation

KW	Kruskal-Wallis
LCR	Liquidity Coverage ratio
Lev	Non-risk weighted leverage ratio
Loandp	Loan to deposit ratio
MBS	Mortgage-Backed Securities
M&M	Modigliani and Miller
MENA	Middle East and North Africa
MG	Mean group
NIM	Net interest margin
Nplta	Non-performing loans to total assets
NSFR	Net stable funding ratio
OLS	Ordinary least square
P-ARDL	Panel Autoregressive Distributed Lag
PMG	Pooled mean group
PPT	Phillips-Perron test
RE	Random effect
ROA	Return on assets
ROE	Return on equity
RWA	Risk weighted assets
SADC	Southern African Development Community
sd	Standard deviation
S-GMM	System Generalised Method of Moment
SPV	Special Purpose Vehicle
STC	Simple, Transparent and Comparable
TCE	Tangible common equity
UK	United Kingdom
USA	United States of America

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CHAPTER ONE

INTRODUCTION

1.1 Introduction to the study

Banks operate in one of the most internationally regulated environments as they are characterised by a history of bank failures (Berger, Herring, & Szegö, 1995). Banks perform the role of financial intermediation by facilitating the flow of funds between the surplus and the deficit units. This role banks play enhances the well-being of an economy (Nkopane, 2017); as such, there arises a need to develop public policies relevant for regulating and supervision of banks to ensure the stability of banking sectors. A universal tool among bank regulators to regulate banks is capital. Banks are required to set aside some amount of funds essential to cover their risk (Kahari, 2016; Soile-Balogun, 2017). The importance of banks in modern economic activities cannot be overemphasised, and only well-capitalized banks can serve the needs of the real economy to promote sustainable growth (Bandt, Camara, Maitre, & Pessarossi, 2018; Kana, 2017). The traditional function of bank capital is to protect bank depositors' funds against losses (Lindquist, 2004; Moore, 1961; Robinson, 1941). However, banks tend to hold too little capital when they are not regulated. Regulation of banks is a controversial issue as bank regulators from different countries seek best practices to enhance their banking sector stability (Manlagnit, 2015). For instance, the 2007/09 global financial crisis saw the "too big to fail banks" failed or bailed out by the government in the developed countries (Bandt et al., 2018).

As a consequence, critical questions were brought up by bank regulators on the adequacy of the existing regulations and the prevention of future crises. Many bank regulators follow principles and standards published by a Committee known as The Basel Committee on Banking Supervision (BCBS) because they are seen as best practice. Also, bank regulators wanted to be universally regulated by common standards (Manlagnit, 2015). In response to the 2008 financial crisis, bank regulators in each jurisdiction impose higher capital requirements (hereafter CAR) published by the BCBS to reduce the probability of bank failure (Walter, 2019). The Basel capital regulations in the post-financial crisis increased the quality and quantity of the regulatory capital with the aim of strengthening bank resilience to lower the probability of banking crises (BCBS, 2010; Ozili, 2019). With the Basel committee post-crisis regulations, there are arguments about the impact[1] of higher CAR on the performance of banks, especially for banks in the developing countries (Beck, Jones, & Knaack, 2019; Swamy, 2018).

The Basel Committee on Banking Supervision (BCBS), established in 1974, develops principles and standards employed by banking authorities (Jablecki, 2009). Since her inception, the BCBS has established a series of regulations on capital and liquidity requirements, commonly known as Basel Accords. The first Basel accord is known as Basel I introduced in 1988, followed by Basel II in 2004, Basel III in 2009-10, and the latest accord- Basel IV[2] in 2016, with its implementation date set to be in the year 2022. The Basel I introduced, for the first time, minimum CAR computed by assigning simple risk weights to different categories of bank assets (Magnus, Margerit, Mesnard, & Korpas, 2017). The Basel I and II standards allowed countries to adopt the Basel standards according to their interpretation, thus, causing regulatory adjustments across jurisdictions that implemented it (Dipatane, 2012; Jones & Zeitz, 2017). This gave banks excessive leeway in the interpretation of the Basel standards. Under Basel I and II accords, the trading book has a lower capital requirement while the banking book has higher capital (Jablecki, 2009; Kasse-Kengne, 2018). Banks in the developed countries exploited these loopholes of low capital for the trading book and restructured their balance sheet by

[1] This includes the possibility of higher funding costs, and increase in cost of financial intermediation Naceur and Kandil (2009); part of which is usually passed to customers (Taskinsoy, 2018).

[2] Basel IV accord is a finalization of Basel III post-crisis reforms (BCBSa, 2017; BCBSb, 2017) commonly referred to as Basel IV (Gyntelberg, 2018; PwC, 2017). It was set to be implemented in 2022, but due to COVID-19 has been revised to be implemented in the year 2023 (BCBS, 2020)

moving assets from the banking book to the trading book to achieve lower CAR resulting in capital arbitraging (Jablecki, 2009).

One of the strategies used by the banks to achieve capital arbitrage was securitisation. Securitisation is regarded as one of the most important financial innovations in the modern financial markets used by banks to restructure their balance sheet to convert banks illiquid loans into marketable loans (Buchanan, 2017; Uzun & Webb, 2007). The securitisation process gave banks liquidity support and encouraged banks to lend more for profit, while at the same time enabled banks to keep low CAR against risk exposures from the trading book (Bakoush, Abouarab, & Wolfe, 2019; Cullen, 2018). This led banks in some countries to take undue risks and hold unduly low capital reserves that are not linked to their risk exposures, thus, in the end, led to the 2008-2009 global financial crisis (Balin, 2008). According to the Federal Deposit Insurance Corporation in the United States, between 2009 and 2016, 491 banks failed in the United States only, costing $1.375 trillion loss (Federal Deposit Insurance Corporation, 2019).

A series of banking failures have characterised the banking sector in African countries during the ’80s and the ’90s (Triki, Kouki, Dhaou, & Calice, 2017). The bank failures led many African countries to adopt international financial sector reforms-Basel regulations and standards to reduce banking sector fragility and improve the banking sector's efficiency and stability to foster economic growth (Triki et al., 2017). Despite the adoption of Basel standards, the banking sector in many African countries remains under-developed; thus, the underdevelopment of African banking sectors limits the sector from being fully integrated into the global financial system (Demetriades & Fielding, 2012; Kahari, 2016). Consequently, African banks were shielded from the direct impact of the 2008 financial crisis, such as bank collapse and bank failures as experienced in developed countries. However, other sectors in African countries such as oil production and mining sectored suffered a significant decline in demand for exported commodities. The decline in demand for exports in other sectors of African economies may increase non-performing loans for banks and a decline in loan demands, mostly commercial loans

(Kahari, 2016; Soile-Balogun, 2017). As a result, African banks may not be spared from the 2008 financial crisis' spill-over effect.

The 2007-2009 financial crisis paves the way for the revision of the Basel II standards by the BCBS to increase the resilience of banks for financial stability and to restore stakeholders' confidence, which led to the introduction of Basel III in 2009/2010 (BCBS, 2009; Cohen & Scatigna, 2016). The Basel III accord in the post-financial crisis introduces strict measures aimed at improving the quality of CAR by increasing common equity and reducing the use of debts to achieve a higher CAR (Mahapatra, 2012; Walter, 2019). To further strengthen the Basel CAR and the resilience of banks after the 2008 financial crisis, the Basel Committee observed a wide disparity in the way banks compute the risk-weighted assets (RWAs), a denominator of the capital ratio, and how the calculation of RWAs variations across banks can undermine the efficiency of Basel III CAR (BCBSa, 2017; Munoz & Soler, 2017). As a result, the BCBS initiated a comprehensive review of the Basel III capital framework in 2012, leading to the Basel IV framework's introduction in 2016 to be implemented in the year 2023 (BCBS, 2020; BCBSa, 2017; Munoz & Soler, 2017). Basel IV accord introduces a standardized approach in the calculation of the RWAs of banks. The RWAs is a denominator of the Basel capital ratio, which determines the amount of capital to hold relative to each bank risk exposure (BCBSa, 2017; BCBSb, 2017). Basel IV provides a standardised approach that allows for comparability of capital ratios across banks by stakeholders and to reduce the variability of RWAs across banks (BCBSb, 2017; Gyntelberg, 2018; Munoz & Soler, 2017). In essence, Basel IV is meant to provide global minimum standards to deal with past financial crises and prevent future financial crises by increasing banks' capitalisation (Gyntelberg, 2018).

In principle, only Basel member countries are obliged to comply with the changes in the Basel CAR. Still, because Basel principles and standards are seen as international best practice regulatory standards, non-Basel member countries chose to adopt it (Beck et al., 2019). The African governments decided to adopt it to signal the sophistication of the African banking sector, to attract more foreign investments, and reassure foreign investors of a safe and reliable system for their funds (Beck et al., 2019). While the banking industry in the developed countries faces disappointing returns and sluggish growth in the past five years from 2012 and 2017, with return on equity (ROE) within a specific range between 8 and 10 percent, the African banking industry provides a refreshing contrast. African banking revenue pools grew at a compound annual growth rate of 11 percent in constant exchange rates from $88 billion to $129 billion because the banking population grew from 170 million in 2012 to nearly 300 million in 2017, with an expected further rise to 450 million within five years (Chironga, Cunha, Grandis, & Kuyoro, 2018).

Despite the positive outlook of African banks, several factors make the Basel framework relevant to the African context. For instance, there are gaps in terms of capital adequacy, which often restricts African banks' capacity to finance loan demands to customers (Okoye, Adetiloye, Erin, & Evbuomwan, 2017; Waithaka, 2013). Hence, most of the loan facilities provided by African banks are short term, having a maximum maturity of one year. Also, many banks in Africa are excessively liquid for fear of bad loans (Andrianova, Baltagi, Demetriades, & Fielding, 2015; Asongu & Odhiambo, 2018). The government in countries like South Africa, Kenya, Nigeria, Zambia, Egypt, Ghana involves regulatory reforms to restructure the banking sector to provide support for economic development and reduce bank failures (Abdel-Baki, 2012; Soile-Balogun, 2017). However, most of the African countries are slow in embracing changes in Basel regulatory requirements compared to South Africa and Egypt that have progressed to implement Basel III CAR. As a result, bank performances remained poorly, thus, leading to inefficient financial intermediation for financial inclusion in the global market. Implementation of Basel II CAR improved regulatory, supervisory measures, improved risk measures, and corporate governance standards in Nigeria, Egypt, and South Africa (Abdel-Baki, 2012; Okoye et al., 2017; Soile-Balogun, 2017).

Furthermore, observation of South African banks reveals that implementing changes in Basel levels from II to III reduces non-performing loans (Bloomberg, 2019). The implementation of higher Basel CAR is perceived by African banks to be stringent, and therefore many African countries are slowly adopting the Basel standards (Kahari, 2016).

From the previous, it is imperative to examine the implications of Basel CAR for African banks. As a result, this study examines the potential impact of implementing tighter and higher capital regulations on African banks' growing profitability. Banks react to higher CAR in various ways depending on institutional differences and the extent of bank reliance on non-common equity capital (Angelini, Clerc, & Cúrdia, 2015; Chun, Kim, & Ko, 2012). Using common equity to achieve higher CAR can be expensive than debt and may affect banks' lending and performance (Gropp, Mosk, Ongena, & Wix, 2018). Figure 1.1 below shows the Basel CAR introduced by the Basel committee since its inception in 1988:

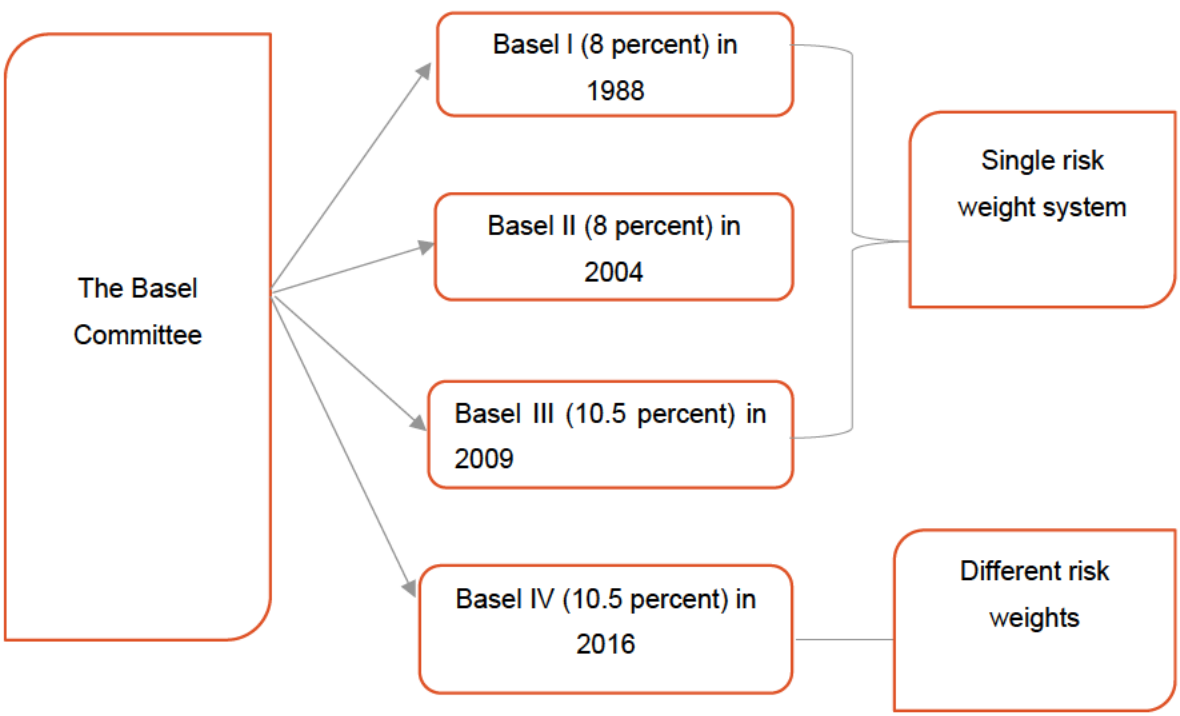

Figure 1. 1: Development of Basel CAR

Source: Author's design

From Figure 1.1 above, Basel IV introduces a wide range of standardized risk weights for risky and less risky loans within bank class assets such that risk-weights are assigned to individual loan assets from a list of rating bucket provided in Basel IV CAR depending on the bank's risk exposure rather than assigning a single risk weight to a class asset. It implies that there may be a different risk within the same risk class assets (BCBSa, 2017; Munoz & Soler, 2017). The Basel committee introduces, for the first time in Basel IV, a disconnection between risk and capital by eliminating flat single risk weights on class assets (BCBSa, 2017).

1.2 Statement of the problem

There have been debates about the impact of a new CAR on the performance of banks. The growing bodies of bank capital regulation literature favouring the Basel III CAR (Angelini et al., 2015; Locarno, 2011) argue that there are significant macroeconomic benefits of increasing bank equity capital and for a safer banking system. However, the impact of a higher CAR on banks is subject to uncertainty (BCBS, 2010), and this is currently the case with the proposed Basel IV. Higher CAR can have an impact on the performance of banks negatively or positively. Profitability is an essential prerequisite for a bank's survival in the competitive banking industry for expansion and returns to shareholders. In Africa, the poor performance of banks, fragility, and vulnerability to bank failures are linked to inadequate capitalization, higher incidences of non-performing loans, a higher level of credit and liquidity risks, high cost of financial intermediation, excessive liquidity arising from fear of lending because of bad debt, high-interest rate spreads, high inflation rates, high-interest rates, lower deposit rates to capital investment, high volatility in the exchange rate and low growth in GDP growth (Dipatane, 2012; Munyambonera, 2013). For example, seven indigenous banks failed in Ghana between 2017 and 2018 due to inadequate minimum CAR, high non-performing loans, and weak corporate governance (Benson, 2019). South Africa has two bank failures between 2014 and 2018 from bad management, unsecured lending, and liquidity problems. A higher capital improves bank resilience to withstand negative shocks and contributes to overall financial stability.

For African banks that adopted the existing Basel CAR, it improves asset quality and decreases non-performing loans. At the same time, higher Basel CAR through common equity tends to be expensive for banks and can impact banks' performance and the ability to lend. It was changing from Basel II to III accord reduced non-performing loans for South African banks but also led to change in banks moving away from corporate lending to other loan assets with low-risk weights. In Egypt, the implementation of CAR led to the loss of bank customers to shadow banking (informal loans) (Abdel-Baki, 2012). This poses a major question of whether the higher capital requirement in the new Basel IV will benefit the African Banking sector or not.

Lack of compliance with changes in Basel's higher CAR makes many African banks remain excessively liquid due to fear of lending arising from high default rates among borrowers (Demetriades & Fielding, 2012). This excessive liquidity continues to pose an obstacle to the growth of bank assets and performance despite the existence of a high number of untapped banking populations with opportunities for revenue growth. Interest rates on loans in Africa are higher than what is obtainable in developed countries. African banks are characterised by low-income customers. Transferring the cost of higher capital to customers, on the one hand, the banks can lose customers to shadow banks depending on customer switching costs. On the other hand, if banks bear the cost of higher capital, the banks' profitability may decline (Abdel-Baki, 2012; Chironga et al., 2018; Knyazeva, 2016). Also, a higher capital requirement through common equity can reduce the number of African banks.

Furthermore, large bank failures can have a widespread economic impact that countries may not recover from within the short term (Walter, 2019). Higher capital requirement is relevant, but the potential impact of Basel IV on the performance of banks in Africa has not been examined. Thus, understanding the possible impact of the Basel IV CAR on the performance of banks in Africa is important. Additionally, growth in the securitisation markets in African countries has been slow. Securitisation provides liquidity to increase bank lending. Basel I and II have been credited for the growth of securitisation in the developed countries for expansion of loans and liquidity, while African banks are yet to embrace this financial innovation fully. African banks are lagging in adopting changes in Basel requirements, which may be beneficial to increase bank resilience. At the same time, higher Basel CAR tends to be expensive for banks and can impact banks' performance and the ability to lend. This study examines the impact of the new CAR introduced under the Basel IV framework on the performance, lending, securitisation, and resilience of commercial banks in selected African countries for which data is available. To the best of the researcher’s knowledge, no study had ever assessed the potential effects of higher CAR on the performance of commercial banks in Africa hence the research gap that the current study sought to fill.

1.3 Research aim

The aim of the study is to examine the potential impact of Basel IV capital requirements on the performance and resilience of banks in Africa. To achieve this aim, specific research objectives have been formulated stated in session 1.3.1.

1.3.1 Research objectives

Given the motivations in the introduction to the study and the statement of problem, the main objective of this study is to examine the potential impact of Basel IV CAR on the performance of commercial banks in selected African countries. The primary research objectives, therefore, are to:

i. examine the potential impact of Basel IV capital requirements on the performance of banks in selected African countries;
ii. determine the impact of changes from Basel III to IV capital requirements on bank lending ability of selected African countries;
iii. examine the potential impact of Basel IV capital requirements on securitisation activities; and,

iv. investigate the impact of capital adequacy and other determinants on the resilience of African commercial banks

1.3.2 Research questions

To achieve the formulated objectives, answers are provided to the following research questions:

i. What will be the impact of changes from Basel III to IV on the performance of African commercial banks?
ii. What the impact changes from Basel III to IV will have on African bank lending activities?
iii. How will the adoption of Basel IV affect the securitisation activities among African commercial Banks?
iv. Is there a relationship between securitisation activities and the performance of commercial banks in the African context?
v. To what extent is the resilience of African commercial banks affected by various determinants of capital adequacy?
vi. How will the introduction of a new Basel IV assist in improving commercial banks' resilience in African countries?

1.4 Methodological scope

This study examines the potential impact of Basel IV CAR on the performance, lending, securitisation, and resilience of commercial banks in selected African countries using information contained in the banks' annual published financial statements for 19 years (2000 and 2018). As a result, the research design is quantitative research employing secondary data to achieve the aim and objectives of this study. This study used a quantitative research method consisting of panel data of commercial banks in Africa. The commercial banks must also comply with the existing Basel II CAR or Basel III CAR within the sample period considered. By fully considering the panel structure of the secondary data, the quantitative research approach enables the study to analyse the potential impact of Basel IV and comparative analysis with existing Basel II and III capital ratio impact on commercial banks in Africa over space (cross-sectional analysis) and time (longitudinal analysis) and also allowing the study to account for unobserved heterogeneity across individual banks and years. A desk review approach was employed to collect data from various secondary sources. This includes financial reports, online data base, statistical database, The Basel Committee regulations documents, National Banking Acts in selected African countries, gazettes, journals, books, newspapers, and other sources were considered as centres of information for the study.

Standardized financial data for easy comparison are sourced from Bloomberg and S & P Capital IQ online database. One hundred thirty-seven commercial banks listed on all stock exchanges in Africa were included in the study population. However, many African countries lack data; therefore, 41 commercial banks from thirteen African countries with sufficient financial data covering the sample period are selected. Namely, Botswana, Egypt, Ghana, Kenya, Mauritius, Morocco, Namibia, Nigeria, South Africa, Swaziland, Tanzania, Uganda, and Zimbabwe. The 41 commercial banks from 13 African countries represent the commercial banks in Africa in terms of size, performance, and Basel compliance. Therefore, the final sample is an unbalanced panel consists of 41 banks that have adopted Basel II or III from 13 African countries. The sample period of 2000-2018 is considered because BCBS introduced Basel II in 2004. It allowed the study to draw a conclusion on the impact of Basel IV as if they had been adopted in the period considered vis-à-vis existing Basel regulations. Some studies have examined the potential impact of new CAR before implementation Giordana and Schumacher (2017); Gyntelberg (2018) using sample representative banks drawn from historical data of banks in their respective samples.

In this context, this study simulates Basel IV capital ratio using aggregated financial data of selected commercial banks in Africa to create sample representative banks as if these banks had implemented the Basel IV CAR since the year 2000. The study then analyses the sample bank simulated data compared to actual data using the regression analysis of choice to examine the possible impact on performance under certain assumptions while holding other conditions constant. This is to enable the study to explore the potential effect of Basel IV CAR on banks in Africa, whether it will negatively or positively impact the performance of banks in Africa, given their challenges and growing profitable opportunities. This study uses financial ratios from historical data to achieve the study objective, and the use of sample representative bank is in line with Giordana and Schumacher (2017); Gyntelberg (2018); Swamy (2018). For a more robust comparison, the study examines the impact of changes from Basel II, III on the performance, lending, securitisation, and resilience of banks in Africa. The study employs different methodologies to achieve the study objectives. The study applies a fixed effect, random effect models, and panel ARDL model (pooled mean group, mean group, and dynamic fixed-effects models) on the impact of Basel CAR on performance. The impact of Basel CAR on bank lending was achieved in two-parts. To determine whether compliance with higher Basel capital led to portfolio shifts achieved using ANOVA. The second part of the study employs the Generalised Method of Moments (GMM) and panel ARDL model (PMG, MG, and DFE) to examine Basel CAR long-run relationship on performance and lending. Basel capital and securitisation activities were achieved using fixed and random effects. Basel capital and resilience were achieved using logit regression and fixed-effect model. The methodologies employed for each objective are according to the literature and nature of data, which enables the study to arrive at the conclusion of whether Basel IV higher capital is beneficial to the African context.

1.5 Significance of the study

Basel IV CAR was introduced in 2016, with its proposed implementation date set to be implemented in 2023. Being a relatively new Basel accord and not yet implemented, this study presents an investigation on the potential impact of Basel IV CAR and compares it with the effect for existing Basel II and Basel III CAR on performance and resilience of commercial banks, considering that most of the African countries are slow in embracing changes in Basel regulatory requirements. Consequently, this study provides inferences towards improving the weak banking regulatory environment for policy purposes to the regulatory authorities, government and stakeholders in African banking industry. In addition, the outcome of this study can correct the misconception surrounding the relevance of Basel regulation in the African setting given that many African banks are constrained by capital inadequacy, weak regulatory requirements which make them inefficient even in the presence of revenue growth opportunities from a growing market, unbanked population and high-interest rates. Banks with low capital ratios may be exposed to more regulatory pressure to comply with higher Basel CAR. Several factors, such as capital inadequacies, which often restricts African banks' capacity to finance loan demands to customers, make the Basel framework relevant to the African context. Nevertheless, compliance with higher capital using equity is not cheap.

The new accord represents not just a set of regulatory CAR across the globe for banks; having a resilient financial system requires an adequate regulatory framework. Hence, it is important to find a balance between the changes in Basel CAR, the resilience of the banking sector, and the performance of banks to serve the economy. This study seeks to examine the impact of the Basel IV regulation before it is implemented, and as such, it provides an understanding of the implication of the new Basel framework for African banks. This study is the first to the best of the researcher's knowledge to examine the potential impact of Basel IV CAR on the performance and resilience of banks, especially in Africa. Therefore, the insight offered in this study is key to the implementation of the proposed Basel IV by policymakers, monetary authorities, and supervisory bodies such as Reserve banks and Central banks in African countries to make meaningful regulatory decisions that are beneficial to the African banking sector, customers, and the economy. The finding of this study also assists investors and stakeholders in investment decisions. The results are useful to banks, researchers, and practitioners in the African banking industry to have empirical evidence of the possible impact of Basel IV regulations on commercial bank performance and resilience. Overall, this study contributes to literature towards the understanding of the potential effect of a new Basel in the African context and other continents with similar characteristics of banking sectors. The study becomes one of the few studies to examine the impact of a new Basel regulation before its implementation.

1.6 Brief description of the study objectives

For this study, each specific objective in session 1.3.1 was examined in separate chapters. The first objective, the potential impact of Basel IV CAR on the performance of banks in Africa was achieved in chapter 3. While the second objective, to determine the impact of changes from Basel III to IV capital requirements on bank lending was achieved in chapter 4. The third objective, to examine the potential impact of Basel IV capital requirements on securitisation activities, was achieved in chapter 5. The last objective, to investigate the impact of capital adequacy and other determinants on the resilience of African commercial banks was achieved in chapter 6. Hence, there is the need to describe the study objective to establish how they are coordinated to achieve the study's aim.

1.6.1 Basel capital and bank performance

The first objective of the study was to examine the potential impact of Basel IV CAR on the performance of banks in Africa. The Basel Committee, in the post-2008 financial crisis, increased the quality and quantity of the minimum regulatory capital by requiring a higher level of common equity with the aim for a stronger bank resilience to lower the probability of banking crisis (BCBS, 2009; BCBSa, 2017; Walter, 2010). Higher CAR can impact on the performance of banks negatively or positively. Cohen and Scatigna (2016) note banks that are well capitalised in the post-financial crisis performed better and have the ability to lend more. Another strand of literature views higher capital to improve bank managers' efficiency in monitoring borrowers effectively because shareholders demand higher returns and lose more in case of bank failure. That is, well-capitalized banks tend to be more cautious in their investment decisions (Giordana & Schumacher, 2017). This explains why changes in Basel capital levels may positively impact the performance of banks (Bandt et al., 2018). However, there are arguments about the impact tighter CAR will have on banks, especially for banks in developing countries (Beck et al., 2019). For instance, the possibility of higher funding costs and an increase in the cost of financial intermediation (Naceur & Kandil, 2009). In this context, banks are assumed to pass a share of these costs to their customers in higher spreads, resulting in a higher cost of financial intermediation (Taskinsoy, 2018). The higher cost of financial intermediation could lead to a decline in the demand for loans, which negatively affects the performance of banks. Banerjee and Majumdar (2017) find that although the profits of banks in the United Arab Emirates (UAE) increased over the years, the introduction of a higher capital adequacy ratio has a significant and negative effect on the performance of banks. External factors such as industry-related and macroeconomic determinants may also impact banks' performance (Naceur & Omran, 2011). The study of the relationship between capital adequacy and performance continues to be a fundamental issue in the literature, and findings of this literature are often inconclusive with the introduction of tighter regulations.

African banks possess revenue growth opportunities from a growing market, unbanked population, and high-interest rates. African banks are characterised by low capital ratios and low-income customers (Chironga et al., 2018). The implementation of changes in Basel CAR eliminates capital inadequacy, bad management, liquidity problems, fraud, corporate governance issues, and risk management (Jones & Zeitz, 2017) that African banks can benefit from. Further evidence from literature provides that better-capitalised banks are associated with higher profits (Bikker & Vervliet, 2018). Nevertheless, banks with low capital ratios may be exposed to more regulatory pressure to comply with higher Basel CAR (Tanda, 2015). Higher CARs are expensive; there are arguments that banks may pass any additional increase in banking cost to customers, which may be detrimental to the performance of banks in Africa, depending on customers switching costs to informal lenders in Africa. However, enforcement of higher capital levels has been found to improve asset quality, risk measures, and corporate governance in African countries that have adopted Basel II or III CAR like Nigeria, Egypt, and South Africa (Abdel-Baki, 2012; Okoye et al., 2017; Soile-Balogun, 2017).

1.6.2 Basel capital and bank lending

A higher level of capital may impact on the performance of banks by reducing/or increasing lending. Banks earn interest income from lending; as a result, more lending should increase the performance of banks and vice versa. This makes it relevant to examine the impact of higher Basel capital on bank lending as the second objective for the study. Higher CAR affects the bank’s everyday decision making in lending, capital, liquidity, operations, investments, funding, and all these components are very much interconnected and directly affect any bank's profitability (Swamy, 2018). Banks may take on higher risk when higher capital is implemented to generate a higher return on equity so that shareholders can have adequate returns on their investments, increasing lending rates and reducing volumes of the loan (Blum, 1999; Gabriel, 2016). On bank lending in emerging economies, Bergess (2012) find that implementation of Basel II in Latin America, on average increased lending activities and bank capitalization. It also protects depositors, consumers, and investors, and at the same time stimulating economic growth.

Similarly, Basel I's implementation in Nigeria increased bank capital and lending activities, which boost economic activities (Okoye et al., 2017). Evaluating the effect of Basel III, Ambrocio and Jokivuolle (2018) observe that changes in CAR introduced by the Basel committee in the post-crisis may cause a downshift in lending to the SMEs. The benefit of raising bank equity for higher CAR should increase the capacity of banks to lend more. However, Haubrich and Wachtel (1993); Tchana Tchana (2012) argue that higher CAR can hinder economic growth as banks shift portfolios from more productive, risky investments towards less productive, safe assets. Abdel-Baki (2012) questions if the implementation of Basel III in emerging countries will add more burdens of costs to the banks operating in overtaxed economies. Bank failures in Africa as of 2018 due to capital inadequacy and other inefficiencies could otherwise be averted with compliance to higher Basel CAR.

1.6.3 Basel capital and securitisation

In furtherance to the impact of higher capital on performance, the introduction of the Basel I accord led to the development of financial instruments used by banks to transform their illiquid loans to marketable securities. The expected earnings from the sale of the loans securitised, enable the banks to issue more loans and may increase the performance of banks. With the introduction of minimum capital with Basel I CAR, banks in developed countries, found it a burden to set aside funds as safety nets whenever they lend to clients. The banks found ways to avoid holding minimum CAR by creating loopholes around the adjusted standards known as regulatory capital arbitrage (Allen, 2004; Blundell-Wignall & Atkinson, 2010). The tool used to achieve capital arbitrage was securitisation (Jablecki, 2009). Additionally, banks use securitisation to increase lending volume and source liquidity (Cullen, 2018). Securitisation involves the pooling of traditional class assets of bank (mortgage loans, commercial loans, credit card loans) together, bundling and selling in units by another entity known as special purpose vehicle (SPV) to investors in the securitisation market for immediate liquidity (Jablecki, 2009)

The increase in securitisation activities before the 2008 financial crisis increased bank exposure to market risk even though the banks use securitisation to transfer credit risk to achieve a minimum capital requirement (Jablecki, 2009). Basel II CAR had less capital buffer for securitisation exposure and trading book risk, enabling banks to achieve capital arbitrage. This is why the BCBS introduces a new securitisation framework (STC) in 2016 (BCBSa, 2016). The STC framework will also eliminate the overly complex securitisation process and limit the use of credit rating agencies in existence (BCBSa, 2016). The STC framework introduces standardisation in the calculation of bank securitisation exposure, simplicity, and transparency in the securitisation process to benefit less sophisticated banks (such as African banks) to originate securitisation (BCBSa, 2016). Consequently, there is a need to examine the potential impact of the new securitisation framework and Basel IV CAR on securitisation transactions in African banks.

1.6.4 Basel capital and resilience of banks

As a result of securitisation activities used by banks to achieve regulatory capital arbitrage, to meet minimum CAR, and for more lending, the capital ratios of such banks were not reflecting the banks risk exposures. This threatened the stability of banks, thus led to the 2008 financial crisis. The banking system in many African countries were not directly affected by the 2008 financial crisis because of their limited exposure to foreign risks. However, many African banks are fragile and vulnerable to crisis as some of these banks are non-compliant with Basel regulations (Dipatane, 2012; Okoye et al., 2017). For instance, banks in Ghana, as of 2018, experienced bank failures (Benson, 2019). There was also the failure of the African Bank in South Africa in 2014, arising from bad practices of unsecured lending (Batra, 2017; Van Spaendonck, 2017). Kenya experienced three bank failures between 2015 and 2016 arising from fraudulent lending, poor risk management practices, weak regulatory and supervisory powers, and inefficient banking laws (Waithaka, 2013). The reasons above make the impact of Basel CAR on the resilience of banks the fourth objective. After examining the performance, lending, and securitisation, studying banks' resilience becomes imperative since bank failure usually affects the economy. Basel III and the new Basel IV are tighter capital regulations introduced after the financial crisis in order to strengthen bank resilience and reduce future banking failures (BCBS, 2009; BCBSa, 2017; BCBSb, 2017; Giordana & Schumacher, 2017). Financial resilience is the ability of the banks to absorbs short-term shocks and long-term changes in the economy without affecting the functions of the banks (Oughton, 2017). Giordana and Schumacher (2017) model the potential impact of Basel III on the probability of bank default and finds that the probability of a bank default reduces if the banks had adhered to Basel III before the financial crisis. Thus, the major question is whether or not the new Basel IV improves the resilience of banks, especially in developing countries such as Africa.

1.7 Structure of the Thesis

The thesis consists of seven chapters. The first chapter focuses on the introduction of the study and the statement of the problem. The main purpose of this chapter is to provide a brief introduction and motivation for the study. As a result, this chapter highlights the main aim and objectives, methodological note, significance, and structure of the thesis.

Chapter 2 provides an overview of Basel accords and the African banking sector. The purpose of the chapter is to discuss the history of Basel regulations, Basel IV CAR, followed by in-depth discussions of nature and developments in the African banking industry and future growth amidst challenges. This chapter also discusses the cost of bank lending in Africa and the issue of Non-performing loans.

Chapter 3 presents the first objective of the study, the potential impact of Basel IV CAR on the performance of commercial banks in selected African countries. The main sections include the introduction, description of theories relevant to CAR such as the static trade-off theory, Modigliani and Miller theory, and capital arbitrage theory, literature review, empirical methods, results, and discussions as well as the concluding remarks.

Chapter 4 presents the second objective being an examination of the impact of changes from Basel III to IV CAR on bank lending in selected African countries. The chapter includes an introduction to the objective, relevant theories such as the modern portfolio theory, the static trade-off theory, M-M theory, and the capital arbitrage theory, discussions on the related literature on bank lending and portfolio shifts, empirical methods, results, and discussions, and the conclusion of the chapter.

Chapter 5 presents the third objective to examine the potential impact of Basel IV CAR on securitisation activities. The section includes capital arbitrage theory, discussion of the empirical literature, empirical methods, results, and discussions, and conclusion.

Chapter 6 presents the fourth objective to examine the impact of capital adequacy and other determinants of capital adequacy on the resilience of commercial banks in Africa.

The chapter includes an introduction, the reasons for banks to holding capital, relevant theoretical such as moral hazard and deposit insurance, followed by a discussion of related literature, empirical methods, results, and discussions and the concluding remarks for the chapter.

Chapter 7 presents the conclusions to the study and policy implications. In summary, the implementation of higher Basel CARs in an attempt to reduce banking failures and improve the resilience of banks affected the performance and lending of banks negatively in the short run but, in the long run, improve bank lending and the performance of banks in Africa. In addition, non-performing loans declined as banks transitioned from lower to higher Basel level. In summary, it is expected that a higher CAR of Basel IV will have a positive and significant impact on the performance of banks in Africa in the long run. The benefit of higher Basel CAR will increase the capital adequacy of African banks to enable these banks to take on more risks to support growing African economies. It is recommended that to achieve higher Basel capital in Africa, bank regulators should implement the higher Basel standards over a medium-term period to allow banks to prepare to prevent any macroeconomic costs from loan reductions in the short term. It is also recommended that banks in Africa should embrace the Basel CAR with caution. The limitation of the study, Basel IV capital is new, and historical data was simulated in line with Basel IV CAR to achieve the study objectives.

CHAPTER TWO

OVERVIEW OF BASEL ACCORDS AND THE AFRICAN BANKING SECTOR

2.1 Introduction to Basel accords and the African banking sector

Does a bank have adequate capital to cover for unexpected losses? The question is essential to assess the resilience of banks and the reason for the development of Basel regulations. Banks play a major role in the stability and growth of the economy, and there is a significant need for developing policies for the stability of the banking system. Since the recent financial crisis, bank regulatory capital ratios have increased steadily for banks implementing Basel III CAR (Cohen & Scatigna, 2016). According to Manlagnit (2015), the increase in bank capital ratios due to changes in Basel CAR influences banks' behaviour in the post-financial crisis greatly. This chapter presents the background on the history of Basel regulations, Basel IV CAR, followed by discussions of nature and developments in the African banking industry and future growth amidst challenges, followed by a brief discussion on the characteristics of the banking system in selected African countries, and finally provides a discussion on the cost of bank lending in Africa and the issue of non-performing loans.

2.2 Brief historical review of Basel I, II, and III accords

Two key events in the early 1970s causing disturbances in the international financial and currency market led to the necessity of creating a Committee that will be responsible for improved quality of banking supervision globally using regulations and standards known as the Basel committee. The first event was the significant cut in oil production during the Arab-Israeli Yom Kippur War in 1973, causing the price of oil to quadruple. This created large international financial imbalances from the flow of funds between oil producers (creditors) and oil importers (debtors) (Alessi, 2012). The second event was linked to a number of crisis in the international financial and currency markets, such as the final collapse of the Bretton Wood System in 1973, the closure of the Franklin National Bank of New York in 1974, and the failure of Bankhaus Herstatt in West Germany in 1974 (Alessi, 2012; Gabriel, 2016; Ma, 2016). These events caused significant losses for associated financial institutions, leading to the need for standardized regulations among the G-10 countries made up of eleven industrial countries (Gabriel, 2016; Munyambonera, 2013). In 1974, central bank governors from G-10 countries (Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Switzerland, Sweden, United States of America, and the United Kingdom) came together to establish a committee initially named the Committee of Banking Regulations and Supervisory Practices with the aim of having healthy financial stability through improved quality of banking supervision using regulations developed by the Committee, and employed by each regulatory authorities initially across the G-10 countries to regulate banks (Jablecki, 2009; Munyambonera, 2013). The Committee, now called The Basel Committee on Banking Supervision (BCBS), has her membership expanded to more than 26 countries in the world (Gabriel, 2016; Munyambonera, 2013). The BCBS is tasked with the formulation of broad supervisory standards and guidelines. Since her inception, the BCBS has established a series of regulations on capital and liquidity requirements, commonly known as Basel Accords. The Basel accords' principles and standards are never intended to have legal force (Jablecki, 2009). Instead, they are a statement of best practices in the expectation that regulatory authorities in individual countries will implement through detailed statutory arrangements that are best suited to the country’s national system (Jablecki, 2009).

At inception in 1988, the Basel I accord was introduced as a universal standard to promote harmonisation of regulatory and capital adequacy standards and the international banking system's stability within member states of the Basel Committee (Abdel-Baki, 2012; Lotto, 2016). In 2004 when BCBS announced the introduction of Basel II, more than one hundred countries signaled their interest to adopt the Basel II accord (Manlagnit, 2015). Many countries have since accepted the Basel accord as the best international banking standards to regulate their jurisdictions' banking systems (Dipatane, 2012; Lotto, 2016). The Basel Accords developed to promote improved banking supervision quality, especially the regulatory CAR (Dipatane, 2012; Sadien, 2017). The minimum CAR became an important instrument for bank regulations and stability, making the Basel accords-Basel I, II, III & IV the most universally acceptable standards for bank regulators (Lotto, 2016; Manlagnit, 2015).

2.2.1 Basel I accord

The Basel I accord introduced in 1988 came into full effect in 1992 (Blundell-Wignall & Atkinson, 2010). The accord introduced capital ratios to provide adequate capital against risk exposures in the bank loan book known as credit risk (Blundell-Wignall & Atkinson, 2010; Jablecki, 2009). “Credit risk is mostly defined as the potential that a bank borrower or counterparty will fail to meet its obligations under agreed terms” (BCBS, 1999b, p. 1). According to the BCBS, the Basel I accord CAR account for credit risk; however, the CAR implicitly covers other unmeasured risks not explicitly mentioned (BCBS, 2001). The composition of the Basel I capital ratios is Tier1 capital plus Tier2 capital. Tier1 capital, defined as the core capital to absorb unexpected losses, represents a minimum of 4 percent of equity and reserves, excluding goodwill (Kahari, 2016). The Tier2 capital is a supplementary capital for Tier1 made up of undisclosed reserves, subordinated debts, hybrid capital instruments, general provisions/loan loss reserves, and asset revaluation (Blundell-Wignall & Atkinson, 2010). The Tier1 plus Tier2 capital equals an 8 percent minimum capital ratio for Basel I accord (Kahari, 2016).

The motive for Basel I accord was to provide stability in the international banking system through promoting adequate capital and better supervision of banks in participating countries (Blundell-Wignall & Atkinson, 2010; Dipatane, 2012). After implementing the Basel I accord, there were rapid developments in the banking industry, globalization, and financial innovations in the financial markets, which rendered the accord inadequate to adequately cover banks' risk exposures (Dipatane, 2012; Jablecki, 2009). For instance, banks looked for other alternatives to cover risk exposures. In response to these rapid developments in the financial market, the BCBS amended the Basel I CAR to incorporate market risk in 1996 to apply capital charges to market risks incurred by banks (BCBS, 1996). Market risk is “defined as the risk of losses in on-and off-balance-sheet positions arising from movements in market prices” (BCBS, 1996, p. 2).

Nevertheless, one of the criticisms of Basel I was its narrowness in scope to ensure adequate financial stability in the international financial system (Dipatane, 2012). Other criticisms were regulatory capital arbitrage, a divergence between Basel I measured risk and actual (unmeasured) risks (BCBS, 2001; Jablecki, 2009). In addition, inadequate risk measures and techniques against advanced credit risk such as securitisation. As a result, Basel I accord was reviewed, the revised framework is known as Basel II accord to cover new approaches against credit risk and market risk, and the introduction of operational risk as a solution to the weakness of Basel I accord (Balin, 2008; BCBS, 2004; Blundell-Wignall & Atkinson, 2010). Furtherance to the rapid developments in banking practices and innovation such as securitisation, evolving technology, and complex financial products are increasingly important factors to account for in capital ratios of banks. This led to the BCBS introducing a capital charge for other risks to accommodate banks' particular risk profile known as operational risk (BCBS, 2001). The different methods available to evaluate operational risk are the simplest approach, the Basic indicator approach, and the standardized approach (BCBS, 2001; BCBSb, 2016).

2.2.2 Basel II accord

Basel II accord has three pillars: Pillar I on the minimum CAR; Pillar II on the supervisory powers of regulatory authorities; and Pillar III on market discipline (BCBS, 2004; Waithaka, 2013). Basel II was expected to yield more benefits in helping banks and supervisors manage risks, improve financial stability, and enable market participants to make better risk assessments (Lotto, 2016; Manlagnit, 2015). The Basel II minimum capital ratio remained at a minimum of 8 percent. Basel II introduces two approaches for evaluating credit risk, three approaches for operational risk (BCBS, 2004). Banks can apply either the standardized or internal rating approaches for credit risk (BCBS, 2004; Leventides & Donatou, 2015). A standardized approach enables smaller banks with no expertise to develop their models in terms of risk assessment. It relied on external credit rating agencies or fixed-risk weights (Blundell-Wignall & Atkinson, 2010). The internal rating approach allows banks to develop and use their models to measure the credit risk with approval and acceptance by the central bank (Blundell-Wignall & Atkinson, 2010). For operational risk, there was a new capital requirement charge. The banks can use either the basic indicator approach, the advanced measurement approach (AMA), or the standardized approach to calculate the capital charge for operational risk (BCBS, 2004). Banks that are internationally active with significant operational risk are expected to use either AMA or a standardized approach (BCBS, 2004). Market risk assessment is still based on two approaches set by the Basel I amendment accord of 1996 (Gabriel, 2016). The first approach is the bank's own measure of value-at-risk, and the second is the standardized approach, either of the two approach a bank can employ for market risk assessment (BCBS, 2004; Gabriel, 2016). These measures showed that Basel II accord is a more risk-sensitive approach with incentive for better risk assessment and management compared to Basel I.

Table 2. 1: Comparing the composition of Basel I and Basel II capital ratio

Basel I	Basel II
$\frac{Regulatory\ capital}{Risk\ weighted\ asset} = Bank\ Cap\ ratio \geq 8percent$	$\frac{Regulatory\ capital}{Risk\ weighted\ asset} = Bank\ Cap\ ratio \geq 8percent$
Risk-weighted asset= Credit risk + Market risk	Risk-weighted asset= Credit risk + Market risk + Operational risk

Source: Author's compilation, 2020

The composition of Basel I and Basel II capital ratio, as shown in Table 2.1, however, there was still criticism for Basel II. Basel II did not address regulatory capital arbitrage since the same risk weight system in Basel I was applied in Basel II (Blundell-Wignall & Atkinson, 2010) even though there were improved approaches to credit risk. Secondly, there was inadequate risk measures and techniques against securitisation. Lastly, the BCBS allowed each country to interpret Basel I and II according to their interpretation. This caused regulatory adjustments across jurisdictions in the interpretation of the Basel accord. As a result, it created loopholes around banks' adjusted regulations to take improper risk and hold low capital reserves, especially for banks that adopted the IRA in Basel II (Dipatane, 2012; Jones & Zeitz, 2017). In addition, there was not much emphasis on CAR to cover risk exposure in banks' trading books (market risk). Subsequently, the 2007-08 global financial crisis revealed many shortcomings of the Basel II Accord as many banks suffered from weak capitalization arising from excessive risk-taking. This prompted the urgent revision of the Basel II accord and the introduction of the Basel III accord in 2010 (Gavalas, 2015; Hossain & Islam, 2017).

2.2.3 Basel III accord

Basel III accord is a comprehensive set of reforms introduced in 2009/10. It aims to; firstly improve the banking sector's ability to absorb shocks arising from financial and economic stress; secondly, improve the risk assessment and management, which ensure that risk is adequately accounted for and reported; thirdly, strengthen bank's transparency and disclosures (Nkopane, 2017; Nyantakyi & Sy, 2015). Basel III accord allows for uniform regulatory adoption across jurisdictions that implement it. This is to avoid adjusted regulations that cause distortions in interpreting and implementing the principles and standards. In this regard, for African countries that adopt selective compliance, for Basel III, it is a total package; there is no selective adoption of the capital.

The changes introduced in the Basel III accord incorporated the lessons learnt from the 2008 financial crisis, and it also addressed the Basel I & II accord criticisms. Basel III increased the quality and quantity of capital. The Basel III accord focuses on reforming the regulatory capital, which is the numerator of the capital ratio through the elimination of the use of Tier1 + Tier2 in the regulatory capital (the numerator of capital ratio) in which Tier2 allows for the use of subordinated debt, thus, replacing with the use of tangible common equity (TCE). TCE is the highest form of capital that allows only equity and retained earnings in the regulatory capital (Yan, Hall, & Turner, 2012). Basel III also introduced capital charge for securitisation exposure, which eliminates regulatory arbitrage. Banks tend to underestimate risks in boom times, which can increase loan losses and erode capital and overestimate risk in recession period; as a result, forcing banks to cut back lending (Blundell-Wignall & Atkinson, 2010). In general, Basel I and II CAR were not risk-sensitive to macroeconomic conditions.

Conversely, Basel III CAR targets bank-level or micro-prudential requirements to increase the resilience of banks in the period of stress, and macro-prudential regulations, to prevent systemic risks that can spill-over across the banking sector (Nyantakyi & Sy, 2015). The Basel III accord deals with mitigating the procyclicality amplification of the systemic risk overtime using countercyclical buffer (Dipatane, 2012; Nyantakyi & Sy, 2015). Basel III capital buffers' procyclicality and leverage ratios increase the sensitivity of bank capital to business cycles like boom and trough periods (Blundell-Wignall & Atkinson, 2010). The Basel III accord introduce liquidity requirements: the Liquidity Coverage Ratio (LCR) and Net Stable Fund Ratio (NSFR), new CAR, capital floors, and leverage ratios intended to increase bank's ability to absorbs shocks during either in boom or burst to avoid systemic risk and to create stability in the financial system (BCBSa, 2017; Brei & Gambacorta, 2014; Walter, 2010).

The Basel III capital ratio remains at 8 percent with an additional countercyclical buffer, which increased the capital ratio from 8 percent to 10.5 percent (Gabriel, 2016). The Basel III accord significantly improves the quality of capital, breaking Tier1 capital into two categories: tangible common equity Tier1 (CET1), and additional Tier1. The CET1 introduces high-quality capital in its composition to include common equity shares and retained earnings (Blundell-Wignall & Atkinson, 2010). Figure 2.1 below summarises the developments in the risks charged to capital ratios in the Basel accord (Basel I, II, III, and IV).

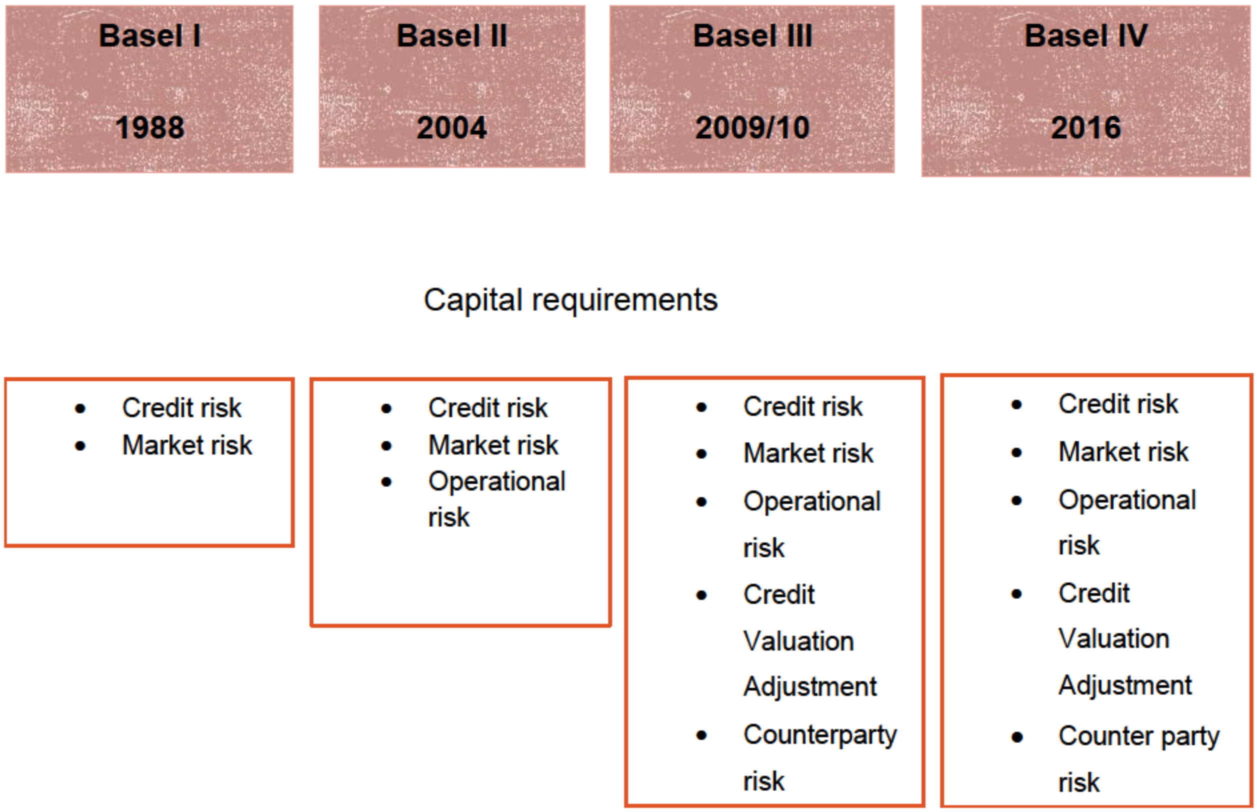

Figure 2. 1: Basel risk composition comparison

Source: Author's design

2.3 Basel IV and essentials of Basel IV accord

After the introduction of the Basel III accord, the BCBS initiated a comprehensive review of the Basel III capital framework in 2012 involving the revision of the denominator (RWAs) of the Basel III capital ratio (Magnus et al., 2017; Munoz & Soler, 2017). The revision was finalized in 2016 and called the "Basel IV accord" (BCBSa, 2017; Munoz & Soler, 2017). Basel IV accord aimed at increasing the comparability, simplicity, and risk-sensitivity of the capital ratio of different banks (Eland, Vaussy, & Lima, 2017; Munoz & Soler, 2017). The changes introduced in the Basel IV accord include standardization of RWAs, setting up of capital floors to constrain existing bank internal models, revision of securitisation framework, increasing leverage ratio for G-SIBs (Eland et al., 2017; Munoz & Soler, 2017). Banks operate in an imperfectly competitive or competitive market

(Ruthenberg & Landskroner, 2008); therefore, Basel IV may have different degrees of effects on individual banks' performance and lending. Consequently, it is important to examine the potential impact of Basel IV CAR on the performance of banks in Africa.

Basel IV capital ratio focuses on the composition and calculation of the risk-weighted side (denominator) of the capital ratio (BCBSa, 2017; Munoz & Soler, 2017). The Basel IV minimum capital ratio remains at 10.5 percent like Basel III. The composition and calculation of RWA in Basel IV are different from Basel I, II, and III. The standardization of calculation of the RWA will eliminate different approaches employed for risk assessment by banks (BCBSa, 2017). Also, Basel IV improved the risk-sensitivity of market risk and operational risk by replacing existing approaches with new standardized approaches for risk exposures (BCBSb, 2016; PwC, 2017).

2.3.1 Constituent of risk-weighted asset in Basel accords

The risk-weighted assets (Denominator of capital ratio) consists of bank assets, which include cash, securities, and loans made to individuals, businesses, other banks, and governments (BCBS, 2004). Each asset class has different risk qualities. A risk weight is assigned to each asset class serving as an indication of the risk in a bank's asset portfolio (BCBS, 2004; Jablecki, 2009). The BCBS under Basel I, II, and III CAR created five risk categories into which all assets in a bank balance sheet falls into (0 percent, 10 percent, 20 percent, 50 percent, and 100 percent). The risk weights are presented in Table 2.1 below:

Table 2. 2: Asset categories in RWA

Risk-weights	Asset categories
1st category of weight assets at 0 percent	The assets in this category are riskless. Cash held by the bank Exposure to Sovereign debt and Central banks
2nd category of weight assets at 20 percent	The assets in this category are of low risk. Multilateral development bank debt (MDB) Non-central government public sector entities (PSE)
3rd category of weights assets at 50 percent	The assets are known as moderate risk. Residential mortgage
4th category of weights assets at 100 percent	Bank claims on the private sector All capital instruments issued by other banks Real estate and other equity assets held by the bank Corporate loans
5th category of weights assets at 0, 10, 20, or 50 percent depending on central bank discretion	Claims on domestic public sector entities

Source: BCBS (2004); Kahari (2016)

Basel IV CAR introduces a wide range of standardised risk weights for risky and less risky loans within bank class assets. Such risk-weights are assigned to individual loan assets from a list of rating buckets provided in Basel IV CAR depending on the bank's risk exposure rather than assigning a single risk weight to a class asset presented in Table 2.2. The variation in risk exposures within a class asset can undermine the Basel III capital ratio (BCBSb, 2017). It implies that there may be a different risk within the same risk class assets, which Basel IV helps to address for credibility and the finalisation of the risk-based capital framework (BCBSb, 2017; Munoz & Soler, 2017).

Table 2. 3**:** Basel IV standardized approach

Risk-weights	**AAA to AA_**	**A+ to A_**	**BBB+ to BBB_**	**BB+ to B_**	**Below B_**	**Unrated**
Exposures to Sovereigns and Central Banks	0%	20%	50%	100%	150%	100%
Exposures to non-central government PSE	20%	50%	100%	100%	150%	100%
Exposures to MDB	20%	30%	50%	100%	150%	50%
Exposures to banks licensed to take deposits (External rating)	20%	30%	50%	100%	150%	
Exposure to covered bonds: Rated	10%	20%	20%	50%	100%	
Exposures to Corporates	20%	50%	75%	100%	150%	100%
Exposures to real estate	LTV≤50%	LTV≤60%	LTV≤80%	LTV≤90%	LTV≤100%	LTV>100%
Risk-weights for residential	20%	25%	30%	40%	50%	70%
Where repayment is dependent on cashflow generated from property	30%	35%	45%	60%	75%	105%

Note: LTV ratio for real estate is the amount of loan divided by the value of the property

Source: BCBSa (2017)

Further requirements in Table 2.3 above show banks may assign 65 percent risk-weights to exposures to corporate loans that are investment grades. An investment-grade company has adequate funds to meets its credit obligations. In addition, for exposure to small and medium enterprises (SMEs), a 75 percent risk weights apply to SMEs that meet specific turnover sales criteria and 85 percent otherwise. Exposures to individuals and retail such as personal loans, credit card loans, auto loans, leases, educational loans, among others, 75 percent risk weights apply. The Basel IV CAR introduces, for the first time, a disconnection between risk and capital by eliminating flat single risk weights on class assets (BCBSa, 2016, 2017). Therefore, this study aims to examine the potential impact of the new Basel IV CAR on performance, lending, securitisation, and the resilience of banks in Africa.

2.4 Criticisms levelled against Basel accords in developing countries

The aim of the introduction of the Basel accord is for the harmonization of banking regulation for international banks for global financial stability; provide a comprehensive framework to manage risk to strengthen the resilience of banks and lower the probability of banking crisis (Bergess, 2012; Kahari, 2016). Critics argue that Basel I and II accords are primarily designed for large banks in the developed economies involved in a wide range of complex activities with significant cross-border operations. However, regulators from developing countries such as Brazil, China, India, the Philippines, and United Arab Emirates adopted the Basel accord to improve their banking sector performance (Bergess, 2012; Manlagnit, 2015).

Some studies argued that the Basel accords are not for African settings. Aside from South Africa, the majority of banks in Africa focus on traditional banking of loans and deposits (Chironga et al., 2018; Kim & Sohn, 2017). Likewise, the Basel capital ratio composition requires equity capital. Still, because the capital market in many African countries is not deepened (Kahari, 2016), it is difficult for African banks to raise the required equity capital to comply with Basel CAR. In the Basel II accord, international credit rating agencies were needed to rate the financial instruments of banks and individual banks as a whole. Accessing the bank as a whole requires the assessment of the bank's loan books. While banks in the developed countries receive more favourable ratings, banks from African countries found it difficult and expensive to access these credit rating agencies such as Fitch, S & P, and Moody for credible ratings. The implications, many African banks will not have access to the international market to source cheap liquidity on their financial instruments; thus, the lending capacity of the bank reduces. Alternatively, for African banks that eventually could afford the rating agencies' services, such banks are assigned unfavourable ratings due to the differences in accounting practices and banking regulations (Balin, 2008; Bergess, 2012). International banks and foreign investors will deem such banks as risky and unsafe. If eventually, these banks have access to funds, they are given under strict conditions compared to banks with favourable ratings (Abdel-Baki, 2012; Balin, 2008). The 2008 financial crisis found the credibility of the credit ratings unreliable; thus, the Basel IV accord limit credit rating agencies' services significantly. In the Basel IV accord, the rating agencies are allowed to be used for regulatory purposes on the permission of the regulatory authorities in Jurisdictions and subject to continuous review on criteria and conditions such rating agencies must follow (BCBSa, 2016, 2017).

Still on criticism, if a bank has an unfavourable credit rating, this factor may force such bank to keep unduly high CAR above the risk retained in the books. As a result, it increases the cost of lending, which declines the volume of lending because Basel II CAR penalizes the over-estimation of the risky bank (Abdel-Baki, 2012). Furthermore, inadequate representation of developing countries in the Basel Committee causes Basel's analysis and recommendations to appear non-inclusive, especially for less developing countries like Africa (Balin, 2008; Bergess, 2012). A more inclusive and appropriate representation of regulatory authorities from developing countries in BCBS would allow for a fairer system, better-implemented regulation, and a more stable global financial system (Abdel-Baki, 2012; Bergess, 2012). These criticisms were taken into account for the global representation of the largest emerging market economies in the Basel Committee membership. South Africa is a member in drafting the Basel III accord for an all-embracing global framework (Abdel-Baki, 2012). Furthermore, the Basel IV accord was introduced as a finalisation of the Basel III accord (BCBSa, 2017; BCBSb, 2017) with representation from developed and emerging economies. Therefore, the impact of new Basel IV CAR need to be examined for Africa and how it will be beneficial for African banking system.

2.5 The nature of the African banking sector

The 2007-08 financial crisis, which began in the United States, spilt over to many banking systems in Europe, Asia, and Latin America, including Australia. There was a high perception that Africa's banking system would be affected due to its fragility (Allen & Giovannetti, 2011). On the contrary, African banks were sheltered from the financial crisis's effects because of their low integration with the global financial markets (Abdel-Baki, 2012; Allen & Giovannetti, 2011). On the other hand, most African banks are small in absolute and relative terms with underdeveloped and fragile banking systems. As a result, they can only offer basic financial services such as short-term loans compared to banks in developed countries that provide short, medium, and long term loans (Beck & Cull, 2013; Kahari, 2016). Many African countries adopted Basel standards to improve the banking sector stability (Triki et al., 2017). Some African governments introduce Basel CAR to attract foreign direct investments to signal investors a safe banking system. Nevertheless, the performance of banks in Africa has remained poor because of the lack of enforcement of the Basel regulation by the regulatory authorities even though African banks are profitable because riskier assets are remunerated with higher returns (Demetriades & Fielding, 2012; Munyambonera, 2013). The poor performance of banks in Africa are linked to inadequate capitalization, higher incidences of non-performing loans, a higher level of liquidity risks, high cost of financial intermediation, high-interest rate spreads, high inflation rates, high-interest rates, lower deposit rates to capital investment, increased volatility in the exchange rate and low growth in Gdpgrowth (Munyambonera, 2013; Okoye et al., 2017).

Basel capital regulations are seen as international best practices. The Africa banking system has benefitted from improving the quantity and quality of capital, eliminating banking fragility, reducing bank failures, and incidences of non-performing loans. For instance, the implementation of Basel I and II CAR increase the capital ratios of banks in Nigeria, South Africa, and Egypt (Abdel-Baki, 2012; Okoye et al., 2017). Furthermore, higher capital increased the loan portfolios of banks in Nigeria and South Africa. Egypt saw an increase in deposit-taking, but not yet in loan increase as some customers were lost to shadow banks, but their capital levels increased (Abdel-Baki, 2012). South Africa and Egypt have implemented Basel III CAR (Sadien, 2017; Zaky & Soliman, 2017). These advancements in the implementation of Basel II and Basel III CAR show that African banks can adopt higher CAR. Amidst the challenges most African banks face, very few banks are already tapping into the opportunities in the African market. For instance, South African banks are successfully expanding into other African countries that many local banks strive to stay alive in. South African banks are well-capitalized, which have given these banks the advantage for cross-border banking activities in populous African continents for revenue opportunities (Mecagni, Marchettini, & Maino, 2015; Nkopane, 2017). Additionally, few Nigerian banks expand into their neighbouring West African countries, while Kenyan banks compete favourably in technology and innovative mobile banking within African countries (Mecagni et al., 2015).

From the foregoing, not all banking systems in Africa are under-developed (Kahari, 2016). However, bank regulators in many African countries adopt a selective approach in the Basel framework in their country's national banking regulations. This results in increasingly crippling the banks from delivering more significant financial development and inclusion (Triki et al., 2017) because of bank regulators' conservative approach to changes in Basel CAR. From the foregoing, studies such as Abdel-Baki (2012); Beck and Cull (2013); Triki et al. (2017) states that the national regulations in most African countries need upgrading to the international standards for a "best fit" approach rather than a "best practice" approach. However, in developed economies, regulators seek best practices. Factors such as capital inadequacies; lack of depth in many African countries capital market to support banks to raise adequate equity capital led these studies (Abdel-Baki, 2012; Beck & Cull, 2013; Triki et al., 2017) to call for a best-fit approach for compliance to Basel CAR, due to varying level in the financial developments of African banks. That it will help the African banking system grow into a well-functioning banking system (Beck & Cull, 2013; Triki et al., 2017). Best-fit arguments were justifiable for African banks under Basel I and II accord because the two accords allowed each jurisdiction to interpret the accord to suit their banking needs. In this regard, bank regulators in Africa could adopt selective Basel CAR in their banking regulations. As such, Nyantakyi and Sy (2015) argue that African banks are adequately supervised with selective adoption. Despite this argument of best-fit approach and adequate supervision under selective Basel CAR adoption in African national banking regulations, many of the African banks face a number of challenges mentioned earlier leading to distress and failures due to their regulatory authorities not embracing changes in Basel regulations but they rather stick to outdated and inadequate regulations that are inadequate to cover bank risks and yet kept claiming that the higher Basel accords are not the best-fit regulations for their banking industry.

Moreover, the best-fit approach embraced has caused much African banking industry to remain under-developed. Basel III and IV do not allow a selective approach. Basel CAR's implementation eliminates weak banks and emerges stable banks to serve African economies' needs. As witnessed in South Africa for implementing Basel II CAR; also Nigeria for implementing Basel I CAR where 25 banks emerged out of 89 banks after the implementation period (Okoye et al., 2017). Additionally, in the developed markets and other emerging countries, banks have moved away from the “originate to hold” model to preferably an “originate and sell” model. The former involves accepting deposits (usually short term in nature) from the public, transforming into loans. The latter involves issuing loans and selling such loans in the securitisation market (Bakoush et al., 2019). Since deposits are generally short term, African banks are constrained to make long term loans. Also, capital inadequacies restrict bank capacities to provide only short-term loans (Triki et al., 2017). Implementation of higher CAR will make banks in Africa re-organize their revenue-generation model and seek new ways to increase profits other than providing basic financial services, which may increase competition and expansion of the banks in Africa (European Investment Bank, 2016; Zaky & Soliman, 2017). Therefore, examining the impact of changes in the Basel regulatory framework in the African industry is important; thus, this study's relevance.

2.5.1 Securitisation in Africa

Furthermore, the origination of securitised loans is very low in Africa. Securitisation contributed to increased bank lending in developed countries, especially before the 2008 financial crisis (Jablecki, 2009). The incentives to securitise loan assets fill the gap in the shortage of loan supply leading to accelerated economic growth in the developed countries. Although African banks are making revenue from their basic financial services, there is room for expansion. For instance, South Africa is leading in Africa's securitisation activities with 948 securitisation transactions between 2002 and 2018. This volume of securitisation from South Africa is also still low. Egypt and Nigeria are following with 62 securitisation and 3 securitisation respectively so far as of 2010. Kenya has none, even though the country has implemented the regulatory framework to facilitate the issuance of securitised loans from banks (Munene, 2010). This study focuses on South Africa securitiation due to a lack of comprehensive data on securitisation activities for African banks. The BCBS introduced a revised securitisation framework in 2016; this study examines the framework and Basel IV CAR requirements impact on banks' securitisation and performance in Africa. Subsequently, a brief overview of selected African banking systems relevant to the study is discussed in the next session. The selected African banking systems discussed have been identified during data collection as having commercial banks within their banking systems in compliance with Basel II or Basel III CAR. Also, the selected banking system has relevant data for the study sample chosen period. Furthermore, it is to be noted that some African banks comply with Basel II or Basel III CAR even though their countries have not implemented higher Basel CAR. The banks in these positions are usually involved in a cross-border range of banking activities, so such banks stay updated with relevant Basel changes to keep business going with the international banks and investors.

2.5.2 South African banking sector

Over two decades, the South African banking system has evolved quickly to meet the challenges of digitisation and compares favourably with the banking system in many developed countries. South African banks are viewed as world-class, with well-capitalized banks, technology, infrastructure, and a strong legal and regulatory environment (Sadien, 2017). The stable regulatory environment and the early implementation of risk management systems of Basel II helped protect the banking system from the 2008 financial crisis (The Banking Association South Africa, 2019). Advancement in technology is also a big move for financial inclusions to reach the unbanked to access banking products for more profits (Beck & Cull, 2013), which South African banks have capitalized on. South African banks' strength in competition, advancement in technology, and adequately capitalized above the minimum requirements is also their weakness (Nkopane, 2017). The implementation of Basel II and Basel III accord enhanced the banking operations and cross-border activities, but lending within their country declined (Nkopane, 2017). Another weakness is the competition. The South African banking sector is monopolized by the top four largest banks, with combined assets of 90 percent (Adesina & Mwamba, 2016). The monopolized banking sector is causing high cost of lending and unhealthy competition unfavourable to medium and small banks operating in the country (Kasse-Kengne, 2018; Nkopane, 2017). With the advancement in technology, these monopoly banks are reducing the number of their physical branches as more than 700 branches of these top banks have been shut down between 2011 and 2019 (Tarrant, 2019). This leaves a number of populations not literate in the use of technology at a disadvantage and at an extra cost of finding another near physical branch for banking facilities. Other Southern African Countries (SADC) are dominated by foreign banks and are ready to dispose of their interest due to a decline in commodity prices. As a result, the decline is causing an increase in non-performing loans and tight liquidity (European Investment Bank, 2016). Increasing regulatory CAR, risk management, and product transparency remain important for the banks in SADC (European Investment Bank, 2016).

2.5.3 Nigerian banking sector

Before the recapitalization exercise in 2005, Nigerian banks were small in size. They were characterised by bank failures, fragile, low lending, high operating cost, under-developed, and unimpressive performance (Soludo, 2006). The successful implementation of Basel I CAR in which the Central Bank of Nigeria (CBN) used a best-fit approach to recapitalize Nigerian banks from N2 billion to N25 billion tackled most of the problems listed earlier. But it led to a reduction in the number of banks from 89 to 25 (Okoye et al., 2017). After the implementation of Basel I CAR in 2005/2006, the operations of the Nigerian banks increased lending increased, and cross-border activities into neighbouring West-African countries also increased (Soludo, 2006). These rapid developments caused a lot of regulatory and supervisory problems for the CBN (Abdul, 2017). Yet, the CBN failed to implement Basel II CAR; the global financial crisis necessitated the regulatory authority to push for Basel II capital adequacy to manage banking risk (Dafe, 2020). The CBN introduces risk management principles in the Basel II accord but tailored to the Nigerian banking system in 2012 (PwC, 2013). In 2013, CBN issued guidelines on the implementation of Basel II capital adequacy implemented in 2014 as a parallel run with the existing Basel I CAR (Adenusi, 2014). Before its introduction, some Nigerian banks with a presence in international banking were already in compliance with Basel II accord risk management principles (Dafe, 2020). Nigeria was faced with challenges of skilled personnel and expertise to assess and assist banks in implementing the Basel II requirements, and this is a challenge for many African countries (PwC, 2013; Triki et al., 2017). After the implementation of Basel I in 2005, it took so long for the CBN to implement Basel II in 2014. Nevertheless, Obamuyi (2013) suggests that higher CAR for Nigerian banks would increase interest income and economic growth. The Central Bank of Nigeria gives an 8-years implementation period for the implementation of the Basel III accord with effect from 2019 (Agbaeze & Onwuka, 2014).

2.5.4 Egyptian banking sector

The Central Bank of Egypt (CBE) has been actively introducing series of regulatory capital adequacy reforms since the late 1990s’ in regulating the banking industry (Abdel-Baki, 2012; Naceur & Kandil, 2009). The implementation of Basel I 8 percent minimum capital ratio in 1991 reduced the number of banks, increased the cost of financial intermediation, and slowly increased the efficiency of the Egyptian banks (Naceur & Kandil, 2009). The CBE recapitalisation regulatory reforms (Basel I) were seen as costly, higher capital and a reduction in the number of banks led to a banking crisis in 2003 (Abdel-Baki, 2012). For this reason, in 2004, the CBE implemented new sets of consolidation and recapitalization reforms in two phases (Abdel-Baki, 2012). The first phase spans between 2004-2008, while the second phase, 2009-2011, increased banks' capitalization and sound banking industry that supports economic growth (Abdel-Baki, 2012). This led to Egypt successfully implemented Basel II CAR in 2012.

Furthermore, the CBE issued a timeline for the implementation of Basel III CAR for Egyptian banks starting from 2016 at 10.625 percent, 2017 at 11.250 percent, while 2018 and 2019 will be 11.875 percent and 12.5 percent, respectively (Central Bank of Egypt, 2016; Zaky & Soliman, 2017). The implementation of Basel I and II CAR did not increase bank lending because the cost of lending increased, which led bank borrowers to shadow banks, which is a threat to the stability of the commercial banks. Despite this factor, CBE did not relent in introducing higher capital (Basel III) to improve the Egyptian banking sector's resilience and improve the risk management assessment and reporting of the banks (Abdel-Baki, 2012). Zaky and Soliman (2017) argue that Egyptian banks may be forced to improve banking products, customer services and innovate new products that will have a high degree of profitability under Basel III CAR.

2.5.5 Kenya banking sector

Kenyan banking sector lack depth and infrastructural presence for financial inclusion across its population (European Investment Bank, 2016; Jack & Suri, 2011). To fill the gap, telecommunication providers came in with mobile money innovation in collaboration with major banks in Kenya to solve the problems of weak formal banking services that are unreachable to a large number of citizens because of costly financial intermediation (Bateman, Duvendack, & Loubere, 2019; Jack & Suri, 2011). The successful innovation facilitates the issuance of loans and repayment, bill payments, and other financial services for wider reach across the previously untapped banking population. (Bateman et al., 2019; Jack & Suri, 2011). Other regions in East Africa follow suit to replicate mobile money in their respective countries (Jack & Suri, 2011). Although mobile money is a success, the underlying problems that led to telecommunication industries bridging the gap still exist, which the bank regulators have to address. For instance, the default rate on loans in the East Africa region, namely Kenya, Burundi, Rwanda, Tanzania, and Uganda, exceeds 10 percent of the total loan, which is very high compared with international standards (Demetriades & Fielding, 2012; European Investment Bank, 2016). The default rate reached 30 percent because of corruption and political influence to obtain loans to finance the risky project without a proper appraisal, thus making issuance of loans unprofitable for banks such as in Kenya (Demetriades & Fielding, 2012).

Fraudulent lending, poor risk management practices, weak regulatory and supervisory powers, and inefficient banking laws led to three bank failures between 2015 and 2016 (Waithaka, 2013). Kenyan banking laws need an update for the stability and credibility of the banking system (Waithaka, 2013). The Central Bank of Kenya (CBK) introduced features of the Basel II accord in the Kenyan banking law by increasing the minimum CAR fromUS$4 million in 2008 to US$12 million by December 2012 (Gudmundsson, Ngoka-Kisinguh, & Odongo, 2013). Yet, the CBK lacks enforcement of prudential and banking regulations (Waithaka, 2013). Following a similar path of phased in for Basel II CAR, CBK opted to implement Basel III CAR in a phased-in approach starting from the year 2013 for two years (Kombo, 2014). However, according to an observation from Bloomberg (2019), Kenyan banks are still in compliance with Basel II CAR, suggesting that Basel III CAR is yet to be enforced by the CBK in the Kenyan banking sector.

The East African banks need higher capital to reduce non-performing loans and high cost of lending and stability to finance commercial loans, commercial mortgage loans, and other loans relevant for contribution to Gdpgrowth instead of reliance on mobile money that is only relevant to increase consumer spending. Few studies in Africa, such as European Investment Bank (2016); Triki et al. (2017) concluded that compliance to higher Basel CAR reduces transaction costs, reduces corruption in lending, and increases regulators and supervisors' capabilities to monitor banks adequately. More generally, well-capitalized banks have more capacity to increase loans and still meet regulatory CAR (Waithaka, 2013).

2.5.6 Botswana banking sector

Botswana's economic expansion and stability are driven by heavy reliance on the diamond's exportation until the 2008 financial crisis, which affected the demand for diamonds (Dipatane, 2012). The Botswana banking sector has played a key role in the country's economic growth (Keith & Abo, 2010). Before the financial crisis, the Botswana banking sector enjoyed increased profitability from lending to households rather than corporates, high bank charges, and high-interest spreads between deposit and lending, causing high lending costs. The banks also denied banking services to some population groups in the country (Keith & Abo, 2010). Comparing Botswana to the Mauritius and South African banking sectors, the Botswana banking sector lacks financial depth and is characterized by low lending. Also, because all banks in Botswana are foreign, they lack competition, poor banking service, and innovation. After the 2008 financial crisis, diamond demand fell, and banks had to find other avenues to generate income which increased competition (Dipatane, 2012; Keith & Abo, 2010). Nevertheless, Botswana maintains a healthy and stable financial sector.

Bank of Botswana (BoB) regulates the banks in Botswana through the Banking Act to ensure financial stability. Botswana introduced Basel I CAR in their national banking act in 1995 (Dipatane, 2012). According to Dipatane (2012), because the banks were adequately capitalized from the Basel I accord, BoB was skeptical about implementing Basel II arising from the complexities in the Basel II accord and the lack of technical personnel needed to deal with the complexities. However, a recession hit the economy as a result of a decline in the demand for diamonds during the 2008 financial crisis. In addition, the supervisory authorities lacked the capacity to assess, monitor, and validate models used by commercial banks for risk assessments (Dipatane, 2012). Also, in 2015, the banks ran into liquidity problems due to a decline in deposits to finance new loans, which led to the government injecting new funds to support the banks (Mapororo, 2018). In 2014, BoB introduced Basel II on a phased-in basis to run parallel with Basel I accord (Mapororo, 2018). In 2016, the Basel II capital requirement was fully implemented (Mapororo, 2018). At the same time, the other two Pillars of Basel II accord were implemented in phase-in. The BoB consider implementing Basel III CAR at a later date for 2022/23.

2.5.7 Ghana banking sector

Banking services in Ghana are considered inefficient (Soile-Balogun, 2017). Furthermore, macro-economic challenges such as high inflation and an increase in non-performing loans crippled the banking sector in addition to structural and institutional constraints (Owusu-Antwi, 2009; Soile-Balogun, 2017). The turbulent macroeconomic environment's cumulative effect and non-performing loans led to a decline in capital reserves; also, reduction in deposits triggered a series of banking crises within the past five years (Soile-Balogun, 2017). The Bank of Ghana (BoG), the apex regulatory authority, has been ineffective in discharging its supervisory and regulatory responsibility since the 1980s (Owusu-Antwi, 2009; Soile-Balogun, 2017). As a result, BoG ineffectiveness has contributed to major problems of instability and fragility for the commercial banks in Ghana (Owusu-Antwi, 2009). The financial sector assessment program reforms (FINSAP) in 1987, followed by a banking act in 1989, contributed to improvements in the Ghanaian banking sector. The reform saw an increase in bank capitalization and a decline in non-performing loans (Soile-Balogun, 2017). Nevertheless, BoG continued to fail in supervision, monitoring, oversight, and regulatory functions (Annor, Obeng, & Nti, 2020). The apex bank issued licenses to banks on falsified and unverified information. Also, capital adequacy, non-performing loans, asset quality continue to cause bank distress and reasons for continued bank failures in Ghana (Annor et al., 2020), which compliance to Basel CAR could tackle. After seven bank failures between 2015 and 2016, the Bank of Ghana introduced Basel II CAR in its banking law in 2016, which was implemented in July 2018 for the financial system's stability and credibility (Cañamero, Degruson, & Oleksza, 2018). Other proposed agenda by the Bank of Ghana is the finalization of the implementation of Pillar II of the Basel II accord to improve the supervisory powers of the Bank of Ghana (Addo & Tawiah, 2020).

2.5.8 Mauritius banking sector

Mauritius has a well-established banking system in Africa. The banking sector has a wide variety of banking services, from traditional (loans and deposits) to specialized services to cross-border banking activities. The banking sector is segregated within the local economy into two segments, segment A and B-SegA and SegB. Banks in SegA offer traditional banking to households and firms, while banks in SegB, usually large banks, offer banking services to global corporates (Desai, 2016). This system shielded the Mauritian banking sector and the economy from the 2008 financial crisis. The Mauritian economy and population are small, limiting banks in SegA to utilize deposits to expand lending (Desai, 2016).

The country implemented Basel I and Basel II CAR fully in 2009 (Triki et al., 2017). Ramlall and Mamode (2017) show that the Mauritius banking sector was well-capitalized under the Basel II accord. Nevertheless, The Bank of Mauritius transitioned to implement Basel III in 2014, effective from January 2016, to improve the banks' resilience and improve the risk management procedures, transparency and disclosures of banks in Mauritius (Bank of Mauritius, 2014). However, Ramlall and Mamode (2017) argue that the banks might pass the cost of implementing Basel III to customers to sustain the return on equity; thus, the cost of lending may increase, which can decline demand for loans. In contrast, Sookye and Mohamudally-Boolaky (2019), in their study, argues that the implementation of the Basel III accord will give a new dimension on how Mauritian banks manage risks more efficiently. That under the Basel II risk management, the Mauritian banking sector may not be strong enough to absorb shocks that could arise from any future financial crisis and other risks looming in the financial markets, as such, the Mauritian banking sector may be negatively affected, thus calling for the implementation of Basel III higher CAR for Mauritian banks (Sookye & Mohamudally-Boolaky, 2019).

After the implementation of Basel III CAR in 2014, the banking sector experienced a deterioration of asset quality of the banks between 2015 and 2016 but improved subsequently; thus, the profitability of Mauritius banks remained positively stable as at the end of June 2018 as a return on equity increased by 1.2 percent between December 2016 and June 2018 (Bank of Mauritius, 2018). Although there was a slight increase in non-performing loans, it stood at 6.5 percent in 2018, which is low compared to the ratios from the banking sector in many African countries (Bank of Mauritius, 2018).

2.5.9 Morocco banking sector

Morocco has a well-established and sophisticated banking system in Africa (Triki et al., 2017). The Moroccan Central Bank Bank Al-Maghrib (BAM), the regulatory authority, implemented Basel II CAR (Triki et al., 2017). In 2010, BAM put forward the implementation of Basel III CAR with effects from 2014 set to be completed in 2019 (Attijarlwafa Bank, 2015). The aim of introducing Basel III is to continue to strengthen the resilience of banks in Morocco both locally and cross-border. Basel III enhanced the Moroccan banks financial deepening as the number of bank accounts increased by 4.9 percent in 2016 and 6.4 percent in 2017; while total bank assets increased by 122 percent in the same period (Oxford Business Group, 2020). Although the Moroccan banking sector is also controlled by top three banks having a combined asset of 65 percent. But the 2015 Moroccan banking law provided necessary regulations enhancing a new development phase introducing Islamic banks referred to as participatory banks to further enhance the financial depth of their Moroccan banking sector (Oukili & Hamiche, 2020). For the reason that Morocco has a large population of Muslims in which the participatory banks can convince for deposit and loans to avoid bank interest, which could further expand the financial inclusion of the populace (Oukili & Hamiche, 2020). According to Oxford Business Group (2020), one-third of Moroccan banks' lending is to households, followed by corporates, while lending to agriculture is low at 3.8 percent in 2017. Non-performing loans are at a single digit of 8.3 percent, profitability measured by return on asset is low at 0.9 percent, but it is high when measured with return on equity at 9.5 percent as of 2017.

2.5.10 Tanzania banking sector

It is the second-largest economy in East Africa (European Investment Bank, 2016). Tanzania banks maintain a high capital ratio above the Basel I, II, and III minimum CAR (Lotto, 2016). Despite the high capital ratio, the contribution of lending to the private sector in the percentage of Gdpgrowth is less than 25 percent in the Tanzanian banking sector. In addition, the banking sector is not transformed because of selective compliance with certain features of the Basel accord. Also, there is no specific Basel accord that the bank of Tanzania uses in its banking Act. According to Bank of Tanzania (2019), there are commercial banks that could not meet the 10 percent core capital ratio set by BoT in 2019. The BoT could be setting arbitrary capital level to signal a strong banking sector for international investors. Compliance with changes in Basel CAR will help the Tanzania banking sector as experienced in South Africa, Nigeria, and the Egyptian banking sector.

2.5.11 Namibia banking sector

Namibian banking sector implemented Basel II in 2010 (Kaira, 2013); furthermore, to enhance the resilience of the Namibian banking sector, The Bank of Namibia, the regulatory authority, implemented Basel III CAR with effect from 1st September 2018

(Government Gazette Namibia, 2018). The non-performing loans are less than 5 percent even though non-performing loans increased from 3.6 percent in 2018 to 4.8 percent in 2019 as a result of recessionary economic conditions but still below 5 percent (Bank of Namibia, 2020). As a result of maintaining a strong Basel CAR, the Namibian banking sector continue to be profitable despite the prevailing conditions in the macro-economic environment (Bank of Namibia, 2020)

2.5.12 Swaziland banking sector

Swaziland experienced slower growth, mainly attributable to an unfavourable external environment (Central Bank of Swaziland, 2017). The challenges in the economy constrain the banks to access foreign direct investment and are likely to pay a high premium to attract FDI (Central Bank of Swaziland, 2017). The high cost of funds is passed down to borrowers leading to the high cost of lending. The Central Bank of Swaziland maintains that although the banks continue to grow but maintaining the resilience of the banking sector remains a challenge. Bank profitability continues to weaken for 2016 and 2017 consistently as a result of the unfavourable macroeconomic environment, increase in non-performing loans, increase in operating costs, high inflation and, weakened asset quality continues to threaten the going concern of the banks in the country (Central Bank of Swaziland, 2017). The bank of Swaziland maintains that the banks remain well-capitalized above the minimum 8 percent, with an aggregate industry-wide capital adequacy ratio at 23.5 percent and non-performing loans at 28 percent in 2017 (Central Bank of Swaziland, 2017). The banks maintain high capital reserves, but if the high reserves are not linked to the proportion to risk exposure banks face, it may cripple the functions of the banks, and such banks will continue to remain inefficient. The banks in Swaziland are faced with credit risk, operating risk, market risk, and liquidity risk, which are accounted for in Basel accords that Swaziland banks can benefit from if implemented.

2.5.13 Uganda banking sector

Uganda is the third-largest economy in East Africa (European Investment Bank, 2016). The banking sector in Uganda is relatively under-developed with a low rate of financial inclusion as banking services are less prominent in rural areas than in urban areas (European Investment Bank, 2016). The percentage of credit to the private sector compared with Gdpgrowth is less than 20 percent in the past twenty decades. Bank capital is above the minimum CAR of 8 percent. Nevertheless, the bank sizes are small and inefficient. The banking system also relies on M-PESA to deliver financial services.

The Uganda banking sector has faced several challenges arising from persistent economic decline, political instability, high inflation, fraudulent lending, and shortage of skilled personnel accounted for the country's slow pace of banking growth (Atuhirwe, 2019; Soile-Balogun, 2017). Seven commercial bank failures had been recorded within 15 years arising from high operational risk, which negatively impacted the profitability of the failed banks (Atuhirwe, 2019). With the growth in technology and mobile banking, the surviving banks will continue to have operational risk management challenges. Atuhirwe (2019) called for strategies to improve the operational risk of the banks in Uganda. The Bank of Uganda (BoU) use Basel I accord in their banking Act for a long time (Bank of Uganda, 2019). In 2019, BoU successfully implemented the three pillars of the Basel II accord (Bank of Uganda, 2019). In addition, the BoU noted that the Uganda banking sector remains resilient, and all commercial banks continue to hold capital above the 10 percent minimum core capital. Non-performing loans declined in 2019 (Bank of Uganda, 2019). Basel II incorporate operational risk for CAR. Furthermore, Basel III and IV CAR have improved operational risk that banks from Uganda can benefit from.

2.5.14 Zimbabwe banking sector

Zimbabwe has a weak economy with a multi-currency system, weak institutional infrastructure, hyperinflation rate, and international sanctions causing economic crisis since the year 2000 (Gono, 2011; Nhavira, Mudzonga, & Mugocha, 2018). The international sanctions affected the Zimbabwe economy and also affected the banking sector. In addition, the banks are threatened with liquidity risk as a result of short-term deposits. Nevertheless, the Reserve Bank of Zimbabwe implemented the Basel II accord with a gradual approach in September 2011 finalized in 2013 to enable for smooth transmission and also to enable the banks to have the required capacity to operate in the Basel II environment (Gono, 2011; Nhavira et al., 2018).

The salient points from each African banking sector reviewed above in compliance with Basel CAR indicate that adequate capital and risk management practices are relevant for a stable banking sector. Many of the banks still maintain traditional banking except South Africa and Mauritius. Also, the bank regulators and banks have shortage of skilled personnel for implementing Basel requirements. However, the performance of the banks that complied with the higher Basel CAR improved. The new Basel IV accord was introduced to further strengthen the resilience of banks. Observation from Bloomberg (2019), over 50 percent of banks in Africa are yet to implement Basel II as of 2018, even though countries such as Namibia, South Africa, Morocco, and Mauritius have implemented Basel III CAR. If African banks embrace the new CAR of Basel IV, will it improve the performance of banks in Africa while at the same time achieving a resilient banking system given the opportunities for revenue growth stemming from unreached clients?

2.6 Cost of bank lending in the Africa banking sector

Securitisation is a source of funding to finance loans apart from customers' deposits. Also, banks can source funds from the international market. However, from session 2.4, African banks are given bad credit ratings or have no access to credit ratings; thus, access to cheap funds from the international market is costly or denied. All these factors contribute to the high cost of lending in Africa. The high prices of loans reduce credit availability to customers (Asongu & Odhiambo, 2018). Also, banks will possibly charge a higher interest rate for considered risky loans (Gabriel, 2016). Furthermore, the high cost of bank loans in Africa is also due to the uncertainty in the macroeconomic environment, political instability, lack of institutional infrastructure for data information on borrowers.

Nonetheless, the high lending spread increases banks' net interest income in Africa (Chironga et al., 2018). However, the high cost of operations, non-performing loans, provisions for loan default, poor risk management erodes bank profits (Andrianova et al., 2015; Chironga et al., 2018). According to European Investment Bank (2016); Triki et al. (2017), compliance to higher Basel capital reduces the cost of lending, which makes lending cheaper. Sookye and Mohamudally-Boolaky (2019) state that compliance with higher Basel CAR forces banks to be innovative, which drives down the cost of lending. For instance, Basel I led to Nigerian banks to issue more loans. Also, South Africa compliance to Basel II facilitated an increase in loans and expansion into cross-border banking activities, financial deepening. Furthermore, the profitability of Morocco banks increased with Basel III CAR.

On the contrary, other studies Nkopane (2017); Nyantakyi and Sy (2015) argue that higher CAR would increase the cost of lending, which may further decrease demand for loans. Nevertheless, well-capitalized banks have more capacity to increase loans (Waithaka, 2013). In addition, in South Africa, Namibia, Mauritius, Egypt, and Morocco, the implementation of Basel III CAR strengthen the banks to manage risks more efficiently and reduce non-performing loans (Bank of Namibia, 2020; Sookye & Mohamudally-Boolaky, 2019). The Basel IV capital provides a bucket list of risk-weight which can drive down the cost of lending provided the banks lend to quality borrowers. Also, the standardization of risk-weights in the calculation of capital ratio under Basel IV will be beneficial for less sophisticated banks in Africa to adopt without incurring more personnel cost to develop models in the calculation of capital charge for a loan.

2.7 Basel IV CAR and non-performing loans from African banks

A performing loan becomes non-performing loan when a borrower defaults in the payment of either/both principal or interest for 90 days past due (Umar & Sun, 2016). In simple terms, it is a loan loss (Umar & Sun, 2016). Non-performing loans are a cost to the banks, affecting the loan asset quality of the banks. The more a bank is exposed to high-risk loans, the higher the non-performing loan (Asiama & Amoah, 2019). An increase in non-performing loans poses a serious threat to any bank's survival (Asiama & Amoah, 2019; Syed, Agha, & Saif ur, 2012).

Capital adequacy has been linked to decline in non-performing loans (Andrianova, Baltagi, & Demetriades, 2011) for two reasons. Firstly, compliance with changes in Basel CAR enables banks to better access borrower’s ability to repay a loan. Secondly, capital can absorb losses from non-performing loans in such a way that it reduces the likelihood of a bank failure (BCBSb, 2017). In Africa, when banks give loans, some lag in following up with the loans, which results in non-performing loans (Waithaka, 2013). Due to inadequate risk management practices, which constrain such banks to follow up payment of loans. Compliance to Basel capital requirements increases the size of banks and improve the risk management practices of banks (European Investment Bank, 2016; Sookye & Mohamudally-Boolaky, 2019). Non-performing loans are accounted for in credit risk in all the Basel accords. Credit risk represents a significant part of banking activities (BCBSa, 2017). Basel CAR account for 80 percent of bank credit risk exposure because, for most banks, loans are the largest source of credit risk (BCBS, 2010; BCBSa, 2017).

The adoption of Basel CAR offers banks a better credit assessment of clients, increasing bank lending and reducing non-performing loans, as seen in Nigeria, South Africa, and Mauritius (Bank of Mauritius, 2018; Nkopane, 2017; Soludo, 2006). In Ghana, rising non-performing loans affect banks' performance because of the lack of compliance with Basel CAR (Asiama & Amoah, 2019). Basel IV aims to reduce the probability of bank failures for a safer financial system (BCBSa, 2017). The introduction of Basel IV CAR's standardized approach will provide increased risk sensitivity for loan assets (BCBSa, 2017; Munoz & Soler, 2017). The identified issue of non-performing loans in Africa are examined in the chapters to come (chapter 3, 4, 5, and 6). To determine if Basel IV CAR will reduce non-performing loans as banks engage in activities that generate profits such as lending and securitisation without affecting the resilience of the African banks.

2.8 Summary and concluding remarks

This chapter discussed the Basel accords, criticisms of the Basel accord for Africa, the nature of the African banking sector, and Basel compliance of selected African countries. Morocco, Mauritius, Egypt, and South Africa have successfully implemented Basel III CAR. Suppose African banks embrace the new CAR of Basel IV. Will it improve the performance, lending, securitisation, and resilience of banks in Africa, given the opportunities for revenue growth stemming from unreached clients?

Implementing Basel IV higher CAR will have its benefits in tackling the challenges in African banks, such as capital inadequacy. However, higher CAR is also without their trade-off. Embracing higher CAR can increase the cost of lending. Higher CAR can reduce the number of African banks and loan volumes. Banks in Africa have growth opportunities; however, the interest rate on loans is high (profits to the banks), making lending costly to borrowers. The study focuses on the newly introduced Basel IV CAR. Understanding the possible impact of the Basel IV framework on the performance, lending, securitisation, and resilience of banks in Africa is essential, thus the relevance of this study.

CHAPTER THREE

IMPACT OF BASEL IV CAR ON THE PERFORMANCE OF COMMERCIAL BANKS IN AFRICA

3.1 Introduction to Basel IV CAR and bank performance

The Basel Committee on Banking Supervision (BCBS) has published four different Basel levels between 1980 and 2020- Basel I, II, III, and IV. Only Basel I, II, and III have been implemented. The Basel IV accord is proposed to be implemented in 2023. The aim of the BCBS for introducing higher Basel level is to strengthen the resilience of the banking system; however, implementation of higher Basel level by banks has its challenges, which may affect the performance of banks. As banks become constrained in their lending ability to the expansion of credits (Naceur & Kandil, 2009). According to Berger (1995), the conventional hypothesis in banking suggests that higher CAR is associated with lower return on equity. There are, however, concerns on the implication that higher CAR would have on the performance of banks in Africa if implemented, considering that the introduction of Basel III and IV came as a result of the financial crisis in the developed countries.

The primary function of banks channelling depositors funds to borrowers plays an important role in providing credit to firms and industries that drives the economic growth in any country (Boateng, 2019; Hoffmann, 2011). A developing economy like Africa cannot survive without a performing banking system. Bank performance in Africa has been threatened due to capital inadequacy, low lending, macro-economic fluctuations, and high non-performing loans. These factors affect banks' performance as a result of lack of compliance to changes in Basel CAR, which in general expose such banks to inadequate risk assessment and management. Examining the impact of higher Basel CAR on banks' performance in Africa has become important due to untapped revenue opportunities in Africa arising from the lack of financial depth of the African banking sector in a populous continent. The previous chapter discussed the history of Basel I, II, and III, and the nature of the African banking sector. This chapter proceeds with discussions on the implications of the Basel CAR on bank performance in Africa, which the first objective of this study. There is a need to account for banks’ responses to higher CAR from Basel IV and their impact on the performance of commercial banks in Africa. The findings will pave the way for understanding whether African banks should adopt the proposed new Basel IV framework or not. This chapter addresses the implications of the changes in Basel CAR and the implications on bank performance in Africa from the literature to the empirical analysis. Therefore, the chapter is divided into four sections. The first section introduces the discussion on Basel IV and the performance of banks. Subsequently, the second section presents the theories and empirical literature on Basel CAR and performance. Next, the third section presents the research methodology, variables, and estimation techniques used to measure Basel CAR and performance. The last section presents the results and explains the discussions and implications of Basel IV CAR for the performance of banks in Africa.

3.2 Bank performance under Basel IV framework

The performance of banks is a crucial element to the survival of banks. At the same time capital regulations are important factors that could be beneficial or detrimental to the performance of banks (Bandt et al., 2018). Due to the nature of banks' business, banks are exposed to many potential risks of losses; deposits withdrawal without notice, uncertainty in loan repayments from borrowers, the state of the economy like recession, among others (Hardy, 1998). These risks affect the performance, the survival of banks, and the banking sector's stability; its negative effects can spill over to the economy (Chiaramonte & Casu, 2017; Hardy, 1998). To these effects, regulatory authorities play an important role in establishing adequate regulations that include capital requirements to address the banks' risks (Chalermchatvichien, Jumreornvong, & Jiraporn, 2014; Roulet, 2018; Walter, 2010).

Nevertheless, the decisions made by the regulatory authorities for the stability of the banking sector, which includes higher capital requirements, affect the performance of banks (Berger & Bouwman, 2013). This begs the question of whether Basel IV CAR will be beneficial to the performance of banks in Africa. In this context, issuing loans is the primary source of earnings to any bank, which increases the performance of banks. However, if a bank experiences a sudden decline in loan quality, such a fall can quickly reduce the bank's available capital. As a result, banks with low capital could be left with inadequate capital to deal with unexpected losses, which can lead to bank failure that can have negative economic consequences (Boateng, 2019; Mamatzakis & Bagntasarian, 2019). The 2008 financial crisis re-ignited bank regulators and policymakers focus on the importance of banks maintaining a certain minimum of CAR to prevent financial crisis (Oino, 2018; Ramlall & Mamode, 2017; Walter, 2019).

Before the global financial crisis, a bank's total capital ratio was clearly defined by the BCBS set to be not lower than a minimum of 8 percent (BCBS, 2004; Dermine, 2013). However, many banks that fell into the risk of bankruptcy in the 2008 financial crisis breached the minimum CAR rule (Schanz et al., 2011). The BCBS introduce Basel III in the post-financial crisis increased the quantity and quality of capital from 8 percent in Basel II to 10.5 percent in Basel III (BCBS, 2009; Hoenig, 2012). The aim is to assist banks to have adequate capital to cover for losses. To ensure banks this aim, the Basel III accord introduced non-risk leverage ratio as a complementary tool for the Basel III CAR to constrain banks from taking additional risk relative to the available capital to cover for risk exposures (Brei & Gambacorta, 2014; Grill, Lang, & Smith, 2015). Thus, resulting in banks not falling below the minimum CAR to strengthen the resilience of banks (Grill et al., 2015). The leverage ratio is set at 3 percent, and it is countercyclical; if a bank risk increase above its available capital, the leverage ratio increases. To prevent the leverage ratio from increasing when risk rise, the bank will have to increase its capital ratio (Brei & Gambacorta, 2014; Gavalas, 2015). Furthermore, the Basel IV accord was introduced in 2016 to standardize the risk-weighted asset calculation, a denominator of Basel III capital ratio, to avoid different models used by banks. Basel IV accord also provides more transparency in bank disclosures of regulatory capital and comparable capital ratios among banks (BCBSa, 2017; BCBSb, 2016).

Arising from the introduction of Basel III and IV CAR, which eliminates the use of debt and increases the use of equity to achieve higher CAR, there is a growing discussion on the possible effect of Basel III capital on bank performance (Bandt et al., 2018; Dermine, 2013; Gavalas, 2015; Mamatzakis & Bagntasarian, 2019; Psillaki & Georgoulea, 2016). Basel IV is new, so there is limited literature on its effect. Nevertheless, Hoenig (2012) explained that using equity capital is a more credible and conservative method of CAR. From the regulators' perspective, increasing the quality and quantity of capital enables banks to have adequate capital to deal with unexpected losses and to reduce systemic risk (Gual, 2011). From the banks' perspective, the Basel III CAR is considered a burden that can negatively affect performance as the Basel III capital ratio composition changed significantly (Gual, 2011; Walter, 2019). It's further considered a burden because Basel III CAR is regulatory; its implementation is enforced on banks by regulatory authorities, usually above banks optimal capital level and not voluntary CAR (Bandt et al., 2018). The perceived expected burden may arise from likely reduction to return on equity due to the rise in the cost of equity arising from the issuance of shares in the capital market (Gavalas, 2015; Gual, 2011; Psillaki & Georgoulea, 2016). Despite the previous arguments, Naceur and Kandil (2009) report that higher CAR increases shareholders' interest in monitoring bank activities. This improves the quality of bank decisions in risk assessments and managements (such as avoidance of reckless loan issuance that can affect quality of loans) and results in improved performance of banks.

The 2008 financial crisis led to many banks collapsing in many parts of the world, in particular the USA and Europe. Still, the African banking industry was not worse hit due to limited integration with the global financial markets, but the effects of the crisis were felt in other sectors of the export-based economy (Allen & Giovannetti, 2011; European Investment Bank, 2016). Banks in Africa generate high income, but capital inadequacies, high levels of non-performing loans, poor asset quality, operational inefficiencies, and macroeconomic factors erode the earnings of these banks that could otherwise be averted by implementing higher Basel levels (Boateng, 2019; Chironga et al., 2018; Munyambonera, 2013). For instance, the implementation of Basel II CAR increased the performance of banks in Egypt and also increased the management efficiency of Egyptian banks and a reduction in inflation (Naceur & Kandil, 2009). Well-capitalized, efficient with lower credit risk banks outperform banks with inadequate capital, less efficient with high credit risk banks (Liu & Wilson, 2010; Mamatzakis & Bagntasarian, 2019).

Arguments from the literature that Basel III higher CAR negatively affects bank performance. The impact is significantly higher in non-crisis European countries such as Ireland and Denmark due to high cost of equity and elasticities of loan demand (Gavalas, 2015; Knyazeva, 2016). But this may not hold in an African setting where there are revenue opportunities (Chironga et al., 2018). As a result, compliance with higher Basel CAR may boost performance or decline performance (Chironga et al., 2018). Therefore, this study examines the relevance of Basel IV CAR for the performance of banks in Africa. The aim of the BCBS for introducing higher Basel level is to strengthen the resilience of the banking system (BCBS, 2009; BCBSa, 2017). Therefore, this chapter compares the impact of higher CAR on the performance of banks under the existing Basel levels of Basel II and III with the proposed new Basel IV CAR. This is to determine whether the implementation of the proposed Basel IV CAR will be beneficial to the banks in Africa and its economy using Basel specific CAR and Bank specific ratios. Performance of banks is interpreted using three indicators of return on equity (ROE), return on assets (ROA) and net interest margin (NIM). Since the BCBS uses equity to achieve higher CAR, which can affect the returns to shareholders or return on assets or interest income of banks. These three indicators are widely used in literature, investors, the central banks, regulatory authorities and rating agencies (Liu & Wilson, 2010; Naceur & Kandil, 2009). The three performance ratios highlight the performance of banks which are crucial for bank stability. This chapter focusses on ROE in the analysis of the impact of higher CAR on performance, while ROA and NIM are for robustness checks.

3.3 Review of literature on Basel IV CAR and bank performance

Capital adequacy is considered an important determinant of the performance of banks (Mapororo, 2018). It plays a prominent role in increasing banks' ability to pursue profitable business opportunities and increases the ability of banks to absorb unexpected losses (Hoffmann, 2011; Mamatzakis & Bagntasarian, 2019). Bank profits are an essential factor of a stable bank in ensuring that a bank continues to operate as a going concern into the foreseeable future (Bikker & Vervliet, 2018; Geroski & Jacquemin, 1988). Many studies examine the impact of regulatory capital on bank performance. Since the introduction of Basel III and Basel IV CAR, research is being carried out in this important bank regulation area though limited for Basel IV CAR.

Basel III and the proposed new Basel IV accord increased the quality and quantity of CAR, eliminating the use of debt in capital ratios. Achieving higher capital through equity may be costly than debts to the banks (Dermine, 2013; Walter, 2019). Well-capitalized banks tend to make better lending decisions, increasing profitability (Admati, DeMarzo, Hellwig, & Pfleiderer, 2013; Tan & Floros, 2013). However, banks can have constraints in raising additional equity from the capital market to achieve higher CAR, which may reduce banks' ability to lend, hence reducing such banks' performance. In another alternative, banks may have regulatory pressure to increase risk-taking to achieve higher CAR using retained earnings (Laeven & Levine, 2009). Findings from empirical literature have no consensus on the impact of higher CAR on the performance of banks. The above studies' conclusions may not be generalized as banks operate in an imperfectly competitive market; therefore, higher CAR can impact bank performance differently across countries (Chun et al., 2012; Mahapatra, 2012; Stolz, 2002). Basel IV accord is new; the accord introduces new requirements (BCBSa, 2017; Munoz & Soler, 2017), which require analysis as its impact may differ from previous Basel levels. The theoretical and empirical literature on Basel CAR and bank performance are discussed next in this session.

3.3.1 Theoretical literature on Basel IV CAR and bank performance

The fundamentals and the composition of Basel capital ratios target the capital structure of any bank. Capital structure refers to the mix of equity and debt employed by a firm to finance its operations, assets, and liabilities (Werner, 2016). Deciding on the mix of equity and debt is a strategic decision for the top managerial level to maximise shareholders' wealth in any firm in the world (Mapororo, 2018). Once a firm arrives at the point where the mix of debt and equity results in the lowest average cost of capital, it is referred to as the firm's optimal capital structure (Diamond & Rajan, 2000; Werner, 2016). The optimal capital structure of a firm trade-off the cost and benefits of debt and equity mix to zero (Bandt et al., 2018). Hence regulations influencing the optimal decisions may produce unusual behaviour on the performance of a firm positively or negatively (Bandt et al., 2018; Fama & French, 2000; Mapororo, 2018).

Banks are highly regulated due to their roles in the economy; a bank failure can cause negative disturbances in economic growth (Diamond & Rajan, 2000). As a result, Basel I, II, III or IV CAR makes banks hold capital above their desired optimal level (Bandt et al., 2018). In this context, according to Modigliani & Miller theory that change in the mix of capital does not affect the firm value (Diamond & Rajan, 2000; Fender & Lewrick, 2016). But literature (Cummings & Wright, 2016; Dermine, 2013; Malovaná, 2017) argues that theoretically, higher CAR is expected to have a negative impact on bank performance due to high cost of issuing equity. Notably, compliance to Basel CAR is regulatory and not voluntary decisions made by the banks (Bandt et al., 2018; Diamond & Rajan, 2000; Mamatzakis & Bagntasarian, 2019; Mapororo, 2018). Several capital structure theories explain banks' improved performance following the implementation of higher CAR, such as the pecking order theory. Perking order theory states that a firm prefers internal to external financing and debt before equity (Myers, 1984). With compliance to Basel III and IV CAR, the use of debt has been eliminated (BCBSa, 2017); thus, pecking order theory is not relevant for this chapter objective. The four competing theories pertinent to this chapter are the static trade-off theory, M & M irrelevance theory, capital arbitrage theory, and the efficient risk hypothesis.

3.3.1.1 The static trade-off theory on Basel IV CAR and bank performance

The static trade-off theory is based on the trade-off between the benefits and the cost associated with debt and equity sources of funds (Mapororo, 2018; Syed et al., 2012). Therefore, finding the best optimal mix of debt and equity where cost and benefit are balanced out is based on the static trade-off theory (Mapororo, 2018; Syed et al., 2012). The static trade-off theory states that “optimal capital structure is reached when the tax advantage to borrowing is balanced at the margin by the costs of bankruptcy” (Myers, 1984, p. 2). Suggesting that firms will prefer to hold more debt than equity because of the tax benefit of debt. However, a firm with too much debt is prone to bankruptcy, which increases the firm's bankruptcy cost (Mapororo, 2018; Syed et al., 2012). When a firm is not profitable enough to pay its principal and interest, the firm's creditors, such as suppliers, banks, employees, government (tax) can sell the firm’s assets to pay the firm’s creditors (Mapororo, 2018). Basel III and IV CAR requires banks to use equity capital to achieve higher CAR.

Nevertheless, Admati et al. (2013); Osborne, Fuertes, and Milne (2012) find that banks have cost constraints when complying with Basel III CAR. However, the cost constraints depend on where the banks set their own desired capital level (Osborne et al., 2012). If each bank has a set optimal capital level, then an increase in capital above such level may reduce profitability. Furthermore, shareholders in banks with low equity capital will demand a higher premium to compensate for bankruptcy risk (Cummings & Wright, 2016). Higher equity capital leads to a fall in return on equity falls because shareholders face lower risks of bankruptcy; the higher the equity capital of banks (Berger, 1995; Cummings & Wright, 2016). The implication of the static trade-off theory for banks; is that a bank may have reached a set optimal capital structure; thus, adopting a new Basel CAR to comply with regulatory authorities may impose new cost constraints (Admati et al., 2013; Diamond & Rajan, 2000). Costs such as issuing new shares can increase the cost of financial intermediation and reduce the return on equity of banks. The ultimate aim of any profit organisation firm is the creation of shareholders' wealth for its owners. Thus, with higher CAR, banks will seek higher return on equity above its cost of equity to create value for their shareholders (Abdul, 2017; Perrone, Ferreira, & Securato, 2015). Assuming all the banks go to the capital market to raise required equity to achieve higher CAR, not all the banks can increase return on equity above its cost of equity since higher equity leads to a fall in return on equity (Perrone et al., 2015). Alternatively, a profitable bank can build up reserves using retained earnings to avoid cost constraints of issuing equity or debt (Ross, Westerfield, & Jordan, 2008). Based on the static trade-off theory, it is expected that compliance with Basel IV CAR has a negative impact on the performance of banks in Africa.

3.3.1.2 Modigliani-Miller's irrelevance theory on Basel IV and bank performance

Before the Modigliani and Miller theory of capital structure in 1958, there was no generally accepted theory on capital structure (Mapororo, 2018). Modigliani-Miller irrelevance theory (M & M)'s states that if a firm's risk only depends on the riskiness of its assets, adjustments in its capital structure to higher CAR will not affect its funding costs (Modigliani & Miller, 1959; Modigliani & Miller, 1963). Furthermore, M & M theory makes assumptions under perfect market conditions (no tax payment, no bankruptcy costs, no agency costs, and asymmetric information) (Fender & Lewrick, 2016; Schanz et al., 2011). In a perfect market, the firm value will be unaffected by the mix (debt plus equity) of how a firm is financed (Fender & Lewrick, 2016; Schanz et al., 2011; Syed et al., 2012). Thus increasing the proportion of equity should not significantly affect the total value of the firm (Admati et al., 2013; Dermine, 2013). It suggests that compliance to increase in Basel higher CAR involving an increase in equity capital level for banks will not affect the performance of the banks.

Basel III and IV CAR eliminated the mix of debt and equity in capital ratios using only equity. This is a major variation in bank's capital structure (BCBS, 2010; Ozili, 2019). However, because equity is expensive (no tax-deductible advantage like debt) and scarce (Cummings & Wright, 2016; Dermine, 2013; Malovaná, 2017), compliance to Basel IV higher CAR may decline performance of banks. Due to the cost of issuing new equities, increase in the cost of lending which reduces the volume of loans which may negatively affect the performance of banks.

3.3.1.3 Capital arbitrage theory on Basel IV CAR and bank performance

The introduction of minimum CAR by Basel I in 1988 led banks to perceive CAR as an unnecessary burden constraining the banks from taking excessive risk (Jablecki, 2009). As a result, banks found ways to avoid holding minimum CAR by creating loopholes around the adjusted standards known as regulatory capital arbitrage (Allen, 2004; Blundell-Wignall & Atkinson, 2010). As such, the banks developed techniques to restructure their balance sheets to circumvent the setting aside of funds necessary as safety nets (capital) as required by Basel I CAR and to achieving lower CAR (Jablecki, 2009; Mahapatra, 2012). Banks use securitisation to restructure the balance sheet to achieve regulatory capital arbitrage (Jablecki, 2009). The development of securitisation is a major financial innovation in modern banking history that banks use to no longer hold loans to maturity in their balance sheet that they used to hold (Ambrose, LaCour-Little, & Sanders, 2005; Oino, 2018). Basel I CAR's implementation aided the use of securitisation by banks to move risky loan portfolios that require holding more capital from the banking book to trading books and trading such risky loans for government securities that require zero percent capital (Haubrich & Wachtel, 1993; Jablecki, 2009). The process enables banks to hold minimum regulatory CAR that is less than banks actual risk exposure. This explains the increase in banks originating securitisation in the developed countries before the financial crisis. Nevertheless, securitisation gave banks immediate liquidity. It increased banks' lending ability, and the banks earn fees from originating the securitisation and interest income from increased lending, which may improve performance.

Furthermore, there are arguments in literature for and against capital arbitrage theory. Studies that have empirically proven this theory are Dionne and Harchaoui (2008) using sample size from Canadian banks; Kasse-Kengne (2018), using South African banks that engage in securitisation of mortgage loans; and Uzun and Webb (2007) using banks in the US. These studies find that banks use securitisation to achieve capital arbitrage to lower CAR. Other empirical studies like Affinito and Tagliaferri (2010); Ambrose et al. (2005); Bakoush et al. (2019); Jablecki (2009); also shows that banks use securitisation to reduce regulatory CAR. Empirical studies against capital arbitrage theory such as Cardone-Riportella, Samaniego-Medina, and Trujillo-Ponce (2010); Martín-Oliver and Saurina (2007) studied Spanish banks, provide empirical evidence that banks do not engage in securitisation solely for capital arbitrage. These findings were supported by an earlier study Minton, Sanders, and Strahan (2004) for US commercial banks and investment finance companies. Their research reports that unregulated firms are likely to securitise more than regulated firms. These studies support the view that securitisation is used to achieve liquidity and risk management rather than capital arbitrage. Giménez Roche and Lermyte (2016) question if securitisation amplifies the business cycle in Austria. Their study report that the simple “originate and distribute” model does not amplify the business cycle boom. However, if the banks use securitisation for capital arbitrage (as a tool to circumvent CAR limitations), it can amplify business cycle (Giménez Roche & Lermyte, 2016). Jablecki (2009); Merton (1995) observe that as long as there is a connection between capital ratios and risk weights of bank assets, banks will always use capital arbitrage as a tool to comply with Basel CAR. Basel IV introduces disconnection between capital and risk. It adds capital requirements for securitisation exposure thus eliminating regulatory capital arbitrage (BCBSa, 2016, 2017). In this context, the changes introduced by Basel IV framework could affect performance of banks that engage in securitisation if their purpose for engaging in securitisation is for capital arbitrage.

3.3.1.4 Agency theory on Basel IV CAR and bank performance

The agency theory explains that agency costs arise from the conflicting relationship between shareholders and managers' risk-taking behaviour and those between debt-holders and shareholders (Jensen & Meckling, 1976; Mapororo, 2018). The agency costs are incurred by the principal (shareholders/owners) in monitoring their agents (managers) because both the shareholders and the managers have different priorities (Laeven & Levine, 2009; Mapororo, 2018; Oino, 2018). Monitoring the agents to ensure no conflict of interest between managers and shareholders can be costly (Oino, 2018). Shareholders want the firm to take more risk to increase dividends or shareholders' wealth, and creditors prefer strategies that increase a firm ability to pay back her debt plus interest, while managers take risk for their personal interest (Laeven & Levine, 2009; Syed et al., 2012). Because banks operate with regulations, capital regulations, in particular, Basel III and IV CAR that require higher equity capital, result in dilution of shares and reduction in risk premium, which reduces the return on equity (Laeven & Levine, 2009). As a result, higher CAR may increase risk-taking of banks as shareholders pressure the banks for more returns on equity (Chalermchatvichien et al., 2014). For this reason, higher Basel CAR may have a positive impact on bank performance. Alternatively, higher CAR increases the shareholders’ incentive to monitor and control risk, reducing losses and increasing bank performance (Pessarossi & Weill, 2013). Meanwhile, the stringent capital requirements, the introduction of leverage ratio, increased transparency and disclosures in Basel III and IV may prevent bank managers from yielding to the demands of shareholders of banks or force managers to act in the best interest of the shareholders.

3.3.1.5 Efficient risk hypothesis on Basel IV CAR and bank performance

Banking regulation has considerable interest at the microeconomic and macroeconomic levels. From the microeconomic level, banks are in the business to make profit for maximization of shareholders wealth, an objective of every firm (Werner, 2016). For this reason, banks take risks (loans, investments, trading of securities) to make profits (Gavalas, 2015). Large banks tend to take more risk and hold less capital and are seen to be more efficient and better able to control risk than smaller banks (Awdeh, El-Moussawi, & Machrouh, 2011). According to Kwan and Eisenbeis (1997), the volume of risk-taking upon by the banks is not the issue but the risk management and controls in place, as such an efficient bank with superior management can increase risk-taking than less efficient banks. However, risks can become costly to monitor and manage, especially having to set aside additional capital, which can have a negative effect on the performance of efficient banks (Kwan & Eisenbeis, 1997). This played out in the 2008 financial crisis, where the large banks failed because of too much risk-taking without adequate capital buffer. Furthermore, agency problems between shareholders and managers can further complicate the efficient risk-taking of banks. In particular, where shareholders' interest do not align with the conservative management, such managements can be deemed inefficient and replaced for not taking more risk (Chalermchatvichien et al., 2014; Kwan & Eisenbeis, 1997).

From the macroeconomic point of view, banks' role in the provision of credit, distribution of financial resources from the depositors to borrowers play an important role in the economic stability, growth and developments (Boateng, 2019). Hence, capital regulations are introduced to strengthen the resilience of banks and to reduce the excessive risk-taking of banks (Laeven & Levine, 2009; Mamatzakis & Bagntasarian, 2019). The efficient risk hypothesis suggests that the more efficient banks tend to hold relatively low capital as higher expected returns from the greater profit efficiency may substitute for equity capital while less efficient banks hold more capital (Hoffmann, 2011; Mamatzakis & Bagntasarian, 2019). Earlier studies such as Kwan and Eisenbeis (1997) find contrary results to the efficient risk hypothesis results that well-capitalized banks are more efficient than less-capitalized banks. Some existing studies suggest that higher CAR does not necessarily increase the efficiency of banks (Chalermchatvichien et al., 2014; Lee & Chih, 2013). Ayadi, Naceur, Casu, and Quinn (2016) used DEA to analyse World Bank Basel Core Principles survey sample data of 863 banks from 63 countries for the period 1996 to 2010. Their study finds that compliance to Basel CAR have no relationship with bank efficiency after controlling for bank specific and macro-economic factors. The implication of their findings provide that higher CAR can affect banks in allocating their resources efficiently.

The efficient risk hypothesis implies that a higher CAR will have a negative impact on the performance of banks. The reason is that the more efficient banks hold risky assets but hold less capital buffer, and their capital is more likely to fall below the minimum requirements (Mamatzakis & Bagntasarian, 2019). Therefore, more efficient banks are expected to be more profitable (Mamatzakis & Bagntasarian, 2019). However, where such banks are forced to increase their minimum CAR, it can affect their performance. Risk-taking must be supported with adequate capital reserve such that if an unexpected condition declines the ability to recover, the bank can use the available capital to absorb the shock without leading to bank run, distress, or ultimate failure (Walter, 2010, 2019). Capital serves as a buffer against unexpected losses; thus, too little capital increases the probability of bank failure whilst excessive capital imposes unnecessary cost on a bank, limiting the bank efficiency and reducing lending (Lee & Chih, 2013; Nkopane, 2017). For instance, Ayadi et al. (2016) find a negative relationship between higher CAR and efficiency for banks in emerging and developing economies. Bank inefficiency leads to leads to constraints of banks' lending capacity to borrowers, affecting businesses and households. The efficiency of banks will be improved with better supervision by the regulatory authorities (Ayadi et al., 2016), which can be achieved with the implementation of higher Basel level, increases the supervisory powers of the bank regulators in addition to higher CAR (BCBS, 2009; BCBSa, 2017).

African banks generally hold excessive capital above their risk exposures, yet many of these banks are less-efficient (Nkopane, 2017). African banks are profitable due to low competition and high-interest rates on loans (Chironga et al., 2018; Nkopane, 2017). However, high operating costs, non-performing loans, volatile macroeconomic environment, and capital inadequacies continue to reduce the performance of African banks (Chironga et al., 2018; Munyambonera, 2013). Prior literature suggests that less costs improve the efficiency of banks, hence increasing the performance (Athanasoglou, Delis, & Staikouras, 2006; Bourke, 1989; Mapororo, 2018). Basel III and IV CAR will enable the banks to have better risk assessment, management, and control. For African banks under the efficient risk hypothesis, Basel IV CAR is expected to increase the efficiency of the African banks and, hence, positively impact on the performance of banks.

3.3.2 Empirical literature on Basel CAR and bank performance

Banks take risk and, higher risk is expected to yield higher returns, and lower risk is associated with probability of smaller returns (Kwan & Eisenbeis, 1997). At the same time, risk-taking without adequate capital could increase the probability of bank failure (Bandt et al., 2018; Lee & Chih, 2013). Capital regulations are put in place by regulators to protect the economy and promote banking sector stability (Malovaná, 2017). Basel III and IV capital regulations use equity to achieve higher capital buffers (BCBSa, 2017; Munoz & Soler, 2017). Equity capital is viewed as expensive because the required return on equity does not remain fixed as CAR increases due to the risk premium charged by shareholders (risk of bankruptcy) going down as equity capital increasing (Admati et al., 2013). As such, capital regulations using equity are an important factor that could be beneficial or detrimental to the performance of banks (Admati et al., 2013; Bandt et al., 2018). With increase in equity capital for Basel III and IV requirements, the new Basel CAR may inhibit banks' ability to increase lending, which may reduce profits, leading to negative impact on return on equity (Cosimano & Hakura, 2011; Lee & Chih, 2013).

The performance of firms is, to some extent, predictable (Fama & French, 2000). Still, for banks, regulations may produce unusual behaviour on their performance because regulators set minimum capital regulations to prevent banks from taking excessive risks (Fama & French, 2000; Hoffmann, 2011). There has been no consensus in the literature on the impact of higher CAR on performance. According to Fender and Lewrick (2016), different definitions for capital ratios employed in the empirical literature, such as total equity divided by total assets, Tier1 capital divided by total assets, among others, arrived at different conclusions on the impact of higher CAR on bank performance. Furthermore, the existence of differences in institutional and regulatory environments, openness of the political system, and the levels of corruption in the operating environments of banks (Chortareas, Girardone, & Ventouri, 2012; Triki et al., 2017) can be one of the reasons for lack of consensus on the studies of regulatory CAR and bank performance. Due to unique risks such as high-interest rates, general decline in macroeconomic variables, and regulatory concerns in banks' operating environment in African countries, the impact of the new Basel IV CAR on the performance of banks is unknown. It may differ from the developed countries, thus the relevance of the chapter.

CAR date back to the 1800s in the United States (Sanders, 2015; Walter, 2019). For instance, CAR in the 1920s' considered a minimum of 10 percent equity to deposit ratio as adequate in the USA (Moore, 1961; Walter, 2019). By 1930, requirements for capital ratios had shifted to equity to total asset ratio (Walter, 2019), but by the 1950s' capital ratios declined after the Second World War (Moore, 1961). As a result, banks in the USA, Canada, and other countries were encouraged to increase their equity margin, which improved equity to asset ratio. In these periods, bank reserves with central banks were considered adequate for capital; shareholders' equity was considered but not necessary (Moore, 1961). According to Walter (2019), important features in the modern capital requirement regimes have been employed in the past decades. Bank CAR has been strengthened significantly, starting with the need for standardized bank regulations (the Basel accords) among the G-10 countries in the late 1980s (Sadien, 2017; Sanders, 2015). Since the inception of Basel I accord in 1988, significant changes in the CAR have resulted in bank CAR becoming more resilient and sophisticated (BCBS, 2010; Ozili, 2019). For instance, the composition of capital ratio under Basel I and II used a combination of debt, equity, and other reserves (BCBS, 2004; Jablecki, 2009). In contrast, the composition of capital ratio for Basel III and IV includes only tangible common equity (BCBSa, 2017; Yan et al., 2012). In addition, Basel IV introduces standardization of risk weights (BCBSa, 2017). Risk weights are important as they determine the level of capital banks must set aside to cover their risk exposures in lending activities (Dionne & Harchaoui, 2008). The higher the risk weights, the higher the capital banks must-have for protection against defaults.

The traditional function of bank capital is to protect depositors' funds against losses (Robinson, 1941). A bank holds too little capital when left without regulations, and may result in bank failures with negative spillovers on the economy (Dermine, 2013). However, bank capital regulations can be severe because equity is expensive and scarce (Dermine, 2013; Walter, 2019). Also, shareholders and investors will invest in profitable banks

(Perrone et al., 2015; Walter, 2019). This incentive makes banks improve on return to equity and share price and may positively impact performance according to one strand of literature (Naceur & Kandil, 2009). The equity serves as a risk-sharing channel whereby shareholders closely monitor banks as the shareholders have a more considerable investment at stake in their own best interest. In short, close monitoring is expected to enhance bank performance (Bandt et al., 2018; Triki et al., 2017). Furthermore, Rizvi, Kashiramka, and Singh (2018) argue that using equity to achieve a higher capital level can decrease the cost of capital, leading to a positive impact on bank performance. In addition, higher capital through equity may increase expected earnings of banks through the reduction of the expected costs of financial distress, including bankruptcy costs (Athanasoglou et al., 2006; Berger, 1995).

In contrast, other strands of literature held that higher CAR through equity reduces the performance of banks (Berger, 1995; Blum, 1999; Knyazeva, 2016; Pasiouras, Tanna, & Zopounidis, 2009). In particular, Blum (1999) argues that increasing CAR may lead banks to take excessive risks and may not motivate the banks to stay in business if they are not making a profit. Higher capital can dilute shareholdings, reducing returns to shareholders (Cohen & Scatigna, 2016; Psillaki & Georgoulea, 2016). Thus, forcing banks to increase portfolio risk to increase returns. To avoid diluted earnings, some banks in the post-financial crisis instead use the build-up of retained earnings to achieve higher capital ratios by reducing risk-weighted assets (Cohen & Scatigna, 2016). Yet, the Basel committee's purpose of tightening CAR is to strengthen bank resilience to reduce bank failures (BCBS, 2009; Swamy, 2018). Higher CAR affects the banks differently, either increase or decrease performance (Kale, Eken, & Selimler, 2015). Hence, there is no consensus in the literature on the impact of higher CAR on the performance of banks. The empirical literature is discussed under the following sub-sessions as follows: the impact of higher CAR on the performance of banks in the developed countries, followed by the impact for banks in the emerging markets and African market. The last empirical literature is on the options banks can use to achieve higher CAR.

3.3.2.1 Empirical literature on the impact of higher Basel CAR on performance of banks in developed countries

The start of Lehman Brothers' filing for bankruptcy in 2008 subsequently led to more than 465 bank failures in the United States alone (Federal Deposit Insurance Corporation, 2019). The Basel Committee introduced Basel III and IV CAR after the 2008 financial crisis intended to strengthen the resilience of the entire banking system (BCBS, 2009; BCBSa, 2017; Hossain, Khan, & Sadique, 2018). The Basel III and Basel IV CAR placed the role of equity capital a fundamental issue for the resilience of banks (BCBS, 2009; BCBSa, 2017; Berger & Bouwman, 2013). However, some literature suggests that increasing equity capital could be counterproductive because it can increase bank risk-taking (Berger & Bouwman, 2013; Dermine, 2013). Nevertheless, banks with higher CAR engage in better lending decisions, which increases bank performance. Higher CAR enables banks to better absorb risk from riskier assets such as loans; the interest income generated from such loans increases performance; also, banks with higher CAR borrow less, which reduces funding cost and further increases bank performance (Tan & Floros, 2013). Even though many banks in the developed countries suffer from the global financial crisis, there are arguments in the literature that implementing tighter capital negatively affect bank performance in developed economies (Knyazeva, 2016; Oino, 2018).

Several empirical studies (Bouheni, Ameur, Cheffou, & Jawadi, 2014; Kale et al., 2015; Oino, 2018; Osborne et al., 2012) have been carried out to provide empirical evidence on the impact of bank regulations and regulatory capital on the performance of banks. In comparison, some others (Dietrich & Wanzenried, 2011; Hoffmann, 2011; Liu & Wilson, 2010) are carried out on the determinants of bank profitability. These studies focus on the regulatory capital; however, their capital ratios differ from Basel capital ratios. Very few studies (Bandt et al., 2018; Gabriel, 2016; Le, Nasir, & Huynh, 2020) have been carried out to provide empirical evidence on the impact of Basel III CAR on the performance of banks. Studies that examine the impact of bank regulations and regulatory capital on the bank performance; for instance, Osborne et al. (2012) examine the impact of capital ratios on the profitability of US banks spanning over several economic cycles between 1977 and 2010 with 5-year rolling window. Using a graphical chat of fixed effect and system GMM in a systematic way to illustrate the changing relationship between capital and profitability over the several economic cycles, their study reports that the long-run relationship between capital and return on assets is consistently positive, but the relationship is cyclical. That positive relationship exists only during the stress period of a financial crisis (Osborne et al., 2012). Oino (2018) findings show that banks were slightly more profitable in the post-crisis period because higher CAR made the banks diversify. The study employs a structural equation model (SEM) with random effects to examine the impact of regulatory capital on banks' performance in Europe using a dataset between 2001 and 2015. Their findings report that higher CAR increased the banks' capital levels, which accounted for the expansion of these banks, which the regulators must take account of (Oino, 2018).

Furthermore, Kale et al. (2015) use Data Envelopment Analysis (DEA) to analyse the effects of regulations on Turkish banks' efficiency over the period 1997 and 2013. Their findings show that tighter regulations, higher capital, and strong supervision positively impact the efficiency of banks in Turkey. Kale et al. (2015) indicate that deregulation and loose supervision can sometimes increase efficiency for the banks. However, it is generally not sustainable due to unstable macro-economic environment and bad risk management practices stemming from inadequate supervision. Other studies with positive impact Bouheni et al. (2014) use GMM to examine the effects of regulations and supervisions on bank profitability from 2005 to 2011. Bouheni et al. (2014) find that strengthened supervision and regulations improved bank profitability and the European banking sector stability.

Studies that examine the determinants of bank performance with positive impact; Liu and Wilson (2010) use equity divided by total assets as a measure of capital, ROE, ROA, and NIM as a measure of Japanese banks' performance. Their findings from multiple regression (fixed effects and GMM) indicates that capital was positive and significantly related to the performance of banks in Japan.

Studies from developed countries that examine the impact of Basel III CAR on the performance of banks have mixed findings. Le et al. (2020) employ a dynamic OLS and fully modified OLS to examine the impact of Basel III on improving the profitability of banks for a comparative analysis between Australia and British banks. They find that the operating earnings of the banks increased but fail to boost bank profits and efficiency. Furthermore, Gabriel (2016) find that return on equity increase with higher capital for European banks under Basel III using fixed and random effects for the period between 2013 and 2015. Also, Kale et al. (2015)'s study shows that higher capital has a positive impact on the performance of banks in Turkey between the period 1997 and 2013. Other bodies of empirical literature find an insignificant impact of Basel III CAR on the performance of banks in the developed countries. Bandt et al. (2018) provide some evidence of the relationship between voluntary and regulatory capital impact on bank performance. The study uses a two-step system GMM. In their findings, Basel III CAR has an insignificant effect on the performance of banks in France. Bandt et al. (2018) provided a reason for Basel CAR insignificance on performance. That voluntary capital had a positive impact on performance; however, for regulatory capital, there has been a beneficial effect of higher Basel CAR for undercapitalized banks but was offset with the negative effect on other banks so that the average effect is insignificant (Bandt et al., 2018).

Conversely, a handful of other studies find a negative relationship between higher CAR and performance. In this context, Hoffmann (2011) examine the determinants of profitability of the US banks for the period 1995 and 2007. The study uses a system GMM estimator on bank-specific and macroeconomic variables to determine the relationship between capital ratio and bank profitability (ROE) for the US banks. Their result finds a negative relationship between capital ratio and profitability. Their findings indicate that US banks ignore potential profitable trading opportunities (Hoffman, 2011). Studies with similar findings Sanders (2015) for US banks use stylized balance sheet for a hypothetical bank to determine the potential impact of Basel III CAR on performance ratios for American banks. The study findings reported that compliance to Basel III CAR was shown to cause the performance ratios (ROE, stock price, and price-earnings ratio) to decline.

Their result suggests that American banks will feel the Basel III higher CAR effect more than banks from other high-income industrial countries (Sanders, 2015). Additional studies with the negative impact of higher capital on bank performance in the developed countries are Berger (1995) for US commercial banks for the period between 1983 and 1989; Dietrich and Wanzenried (2011) for 372 commercial banks in Switzerland over the period of 1999 and 2009 use GMM estimation technique to examine the determinants of profitability. Pasiouras et al. (2009) employed stochastic frontier analysis for 615 commercial banks from 74 countries for 2000 and 2004 to examine the impact of Basel II on bank cost and profit efficiency. Their findings indicated that higher CAR increased cost efficiency but reduced profit efficiency. Similarly, Brissimis, Delis, and Papanikolaou (2008), using DEA analysis, examine the relationship between banking sector reforms and bank performance of 364 banks from ten newly acceded EU countries between 1994 and 2005. Their result showed that capital has a negative impact on the performance of banks in the EU.

Other literature bodies focus on additional capital buffer above the minimum regulatory capital and how the introduction of higher CAR reduces the additional buffer and its effect on the performance of banks. Mamatzakis and Bagntasarian (2019) examine the impact of capital buffer on the performance of banks from 27 EU countries between the period of 2004 and 2013. Their study measure capital buffer as the amount of capital a bank hold in excess of the minimum regulatory requirements with the aim was to link banks that hold risky portfolio hold a higher capital buffer and are more efficient and performing. Using two-stem GMM, their study find that ROE has a positive and significant impact on capital buffer. Implying that more profits enhance banks to hold greater capital buffer using retained earnings when raising capital is difficult (Mamatzakis & Bagntasarian, 2019).

Furthermore, their study finds that ROE positively and significantly impacts banks' capital buffer in the low-performance regime. In contrast, capital buffer decreased for well-performing banks. Suggesting that large banks that are relatively performing banks hold less capital buffer (Mamatzakis & Bagntasarian, 2019). Their findings suggest that higher

CAR enhances bank performance, but the impact is not homogenous for banks with different risk profiles and performance. Similar results are reported by Malovaná (2017) for Czech Republic banks that large banks tend to hold less capital ratios.

Many bank regulation studies from developed countries findings suggest that higher CAR exert a negative impact on the performance of banks, thus leading to the conclusion that higher CAR jeopardises the performance of banks (Berger, 1995; Hoffmann, 2011; Le et al., 2020; Sanders, 2015). Low interest, low profitability, and highly competitive environment contribute to the challenges banks from high-income industrialised economies have to achieve higher CAR, which may have a negative impact on performance (Bikker & Vervliet, 2018; Chironga et al., 2018; Knyazeva, 2016). Bikker and Vervliet (2018) study the impact of a low-interest environment on the United States banks' profitability and risk-taking for 2001 and 2015. Using a combination of static and dynamic models, their study reports that a persistently low-interest rate environment leads to a significant negative effect on the US banks' net interest margin, which is the main source of bank profitability. The findings show that despite the decline in NIM, the US banks' overall profits are not impaired as the banks generate income from non-interest income sources such as securitisation (Bikker & Vervliet, 2018). Banks in the developed countries may have falling earnings, which reduces the returns on equity with higher CAR; however, these banks strive for cost efficiency, improving their performance (Brissimis et al., 2008; Cohen & Scatigna, 2016; Le et al., 2020). There is ample evidence from emerging countries that higher CAR impact positively on the performance of banks. That banks in the emerging economies enjoy high earnings and asset growth, positively impacting performance with higher CAR (Cohen & Scatigna, 2016). Nevertheless, other studies show that higher CAR has a negative impact on the performance of banks in emerging countries, as discussed further in the next session.

3.3.2.2 Empirical studies on the impact of higher Basel CAR on performance of banks in emerging markets

Like any other firm, the primary objective of any bank is the maximisation of shareholders wealth (Bourke, 1989; Perrone et al., 2015). Banking crises such as the 1997 Asian crisis, the 2008 financial crisis have become a threat to economic stability in many emerging economies (Perrone et al., 2015; Pessarossi & Weill, 2013). Credit supply plays a major role in supporting economic growth and development, while banking crisis leads to disruptions in this major role (Hardy, 1998; Lee & Chih, 2013; Roulet, 2018). As such, the banks' stability in these economies became an important factor for the bank regulators. Hence many developing countries started embracing Basel CAR (Lee & Chih, 2013; Perrone et al., 2015; Pessarossi & Weill, 2013). In line with this assertion, from literature, regulatory authorities from emerging markets have further embraced the Basel III CAR either already implemented or underway to implementation (Lee & Chih, 2013; Swamy, 2018). With tighter and improved capital levels, the Basel III CAR may either increase performance or decline performance for banks in the emerging economies. According to Le et al. (2020); Lee and Chih (2013); Mamatzakis and Bagntasarian (2019), higher CAR does not mean an increase in bank performance. However, banks in emerging markets enjoy high earnings and asset growth, which should increase their CAR without negatively affecting the banks' performance (Cohen & Scatigna, 2016). Despite the possibility for high earnings and asset growth, Perrone et al. (2015) argued that banks need prioritizing, better planning for their investment and good lending decisions to provide better return on risk, or aggressive dividend policy to enable banks in the emerging countries to achieve higher CAR

Many studies examine the impact of bank regulations and supervision on the performance of banks. But limited research has been carried out from emerging countries. Considering also that banks react to higher CAR differently depending on legal and regulatory environments (Angelini et al., 2015; Chortareas et al., 2012). Therefore, it is important to discuss the empirical findings from emerging economies. There are few studies from emerging economies, such as Swamy (2018) for Indian banks and Perrone et al. (2015)

for banks in Brazil, that examine Basel III CAR's impact on performance before its implementation in their economy.

In this context, Swamy (2018) modeled the Basel III CAR and used it to construct a stylized representative of Indian banks’ balance sheet to examine Basel III CAR impact on the profitability of Indian banks. The study finds that if RWA is unchanged, a 1 percent increase in capital will increase banks' interest income by a 17 percent. But the banks may achieve an increase in income and higher CAR by reducing risk-weighted assets as the commercial banks in India face challenges in meeting Basel III CAR. This implies that lending will reduce if the bank reduces risk-weighted assets. Nevertheless, there are studies from emerging economies (Awdeh et al., 2011; Datta & Mahmud, 2018; Manlagnit, 2015; Pessarossi & Weill, 2013) that examine the impact of Basel I and II CAR on the performance of banks.

Datta and Mahmud (2018) examine the impact of Basel II CAR on commercial banks' performance in Bangladesh. The study uses ROA and ROE as a measure of performance. Ordinary least square regression was employed on the bank-specific and macroeconomic variables and find a positive and significant impact of Basel II CAR on banks' performance in Bangladesh. The implications of their findings that higher CAR is needed for the stability of Bangladesh economy as operating efficiency and average capital of Bangladesh banks rose with Basel II CAR (Datta & Mahmud, 2018). Still, on Bangladesh, Hossain and Islam (2017) contribute to the empirical literature on Basel CAR's impact on performance but from Islamic banks. Their study examines the effect of Basel II on the operating efficiency and performance using an Islamic bank as a case study. Using the OLS regression model, their result finds that Basel II CAR has a positive and significant relationship on the return on asset. The implication is that because Islamic banks products are asset-based, such banks can bear losses arising from the reduction in market prices of the assets, as such capital adequacy is very relevant for their operations (Hossain & Islam, 2017).

Still, on the empirical studies that examine the impact of higher Basel CAR on the performance of banks in the emerging countries, Pessarossi and Weill (2013) study the effect of higher capital ratio on the cost efficiency of Chinese banks for the period 2004 and 2009. The regulatory changes in CAR enforced by the Chinese government for the banks to adopt the Basel CAR was a justification for Pessarossi and Weill (2013) to use the Chinese banking industry to test the effect of higher CAR. Pessarossi and Weill (2013) use a combination of parametric (DEA and stochastic frontier). Since the government enforced Basel CAR, the capital ratio is treated as an exogenous variable, making the study use a non-parametric approach (two-step system GMM estimation technique) for the robustness of their results. Their study finds that higher CAR increases banks' profit efficiency because the shareholders push for risk becomes reduced when the shareholders have large equity at stake. Thus, suggesting that higher CAR improves the efficiency of banks in China. Their results findings are contrary to Pasiouras et al. (2009), a cross-country study from 74 countries, and Brissimis et al. (2008) for ten newly acceded EU countries. Sample period, level of enforcement of the Basel capital regulations, and institutional environments may have played roles in arriving at different conclusions even though these studies use similar parametric methodologies.

Other empirical studies from emerging countries with a positive impact of Basel CAR on banks' performance include (Awdeh et al., 2011; Manlagnit, 2015). Awdeh et al. (2011), using a two-stage least square, show that changes in regulatory capital positively impact the profitability of 41 Lebanese banks between 1996 and 2008 but increases bank risk. Manlagnit (2015) finds that Basel II positively impacts the performance of banks in the Philippines. But the implementation of more supervisory powers can adversely impede the efficiency of banks in the Philippine. Studies with a negative impact on performance. In this context, Banerjee and Majumdar (2017), using DEA and Tobit regression for conventional and Islamic banks in the United Arab Emirate (UAE) for the period 2009-2015, find that higher CAR has a negative and significant relationship on the performance of banks arising from the high cost of capital for UAE banks. Athanasoglou et al. (2006) examine the determinants of bank profitability for banks in South-Eastern Europe (SEE) for the period between 1998 and 2002. Their study employs a random effect model and finds no evidence of a relationship between capital and performance. Nevertheless, as the SEE banking industry continually evolves, Athanasoglou et al. (2006)'s study calls for higher CAR and new standards in risk management for SEE banks to enhance bank profitability and stability. The relationship between capital and performance continues to be a fundamental issue in the literature, and findings of this literature are often inconclusive with the introduction of tighter regulations.

As bank regulators comply with Basel III capital requirements and possibly Basel IV CAR, there is no consensus on its impact on the performance of banks, especially for emerging countries. Basel III may increase lending rates, which may lower Gdpgrowth in the future (Rizvi et al., 2018). Furthermore, higher CAR can increase the cost of financial intermediation, which may decline lending and result in a negative impact of capital on performance (Naceur & Kandil, 2009; Taskinsoy, 2018). The other effects are mergers, which reduce the number of banks. For instance, Perrone et al. (2015) examine the impact of change in the required capital to Basel III CAR for Brazilian banks on the financial market. Their methodology simulated the regulatory capital required by banks under Basel III by the year 2019, the set implementation date for Basel III CAR. Using the International capital asset pricing model (ICAPM), their results showed that 39 banks out of 58 banks sampled have a return on equity that will not attract new investors and may have to merge to meet Basel III higher capital requirements. Africa is part of the emerging countries; however, the dynamics of the banking industry are different (Triki et al., 2017). The next session will examine the empirical literature focusing on Basel CAR's impact on the performance of banks in Africa.

3.3.2.3 Empirical studies on the impact of higher Basel CAR on performance of banks in African markets

During the 1980s and 1990s, many African governments had to restructure and recapitalize their banking sector to align their practices with international standards to reduce fragility, attract foreign direct investments and consequently promote economic growth and development (Beck et al., 2019; Hardy, 1998; Triki et al., 2017). Despite the extensive banking reforms from many African governments in these periods, bank performance in Africa remains unimpressive over the past decade (Chironga et al., 2018; Munyambonera, 2013). Also, African countries are increasingly criticized for their conservative approach to implementing changes in Basel regulations, preventing the banking sectors from delivering greater financial development and inclusion (Triki et al., 2017). Apart from the economic problems such as slow economic growth, recession, fall in productivity and export goods, banks in the African countries are characterized by capital inadequacies, poor performance, low lending, high non-performing loans, and bank failures (Munyambonera, 2013; Triki et al., 2017). According to Ozili (2019), promoting bank resilience in Africa is important, which requires micro and macro-financial framework in which are contained in the Basel III framework. Still, it is predicted that many African countries will not implement Basel III in the next decades, stating that the requirements do not fit into their economy's banking needs. Ethiopia has opted not to adopt Basel II or Basel III (Beck et al., 2019). Nigeria also chose not to implement Basel II or Basel III after the Nigerian commercial banks' recapitalization in 2005. But the 2008 financial crisis and the rapid developments of Nigerian commercial banks causing inadequacy in existing regulations and supervisory problems pushed the apex regulatory authority to initiate the process of implementing some aspects of the Basel II accord followed by plans to implement Basel III accord with effect from 2019 (Abdul, 2017; Agbaeze & Onwuka, 2014; Dafe, 2020). In other African countries like Ghana, Rwanda, and Kenya, regulatory authorities have advocated for the implementation of Basel II and III to signal a safe banking sector for international investors as part of a drive to establish financial hubs in their countries (Beck et al., 2019).

Nevertheless, banks with low capital ratios will be more exposed to regulatory pressure to achieve Basel III regulatory minimum CAR (Tanda, 2015) because one of the indicators for bank resilience is the level and the quality of capitalization (BCBS, 2009; Hardy, 1998; Walter, 2019). Higher capital can increase shareholders' incentive to monitor bank activities and lower the relative risk position of banks, which improves the performance of banks (Gale, 2004). Given the number of studies on Basel CAR's impact on the performance of banks, studies on this particular topic are very limited in developing countries, specifically African countries. This chapter aims to analyse the impact of Basel IV CAR on the performance of banks in Africa.

As higher Basel CAR became an important factor for the bank regulators in the emerging countries, as discussed in 3.3.2.2, regulatory authorities in many African countries are failing to embrace the higher Basel CAR (Triki et al., 2017). The implications are that the existing requirements become inadequate to protect the banks against risk. The descriptive statistics in empirical studies for the African banking sector identify that banks in Africa are adequately capitalised above the minimum Basel CAR of 8 percent. The average bank capital ratio in Africa is 12 percent (Beck & Cull, 2013; Lotto, 2016; Nkopane, 2017). This could suggest that African banks do not need compliance with Basel III or even Basel IV like banks in the developed countries that fell into a financial crisis with low capital levels. For instance, Boateng (2019) for the Ghanaian banking sector, the average capital ratio is 16.5 percent, yet their banking sector is crippled with bank failure. Tanzania has an average capital ratio of 12.6 percent, and there is no specific Basel accord The Bank of Tanzania uses in its banking Act (Lotto, 2016). The challenge is not the African banks' average capital ratios higher above Basel I, II, III minimum capital ratios of 8 and 10.5 percent (BCBS, 2004; BCBSa, 2017). The challenges are; first, the quality and the composition of the high capital ratio declared. Second, some of the banks may not apply the Basel requirements, such as calculating the risk-weighted assets in arriving at their reported capital ratio. As a result, many African banks have capital buffers either above their risk exposures or below their risk exposures. Thirdly, since Basel III and IV CAR's composition changed significantly, non-compliance to the new Basel requirements means that some African banks will have debt in their capital ratios. Lastly, many others set aside reserves from deposits as capital buffer, it is an old regulatory requirement before the introduction of Basel I CAR (Mapororo, 2018; Moore, 1961; Walter, 2019). This system places constraints on the African banks in modern day banking especially that banking have evolved significantly since the 1940s, thus limiting their expansion into securitisation and credit support to the economy (Mapororo, 2018; Walter, 2019). Hence, the growth of banks in Africa does not match up with banks from other developing economies except South Africa that has fully embraced Basel II and Basel III CAR. This is among the reasons why this chapter examines the potential impact of Basel IV CAR on the performance of banks in Africa for policy purpose. In this context, the chapter examines existing studies on bank regulations and the performance of African banks.

One of the banks' objectives is making more profits; this is essential to pay shareholders taxes, and among others. Profits are essential to enable the banks to continue growing and functioning (Abdul, 2017; Geroski & Jacquemin, 1988). There are few empirical evidence from African countries, for instance, Abdrahamane, Xi, Alpha, and Kargbo (2017) for banks in Mali; Naceur and Kandil (2009) in Egypt; Obamuyi (2013) for commercial banks in Nigeria report that higher capital has a positive impact on performance. Using a sample of 28 Egyptian banks from the period 1989 to 2004, Naceur and Kandil (2009) examine the impact of capital requirements on the cost of intermediation and bank profitability. The profitability ratios are proxied using ROA and ROE, and capital requirements are proxied using capital to total assets. The study employs a two-step GMM estimation technique and finds that higher capital increases bank performance for Egyptian banks, although the cost of intermediation also increases. Triki et al. (2017), using DEA, a non-parametric approach, studied the influence of bank regulations and supervision practices on the efficiency of banks in Africa using a 2010 survey that covers 42 African countries from the African Development Bank on the state of the financial system. Their results report that stringent capital only enhances the efficiency of large banks and low-risk banks. Triki et al. (2017) findings have policy implications supporting the departure from the "one size fits all" approach that some bank regulators have used so far in Africa, adapting some parts of the bank regulations to the size and risk level of the banks being regulated. The policy implications approach from Triki et al. (2017) may work successfully. Still, this approach continually causes the African banking sector un-developed, un-sophisticated, un-supportive to economic growth, and perpetual fragile. When Nigeria recapitalized its banking sector in 2005, it resulted in small and medium 89 commercial banks reduced, which emerged 25 big banks supporting the economy. Some African countries like Egypt, Botswana are already implementing Basel III to strengthen the resilience of their banking sector even though at a slow rate (Ozili, 2019).

Obamuyi (2013) examines the effects of bank capital, bank size, interest income, expense management, and macroeconomic conditions on banks' profitability in Nigeria between 2006 and 2012. The profitability was proxied with ROA; the study employs a fixed-effect model and finds that capital adequacy, interest income, efficient expense management, and favourable macroeconomic conditions contribute to banks' positive performance in Nigeria. Similarly, Abdul (2017) use data period after the 2008 financial crisis between 2009 and 2015 for nine commercial banks in Nigeria with international presence, using OLS. The study finds that amid the 2008 financial crisis, the profits of the sampled banks increased progressively. Policymakers should ensure that the banks' performance is sustained in the implementation of tighter regulations (Abdul, 2017; Obamuyi, 2013).

For cross-country empirical evidence, Munyambonera (2013) examines the determinants of profitability for commercial banks in Sub-Sahara Africa for the period 1996 and 2006. The dependent variable for profitability was proxied using return on asset and net interest margin. Also, the study included capital adequacy measured as equity to total assets as one of the determinants. Using fixed and random effect models, the study finds that capital adequacy positively impacts bank performance. The policy implication was that bank regulators and policymakers to pay attention to bank-specific and macro-economic factors that influence the bank’s profitability. Their study calls for policy interventions for commercial banks in Sub-Saharan Africa to improve performance of banks.

Contrariwise, there are studies (Nkopane, 2017; Ramlall & Mamode, 2017; Sadien, 2017) that show higher CAR negatively impact on bank performance from African countries. Sadien (2017) creates a representative sample bank of the South African banking sector using the top five banks in South Africa. Their results show that a 2 percent increase in capital under Basel III will decrease return on equity by 0.29 percent of South African banks. In their study, the capital ratio was proxied using the equity-to-asset ratio, which is not the Basel III capital ratio definition. Therefore, the study conclusions may not hold.

Nkopane (2017) use questionnaires to obtain bankers view of the impact of Basel III on the performance of banks in South Africa. The study concluded that Basel III is irrelevant for the South African banking system since banks' resilience during the 2008 financial crisis was strong and lending was stable. That too much regulations stifle the banks' innovation, increase financial intermediation cost, and affect economic growth potential (Nkopane, 2017). Studies that use questionnaires usually have sample biases from bankers' negative perception of regulations. According to Abdul (2017), secondary data eliminates such sample biases.

Furthermore, Mauritian banks were adequately capitalized under Basel II requirements. Yet, Ramlall and Mamode (2017) find that Basel III CAR's implementation lower returns on equity and reduction in SME lending. Their study call for tailored regulatory reforms to suit the Mauritius banking sector needs (Ramlall & Mamode, 2017). Other studies such as Naceur and Omran (2011) find no relationship between Basel CAR and the performance of banks in Middle-East and North African countries. Pasiouras et al. (2009) argue that there is a trade-off to be made when increasing CAR in terms of performance. The study finds that increased CAR is positively related to cost efficiency but negatively related to performance.

Some African countries choose not to adopt changes in Basel levels as they are considered stringent and non-compliance to the structure of their banking system (Okoye et al., 2017; Ozili, 2019). However, Dedu and Niţescu (2012) establish that permissive and self-regulation is insufficient for stable financial systems. As seen from the 2008 financial crisis, selective regulatory policies adopted by regulatory authorities across each jurisdiction played a major role in the global financial crisis's build-up. Cohen and Scatigna (2016) state that banks with higher capital ratios in the post-financial crisis are more profitable and have the ability to lend more. In addition, Kahari (2016) examine the effect of Basel regulations in mitigating the effect of bank fragility in seven African countries between the period of 1999 and 2014. The study finds that the regulatory capital ratio has no impact on the growth of total assets. This suggests there is room to accommodate higher CAR that will not constrain bank lending to stimulate economic growth for banks in Africa. Empirical studies provided support for regulators in jurisdictions to stabilize the effect of higher CAR on banks to avoid severe impacts on banks (Angelini et al., 2015; Dermine, 2013), even though that higher capital absorbs losses banks may have in the line of business.

3.3.2.4 Empirical studies on banks options to achieve higher capital

As stated in session 3.3.1, the fundamentals and the composition of Basel capital ratios targets the capital structure of any bank. Furthermore, Basel III and Basel IV CAR introduced by the BCBS after the 2008 financial crisis, eliminate debt to tangible equity (BCBSa, 2017; Munoz & Soler, 2017). Although Basel IV is not yet implemented, empirical studies (Cohen, 2013; Oino, 2018) examine the options banks used to achieve Basel III CAR. The options include raising equity capital, retained earnings and reducing the profits used to pay dividends to shareholders, reducing volume of lending and/or portfolio shift, increasing cost of lending, sale of assets (BCBSa, 2017; Gropp et al., 2018; Haubrich & Wachtel, 1993).

The first option for a bank is to increase equity level by issuing shares to existing or new shareholders. This option is the aim of Basel III and Basel IV CAR after the 2008 global financial crisis Basel CAR to strengthen the resilience of the banking sector (BCBS, 2009; BCBSa, 2017; BCBSb, 2017). Mamatzakis and Bagntasarian (2019) note that achieving higher CAR through equity may be costly to the banks. As a result, banks may want to rely on their retained earnings as another option to increase CAR (Bikker & Vervliet, 2018; Cohen, 2013; Ross et al., 2008). Cohen (2013) observe that retained earnings accounted for the bulk of the increase in CAR for a sample of 82 large banks for the period 2009 to 2012 from developed and emerging economies. According to Oino (2018), EU banks use retained earnings to achieve higher CAR; Lebanese banks also use retained earnings to achieve higher capital levels (Awdeh et al., 2011). Giordana and Schumacher (2017) examine the impact of Basel III capital on the performance of Luxembourgish banks for a period covering 2003q2-2011q3. Their study finds a positive relationship between capital ratio and ROA, suggesting that Luxembourgish banks tend to increase their capital through retained earnings.

Nevertheless, retained earnings can only be available for profitable banks, which increases the chances of a bank to achieve its minimum regulatory capital ratio by allocating part of their profits to raise equity (Bikker & Vervliet, 2018; Ross et al., 2008; Tanda, 2015). Furthermore, banks can intentionally increase their capital above the minimum regulatory requirements to serve as a hedge against low capital to avoid having to raise new equity on short notice, which may be costly (Berger, DeYoung, Flannery, Lee, & Öztekin, 2008; Berger et al., 1995; Malovaná, 2017). For banks that are well-capitalized under Basel II CAR, compliance with Basel III, higher capital may reduce their capital surplus to achieve additional regulatory CAR (Malovaná, 2017).

Apart from retained earnings, another option is for the bank to reduce lending to customers, which can subsequently slow down economic growth; also, banks can increase CAR through an asset sale (Cohen & Scatigna, 2016; Rizvi et al., 2018). The final option is for a bank to reduce its RWA by replacing riskier assets to assets with lower risk-weights known as portfolio shifts (Cohen & Scatigna, 2016; Haubrich & Wachtel, 1993; Malovaná, 2017). This final option also entails banks reducing lending to corporate and retail customers, resulting in lower assets and investment (Gropp et al., 2018; Pessarossi & Weill, 2013). Any of these options banks choose other than the second option “to reduce its operating expenses” can impact the performance of banks and the real economy. Gropp et al. (2018) examine banks' response to the 2011 Basel III capital exercise by the European Banking Authority (EBA) using a quasi-natural experiment. The study carried out a descriptive impact study from banks in 21 European countries, separating banks that participated in the EBA 2011 capital exercise from the non-participated banks. Their study finds that the participatory banks' capital levels increased significantly within 2012 and 2013, but these banks achieved a higher CAR by reducing RWA instead of raising new equity. In particular, the banks reduced lending to corporate and retail. The implication negatively impacted lending, having a real negative effect on the economy (Gropp et al., 2018). In addition, banks do not choose to use equity to achieve higher CAR because equity is perceived to be expensive compared to debt.

3.3.3 Gap in the literature review on Basel IV CAR and bank performance

Higher CAR aims to reduce the probability of banking crisis (BCBSa, 2017; Gabriel, 2016; Swamy, 2018). Using common equity to achieve higher capital, banks may take on a higher risk to generate a higher return on equity (Perrone et al., 2015; Walter, 2019). Alternatively, higher capital can increase bank lending rates, which can reduce volumes of loans and may negatively impact capital on performance (Gabriel, 2016; Naceur & Kandil, 2009). There is no consensus in the literature. The literature gap is that Basel IV is new, if implemented, to what extent Basel IV CAR will impact the performance of banks in Africa given the unique opportunities for growth and risks faced by banks in their operating environment. Also, only a few African countries such as South Africa, Egypt, and Mauritius have implemented Basel III CAR. And many other African countries are still in the process of implementing Basel II. Basel IV accord introduces standardization of capital ratios and disconnection between risk and capital, which are different from features in previous Basel I-III; thus, the chapter will help understand the relevance of the new Basel for African banks. This study fills a gap in the literature by providing the first study of the possible impact of Basel IV CAR on the performance of banks in selected thirteen African countries with bank-level data. In addition, econometric estimates are subjected to high uncertainty. This study is not an exception as it is based on calibrations employed by similar studies to forecast the impact of Basel IV on the performance of banks in Africa.

3.4 Methodology for the impact of Basel IV CAR on bank performance

This chapter is important to examine the potential impact of Basel IV CAR on the performance of banks in Africa. In other to evaluate the impact of Basel IV on the performance of banks in Africa, this study adopts a quantitative research method with the use of secondary data. The secondary data of commercial banks that are compliance with Basel II and III CAR from different African countries over a period of time are used. It is, therefore, a panel data with a combination of cross-sectional and longitudinal data. The quantitative research allows the researcher to examine the impact of Basel regulations on commercial banks from different African countries. In this regard, the researcher can compare the impact of the compliance to Basel CAR changes on the commercial banks to achieve the study aims and objectives.

Furthermore, secondary data is suitable and relevant for this study for two reasons. Firstly, it eliminates sample biases in other studies using questionnaires, according to Abdul (2017). Secondly, secondary data allows the study to use past accounting ratios of the banks to calculate Basel IV capital ratios and create a representative balance sheet to analyse the potential impact of Basel IV and compare with existing Basel II and III capital ratio on commercial banks in Africa. It also allows the study to account for unobserved heterogeneity across individual banks and years. The representative banks created enable the study to analyse the potential impact of Basel IV CAR in line with previous studies such as Giordana and Schumacher (2017) for Luxembourg banks and Swamy (2018) for Indian banks. These studies use sample representative banks to examine the potential impact of Basel III CAR. This session presents the different methods of measuring the performance of banks and the estimated models for the study. It also presents the estimation techniques and the justification for using the techniques.

3.4.1 Data and sample for the impact of Basel IV CAR on bank performance

Since the topic is on Basel capital regulations in Africa, the target population are commercial banks that have implemented Basel II or Basel III CAR. The target population consists of all commercial banks publicly listed on stock exchanges in Africa for which financial statements are publicly available. The dataset was sourced from multiple online databases. Bank performance and financial data are obtained from Bloomberg database as the main database, and additional financial information is sourced from S&P Capital

IQ database. The macroeconomic data are collected from Reserve banks of selected African countries, the World Bank, and Infront database. Bloomberg and S&P Capital IQ database offer standardized financial information that eliminates differences in any country's financial reporting system, thus, making the Basel capital and performance measures comparable between the African countries. Thus, the total population from Bloomberg and S & P capital IQ database consists of 137 commercial banks that are listed on stock exchanges in Africa. Furthermore, for international banks listed in more than one country in Africa, Bloomberg and S & P provide information for banks incorporated in each country and not consolidated data in the parent country.

The study employs two-sample selection criteria for the study sample size. First, the study included all commercial banks from each African country for which consistent and reliable data for the entire sample period 2000-2018 are available. The sample period of 2000-2018 is considered because BCBS introduced Basel II in 2004. This will allow the study to draw a conclusion on the impact of Basel IV as if they had been adopted in the period considered vis-à-vis existing Basel regulations. Second, each bank included in the sample must have complied with Basel II or Basel III CAR. Eighty banks which are non-Basel compliant were excluded from the final sample. Additional sixteen banks were excluded because they have total assets below $500m. These additional banks were eliminated because they also suffer from data insufficiency across the sample periods. The sample represent the commercial banks in Africa in terms of size, performance, and Basel compliance. The sample panel data is a combination of cross-sectional and longitudinal data of 41 commercial banks in Africa over the period of 19 years (2000-2018). The final sample is an unbalanced panel consists of 41 banks that have adopted Basel II or III from 13 African countries, as shown in the table below:

Table 3. 1: Panel data of banks from selected African countries

Country	No of banks	Cum.
Botswana	3	7.32
Egypt	6	21.95
Ghana	2	26.83
Kenya	7	43.9
Mauritius	1	46.34
Morocco	1	48.78
Namibia	1	51.22
Nigeria	9	73.17
South Africa	6	87.8
Swaziland	1	90.24
Tanzania	2	95.12
Uganda	1	97.56
Zimbabwe	1	100
Total	41	

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

The final sample size of 41 banks from 13 African countries have exhaustive data on the dependent and explanatory variables for the study analysis to achieve the study objective.

3.4.2 Sampled bank and simulated capital ratio

Many studies examine the impact of regulatory capital after it has been implemented Awdeh et al. (2011); Kale et al. (2015); Oino (2018), among others. Very few studies have considered examining the impact of proposed regulatory CAR before implementation on banks such as Giordana and Schumacher (2017); Gyntelberg (2018); Swamy (2018). In this context, these studies used banks' historical financial data based on the proposed Basel CAR to simulate capital ratio to examine the potential impact of the new Basel before it was implemented and provided necessary recommendations. In line with prior studies such as Giordana and Schumacher (2017), this study will consider the proposed changes in Basel IV CAR to assess its potential impact on the performance of banks in Africa. For a more robust comparison, the study examines the impact of changes from

Basel II, III, on the performance of banks. Therefore, to achieve simulated Basel IV capital ratio, this study use historical bank data to compute the Basel IV capital ratio according to the Basel IV standardized capital requirements contained in Basel accord of BCBSa (2017) known as finalization of Basel III requirements but technically referred to as Basel IV accord (Bodellini, 2019; Gyntelberg, 2018). It is proposed to be implemented in the year 2022 but revised to be implemented in the year 2023 due to COVID-19 pandemic (BCBS, 2020), which led to economic lockdown for over 8 months in the world in the year 2020.

The chapter uses aggregated financial data of selected banks in Africa to create sample representative banks as if these banks had implemented the Basel IV CAR since the year 2000. The Basel IV simulation approach uses the total assets of banks (cash assets, interbank assets, other interbank assets, short-and long-term investments, commercial loans, consumer loans, residential loans, and other loans disclosed by the banks in their financial statements). Appropriate risk weights using a standardized approach in BCBSa (2017) are applied on the value of the bank assets listed above to calculate the banks' hypothetical credit risk in line with Basel IV requirements. Securitization risk are calculated according to the revised securitization framework of BCBSa (2016). Other risks such as operational, market and other risk is obtained from the banks' financial statements. These risks are added together to arrive at each bank simulated risk-weighted assets for Basel IV. The Basel IV capital ratio is defined as tangible common equity (TCE) divided by risk-weighted assets (RWA). The TCE are held constant, obtained from the banks’ financial statements within the sample period. The study then creates sample representative banks requiring a closing balance sheet with simulated expected RWA to calculate Basel IV capital ratio within the sample period of 2000-2018 while the TCE is held constant. After which the Basel IV capital ratio is obtained by dividing the TCE by the simulated RWA.

The chapter then analyses the sample bank simulated data compared to actual data using the regression analysis of choice to examine the possible impact on performance under certain assumptions while holding other conditions constant. According to Angelini et al.

(2015), it is a defined assumption that banks are required to hold more capital for given assets for banks to comply with higher CAR. Thus, to examine the potential impact of Basel IV CAR on bank performance, the current chapter assumes that banks do not adjust the required return on equity. This implies that the dependent variable is constant, while the Basel IV capital ratio is not held constant. Since the Basel IV has not commenced, the use of representative banks enables the study to examine the potential effect of Basel IV CAR on banks in Africa, whether it will negatively or positively impact the performance of banks in Africa, given their current fragility, and growing profitable opportunities. The creation of sample representative banks to examine the new regulation's potential impact is a well-accepted practice in the literature (Giordana & Schumacher, 2017; Gyntelberg, 2018; Swamy, 2018).

3.4.3 Measuring bank performance and regulatory capital ratio

This chapter aims to examine the potential impact of Basel IV CAR on the performance of commercial banks in selected Africa countries. The financial ratios employed in the chapter include performance ratios, regulatory capital ratios, non-risk weighted leverage ratios, bank-specific variables, and macroeconomic variables. Based on existing literature reviewed in session 3.3.2 indicates that bank-specific and macro-economic factors affect bank performance. The financial ratios are widely used in the literature as they are time-tested ratios, and they are not affected by changes in the price level (Guru, Staunton, & Balashanmugam, 2002). They are usually employed in all financial decision making (Ahmed, Manwani, & Ahmed, 2018; Ombaka & Jagongo, 2018).

3.4.3.1 Regulatory capital ratio on Basel IV CAR and bank performance

In the banking regulations literature, Fender and Lewrick (2016) argue that capital ratios definitions are not necessarily identical across studies on CAR, and results, therefore, may materially differ across studies leading to no consensus in the literature on the effect of higher CAR. For example, studies on bank regulations like Adesina and Mwamba

(2016); Cohen and Scatigna (2016); Sadien (2017) proxy Basel capital ratios using simple capital ratios such as equity/Total assets or equity/RWA, which may not be a true representation of Basel capital ratios. Their results may not reflect the impact of higher Basel CAR on performance. Bank capital ratios are to be calculated using bank asset class and applying the appropriate Basel risk-weights to examine the effect of Basel's higher CAR (BCBSa, 2017; Yan et al., 2012). Basel III and Basel IV capital ratio are defined as tangible common equity divided by RWA (BCBSa, 2017; Yan et al., 2012). Basel regulatory capital ratio is measured according to the Basel Committee (BCBSa, 2017; Yan et al., 2012) as:

$$\text{Capital ratio} = \frac{Regulatory\ capital}{Risk\ Weighted\ Assets} \qquad (3.1)$$

The regulatory capital_(Numerator) consists of common equity, which is made up of common shares, retained earnings, and other reserves. This is otherwise known as tangible common equity. The risk-weighted assets (denominator) consist of risk weight assigned to each category of bank assets in the balance sheet (loans-mortgage, corporate loans, government securities, and interbank borrowing).

3.4.3.2 Bank performance measures

Bank performance is measured using profitability ratios. Profitability ratios are widely used in the empirical literature (Datta & Mahmud, 2018; Gabriel, 2016; Liu & Wilson, 2010; Osborne et al., 2012). The different profitability ratios used in the chapter include return on equity (ROE), return on asset (ROA), and net interest margin (NIM). These are the standard profitability ratios, including earnings per share (EPS) used in banking literature by Athanasoglou et al. (2006); Datta and Mahmud (2018); Gabriel (2016); Giordana and Schumacher (2017); Naceur and Kandil (2009). A bank's ability to maximize returns on shareholders’ investment is a major corporate goal of any organization (Bourke, 1989; Guru et al., 2002; Perrone et al., 2015). Although ROE has been criticized as not risk-sensitive, banks reporting high ROE were the worst hit during the financial crisis relative to those reporting negative ROE (Chun et al., 2012; Gavalas, 2015; Mashamba, 2018). However, ROE is a reflection of profits realized on bank assets for a given capital structure (Gabriel, 2016). Given that the adjustments in capital structures of banks in compliance with Basel higher CAR require more common equity, for this reason, the study selects ROE as the main performance measure (dependent variable). In comparison, ROA and NIM are used for robustness purposes. According to Guru et al. (2002), the choice of the profitability ratio to use depends on the profitability measure's objective. Studies that employ single performance ratios such as Giordana and Schumacher (2017); Malovaná (2017); Obamuyi (2013) proxy performance using ROA to capture the impact of higher capital via retained earnings. While Hoffmann (2011); Perrone et al. (2015); Swamy (2018) proxy performance using ROE to capture the impact of higher capital on shareholders returns on equity. Other studies such as Mamatzakis and Bagntasarian (2019); Datta and Mahmud (2018); Gabriel (2016); Liu and Wilson (2010); Naceur and Kandil (2009) employ multiple performance measures ROE, ROA, and NIM for the reason that the impact of CAR on bank performance differently depending on the measure of profitability used for the study (Athanasoglou et al., 2006; Ozili, 2015). Therefore, the chapter uses multiple performance measures (for a dependent variable) to examine the impact of Basel IV CAR on the performance of banks in Africa.

3.4.4 Estimated model for Basel IV CAR and bank performance

The chapter examines the potential impact of Basel IV capital on bank performance in Africa. Following Giordana and Schumacher (2017) study, this chapter makes assumptions[3] to simulate the banks' balance sheets, as explained in section 3.6.2. Based on the simulated data, the chapter model the objective as:

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[3] Assumptions made in the calculation of RWA: Bank assets used in the calculation of RWA are assumed to be AAA. Commercial loans are assumed to be investment grade.

$$\pi_{it} = f(Cap_{it}, Lev_{it} Bankspec_{it}, Macroeco_t) \qquad (3.2)$$

Where π, Cap, $Lev,$ $Bankspe$ and $macroec$ are profitability, Basel capital, leverage, bank-specific, and macroeconomic variables, respectively. A detailed explanation of these variables is found in Table 3.2. Cap_{it} represents the Basel IV capital variable. $Bankspe_{it}$ represents bank-specific variables include size proxy for bank size—Loan-Deposit ratio proxy for liquidity ratio. A higher ratio suggests a less liquid bank. *Nplta*- a proxy for the ratio of non-performing asset/Total asset. Lev_{it} represents Basel simple non-risk leverage ratio. $macroeco$ represents macroeconomic variables are included as control variables to capture the African countries' macroeconomic situations, which may affect the performance of banks (Oino, 2018). $macroeco$ applied in the literature (Athanasoglou et al., 2006; Hoffmann, 2011) include- Gdpgrowth, interest rates and inflation rates of individual countries. The variables in equation 3.2 are standard and widely supported in the empirical literature Athanasoglou et al. (2006); Hoffmann (2011). The variables used in the chapter are considered in more detail in Table 3.2.

Table 3. 2: Definition of model variables for Basel IV CAR and performance

Variable	Definition	Formula	Expected sign	Source
π	ROE	Profits before tax/Average shareholders equity	Dependent variable	(Gabriel, 2016)
Lev	Non-risk leverage ≥4 percent	Tier1 Capital/average-total assets	Negative	(Brei & Gambacorta, 2014)
Cap	Basel IV capital ratios	Tangible common equity/RWA	Negative	(BCBSa, 2017)
Size	Bankspe	Quintiles of total asset	Positive	(Malovaná, 2017)
Loandp	Bankspe	Loan/Deposit	Negative	(Cardone-Riportella et al., 2010)
Nplta	Bankspe	Nonperforming asset/total loan	Negative	(Mapororo, 2018)
Reporate, Inflat	macroec	Reporate	Negative	(Tan & Floros, 2013)
		Inflation	Positive	
Gdpgrowth	macroec	Gdpgrowth rate	Positive	(Bakoush et al., 2019)

Source: Bloomberg database (2019)

3.4.4.1 Approach to estimate the model specification for Basel IV and performance

In banking literature, parametric and non-parametric approaches have been employed. The use of the parametric approach (accounting ratios) enables studies to answer the impact of higher CAR on performance, such as whether higher car increase earnings, interest income, and return on assets, or equity. While the non-parametric approach (frontier technique) answers if banks are more efficient, efficiency does not mean higher profits. These approaches use performance ratios but to answer different questions (Triki et al., 2017). Overall, the existing findings did not help reach a consensus on higher CAR's impact on performance.

The non-parametric approach measures the efficiency of banks, and the commonly used approach in literature are data envelopment analysis (DEA) and Stochastic Frontier Analysis (SFA) (Alam, 2012; Chortareas et al., 2012; Pasiouras, 2008). DEA uses a programming technique to measure how far an economic agent is off the cost or production frontier (Brissimis et al., 2008; Parman & Featherstone, 2019). SFA uses maximum likelihood for its hypothesis testing. DEA's disadvantage involves the difficulty in hypothesis testing and existence of bias , especially in small samples (Parman & Featherstone, 2019). Simultaneously, SFA failed in estimations with high measurement error variance (Parman & Featherstone, 2019). Some studies employ non-parametric techniques to examine Basel regulations' effects on bank performance (Banerjee & Majumdar, 2017; Chortareas et al., 2012; Manlagnit, 2015; Pasiouras et al., 2009). However, Parman and Featherstone (2019) dispute the methodologies of studies that employ a non-parametric approach because regression models are more stable than the DEA and SFA.

The parametric approach (regression models) captures unobservable effects and heterogeneity of banks in pooled cross-sessional panel data (Athanasoglou et al., 2006; Dionne & Harchaoui, 2008). Evidence from the literature reviewed in session 3.3.2 shows that studies that use the parametric approach employ either the static models or the dynamic panel models. Certain parametric studies (Datta & Mahmud, 2018; Gabriel, 2016; Munyambonera, 2013; Rizvi et al., 2018) use the static models while others (Bandt et al., 2018; Bouheni et al., 2014; Hoffmann, 2011; Pessarossi & Weill, 2013) use dynamic panel models. Very limited studies (Bikker & Vervliet, 2018; Liu & Wilson, 2010; Osborne et al., 2012) have employed the combination of the static and dynamic panel models. The dynamic panel model involves using the dependent variable as also an explanatory variable in a linear equation. Model 3.2 will be estimated using the static and dynamic panel models. This is done for robustness purposes. In addition, a dynamic panel model introduces another dimension by capturing the short-and long-run impact of Basel CAR on the performance of banks in Africa. To the best of the researcher’s knowledge, this study is the first to examine the short-and long-run impact of a new Basel requirement on bank performance.

- *Static model for Basel IV CAR and performance*

This chapter employs fixed effects and random effects estimation techniques to examine the impact of Basel CAR on performance in the sample of African banks. Under the fixed effects, the parameters in equation 3.3 are considered fixed, while under the random effects, the parameters are assumed to be random (Athanasoglou et al., 2006).

$$\pi_{it} = \beta_1 + \beta_2 Lev_{it} + \beta_3 Cap_{it} + \beta_4 Bankspe_{it} + \varphi' macroec_t + \acute{\theta} Year_i + \epsilon_{it} \qquad (3.3)$$

Where i represent specific banks (1…….N), t represents time period (1……N), and π_{it} is the profitability of bank i at time t proxy by ROE, ROA, NIM variables. Hausman test is carried out to select the best fit model between fixed and random effect models. For robustness' sake, the chapter also uses ROA and NIM as an alternative performance measure for equation 3.3.

- *Hypotheses for Basel IV CAR and bank performance*

H_0 is the null hypothesis for the chapter while H_1 represents the alternate hypothesis for the chapter.

H_0: There is no relationship between BIVcap and performance

H_1: There is an inverse relationship between BIVcap and performance

H_2: There is an inverse relationship between leverage and performance

H_3: The relationship between loandp and performance is negative

H_4: The relationship between Nplta and performance is negative

H_5: There is an inverse relationship between Reporate and performance

H_6: There is a positive relationship between Gdpgrowth and performance

H_7: There is a positive relationship between inflation and performance

- *Dynamic panel model* for *Basel IV CAR and performance*

The performance of the banking sector affects all other sectors in all countries. In an attempt to examine the short-and long-run relationship between Basel capital ratios and performance, this chapter employs Panel Autoregressive Distributed Lag (P-ARDL) model to capture the short-and long-run impacts of Basel CAR on the performance of banks in Africa. The justification for using P-ARDL model is that static panel estimations such as fixed and random effects estimations usually cannot distinguish between short-run and long-run impact of Basel CAR on performance (Goswami & Junayed, 2006). Equation 3.4 was developed in line with Pesaran, Shin, and Smith (1999) and Goswami and Junayed (2006). Under the P-ARDL model, equation 3.4 is estimated using the pooled mean group (PMG), mean group (MG), and dynamic fixed effects (DFE). Pooled Mean Group (PMG) estimator was developed by Pesaran et al. (1999). PMG, MG and DFE are preferred estimation techniques of choice for cross-sectional data where observation (N-41 banks) and time period (T-19 years) are both large (Blackburne & Frank, 2007). According to Pesaran et al. (1999), where N and T are both large, non-stationarity becomes an issue, PMG and MG are estimation techniques developed to estimate non-stationary dynamic panels with heterogenous parameters to produce consistent and reliable results (Blackburne & Frank, 2007). PMG estimator provides a way of dealing with homogeneity issues contained in the pool of panel data across countries by constraining the long-run coefficient to be the same but allows the short-run coefficients and the error variances to differ across groups in the short run (Goswami & Junayed, 2006; Pesaran et al., 1999; Simões, 2011). Also, PMG is consistent with large N and T.

In addition to PMG, the chapter use alternative panel data estimators such as dynamic fixed effects (DFE) and mean group (MG) to facilitate comparison of the short-run and long-run findings. The DFE imposes constraints on all slope coefficients under the assumption of homogeneity and allows error variances to be fixed, and the intercepts can vary across groups (Ndambendia & Njoupouognigni, 2010b). The Mean Group estimator imposes no restrictions in the long run, thus potentially less efficient (Pesaran et al., 1999; Tan, 2009). The MG estimates may likely not be a good estimator where either N or T is small (Pesaran et al., 1999). PMG is a better estimator than MG and DFE as it is less sensitive to outliers and either small T or N (Goswami & Junayed, 2006; Pesaran et al., 1999). The Hausman test is employed to test the null hypothesis of the coefficients' long-run slope homogeneity (Tan, 2009). The Hausman test is used to determine the more efficient estimator among PMG, MG, and DFE (Blackburne & Frank, 2007).

The autoregressive distributed lag ARDL (p, q, q, -------, q) model is:

$$\pi_{it} = \alpha_i + \sum_{j=1}^{p} \lambda_{ij}\pi_{i,t-j} + \sum_{j=0}^{q} \delta_{1,ij} Cap_{i,t-j} + \sum_{j=0}^{q} \delta_{2,ij} Gdpgrowth_{i,t-j} + \epsilon_{it} \qquad (3.4)$$

Reparameterization of equation (3.4) using PMG is estimated as:

$$\Delta\pi_{it} = \alpha_i + \phi_i\pi_{i,t-1} + \beta'_{1i}Cap_{it-1} + \beta'_{2i}Gdpgrowth_{it-1} + \sum_{j=1}^{p-1}\lambda^{*}_{ij}\Delta\pi_{i,t-j}$$
$$+ \sum_{j=0}^{q-1}\delta^{*\prime}_{i,ij}\Delta\mathrm{Gdpgrowth}_{i,t-j} + \sum_{j=0}^{q-1}\delta^{*\prime}_{2,ij}\Delta Cap_{i,t-j} + \epsilon_{it} \qquad (3.5)$$

Where i represent a specific banks 1…….N, t represents time period 2000, 2001, 2002, ……2018, and π_{it} is the ROE profitability of bank i at time t. $\phi_i\pi_{i,t-1}$ is a lagged dependent variable. Cap_{it} represents Basel IV variables. $Gdpgrowth_{it}$ are macroeconomic variables to explain the effect on bank performance.

Hypotheses for the short-and long-run impact of Basel CAR on performance will be tested using PMG, MG and DFE.

- *Hypotheses for long-run impact on Basel IV CAR and bank performance*

H_0: There is no long-run relationship between BIVcap and performance

H_1: There is a long-run positive relationship between BIVcap and performance

H_2: There is a long-run positive relationship between Gdpgrowth and performance

- *Hypotheses for short-run impact on Basel IV CAR and bank performance*

H_0: There is no significant relationship between BIVcap and performance in the short run

H_1: There is an inverse relationship between BIVcap and performance in the short run

H_2: There is a positive relationship between Gdpgrowth and performance in the short run

- *Econometric properties of equation (3.4 and 3.5)*

The coefficient on lagged profits and other explanatory variables- β , δ , η θ, ρ, $\dot{\phi}$ are coefficients in the model. The coefficients capture the effects of the explanatory variables on the dependent variable π. α_i and γ_t controls for unobserved heterogeneity and time-specific effects that influence the dependent variable. ε_{it} is the error term for bank i in year t. $Year_i$- the chapter control for year effects by introducing year dummies. β, φ, θ are coefficients of the model that capture the effects on the dependent variables, and ϵ_{it} is the error term for bank i in year t.

- *Hausman test Basel IV CAR and bank performance*

Ho: Random effects is preferred. H_1: Fixed effects is preferred

	Basel II	**Basel III**	**Basel IV**
Hausman test	P<1 percent	P-value>10 percent	P-value>10 percent
	Reject Ho	Fail to reject Ho	Fail to reject Ho
Decision	Fixed effects	Random effects	Random effects

Source: Author's own calculation (2020)

- **Panel unit roots tests for Basel IV CAR and bank performance**

Many econometric applications test for unit root to know if the mean and variance of relevant variables do not change with time (Gengenbach, Palm, & Urbain, 2009; Hamilton, 2003). Some estimation techniques require the panel to be stationary for reliable results, including PMG, MG, and DFE (Ndambendia & Njoupouognigni, 2010a). Stata statistical package used to analyze the chapter estimation techniques offer Augmented Dicker Fuller (ADF) and Phillips-Perron unit root as the appropriate unit root test for unbalanced panel with the following hypothesis: H_0: Panel data have unit roots. H_1: Panel data have no unit roots (Panel is stationary). Unit root is necessary to check of no variable is I(2).

- **Panel Co-integration test for Basel IV CAR and bank performance**

Following the unit root test, studies perform co-integration tests for non-stationary panel data with large T and N to determine whether the study variables have a stable, long-run relationship to avoid spurious regression problem. Variables with the presence of unit roots but not co-integrated, then any form of relationship between them in the level is spurious (Hatemi, 2020). These tests are essential for robustness checks. The study carries out co-integration tests under Kao, Pedroni and Westerlund co-integration techniques for panel data to test the hypothesis: H_0: Panel data have no co-integration.

H_1: Panel data have co-integration. For cross-sectional data, Westerlund (2007) is preferred. H_0: all the panels have no co-integration. H_1: All the panels are co-integrated.

3.5 Results and Discussion of the impact of Basel IV CAR on bank performance

The chapter uses multiple regression analysis models to examine the potential impact of Basel IV capital on bank performance in Africa. This chapter's dependent variable is performance proxy by return on equity (ROE), while the independent variables are Cap, Leverage, size, Loandp, Nplta, Reporate, Inflat and Gdpgrowth variables. The previous session explained the nature of the data, sample size, the model specification, the chapter variables, the estimation techniques to analyze the data, and the justification for choosing the estimation techniques. Before running the regression models, various tests were carried out. First, the descriptive statistics for the chapter key variables presented in tables, including graphical trends on capital ratios and performance of banks in Africa, then followed by the regression analysis results. Thereafter, the interpretation of the results and lastly followed by the discussion of findings.

3.5.1 Graphical and Descriptive analyses for Basel CAR and bank performance

This section provides information about the 41 commercial banks quoted on stock exchanges in Africa that have adopted Basel II or III from 13 African countries in tables for key chapter variables, performance, and capital by country and by Basel level. The chapter's performance and capital variables are analysed using descriptive statistics in graphs to visualize the ROE, banks capital levels, and the implications of Basel III CAR on equity levels and performance for African banks that complied with Basel III CAR.

Table 3.3 presents the summary statistics of the key variables; the dependent variables ROE, ROA, and NIM, and the independent variables-Basel capital ratios, bank-specific ratios, and macroeconomic variables. Table 3.3 shows some interesting features of Basel capital ratios. The Basel IV capital ratio (BIV_capratio) is higher probably because the proposed changes introduced in Basel IV CAR are on the capital ratio's denominator while holding the numerator constant. Also, Basel II, III capital ratio (BII_capratio and BIII_capratio) presents a high average mean above the minimum Basel CAR. This could be due to some of the banks having much equity capital that is not utilized to generate more profits, such as increasing bank loans for fear of losses. The African banks not utilizing their equity explains why the average return on assets (ROA) is low at 2.68 percent. Some banks may have high non-performing loans ranging to 63.4 percent of total bank assets. This may pose a liquidity threat to banks struggling to survive and lead to erosion of capital due to the high incidence of failing loans.

The loan deposit ratio (loan_deposit) shows that, on average, banks in Africa have a high loan to deposit ratio at 87 percent. Some African banks issue loans five times above their own deposits, with the highest range of the ratio at 574.305. Such banks put themselves under liquidity problems and can face the risk of bankruptcy. Capitec bank South Africa has a high loan_deposit ratio at 574.305. It is also the bank having a high Basel IV capital ratio of 301.7 percent. If Basel III or IV CAR had been implemented in the year these events happened between 2002 and 2004, the non-risk weighted leverage ratio would have acted as a back-stopper for such banks to either reduce lending or increase their capital level to 301 percent to issue more loans five times above their total deposits.

Table 3. 3**:** Summary statistics of key variables

Stats	**mean**	**N**	**min**	**max**	**range**	**sd**	**variance**	**skewness**
ROE	20.163	883	-173.5	92.900	266.400	18.382	337.881	-3.461
ROA	2.688	883	-8.992	41.002	49.994	3.323	11.041	6.947
NIM	28.696	761	-42.964	92.306	135.271	14.575	212.441	-0.347
BII_capratio	16.570	551	4.000	46.000	42.000	6.389	40.821	1.274
BIII_capratio	19.074	570	2.901	73.807	70.906	8.150	66.415	1.696
BIV_capratio	20.832	702	0.720	301.789	301.069	23.345	544.981	8.266
Lev	11.382	626	-22.981	94.125	117.106	9.795	95.941	4.866
Loan_deposit	86.966	795	0.160	574.305	574.146	47.092	2217.63	3.030
Nplta	3.994	700	0.029	63.398	63.368	6.146	37.770	5.088
Gdpgrowth	4.810	883	-7.652	19.675	27.328	2.832	8.023	0.290
Reporate	5.798	793	-16.307	22.686	38.993	5.827	33.956	0.110
Inflation	9.442	852	-2.410	32.905	35.315	5.389	29.042	1.238

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

The standard deviation of the BII_capratio and BIII_capratio in Table 3.3 is low, suggesting that many of the banks have difficulty achieving the minimum CAR. The simulated non-risk weighted leverage ratio (Lev) is higher than the Basel requirement of >=4 percent. The ROE, NIM is left-skewed, whereas ROA, Basel capital ratios, bank-specific, and macroeconomic variables are right-skewed. After logging the dependent and independent variables in the study, the summary statistics, as presented in Table 3.3.1, the three dependent variables became left-skewed. The outliers were also eliminated, as shown by the spread between min and max values in Table 3.3.1.

Table 3.3. 1**:** Summary statistics of key logged variables

stats	mean	N	min	max	range	Sd	variance	skewness
ROE	5.261	883	0.000	5.589	5.589	0.212	0.045	-18.427
ROA	2.516	883	0.000	3.932	3.932	0.225	0.051	-2.354
NIM	4.258	761	0.000	4.915	4.915	0.283	0.080	-6.156
BIIcap	2.740	551	1.386	3.829	2.442	0.364	0.133	0.076
BIIIcap	2.867	570	1.065	4.301	3.236	0.405	0.164	-0.154
BIVcap	2.796	702	-0.328	5.710	6.038	0.668	0.447	-0.223
Leverage	2.282	624	0.600	4.545	3.945	0.511	0.261	0.786
loandp	0.867	758	0.002	4.074	4.072	0.431	0.186	2.297
Nplta	0.823	700	-3.531	4.149	7.680	1.076	1.158	-0.432
Gdpgrowth	1.427	859	-1.460	2.979	4.439	0.713	0.508	-1.680
inflat	2.108	841	-0.095	3.494	3.588	0.573	0.329	-0.449
Reporate	1.679	681	-2.227	3.122	5.349	0.953	0.909	-1.601

Source: Author’s calculation based on data obtained from Bloomberg databases (2019)

Figure 3.1 shows a graphic sample of equity holdings of banks in African countries represented in the sample. South Africa banks are leading in compliance with Basel III CAR and having the highest equity capital in Africa. Still, in terms of return on the equity capital, Egyptian banks are leading, as shown in Figure 3.2. This may suggest that banks in South Africa tend to maintain high capital ratios above minimum regulatory requirements as a hedge against low capital to avoid raising new equity on short notice, which may be costly to the banks. The consequence, according to Hoffmann (2011) is that an excessively high capital ratio implies that a bank will operates conservatively and ignore potentially profitable investment opportunities but is less prone to a banking crisis. Therefore shareholders can be willing to accept a lower return on equity (Hoffmann, 2011) like the case of South Africa with higher equity capital in Figure 3.1 but lower returns on equity in Figure 3.2.

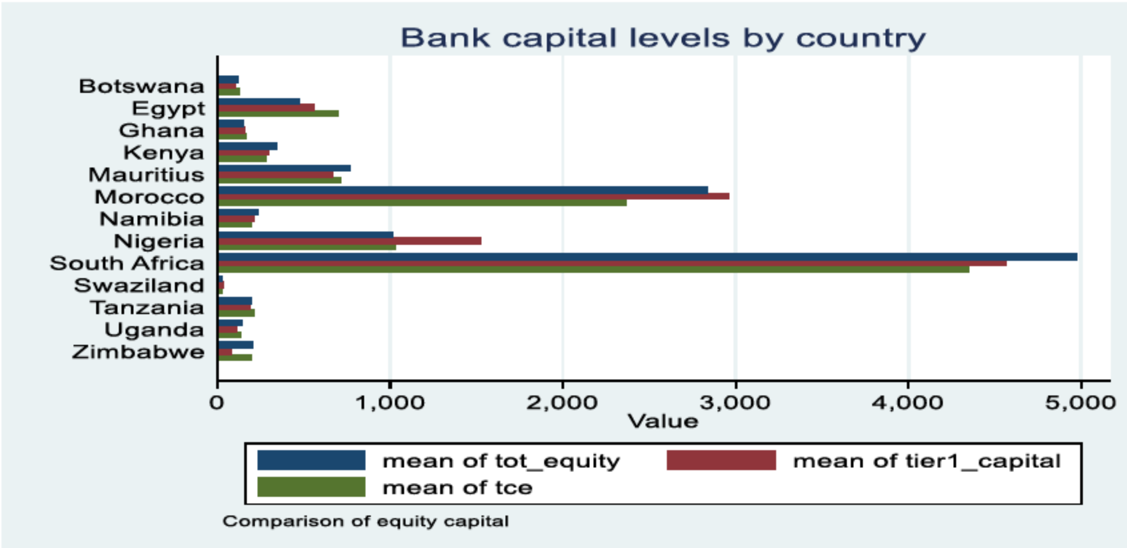

Figure 3. 1: Equity levels in African countries

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

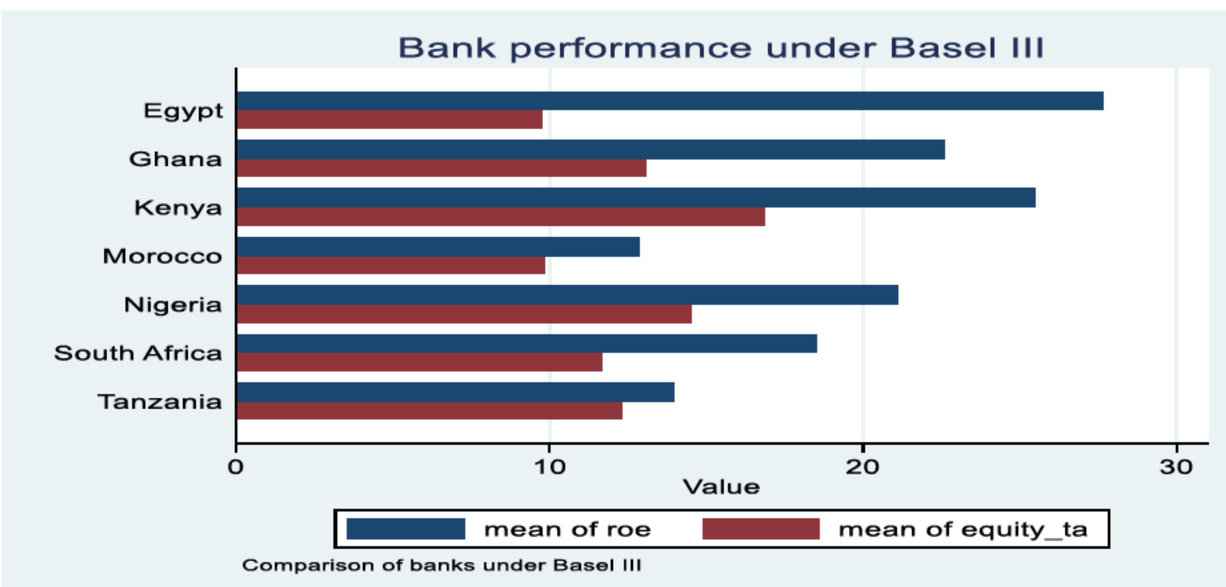

Figure 3. 2: Bank performance in banks African country that adopted Basel III

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

Table 3.4 shows how equity capital increased when banks moved from Basel 2 (Basel II capital ratio) to Basel 3 (Basel III capital ratio) level. Tier1 capital and TCE increased by more than 2000 percent. Even though only a few banks in 7 countries out of 13 countries have adopted Basel III CAR, yet the capital increase moving from Basel 2 level to Basel 3 level is high. Despite the 2000 percent average increase in Tier1 and TCE capital, Table 3.4 shows a slight decrease in the three profitability ratios (ROE, ROA and NIM) when banks change from Basel 2 to Basel 3 level.

Table 3. 4**:** Summary statistics: mean by categories of Basel level

Basel_level	**Tier1cap**	**TCE**	**ROE**	**ROA**	**NIM**
1	1406.637	1365.928	17.87726	2.487689	24.36964
2	1130.612	1121.656	18.30806	2.499948	28.32871
3	4068.267	4225.493	17.5322	2.240154	24.35495
Total	1732.636	1744.764	18.11256	2.447875	27.15008

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

Table 3.5 shows the equity level and return on equity of all African countries in the sample. The Table shows that while South Africa is the leading country with the highest TCE, Morocco and Nigeria are the next leading countries. In terms of ROA, Egypt and Morocco are the lowest in using higher equity capital to generate an efficient return on assets. Botswana has the highest average ROE even though there is no Botswana bank in the sample that have implemented Basel III CAR.

Table 3. 5: Summary statistics: mean by categories of country

Country	Tier1 cap	TCE	ROE	ROA	NIM
Botswana	104.6655	128.0833	38.65385	6.359323	36.10822
Egypt	467.8446	559.1958	12.16655	1.307596	38.91694
Ghana	103.1398	122.2251	26.61684	3.477604	26.49542
Kenya	270.9545	253.6523	18.92154	2.725618	26.06909
Malawi	54.41725	82.00701	32.78546	5.626079	31.36442
Mauritius	668.5769	716.5717	17.42151	2.163465	41.88827
Morocco	2962.746	2364.272	13.73429	1.176842	24.99898
Namibia	214.199	198.8136	26.40191	3.295332	33.99222
Nigeria	1386.786	1013.439	17.24204	2.248708	22.49149
Rwanda	97.3145	103.9375	24.48714	3.821983	35.09875
South Africa	4563.531	4348.17	17.77796	2.280166	24.37131
Swaziland	37.58978	25.9177	24.03294	2.635412	30.32631
Tanzania	188.6674	216.2376	24.87379	2.563448	24.61848
Uganda	79.58041	93.60961	30.57333	4.282963	41.72564
Zambia	75.00579	119.525	17.69542	2.096342	15.20216
Zimbabwe	85.67335	201.773	20.36	2.35825	25.52142
Total	1149.457	1093.524	20.16286	2.688484	28.6958

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

Panel unit roots test

The results of the ADF and PPT unit root test are given in Table 3.6. All the variables are stationary at level using ADF unit root test. The ADF and PPT panel unit root test results for ROE, BIIcap BIIIcap BIVcap and Gdpgrowth shows that at level, the p-value is significant at 5 percent. Therefore, the chapter rejects the H_0 and accept H_1. The result shows that the variables are stationary at level, so there is no need for further differencing.

Table 3. 6: Panel unit root test

Variables	ADF	PPT	Stationary
ROE	0.0000	0.0000	I(0)
BIIcap	0.0000	0.0000	I(0)
BIIIcap	0.0000	0.0000	I(0)
BIVcap	0.0000	0.0000	I(0)
Gdpgrowth	0.0000	0.0000	I(0)

** p<0.1, ** p<0.05, *** p<0.001*

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

. Panel Co-integration test

The panel unit root analysis in Table 3.6 shows the sample is stationary and statistically significant at the 1 percent at level. This refers to a stable correlation among the performance ratio, Basel capital ratios and Gdpgrowth. In addition, this study examines panel co-integration relationship between the performance, Basel capital ratios and Gdpgrowth. Table 3.7 presents the results for the Panel co-integration. In this regard, five of the eight tests are significant at 5 percent significance level. The study rejects H_0 of no cointegration and accept H_1. The result provides strong evidence of the co-integration relationship among Roe, BIIcap, BIIIcap, BIVcap and Gdpgrowth.

Table 3. 7 Panel Co-integration test results for Roe, Basel capital ratios and Gdpgrowth

Pedroni Test		**Kao Test**		**Westerlund**	
Modified Phillips-Perron t	2,8382	Modified Dickey-Fuller t	1,8852	Variance ratio	-3.0209
	(0,0023)		(0,0297)		(0.0013)
Phillips-Perron t	-11,2666	Dickey-Fuller t	-1,0071		
	(0,0000)		(0,1569)		
		Augmented Dickey-Fuller (ADF)	0,7605		
			(0,2235)		
		Unadjusted modified ADF t	-2,2528		
			(0,0121)		
		Unadjusted Dickey-Fuller t	-4,3193		
			(0,0000)		

p-values are in bracket

Source: Author’s calculation based on data obtained from Bloomberg databases (2019)

3.5.2 Analysis of regression results for Basel IV CAR and bank performance

This session presents the results analyzed using the estimation techniques from the static and dynamic panel models for equation 3.3 and equation 3.5. The chapter's objective is to examine the potential impact of Basel IV CAR on the performance of banks in Africa. The section first presents the results for Basel capital ratios, bank-specific and macroeconomic that affect the performance of banks in Africa using fixed and random effects. After that, the chapter presented the findings for the short-and long-term performance of banks in Africa that implemented the Basel CAR using PMG, MG, and DFE estimation techniques.

Equation 3.3 was estimated using random effects (RE), and fixed effects (FE) models and its results are presented in Table 3.8, Table 3.9 and Table 3.10. The Hausman test carried out to test the efficiency and consistency between the FE and RE estimators for equation 3.3. The Hausman test rejects FE and confirmed RE as the efficient estimator for BIIIcap and BIVcap variables but confirmed FE as the efficient estimator for BIIcap. Basel II, III and IV capital ratios are represented as (BIIcap, BIIIcap and BIVcap) in the regression analysis tables. The results for RE are reported in Table 3.8 and Table 3.9, while the FE results are reported in Table 3.10. Table 3.8 summarises the results of the impact of Basel CAR on the performance of banks (ROE) in Africa. Table 3.9 presents robust checks using ROA and NIM. The three models in Table 3.8 and 3.9 represent each Basel level (Basel 2, Basel 3, and Basel 4 capital ratios). The purpose of these 3 capital ratios is to compare the impact of changes in higher CAR on the performance of banks.

Table 3. 8**:** Random effect results for Basel CAR and performance of banks in Africa

Basel levels	**Basel 2**	**Basel 3**	**Basel 4**
	ROE	ROE	ROE
BIIcap	0.025**		
	(0.011)		
BIIIcap		0.066	
		(0.057)	
BIVcap			0.093*
			(0.05)
_Isize_2	0.046***	0.067	0.077
	(0.011)	(0.063)	(0.062)
_Isize_3	0.045***	0.018	0.026
	(0.012)	(0.064)	(0.063)
_Isize_4	0.021	0.023	0.027
	(0.013)	(0.068)	(0.067)
_Isize_5	0.008	0.07	0.085
	(0.015)	(0.082)	(0.081)
Leverage	-0.024***	0.105**	0.078*
	(0.008)	(0.046)	(0.046)
loandp	0.006	0.000	0.042
	(0.009)	(0.052)	(0.059)
Gdpgrowth	0.001	0.013	0.009
	(0.005)	(0.029)	(0.029)
Reporate	0.007**	0.002	-0.001
	(0.003)	(0.02)	(0.02)
Nplta	-0.018***	-0.080***	-0.079***
	(0.003)	(0.018)	(0.018)
inflat	0.027***	0.004	0.007
	(0.006)	(0.04)	(0.039)
_cons	5.359***	4.984***	4.912***
	(0.051)	(0.335)	(0.33)
N	383	403	404
R-squared	0.4582	0.2311	0.1025

Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001

Source: Author’s calculation based on data obtained from Bloomberg databases (2019)

Table 3. 9**:** Random effect results for ROA and NIM

Basel levels	**Basel 2**	**Basel 3**	**Basel 4**	**Basel 2**	**Basel 3**	**Basel 4**
	ROA	ROA	ROA	NIM	NIM	NIM
BIIcap	0.139***			0.789***		
	(0.034)			(0.126)		
BIIIcap		0.082**			0.412***	
		(0.034)			(0.104)	
BIVcap			0.109***			0.171*
			(0.029)			(0.097)
_Isize_2	0.011	0.008	0.021	0.249**	0.260**	0.257**
	(0.032)	(0.037)	(0.037)	(0.112)	(0.11)	(0.113)
_Isize_3	0.004	-0.023	-0.01	0.292**	0.294***	0.288**
	(0.034)	(0.038)	(0.037)	(0.117)	(0.11)	(0.112)
_Isize_4	-0.062*	-0.067	-0.059	0.198	0.258**	0.254**
	(0.037)	(0.041)	(0.04)	(0.125)	(0.113)	(0.116)
_Isize_5	-0.097**	-0.079	-0.062	-0.003	0.039	-0.005
	(0.042)	(0.05)	(0.049)	(0.14)	(0.134)	(0.139)
Leverage	-0.038	0.051*	0.027	-0.095	0.077	0.133
	(0.025)	(0.027)	(0.027)	(0.089)	(0.078)	(0.082)
Loandp	0.052*	0.056*	0.106***	0.278***	0.316***	0.330***
	(0.027)	(0.031)	(0.034)	(0.095)	(0.092)	(0.108)
Gdpgrowth	0.013	0.013	0.007	-0.03	-0.011	-0.041
	(0.015)	(0.017)	(0.017)	(0.053)	(0.055)	(0.055)
Reporate	0.012	0.019	0.016	-0.03	-0.036	-0.046
	(0.01)	(0.012)	(0.012)	(0.036)	(0.038)	(0.039)
Nplta	-0.039***	-0.059***	-0.059***	-0.220***	-0.232***	-0.230***
	(0.01)	(0.011)	(0.01)	(0.035)	(0.033)	(0.034)
inflat	0.044**	0.049**	0.050**	0.061	-0.009	-0.009
	(0.02)	(0.023)	(0.023)	(0.07)	(0.071)	(0.072)
_cons	2.380***	2.288***	2.206***	2.030***	2.659***	3.279***
	(0.16)	(0.194)	(0.191)	(0.581)	(0.634)	(0.642)
N	383	403	404	370	388	389

*Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001*

Source: Author’s calculation based on data obtained from Bloomberg databases (2019)

Table 3. 10: Fixed effects results for ROE

	Basel 2	Basel 3	Basel 4
	ROE	ROE	ROE
BIIcap	0.018		
	(0.012)		
BIIIcap		-0.001	
		(0.069)	
BIVcap			-0.036
			(0.068)
_Isize_2	0.066***	0.095	0.089
	(0.013)	(0.081)	(0.081)
_Isize_3	0.073***	0.066	0.06
	(0.015)	(0.088)	(0.088)
_Isize_4	0.076***	0.068	0.061
	(0.019)	(0.109)	(0.108)
_Isize_5	0.073***	0.062	0.043
	(0.025)	(0.159)	(0.159)
Leverage	-0.012	0.148**	0.157**
	(0.01)	(0.065)	(0.063)
Loandp	-0.002	0.002	-0.02
	(0.011)	(0.066)	(0.076)
Gdpgrowth	0.001	0.02	0.023
	(0.005)	(0.032)	(0.031)
Reporate	0.008**	-0.003	-0.003
	(0.003)	(0.023)	(0.023)
Nplta	-0.016***	-0.088***	-0.085***
	(0.003)	(0.021)	(0.021)
inflat	0.035***	0.047	0.055
	(0.007)	(0.049)	(0.049)
_cons	5.298***	4.959***	5.056***
	(0.052)	(0.368)	(0.383)
N	383	403	404
R-squared	0.4791	0.1175	0.1162

*Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001*

Source: Author’s calculation based on data obtained from Bloomberg databases (2019)

3.5.2.1 Interpretation of the Results: Static model

This section presents the interpretation from the panel data estimation using RE to analyse the impact of Basel IV CAR on the performance of the selected commercial banks in Africa. The results for higher Basel CAR on performance using ROE, ROA, and NIM are similar. In the context, BIIcap, BIIIcap and BIVcap have a positive coefficient on the performance of commercial banks for selected African countries. However, the degree of significant impact differs with the different performance measures used in the chapter analysis. The different degree of impact is consistent with literature that stated that the impact of CAR on bank performance depends on the measure of profitability employed in the study (Athanasoglou et al., 2006; Ozili, 2015). The estimation results for ROA and NIM indicated that the coefficient of BIIcap, BIIIcap, and BIVcap had a positive and significant impact. The positive effect on ROA for BIIcap, BIIIcap, and BIVcap at 1 percent, 5 percent, and 1 percent level of significance suggests that higher Basel CAR increases banks' efficiency to utilize capital to generate higher returns on assets appropriately. Also, the positive effect on NIM at 1 percent for BIIcap and BIIIcap suggests that higher CAR increased bank lending activities, which increased the interest income of the banks. BIVcap has a positive impact on NIM at 10 percent, which means that change from Basel III to Basel IV would result in less interest income for the banks. Of the three performance ratios, higher Basel CAR has a persistent impact on ROA. Nevertheless, ROA and NIM were used as robustness checks by substituting ROE for ROA and NIM in Table 3.9; therefore, ROE's results are discussed for this chapter.

The estimation result presented in Table 3.8 indicated that the coefficient of BIIcap and BIVcap had a positive and significant impact on ROE. The positive coefficient of 0.025 and 0.093 means that holding other variables in the regression constant, a unit increase in BIIcap and BIVcap would lead to about 2.5 percent and 10 percent increase in ROE. BIIIcap is not significant. There is no evidence of BIIIcap influencing ROE as the relationship is statistically insignificant. BIIIcap is a prerequisite for BIVcap. As such, the significant results under Basel 4 model suggest that the banks have adapted to the strict regulations imposed by BIIIcap requirements, thus enhancing the banks to adjust to the implementation of BIVcap and yield positive returns to shareholders. For these reasons, the findings suggest that Basel IV CAR has a positive impact on the ROE. Furthermore, the findings of BIVcap for African banks is contrary to the static-trade off theory, which imply that each bank has a set optimal capital level, then an increase in capital above such level may reduce profitability, thus adopting a new Basel CAR to comply with regulatory authorities may impose new cost constraints (Admati et al., 2013; Diamond & Rajan, 2000).

Bank size is an important determinant of performance and achieving higher capital (Malovaná, 2017). From literature, that large banks have the benefits of economies of scale, diversified, adequately capitalized, and easier access to capital markets. Thus, a positive relationship of higher CAR on performance may exist for large banks relative to smaller banks (Mamatzakis & Bagntasarian, 2019; Ozili, 2015; Tan & Floros, 2013). From the result in Table 3.8, Isize2 and Isize3 were found to impact ROE under Basel 2 model positively. The positive coefficients at a 1 percent level of significance showed that a unit increase in BIIcap resulted in a 5 percent increase in ROE for smaller banks. The results suggest that smaller banks are relatively more profitable than large banks. The result is consistent with Tan and Floros (2013) that show that smaller banks in China are easier to manage, which led to higher profitability.

Furthermore, the Isize4 and Isize5 (large banks) have insignificant impact on ROE explains the complex and costly structure of large banks. Although the positive impact of size under Basel 2 model on performance is consistent with the findings of Mamatzakis and Bagntasarian (2019) for banks in the EU, but also inconsistent with their study in terms of that larger banks in the EU may hold higher capital to reduce their probability of bankruptcy. Still, in line with Tan and Floros (2013), smaller banks hold more capital than larger banks in emerging countries, yielding higher returns on equity. This implies that smaller banks increased their capital ratio above the minimum requirements under Basel 2 model to avoid the cost associated with low capital and the difficulties in accessing capital markets in case of emergencies, which ultimately improved the profitability of the smaller banks.

Size is not significant under Basel 3 and Basel 4 model. Firstly, this can be interpreted that tighter regulations may not be favourable for smaller banks (Nkopane, 2017), resulting in insignificance under Basel 3 and Basel 4 model. Since large (Isize 4 and Isize5) banks had no significant impact on performance under Basel 2 model, it would be expected for the large banks not to significantly impact performance for higher Basel level. Because according to Mamatzakis and Bagntasarian (2019), large banks tend to hold low capital buffers. Thus, higher CAR results in drop in the large banks' capital ratios, which may affect the returns on equity. Secondly, BIIIcap and BIVcap require an increase in equity capital, and as a result, many banks in Africa may struggle to access capital from the capital market. This implies that banks would reduce their excess capital and try to maintain minimum regulatory capital (Malovaná, 2017). As a result, size would not impact return on equity for Basel 3 and Basel 4 models. As suggested by Perrone et al. (2015) that many banks may not have ROE to attract new investors to achieve higher Basel levels.

Leverage was expected to have a negative impact on performance because the non-risk weighted leverage ratio introduced by BCBS in Basel III and IV accord should act as a back-stop against risk. Such that a bank either increases capital to take on more risk or reduce lending (BCBSa, 2017; Munoz & Soler, 2017). Leverage has a negative and significant impact on performance under Basel 2 models 1 percent level of significance. While leverage was positive and significant for Basel 3 and Basel 4 models at 5 and 10 percent level of significance. The positive results suggest that the bank risk level became low with higher capital, such that banks became conservative by trading profitable opportunities for higher capital.

Loan to deposit ratio proxy for liquidity. Loandp has no significant impact on ROE. Npl proxy by non-performing loan to total asset is negative and significant across the three Basel 2, 3 and 4 model. The banks will have to focus on credit risk management Athanasoglou et al. (2006) and embrace Basel prudential principles. Reporate and inflation rate have a positive impact on ROE in Basel 2 model. Gdpgrowth, Reporate, and inflation rate are not significant under Basel 3 and 4 model.

Table 3. 11: Results for ROE: PMG, MG and DFE

PMG				MG			DFE		
	Basel 2 D.ROE	Basel 3 D.ROE	Basel 4 D.ROE	Basel 2 D.ROE	Basel 3 D.ROE	Basel 4 D.ROE	Basel 2 D.ROE	Basel 3 D.ROE	Basel 4 D.ROE
Long run									
BIIcap	1.791***			-0.082**			-0.006		
	(0.49)			(0.039)			(0.009)		
Gdpgrowth	0.149***	0.277***	0.419***	0.011	-0.21	-0.731	0.011***	-0.003	0.000
	(0.034)	(0.048)	(0.08)	(0.027)	(0.212)	(0.631)	(0.003)	(0.02)	(0.016)
BIIIcap		1.678***			0.294			0.065	
		(0.34)			(0.327)			(0.051)	
BIVcap			1.586***			0.035			0.022
			(0.338)			(0.096)			(0.027)
Short run									
ECT	-0.685***	-0.648***	-0.659***	-0.685***	-0.648***	-0.659***	-0.966***	-0.799***	-0.780***
	(0.048)	(0.054)	(0.054)	(0.048)	(0.054)	(0.054)	(0.009)	(0.045)	(0.04)
BIIcap	-1.257***			-0.031**			-0.006		
	(0.087)			(0.013)			(0.009)		
Gdpgrowth	-0.090***	-0.241***	-0.319***	0.012*	-0.062	-0.043	0.011***	-0.003	0.000
	(0.009)	(0.071)	(0.063)	(0.007)	(0.071)	(0.06)	(0.003)	(0.016)	(0.012)
BIIIcap		-0.981***			0.106			0.052	
		(0.151)			(0.112)			(0.04)	
BIVcap			-1.019***			0.027			0.017
			(0.097)			(0.04)			(0.021)
_cons	3.667***	3.263***	3.514***	3.667***	3.263***	3.514***	5.099***	4.059***	4.055***
	(0.252)	(0.334)	(0.288)	(0.252)	(0.334)	(0.288)	(0.054)	(0.26)	(0.214)
Hausman	0.9997	0.9973	0.9963	0.9992	0.9996	0.9991			
N	519	542	649	519	542	649	519	542	649

*Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001*

Source: Author’s calculation based on data obtained from Bloomberg databases (2019)

Table 3. 12**:** Results for ROA: PMG, MG and DFE

PMG				**MG**			**DFE**		
	Basel 2	Basel 3	Basel 4	Basel 2	Basel 3	Basel 4	Basel 2	Basel 3	Basel 4
	D.ROA	D.ROA	D.ROA	D.ROA	D.ROA	D.ROA	D.ROA	D.ROA	D.ROA
Long run									
BIIcap	0.861			0.144			0.066***		
	(2.708)			(0.156)			(0.023)		
Gdpgrowth	0.099	0.143***	0.175***	-0.018	-0.127	-0.006	0.016*	0.014	0.000
	(0.442)	(0.033)	(0.032)	(0.067)	(0.164)	(0.071)	(0.009)	(0.011)	(0.013)
BIIIcap		0.827***			0.422			0.130***	
		(0.23)			(0.258)			(0.029)	
BIVcap			0.796***			0.004			0.073***
			(0.186)			(0.086)			(0.022)
Short run									
ECT	-0.715***	-0.686***	-0.688***	-0.715***	-0.686***	-0.688***	-0.969***	-0.840***	-0.707***
	(0.06)	(0.054)	(0.05)	(0.06)	(0.054)	(0.05)	(0.042)	(0.038)	(0.033)
BIIcap	-0.356			0.259			0.064***		
	(0.248)			(0.262)			(0.023)		
Gdpgrowth	-0.068**	-0.090***	-0.107***	0.003	0.008	0.013	0.016*	0.012	0.000
	(0.032)	(0.018)	(0.018)	(0.03)	(0.015)	(0.015)	(0.008)	(0.009)	(0.009)
BIIIcap		-0.460***			0.108**			0.110***	
		(0.062)			(0.044)			(0.024)	
BIVcap			-0.533***			0.015			0.052***
			(0.064)			(0.041)			(0.016)
_cons	1.122*	1.396***	1.717***	1.122*	1.396***	1.717***	2.241***	1.784***	1.641***
	(0.588)	(0.184)	(0.21)	(0.588)	(0.184)	(0.21)	(0.115)	(0.111)	(0.086)
N	519	542	649	519	542	649	519	542	649

*Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001*

Source: Author’s calculation based on data obtained from Bloomberg databases (2019

3.5.2.2 Interpretation of the results: Long-run and Short-run analysis

Equation 3.5 was estimated to examine Basel IV CAR's long-run impact on the performance of banks in Africa using PMG, MG, and DFE. Due to the reasons that RE and FE estimation results presented in Tables 3.8, 3.9 and 3.10 could not separate the long and short-run impact of implementing Basel CAR. Therefore, the long-run impact of BIIcap, BIIIcap and BIVcap and ROE were analysed using PMG, MG, and DFE. The estimation results for PMG indicated that BIIcap, BIIIcap and BIVcap are significant and contribute positively to the performance of banks in the long run. Gdpgrowth also has a positive and significant impact on the performance of banks in the long run. The PMG estimation for the short run shows that BIIcap, BIIIcap and BIVcap have a negative and significant impact on performance.

For the MG results in Table 3.11, BIIcap has a negative and significant impact on performance both in the short run and the long run at a 5 percent level of significance. However, BIIIcap and BIVcap have no significant impacts on performance in the short and long-run. Gdpgrowth has a positive and significant impact on performance under Basel 2 model in the short run. In the long-run, Gdpgrowth has no significant impact. Gdpgrowth has no significant impact both in the short and long run for Basel 3 and 4 model. The MG estimation results, as shown in Table 3.11, provide another long-run result. The error correction coefficient is significant and negative, confirming the long-run relationship between BIIcap, BIIIcap and BIVcap and ROE. In addition, because the long-run coefficient of BIIIcap and BIVcap is positive and insignificant under Basel 3 and 4 model, while BIIcap is negatively significant, it implies that the long-run impact of Basel capital ratios and ROE seems to be unstable. This chapter applies the Hausman test to select the more appropriate estimation technique for the long-run relationship suitable for the chapter panel data. According to the Hausman test results regarding the long-run relationship between MG and PMG, PMG is a better estimation technique.

Considering the DFE result in Table 3.11, the three levels of Basel capital ratios have no significant impacts on the performance of banks in the long and short run. However, the

DFE result in the short run reveals that the Gdpgrowth has a positive and significant impact under Basel 2 model and the same impact in the long run at the 1 percent level of significance. According to Tan (2009), the DFE estimation method is the opposite extreme of the MG estimation method, which restricts both the long-and the short-run coefficients. In other words, the DFE estimation method assumes that the panel data for multiple countries is pooled as a single entity. Therefore, each explanatory variable has a common coefficient without the coefficients of individual countries. In particular, the restrictions on short-run effects are not consistent with economic intuition. As shown in the DFE estimation results in Table 3.11, the Basel capital ratio and ROE have a long-run correlation, and the long-run coefficient is insignificantly negative. Hence, the long-run effect is not stable, possibly owing to the DFE estimation restrictions, and the short-run coefficient is significantly negative. According to the Hausman test results regarding the long-run relationship between MG and DFE, DFE is a better estimation technique.

However, considering the better estimator between PMG, MG, and DFE, from the results presented in Table 3.11, as far as the sign, significant impact, and the theoretical consistency of the estimated coefficients in the results presented, the PMG performs the best among all the three estimation techniques. This chapter result confirms other literature (Goswami & Junayed, 2006; Pesaran et al., 1999; Tan, 2009) that PMG is a better estimator. BIVcap persistent positive and significant impact on the performance of banks in the long run for PMG is inconsistent with the static trade-off theory. BIVcap negative and significant impact in the short run is consistent with the static trade-off theory where it is expected that compliance to BIVcap will have a negative impact on the performance of banks in Africa, but only in the short run. The results are also contrary to the M&M theory as BIVcap negatively impacted performance in the short run. The negative impact on performance could arise from cost of issuing new equities, increase in cost of lending which may the reduce volume of loans.

The error correction term (ECT) in Tables 3.11 shows that there is co-integration among the panel variables, indicating the existence of a stable and converging long-run relationship between Basel capital ratios, Gdpgrowth, and ROE.

Table 3. 13: Individual country analysis (PMG)

Nigeria				Egypt			South Afrca			Kenya		
	Basel 2	Basel 3	Basel 4	Basel 2	Basel 3	Basel 4	Basel 2	Basel 3	Basel 4	Basel 2	Basel 3	Basel 4
	D.ROE	D.ROE	D.ROE	D.ROE	D.ROE	D.ROE	D.ROE	D.ROE	D.ROE	D.ROE	D.ROE	D.ROE
Long run												
BIIcap	1.792***			1.653***			1.906***			0.130***		
	(0.49)			(0.389)			(0.204)			(0.031)		
Gdpgrowth	-0.012	0.218***	0.250***	0.755***	0.818***	1.507***	0.424***	0.597***	0.648***	0.488***	0.501***	0.478***
	(0.017)	(0.037)	(0.047)	(0.165)	(0.226)	(0.282)	(0.048)	(0.058)	(0.076)	(0.12)	(0.015)	(0.024)
BIIIcap		1.596***			1.451***			1.770***			0.119**	
		(0.325)			(0.431)			(0.168)			(0.053)	
BIVcap			1.512***			1.301***			1.783***			0.130***
			(0.323)			(0.267)			(0.196)			(0.006)
Short run												
ECT	-0.963***	-0.791***	-0.862***	-0.875***	-0.578***	-0.820***	-0.560***	-0.648***	-0.685***	-0.577***	-0.507***	-0.594***
	(0.084)	(0.116)	(0.127)	(0.168)	(0.191)	(0.129)	(0.111)	(0.096)	(0.177)	(0.107)	(0.075)	(0.089)
BIIcap	-1.752***			-1.498***			-1.110***			-0.075***		
	(0.159)			(0.29)			(0.203)			(0.013)		
Gdpgrowth	0.016*	-0.180***	-0.213***	-0.634***	-0.901**	-1.571***	-0.229***	-0.377***	-0.436***	-0.279***	-0.251***	-0.279***
	(0.01)	(0.022)	(0.029)	(0.124)	(0.452)	(0.378)	(0.043)	(0.055)	(0.113)	(0.053)	(0.038)	(0.042)
BIIIcap		-1.335***			-0.167			-1.145***			-0.060***	
		(0.197)			(0.801)			(0.156)			(0.009)	
BIVcap			-1.362***			-0.829**			-1.224***			-0.076***
			(0.206)			(0.344)			(0.305)			(0.011)
_cons	5.105***	4.369***	4.701***	4.721***	2.173	4.447***	3.046***	3.396***	3.614***	3.017***	2.640***	3.071***
	(0.452)	(0.629)	(0.699)	(0.902)	(1.475)	(0.674)	(0.547)	(0.468)	(0.916)	(0.552)	(0.403)	(0.455)
N	92	89	117	65	70	82	88	90	100	98	106	132

*Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001*

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

Table 3.13 reports country by country potential impacts of Basel IV CAR on the performance of banks in Africa using PMG as a better estimator over MG and DFE on the grounds of better precision, according to Pesaran et al. (1999). PMG performs the best in the three-panel estimators in significance and theoretical consistency (Goswami & Junayed, 2006). The short-and long-run estimations were done for countries with sufficient bank data (Nigeria, Egypt, Kenya, and South Africa). Its relevance is to examine the extent to which the impact of higher CAR varies by re-estimating the models in Table 3.12 and reported in Table 3.13 for individual African countries in the sample. The error correction term (ECT) in Table 3.13 shows that there is co-integration among the panel variables in the long run. To summarise, there is empirical evidence that the BIVcap will have a positive and significant impact on the performance of banks in Africa as a whole and in the individual African countries in the long run. Also, the implementation of the BIVcap will have a negative and significant impact on the performance of banks in the short run in Africa as a whole and the individual countries.

3.5.3 Discussion of findings on Basel IV CAR and bank performance

The chapter examines the impact of Basel capital ratios on the performance of commercial banks in selected African countries using static and dynamic panel models. For the static model, the model uses RE for regression analysis, which considers other factors that can affect the performance of banks other than Basel capital ratios. Basel II capital ratio require 8 percent minimum of Tier1 capital divided by RWA. Basel III and Basel IV capital ratios require 10.5 percent minimum of tangible common equity divided by RWA. The results show that BIIcap improved the performance of banks in Africa but BIIIcap has no significant impact on performance. The Basel 3 model allows the chapter to compare the impact of the change from BIIcap to BIIIcap. Since ROE is a return on investments to shareholders, banks would rather use profits to achieve higher capital resulting in lower ROE in Basel 3 model. This is further confirmed with alternate performance measures as the BIIcap, BIIIcap, and BIVcap significantly impact ROA and NIM (efficiency) than ROE. The results of the RE suggest that Basel IV capital ratio will positively impact the performance of banks in Africa. Basel IV CAR requires the restructuring of capital ratio calculation; therefore, if a bank successfully implements Basel III CAR, Basel IV will start to yield an increase in ROE. The result corroborates the findings of Oino (2018). Also, the result is similar to Gabriel (2016) that ROE slightly increase for European banks after the implementation of Basel III. Capital is a major determinant of bank performance. With an increase in equity capital for Basel III and IV CAR (BCBSa, 2017), the new Basel CAR in literature was expected to reduce profits, leading to a negative impact on performance (Cosimano & Hakura, 2011; Lee & Chih, 2013). Also, the results are contrary to the expected hypothesis that Basel IV will negatively impact banks' performance in Africa. The results from African countries have shown otherwise for ROE, ROA, and NIM, that Basel IV CAR would positively improve the performance of African banks. Furthermore, it was determined that smaller banks (bank size) had improved performance under Basel 2 model for ROE. Size (smaller banks) have a more positive and significant impact on NIM under Basel 2, 3 and 4 model. This suggests that smaller banks are easier to be managed to meet higher CAR and also generate more interest income and better efficient if well- capitalized (Munyambonera, 2013; Tan, 2016). Under Basel 2, Basel 3, and Basel 4 model, size has no significant impact on ROA for large banks. The policy implication is that the African government, when introducing higher Basel levels, would ensure that the Basel IV CAR regulations are adapted for smaller banks. Since the smaller banks had higher returns on equity, returns on asset, and persistent net interest income relative to the large banks with higher Basel levels. Capital regulations introduced by African regulatory authorities should ensure that the smaller banks' interest income generation is not affected. One way is to ensure that compliance to higher Basel CAR would not impose high costs that may force such banks to increase the cost of lending, which may negatively affect the interest income of the smaller banks.

It was expected that leverage was expected to have a negative impact on performance because the non-risk weighted leverage ratio introduced by BCBS in Basel III and IV should act as a back-stop against risk. Such that a bank either increases capital to take on more risk or reduce lending (BCBSa, 2017; Munoz & Soler, 2017). The positive results for leverage on ROE under Basel 3 and Basel 4 model suggest that the African bank risk level became low with higher capital, such that banks became conservative by trading profitable opportunities for higher capital. Loan to deposit ratio appears to exert a positive influence on ROA and NIM. This suggests that higher CAR may be an indication of bank ability to utilize its deposits to issue more loans and leads to higher returns on assets and interest income for African banks. Non-performing loan to total asset (Nplta) has a negative and significant impact on ROE, ROA and NIM. The banks will have to focus on credit risk management (Athanasoglou et al., 2006) and embrace Basel prudential principles. Finally, for macroeconomic variables, inflation exerts a significant impact on bank asset earnings (ROA).

The chapter provided further evidence on the short-run and long-run impact of Basel capital ratios on performance. From the result, it is expected that higher Basel levels would negatively affect the ROE in the short run. Nevertheless, investors could willingly invest in the banks in anticipation of increasing returns in the future as bankruptcy risk declines with higher equity capital. The short-run results are closely related to static trade-off theory. That increase in capital above a set optimal capital level can reduce the bank profitability (Cummings & Wright, 2016) due to cost constraints of issuing equity to achieve higher capital (Admati et al., 2013; Osborne et al., 2012). The negative short-run impact of Basel capital ratios in Africa also in line with Knyazeva (2016) for Basel III in EU; Naceur and Kandil (2009) for Egypt. Knyazeva (2016) found that Basel III higher capital requirement introduced in Europe decreased return on equity in many European banks. It is important to note that African banks may also be affected by the high cost of issuing equity capital upon higher CAR implementation. Knyazeva (2016) and Naceur and Kandil (2009) identify the high cost of capital as a factor contributing to the negative impact of Basel III on performance. It is apparent that the Basel IV capital ratio will not be spared from having a negative impact on banks' performance in Africa in the short run.

From the result obtained in all the regression analyses, the chapter can raise the question of whether Basel IV CAR will be beneficial to banks in Africa considering the negative of these requirements the short-run performance of the banks. Although increasing CAR has been known to lower the relative risk position of banks (Gale, 2004), however, compliance to higher Basel CAR has been known to reduce the number of banks in developing countries such as Brazil (Perrone et al., 2015) and Nigeria (Okoye et al., 2017). In addition, Kenya speculates that Basel III CAR's implementation may force banks to merge (Ombaka & Jagongo, 2018). However, in the U.S., banks are targets for acquisitions if they are well-capitalized (Valkanov & Kleimeier, 2007). Observation from the chapter's sample shows that over 50 percent of African banks are medium-sized banks as of 2018, while 25 percent are relatively large, and 15 percent are big banks, with only South Africa topping the list of the big banks in the sample. The characteristics of bank size in Africa from the sample may limit these banks to tap into opportunities for revenue growth. Therefore, the implementation of tighter regulations from Basel IV to reduce banking failures and improve the resilience of banks negatively affect the performance of banks in the short run. But, in the long run, it improves bank performance. At the same time, many banks may merge to achieve Basel's higher CAR in Africa. Furthermore, macroeconomic variable contributes to the positive performance of banks in the long-run but does not contribute to performance in the short run. The result is consistent with Tan and Floros (2013). The positive impact of Gdpgrowth on performance, in the long run, reflects the ability of commercial banks in Africa arising from higher CAR that as economic activities increase, the performance of the African banks would increase. This suggests because the banks are adequately capitalised, that during economic boom, the commercial banks will have the ability to increase lending rather than being constrained, resulting in improved performance. Several empirical studies (Cohen & Scatigna, 2016; Cosimano & Hakura, 2011; Le et al., 2020; Sanders, 2015) and bankers (Nkopane, 2017; Oino, 2018) argue that the higher CAR will penalize the commercial banks by reducing their ability to lend and negatively affecting the bank performances. From the chapter analysis results, higher Basel CAR would increase the performance (ROE, ROA, and NIM) of commercial banks in Africa.

3.6 Conclusions on Basel IV CAR and bank performance

Bank performance in Africa over the past decade remains unimpressive as the banks are characterised by capital inadequacies, low lending, poor performance, and bank failures. Also, African countries' regulatory authorities are increasingly criticized for their conservative approach to implementing changes in Basel regulations, preventing the banking sectors from delivering greater financial development and inclusion. The unimpressive performance has revealed that the many African government's regulatory rules constrain the performance of the African banks and these outdated regulations are not sufficient to protect the banks from fragility and failures. Basel III and Basel IV's capital requirements were introduced by the Basel Committee to address these problems. But it is predicted that many African countries will not implement Basel III in the next decades, stating that the requirements do not fit into their economy's banking needs. This chapter's results have shown that the performance of banks improved especially the smaller banks with higher Basel CAR; thus, it will be beneficial for regulatory authorities in Africa to consider the implementation of Basel III and Basel IV CAR.

The chapter analysis results confirm that the African banking sector needs a tighter capital requirement for a more efficient and profitable banking sector to finance more lending to corporates and households. The benefit of higher Basel CAR will increase the capital adequacy of African banks to enable these banks to take on more risks to support growing African economies. It is recommended that regulatory authorities in Africa should embrace the Basel CAR with caution. In summary, Basel II and III CAR have a positive impact on the performance of banks in Africa in the long run. It is expected that higher CAR of Basel IV will have a positive and significant impact on the performance of banks in Africa in the long run.

In recent years, companies from developed countries are considering Africa as their destination for investment. With the African governments coming together to allow open trade, the African banking industry will continue to evolve as the banks increase their global involvement. This may lead to inadequacies of existing bank regulations that are not compliant with higher Basel levels, which could directly negatively impact the performance of such banking industry. Therefore, it would be beneficial for regulatory authorities in Africa to implement Basel IV CAR to increase the resilience of these banks to support a growing African economy and to reduce bank failure due to capital inadequacies, as shown from recent Ghana bank failures. It is suggested that if Basel IV be implemented, regulatory authorities should allow banks to adopt the higher Basel levels within a wide span period, reducing the negative impact of the regulatory requirements, especially on smaller banks.

CHAPTER FOUR

CHANGES FROM BASEL III TO IV CAR AND LENDING ABILITY OF BANKS IN AFRICA

4.1 Introduction to Basel CAR and bank lending

Banking reforms in Africa since the ‘80s have aimed to increase the stability of the banking sector, increase competition, and foster economic growth (Triki et al., 2017). Many African countries adopt Basel regulations to reduce banking sector fragility and improve the banking sector's efficiency and stability (Triki et al., 2017). Despite the adoption of Basel standards, the banking sector in many African countries remains under-developed; thus, they are yet to fully integrate into the global financial system (Demetriades & Fielding, 2012; Kahari, 2016). For instance, there are gaps in capital adequacy, which often restrict the capacity of African banks to finance loan demands to customers (Okoye et al., 2017; Waithaka, 2013). Hence, most of the loan facilities provided by African banks are short term, having a maximum maturity of one year, while many banks in Africa are excessively liquid for fear of bad loans (Andrianova et al., 2015; Asongu & Odhiambo, 2018). Excess liquidity is a feature of financial underdevelopment, suggesting low loan output. African banks complain of lack of creditworthy borrowers, while at the same time, households and corporates find loan financing as a major constraint in Africa (Andrianova et al., 2015; Demetriades & Fielding, 2012). In contrast, corporates and SMEs rely on banks for over 76 percent of their financing in Europe (Roland Berger, 2017). As a result of globalization and increased financial market activities from banks in developed countries.

Lack of compliance to Basel CAR changes will leave African banks with low capital ratios, constrain such banks from increasing lending, and improve risk measures and assessment. Basel regulations are created to provide adequate capital requirements to guard against risk, such as credit risk in bank loan books arising from lending (Balin, 2008). Regulatory authorities in African countries like South Africa, Egypt, Mauritius, Morocco, and Namibia involve changes in Basel regulations to restructure banks to provide support for economic development and reduce bank failures (Abdel-Baki, 2012; Soile-Balogun, 2017). However, most countries are slow in embracing Basel regulatory requirements changes compared to South Africa, Egypt, and Mauritius that have progressed to implement Basel III CAR. As a result, bank lending ability remained low with high non-performing loans, leading to a lack of financial depth and inefficient financial intermediation. Implementation of Basel II CAR increased credit expansion in Nigeria and South Africa (Sanusi, 2010; Soile-Balogun, 2017).

Furthermore, Basel I and II's implementation has been credited with increasing capital ratios and credit expansion in developed countries (Jablecki, 2009). Also, observation of South African banks reveals that implementing changes in Basel levels from II to III reduces non-performing loans (Bloomberg, 2019). African banks perceive higher Basel CAR to be stringent, so many African countries are slowly adopting the Basel standards (Kahari, 2016). However, the advancements in Basel II and Basel III CAR's implementation by South Africa, Egypt, Mauritius, and Morocco show that African banks can adopt higher CAR. From the foregoing, it is imperative to examine the implications of Basel CAR for African banks. As a result, this chapter examines the potential impact of changes from Basel III to IV CAR on the lending ability of commercial banks in Africa.

On the positive side, the implementation of higher CAR should reduce banking fragility, which is a characteristic of many African banks. However, higher capital to reduce bank fragility is not cheap since it is expensive for banks to achieve higher capital with equity. There is the argument that the cost of lending increase (Cosimano & Hakura, 2011). Banks may also engage in portfolio shifts to avoid capital holding, especially for loans with high-risk weights. For African banks, the question is, what will be the impact of change from Basel III to Basel IV on bank lending and the degree of the impact on bank ability to lend. To analyse, this chapter examines the current Basel capital impact on bank lending, in addition, this chapter examines the bank behaviour to the current Basel rules specifically, what types of loans the banks engaged in with changes in existing Basel and the likely effects of Basel IV on bank lending in Africa. The previous chapter provided empirical discussion and analysis of the potential impact of Basel IV CAR on the performance of commercial banks in African countries. This chapter offers discussions on the second objective relating to the Basel CAR and the implications for bank lending in Africa. The objective of the chapter is achieved in two steps. It examines African banks' responses to higher CAR in terms of portfolio shift and examines the impact of higher CAR on bank lending. The findings will pave the way for understanding whether African banks should adopt the proposed new Basel IV framework or not. This chapter is divided into four sections. The first section introduces the discussion on Basel CAR and bank lending. Subsequently, the second section presents the theories and empirical literature on Basel CAR and lending. Next, the third section presents the research methodology, variables, and estimation techniques used to measure Basel CAR and lending. The last section presents the results and explains the discussions and implications of Basel IV CAR for loan portfolio shifts and lending growth for African banks.

4.2 Changes in Basel CAR and bank lending

Basel regulation originates from microeconomic concerns over the banking system's stability because banks play an important role in the global economy. The banks do not entirely bear the cost of bank failure, and, as a result, the banks are subjected to internationally coordinated regulations (BCBSa, 2017; Oino, 2018). Over the years, Basel regulation has undergone significant changes and has shifted from being non-risk sensitive to become more risk-sensitive by placing more emphasis on mitigation of risk (Munoz & Soler, 2017; Noss & Toffano, 2016). The first set of Basel accords, namely Basel I and Basel II, were not sufficiently risked sensitive because risk-weight systems in these accords opened up opportunities for regulatory capital arbitrage (Jablecki, 2009). This resulted in an introduction of capital buffers, non-risk leverage ratios in Basel III. In addition, the finalization of Basel III in 2016, referred to as Basel IV accord introduces a wider catalog of risk-weights for different risk exposures. Basel IV CAR also introduces simplicity and comparability of capital ratios. The changes introduced in Basel III and IV have increased the risk sensitivity of Basel III and Basel IV capital ratios (BCBSa, 2017;

Munoz & Soler, 2017). As a result, Basel III and Basel IV regulations have also changed from structural regulation to more market-oriented regulation (Munoz & Soler, 2017).

The social benefits of higher CAR entail promoting a healthy financial system, lowering the probability of bank failure, and increasing lending activities, which may ultimately increase economic activities (Admati et al., 2013; BCBSa, 2017). However, implementing higher CAR may increase the cost of funding and lending, reduce the return on equity, and result in less capital available for bank lending (BCBS, 2010; Nkopane, 2017). As a result, changing Basel capital induces banks to raise the cost of lending to customers, which may negatively impact bank lending and, consequently, harm economic growth (Ljung & Schennings, 2018; Psillaki & Georgoulea, 2016). Also, competition for scarce equity capital may play an essential role in the allocation of credit. For instance, Berger et al. (1995) state that increasing capital might alter bank behaviour to choose portfolios with different risk and return profiles. That is, the risk-weights in various Basel accords can influence how banks allocate funds in their loan-portfolios, known as portfolio shift behaviour (Bruno, Nocera, & Resti, 2017).

The impact of higher CAR can affect banks' ability to supply loans (Ambrocio & Jokivuolle, 2018; Jablecki, 2009; Neethling, 2014). Bank lending is a major source of income to a bank and is assumed to positively affect banks' performance (Datta & Mahmud, 2018). In addition, bank lending plays a crucial role in supporting business activities for economic growth (Berrospide & Edge, 2010; Noss & Toffano, 2016). Although the purpose of higher CAR is to reduce the probability of a banking crisis (BCBSa, 2017; Gavalas, 2015), its effects on banks' lending ability, especially for banks in Africa, has not been fully investigated?

Since the 1990s, African economies have experienced accelerated economic growth (Mecagni et al., 2015). The robust economic growth in Africa may be attributed to the expansion of access to financial services, upgraded regulatory and institutional capacities of the commercial banks (Mecagni et al., 2015). Additionally, African banks remain highly profitable as measured by net interest income and return on assets (Chironga et al., 2018). Despite these achievements, African banking systems lack depth compared to the rest of the world (European Investment Bank, 2016). Comparing Africa to other regions, Figure 4.1 shows that there has been an increase in bank lending since 1990, but bank loans to the private sector have declined by 23.5 percent in the last ten years in Africa. The recession following the 2008 global financial crisis in the developed countries, African countries became affected with the spill-over effect such as fall in aids and foreign direct investments from donor countries battling with recession, having consequences for the African economy and the financial sector as a whole (Allen & Giovannetti, 2011; Sanusi, 2010). In addition, African banks inability to improve capital adequacy, accentuated by weak consumer demands, fall in global output, and unstable exchange rate, affected Africa through both the financial and real (trade, remittances, and aid) channels (Allen & Giovannetti, 2011; Sanusi, 2010).

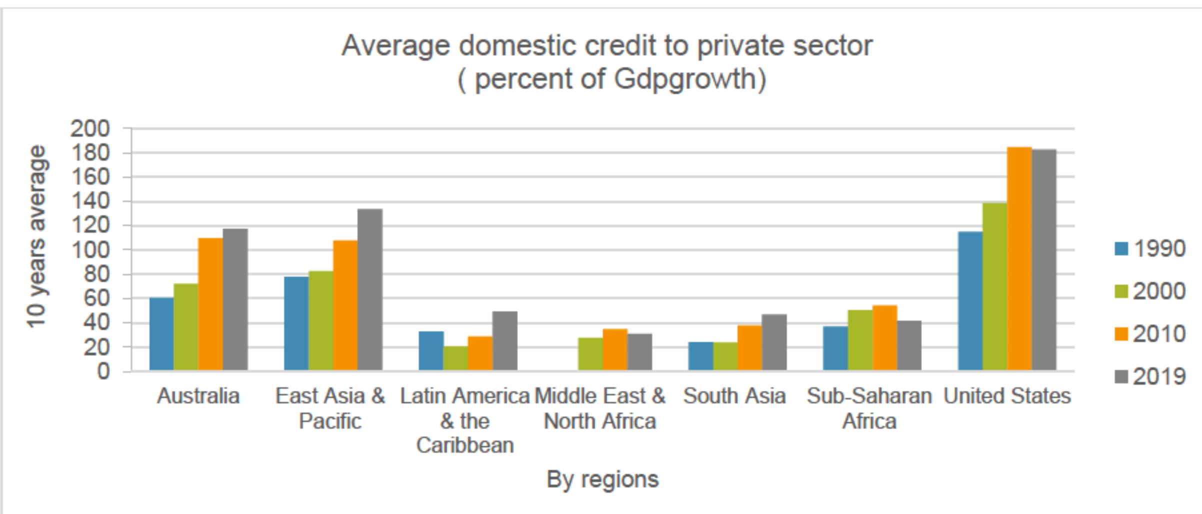

Figure 4. 1: Growth of Bank lending in Africa

Source: World Bank (2020)

African banks are characterized by excessive liquidity, which means low lending arising from fear of high loan default and short-term lending maturities (Andrianova et al., 2011; Asongu & Odhiambo, 2018). African banks complain of lack of grade quality borrowers while at the same time, individuals and businesses find a lack of access to finance as a significant constraint (Asiama & Amoah, 2019; Asongu & Odhiambo, 2018; Balin, 2008). Higher capital increases the ability of banks to lend and diversify loan portfolios (Waithaka, 2013). Yet, many banks in Africa are small in capacity to sustain economic growth because of capital inadequacies. Because their financial reforms are not keeping pace with the Basel regulatory framework changes. As a result, their regulatory framework may not align with international practice (European Investment Bank, 2016). As a result, African banks generally remain liquid, and non-performing loans continue to rise as of 2019 compared to banks in the developed countries, as shown in Figure 4.2. The rise in non-performing loans is linked to non-compliance to changes in Basel CAR (Mecagni et al., 2015). From developed countries, banks from Australia and the United States have non-performing loans below 3 percent. In Africa, banks from Botswana, Namibia, Mauritius, and South Africa have non-performing loans below 5 percent. These African countries have low non-performing loans due to the banks' compliance to higher Basel CAR compared to countries like Ghana, Central Republic Africa, and Equatorial Guinea, with the highest non-performing loans of 15.6 percent, 18.9 percent, and 17.79 percent respectively. Compliance with changes in Basel CAR is important to enhance bank capital to minimise bank exposures to risks from credit, operations, markets, and other risks.

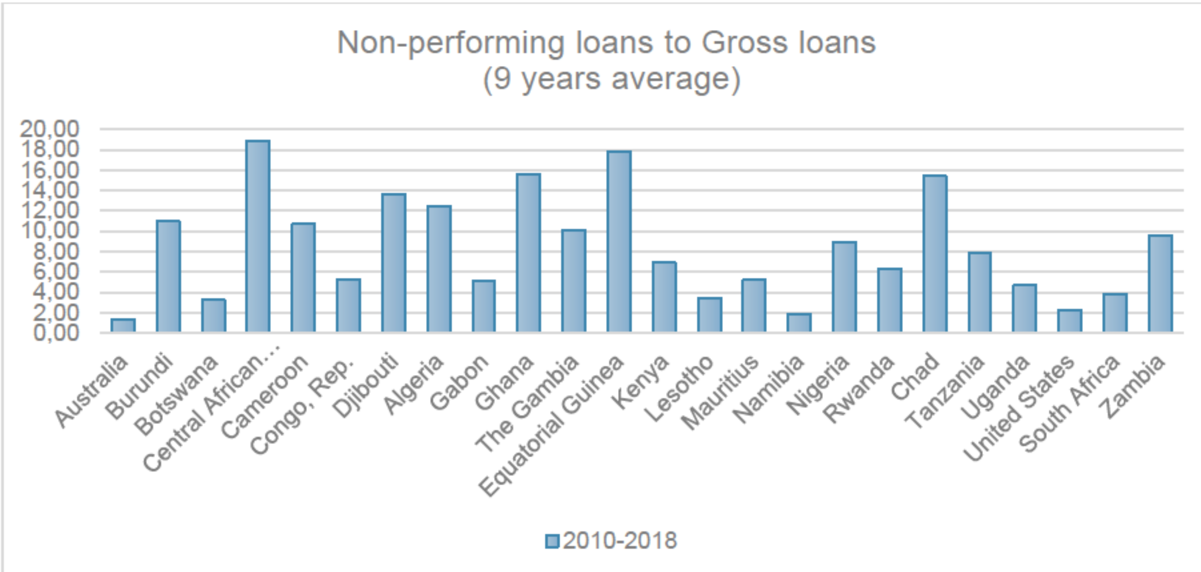

Figure 4. 2: Non-performing loans in Africa 2010-2018

Source: World Bank (2020)

African banks remain highly profitable as measured by net interest income and return on assets despite low lending compared to banks in developed countries (Chironga et al., 2018). However, these African banks have high operating costs; also, the interest rate on loans is very high, making credit costly to borrowers compared to banks in developed countries. Earlier studies, such as Berger et al. (1995), argue that using equity to achieve higher capital may reduce funding costs, driving down interest rates on loans. On the contrary, higher capital might alter bank behaviour to lend less for loans with high risk-weight such as corporate loans and commercial mortgage or reduce bank lending (Ashok & Abhiman, 2002; Bruno et al., 2017; Haubrich & Wachtel, 1993).

The purpose of higher CAR is to reduce the probability of banking crisis (BCBSa, 2017; Gavalas, 2015), which is prevalent in Africa but poses question on what will be its effects on banks' lending ability, especially for banks in Africa where lending is currently low.

Basel IV is proposed to be implemented in 2022,[4] while most African banks lag in implementing the existing Basel CAR. It is imperative to examine the potential impact of Basel IV CAR on bank lending in Africa. This is done by first examining the impact of changes in Basel CAR on bank portfolio shifts to determining if banks in Africa engage in a shift in bank lending from risky loans to less risky to achieve higher CAR. The results allow the chapter to access African banks' potential lending behaviour for compliance with Basel IV CAR. Subsequently, the chapter evaluates the impact of capital and other determinants on bank lending at different Basel levels (Basel II, III, and proposed Basel IV). The findings provide insight for African banks and regulatory authorities as to the implementation of the proposed new Basel IV framework or not.

The aim of the BCBS for introducing a higher Basel level is to strengthen the resilience of the banking system; however, implementation of higher Basel level by banks has its challenges, which may affect bank lending. Literature hypothesizes that banks need to raise more equity to maintain the same lending volume when their capital ratios increase (Ljung & Schennings, 2018). Since the African banking lending system is low, as evidenced in Figure 4.1, it is imperative to examine the impact of Basel IV CAR on bank lending in Africa.

4.3 Review of literature on Basel CAR and bank lending

Capital regulation seems to be the most appropriate tool for regulating banks to reduce the probability of bank failures (Bikker & Vervliet, 2018; Stolz, 2002). The reason is that deposit insurance has been an incentive for banks to take an excessive risk (Abdrahamane et al., 2017; Stolz, 2002). Whereas capital is tied to the portfolio risk of banks to prevent excessive risk. Therefore, the more capital banks have, the more robust their buffers to absorb unexpected losses and the more ability for banks to lend and is healthy for economic growth (Bikker & Vervliet, 2018; Stolz, 2002). However, banks can

[4] Revised to 2023 due to COVID I9(BCBS, 2020)

cut back the supply of loans in response to an increase in regulatory CAR, changes in monetary policy or government directives, or hike in interest rates (Ambrocio & Jokivuolle, 2018; Jablecki, 2009).

The impact of higher CAR on bank lending has been studied from several perspectives. A strand of the literature explored the impact of capital on the cost of funding and lending spreads (Slovik & Cournède, 2011; Šutorova & Teply, 2013). In contrast, other studies followed the macroeconomic approach (Angelini et al., 2015; BCBS, 2010) of providing evidence on the impact of higher capital on the economy. However, these studies do not offer a detailed analysis of the impact of higher CAR on individual bank behaviour. Another strand of literature (Carbó-Valverde, Marqués-Ibáñez, & Rodriguez-Fernandez, 2011; Kim & Sohn, 2017) uses a microeconomic approach to explore the impact of higher capital on bank lending using bank-level data. Given the implementation of Basel III CAR and the introduction of Basel IV in 2016, most studies on Basel III CAR focus on developed countries Carbó-Valverde et al. (2011) for Spanish banks; Ljung and Schennings (2018) for Swedish banks; Wallen (2017) for banks in the United States; Gavalas (2015) for banks from 15 European countries and to other developing countries Naceur and Omran (2011) for banks in the middle east and northern Africa and Padganeh, Mehdu, and Asl (2015) for United Emirates banks. The next sessions present the theoretical literature and empirical review of studies linking CAR to bank lending.

4.3.1 Theoretical review on Basel CAR and bank lending

Certain theories explain the possible impact of higher capital on bank lending. The relevant theories include the modern portfolio theory, the static trade-off theory, and the Modigliani and miller theory.

4.3.1.1 The Modern Portfolio Theory on Basel IV CAR and bank lending

The Modern Portfolio Theory (MPT) posits that a firm can attempt to maximize the expected return on a portfolio of assets for a given level of portfolio risk (Bennett, 1984; Waithaka, 2013). MPT provides insights into how a bank can manage its loan portfolios' riskiness to maximize returns and meet minimum CAR (Bennett, 1984). A well-capitalised bank has more capacity to expand and diversify loan assets into commercial lending, consumer lending, residential and commercial mortgage, credit card loans, among others, to minimize risk, maximize returns, and, at the same time, meeting the minimum CAR (Waithaka, 2013). Contrariwise, banks with low capital ratios adjust loan portfolio by decreasing the volume of loans with high risk-weight like commercial loans to improve capital ratios. Such adjustments tend to reduce loan growth, and such banks will grow slower than other well-capitalized banks (Waithaka, 2013). The changes in Basel CAR and the bank's capital positions can influence bank decisions on lending, particularly the distribution of loans between low-risk weighted assets and high-risk weighted assets (Bruno et al., 2017; Haubrich & Wachtel, 1993). The chapter seeks to examine the behaviour of banks in Africa to higher CAR. Does African banks increase or decrease loans to maximize returns to achieve higher capital.

4.3.1.2 The static trade-off theory on Basel IV CAR and bank lending

Contrary to the static trade-off theory in session 3.3.1.1 in the context of changes in CAR and bank lending ability, compliance to Basel CAR forces banks to hold capital above the optimal level. This can influence portfolio shifts and imposes costs on banks, which can likely impact banks' lending ability (Buser, Chen, & Kane, 1981; Osborne et al., 2012). Due to banks' role in providing credit, banks are subjected to strict regulations; thus, setting optimal capital may not be feasible for the banks. The implication is that compliance with higher capital can reduce bank lending.

4.3.1.3 Modigliani-Miller's theory on Basel IV CAR and bank lending

Referring to M&M theory in session 3.3.1.2, there are cost constraints for banks to raising equity, which causes changes in Basel CAR to have real effects on bank lending (Bridges et al., 2014; Ljung & Schennings, 2018) either in the short or long run. The costs mostly associated are a rise in bank funding cost, as a result, increase interest rates on loans and consequently reducing bank’s ability to lend (Cosimano & Hakura, 2011; Gavalas, 2015; Naceur & Omran, 2011). Other costs include the decision by bank management to cut dividends to shareholders versus retained earnings. The cost implications will depend on the approach. A bank can decide to achieve higher capital to raise equity or increase retained earnings (Bridges et al., 2014). Cosimano and Hakura (2011) find evidence contrary to the M&M theory that raising equity capital influences banks' loan pricing decisions in advanced economies. In contrast to the studies above, Ljung and Schennings (2018) conclude that M&M theory holds for Swedish banks. Their study implied that an increase in CAR under Basel III had not affected bank lending.

Banks tend to alter the supply of loans in compliance with an increase in regulatory CAR (Ambrocio & Jokivuolle, 2018; Bernanke, Lown, & Friedman, 1991; Jablecki, 2009). In this case, banks capacity to lend is affected if the market to access equity for higher capital is not effortless; as such, capital and bank lending tend to generate an inverted U-shape relationship (Fender & Lewrick, 2016; Iwatsubo, 2007). As a result, the elasticity of supply of loans is higher when the capital ratio is low. That is, the supply of loans responds more than proportionally to changes in CAR. Other things being equal, well-capitalised banks are better positioned to absorb shocks. Such banks adjust lending less during economic troughs to avoid regulatory capital shortfalls than banks with low capital ratios (Tabak, Noronha, & Cajueiro, 2011). Lending in Africa is low, and many African banks are characterised by capital inadequacy. Thus, the importance of examining banks' behaviour to higher capital with regards to loan portfolio shifts and the impact of changes in Basel CAR on the lending ability of banks in Africa if it will be beneficial for African banks.

4.3.2 Review of empirical studies on Basel capital and bank lending ability

Bank regulatory authorities tend to use CAR as a tool to strengthen the resilience of the banking sector (Bridges et al., 2014). An increase in CAR affects the banks' capacity to lend, yet banks generate their revenue from interest charged on loans. Although African banks are characterised by low lending, however, the high-interest rate charged on loans makes the African banks profitable compared with banks from developed countries with low-interest rates (Chironga et al., 2018). The literature also argues that banks respond to an increase in CAR by reducing lending more to corporates, real estate, and commercial mortgage but lend more to consumers. Basel IV is a comprehensive set of reforms to strengthen the banks, standardization of calculation of capital ratios, and improvement in the banking sector's risk management. Therefore, will compliance with higher Basel CAR increase the lending ability of banks in Africa? What is the relevance of Basel regulations in Africa? Some recent studies have discussed the significance of higher CAR on bank lending (Gavalas, 2015; Lee & Chih, 2013). There will be a review of the empirical literature on the effect of higher CAR on bank lending in this chapter.

4.3.2.1 Empirical studies on the impact of Basel CAR and bank lending

Ample studies have examined the impact of the new regulatory framework of Basel III on bank lending rates and loan growth. For instance, Cosimano and Hakura (2011) report that higher CAR led to large banks, raising the cost of funding, and led to higher lending rates in advanced countries. Their empirical evidence using Generalised Methods of Moments (GMM) estimations suggested that when equity-to-asset ratio increase by 1.3 percent, the banks will increase interest rates by 0.16 percent. As a result, loan growth decreases by 1.3 percent in the long. Moreover, factors such as cross-country differences, the elasticity of loan demands, loan interest rates, and bank net cost of raising equity, contributed to the large variation across countries in their results between crisis and non-crisis countries. Wallen (2017) also reports an increase in the lending spread in the United States banks. Šutorova and Teply (2013) empirical findings find that a 1 percent increase in the capital ratio for EU banks increases lending rates by 0.188 percent, resulting in a decrease in loan volume by 2 percent. Their result is suggesting that higher CAR decline bank lending. Furthermore, Padganeh et al. (2015), using primary and secondary data, and ANOVA for comparison, show that the implementation of Basel III will lead to higher loan pricing and a decrease in profitability for banks in the United Arab Emirates. In Australia, result from a scenario analysis suggested that a 5 percent change increase in equity capital, will increase lending cost on bank customers by 0.2 percent (Cummings and Wright, 2015). The implementation of Basel III higher CAR could have unintended consequences for the cost of capital, bank lending patterns, and risk migration (Gavalas, 2015; Padganeh et al., 2015).

The implications of higher lending rates from findings in the above studies; if interest rates on loan increase with the supply of loans constant from the banks, demand for loans from borrowers can decline depending on loan elasticity of demand. Also, the supply of loans will depend on banks' incentives for risk-taking or financial situation (BCBS, 2010; Noss & Toffano, 2016). An increase in CAR can increase the cost of lending, affecting the economic output (Angelini et al., 2015; Slovik & Cournède, 2011). Higher CAR will have different impacts on banks, depending on the individual bank business models. Chun et al. (2012) find that investment banks and mortgage banks show negative lending spreads over the sample period of 2005 and 2010 in their cross-country analysis. Their results conclude that investment and mortgage banks cannot pass the cost of higher capital to customers; thus, it was recommended that banks with investment and mortgage business models should decrease lending spreads rather than increase (Chun et al., 2012).

Banks raise lending rates to compensate for the cost of holding more capital (Chortareas et al., 2012; Naceur & Omran, 2011). Higher capital may induce the ability of a bank to take more risks, which means its ability to give out more loans and, in turn, generate higher returns (Roulet, 2018; Stolz, 2002; Waithaka, 2013). On the contrary, some empirical studies Gabriel (2016); Junge and Kugler (2013) suggest that an increase in CAR will reduce bank's ability to taking more risks and, therefore, lower expected returns on equity. As a consequence may reduce the ability of banks to provide lending to the economy (Gabriel, 2016). If equity capital is low and too costly to raise new shares, banks reduce lending, or else they fail to achieve the minimum CAR (Tabak et al., 2011).

Certain studies Cohen and Scatigna (2016); Karmakar and Mok (2015); Kim and Sohn (2017) find a positive impact of higher CAR on bank lending. Kim and Sohn (2017) examine whether the effect of CAR on bank lending is dependent on the level of bank liquidity in the United States. Their study shows that higher capital has a significant and positive effect on loan growth only after large banks retain sufficient liquid assets. Similarly, Karmakar and Mok (2015) find a moderate positive relationship between capital ratios and bank lending for commercial banks in the United States from 1996 to 2010. Also, that bigger banks respond more to changes in capital ratio. Comparing developed and emerging countries, Cohen and Scatigna (2016) examine the impact of capital on bank lending and the real economy on a sample of 101 banks using descriptive statistics. Their study finds that the banks from developed countries that emerged after the financial crisis with higher capital did not appear to reduce lending to comply with higher CAR but had to reduce dividend payout to increase retained earnings. Banks in emerging countries continue to enjoy increased earnings and asset growth; thus, banks from emerging countries achieve higher capital using retained earnings without reducing dividend payout (Cohen & Scatigna, 2016). Furthermore, Ljung and Schennings (2018), using fixed and random effects model, find that Basel III CAR has no impact on bank lending in Sweden. Their study concludes that the regulators were successful in increasing bank capital levels without harming Swedish banks' lending behaviour. A similar finding was found by Neethling (2014) for South Africa that higher capital has an insignificant impact on credit supply for the period 1990 and 2013. An observation noted by Neethling (2014); Nkopane (2017) that South African banks hold capital above the minimum regulatory capital. This can be a reason for changes in capital levels, not impacting bank lending in South Africa.

Subsequently, Bridges et al. (2014) for UK banks, Peek and Rosengren (1995) and Furfine (2001) for US banks; Roulet (2018) for EU banks and Tabak et al. (2011) for Brazil find a negative impact of higher CAR on bank lending. Bridges et al. (2014) examine the impact of changing CAR on bank lending in UK banks for the period 1990 and 2011. Their study finds that an increase in CAR reduces loan growth, but the loan growth recovers on average within three years. There is no consensus on the impact of higher CAR on bank lending. However, since Basel IV CAR is new, there are limited studies on its impact on bank lending in Africa and if it will increase bank lending, which is the aim of this chapter.

Furthermore, banks react differently to changes in regulatory CAR (capitalized and under-capitalized banks). The most significant constraint will be for undercapitalized banks to achieve higher CAR, even if loan demand increases (Bernanke et al., 1991; Nkopane, 2017; Peek & Rosengren, 1995). Banks with higher capital will attract credit-worthy customers. Under-capitalised banks can increase interest margin via high-interest rates to achieve higher capital. Customers who are willing to borrow from under-capitalised banks at high-interest rates are considered inherently risky (Ozili, 2015).

Before the financial crisis, banks in Europe were not so keen on having capital above the minimum CAR. But with the implementation of Basel III CAR, the banks are gradually increasing their capital buffers but temporarily suspending lending with the largest effect of the suspension on commercial real estate lending, corporate lending, and secured 1-4 family mortgage (Bridges et al., 2014). The impact higher capital will have on bank lending is likely to vary depending on factors cited in the literature, such as the bank’s capital structure, financial situations, and macroeconomic situations. However, there is very limited literature from Africa that examines banks' response to higher CAR. There is a need to study the impact of higher capital on bank lending in Africa, especially the impact of the proposed Basel IV CAR on bank lending.

4.3.2.2 Empirical studies on the cost of higher CAR

The Basel capital ratio in the post-financial crisis aims to improve banks' resilience to absorb shock, thus avoiding negative spillover into the banking system and the real economy that African banks can benefit from (BCBS, 2009; Walter, 2010). Determining the optimal CAR to achieve resilience requires balancing the benefits of resilience against the possible cost of higher CAR (Elliott, 2010; Mohan & George, 2013). Arising from the

2008 financial crisis that started in the United States but spilled over globally, the Economist's common consensus is for uniform standards aimed at restructuring the global financial system (Abdel-Baki, 2012; BCBS, 2010; BCBSa, 2017). The cost of compliance may differ from one region to another. Taskinsoy (2018) finds that to achieve 10.5 percent higher regulatory capital for Basel III, banks in South East Asia will increase cost of lending by 0.68 percent. Abdel-Baki (2012) questioned if the uniform set of standards would be compatible with economic systems with varying financial developments like Africa. Admati et al. (2013) argue that higher CAR may be costly for banks but improve bank decisions against poor lending, which lowers the probability of bankruptcy.

It has been indicated by Abdel-Baki (2012); Naceur and Kandil (2009) in Egypt, Nkopane (2017) in South Africa, and Gavalas (2015) in Europe that higher capital will increase the cost of lending, and banks will successfully pass it to their customers. South African banks may initially bear the cost of implementing higher CAR but eventually pass them to banking customers, making bank lending inaccessible to the majority of poor South African citizens (Nkopane, 2017). The Egyptian banks raise the cost of intermediation to make up for a higher risk-return to shareholders, which lowered loan demand (Abdel-Baki, 2012; Naceur & Kandil, 2009). Abdel-Baki (2012) observes that compliance to Basel III CAR may lead Egyptian banks to cross-list their shares to access the required capital to avoid passing high cost of capital to their borrowers. South African banks maintain a significantly high level of capital above the minimum regulatory requirements and above their exposures to risks to avoid penalties and fines from regulators (Nkopane, 2017). The practice can overburden the banks leading to reduced lending just to satisfy the regulatory authorities above the economic needs (Nkopane, 2017).

Many other important factors can affect bank lending other than changes in regulatory CAR (BCBS, 2009). These factors range from bank size, accounting treatment, macroeconomic conditions, bank's capital structure differences in the cost of capital in various countries (BCBS, 2009; Noss & Toffano, 2016). On the bank size, it determines the banks' ability to provide funds to borrowers, thus becoming an indicator of stability to depositors (Soludo, 2006). Large banks can diversify loan portfolios by investing in various securities and investments. Also, large banks can take on more risks with high expectations that the government can bail them out to avoid systemic risk, thereby enabling increased lending. In contrast, smaller banks tend to pursue traditional lending (Kim & Sohn, 2017). In contrast, in Indonesia, large banks are less likely to take more risks because most large banks are state-owned banks (Rumondor & Bary, 2020).

In the United States, when a bank faces capital inadequacy, there is debate around its size, that the bank is too big (Bernanke et al., 1991) as bank size can have a negative impact on loan growth arising from a bank becoming extremely large due to bureaucratic reasons and tend to lend less to small scale businesses (Athanasoglou et al., 2006; Roulet, 2018). Small banks have a comparative advantage in processing information to lend to small businesses (Roulet, 2018). But if large banks use technical expertise and economies of scale to process information to borrowers, bank size can positively impact loan growth. After Nigerian banks recapitalized between 2004 and 2005, the bank size increased concurrently and led to a significant increase in bank lending to the private sector from 5 percent to 31 percent (Soludo, 2006). Similarly, Egyptian banks' size increased steadily after implementing Basel I and II CAR in 1991 and 2003 (Naceur & Kandil, 2009). However, in Egypt, the increase in CAR did not increase bank lending in the economy, but it increased competition among banks and reduced inflation (Naceur & Kandil, 2009). Roulet (2018) find that bank size has a negative and significant impact on loan growth for European banks.

Higher CAR is likely to crowd out smaller banks that cannot raise sufficient capital (Nkopane, 2017). Still, smaller banks are needed for competition with large banks to drive down the cost of loans to borrowers (Asongu & Odhiambo, 2018). Regulators in Africa should protect small banks when having higher capital regulations implemented, except if their aim is to increase banks' size in their jurisdictions. The one-size fit all method of Basel CAR are questioned in literature for emerging countries, for instance, Abdel-Baki (2012) in Egypt; Datta and Mahmud (2018) in Bangladesh. According to Mamatzakis, Staikouras, and Koutsomanoli-Fillipaki (2005), higher CAR became a significant factor in the South-Eastern Europe regulatory reform that reduced the number of banks in operation in the region between the period 1998 and 2002. In Nigeria, the 2004/2005 recapitalization reduced the number of banks from 89 to 25 (Okoye et al., 2017). If higher CAR reduces the number of smaller banks, this will reduce competition for the large banks. Thus, large banks can increase banking costs at poor customers' expense (Nkopane, 2017). For instance, large South African banks are regularly being investigated by the regulatory authorities for price wars to make banking affordable to unbanked masses (Nkopane, 2017). From the empirical literature presented, there can be concerns about the impact higher CAR could have on small and medium-sized banks. This chapter includes different sizes of banks in Africa to examine their effects on bank lending with changes in Basel CAR.

Similarly, the deposit ratio is a factor that can affect bank lending (Carbó-Valverde et al., 2011; Yan et al., 2012). Banks rely on depositors' funds as one of the major sources to finance lending (Gabriel, 2016; Yan et al., 2012). Capital acts as a buffer and liquidity function against unexpected losses, promoting bank lending, but it is not a source of funds for lending (Roulet, 2018; Waithaka, 2013). Before the 2008 financial crisis, cash proceeds from securitisation were used by large banks in the developed countries to replace traditional depositors' funds for lending (Bakoush et al., 2019). Yan et al. (2012) suggest that European banks will have to focus more on increasing depositors' funds to finance lending under Basel III. Depositors' funds positively impact loan growth in Nigerian and Spanish banks, increasing lending (Carbó-Valverde et al., 2011; Olokoyo, 2011). Higher capital increased the deposit ratio in Egypt but did not increase lending (Abdel-Baki, 2012). In addition, non-performing loans result from lax credit policies of banks that can affect loan performance and affect banks' asset quality in the balance sheet (Carbó-Valverde et al., 2011). Gavalas (2015) find that non-performing loans have insignificant impact on bank lending in the European advanced countries.

The Basel III CAR introduces a non-risk leverage ratio defined as Tier1 capital divided by total assets, an independent risk assessment (Brei & Gambacorta, 2014; Psillaki & Georgoulea, 2016). In good times, demand for credit increases; other things being equal, banks increase the supply of loans to meet demand. To increase the supply of loans, a bank should increase capital; if not, the leverage ratio falls below the minimum 3 percent under the Basel III accord and 4 percent under the Basel IV accord (BCBSa, 2017; Brei & Gambacorta, 2014; Munoz & Soler, 2017). Thus, forcing banks with less capital to either increase capital or reduce lending activities. Therefore, the leverage ratio is expected to act counter-cyclically, be tighter in booms, and relax in recession. To improve the financial system's resilience and foster the flow of credit for economic growth (Baldo, Bucalossi, & Scalia, 2018). Brei and Gambacorta (2014) opine that leverage ratio can interact with monetary policy and adjust bank behaviour to alter the supply of loans in response to monetary policy changes. The new Basel regulations provide a non-risk weighted leverage ratio, which is expected to negatively correlate with loan growth (Baldo et al., 2018; Brei & Gambacorta, 2014). The leverage ratio places more constraints on banks in booms and less constraint in recession, thereby reducing banks' ability to manage liquidity when under stress (Baldo et al., 2018; Brei & Gambacorta, 2014; Psillaki & Georgoulea, 2016). In addition, Grill et al. (2015) argument using a theoretical model finds that the benefits for leverage ratio to limit banks from excessive risk-taking outweighs the cost of higher capital, resulting in the more stable financial system. But, if a bank is limited in its ability to take risks, how will the bank make profits? A firm needs to make a profit to be a going concern. Baldo et al. (2018) find that the leverage ratio acted as a constraint to some banks in Europe, but their study could not ascertain if the constraint comes from central bank borrowing or changes in bank assets' risk weights.

The macroeconomic conditions prevailing in a country as measured by macro-economic indicators such as inflation, Reporate, and Gdpgrowth can positively or negatively impact on bank lending (Berrospide & Edge, 2010; Roulet, 2018). Lending is relevant to real economic activities (Berrospide & Edge, 2010). Roulet (2018) and Kim and Sohn (2017) empirical findings show that Gdpgrowth has a positive and significant impact on commercial bank lending in Europe and the US. Kim and Sohn (2017) findings for US banks suggest that large banks are more procyclical than smaller banks. That is, large banks can reduce lending according to the state of business cycle. On the contrary, BCBS (2010); Berrospide and Edge (2010); Rizvi et al. (2018) find that implementation of the

Basel III capital requirement can lower Gdpgrowth in the future because higher lending rates as a result of higher CAR can lower loan demands. Similarly, Cohen and Scatigna (2016); Fender and Lewrick (2016) state that compliance to higher CAR within a short period may impose some short-term macroeconomic costs by causing banks to reduce loan volumes for customers.

Furthermore, Noss and Toffano (2016) show that changes in CAR declined bank lending for the UK banking system, but the effect of the decline in bank lending is insignificant on Gdpgrowth. Reporate is the rate central banks lend money to commercial banks. Therefore, Reporate is used to proxy market funding cost, which is relevant for bank lending. Carbó-Valverde et al. (2011) find a negative impact of Reporate on bank lending in Spain. From the previous, other determinants such as bank size, deposit ratio, macro-economic conditions can impact bank lending other than CAR. As a result, it is relevant to incorporate these factors to investigate the impact of higher Basel CAR on bank lending. In summary, higher CAR is not cheap; there is no consensus in the literature on the impact of higher capital. From the literature, higher capital increase or decrease lending. In Africa, lending is low, despite the opportunity for revenue growth. Because Basel IV capital requirement is new, the literature on Basel IV is somewhat limited. New Basel IV creates a disconnection between capital and risk. It raises some questions as to the impact of Basel IV CAR on bank lending. This is why the chapter examines the impact of Basel IV CAR on bank lending in Africa.

4.3.2.3 Empirical studies on Basel CAR and portfolio shift

Shortly following Basel I CAR's introduction in 1988, banks in the US reduced their lending to corporates and simultaneously began investing in government securities (Furfine, 2001). As a result, corporate lending fell by six percentage points between 1989 and 1994 while US government securities increased by 10 percentage points in the same period, contributed to the credit crunch (Dionne & Harchaoui, 2008; Furfine, 2001; Sanders, 2015). Following the credit crunch of 1990 in the US, many empirical studies have been carried out to determine the extent to which changes in Basel CAR were responsible for shift in bank portfolio. These studies focus on identifying whether decline in lending was caused by the credit crunch or the introduction of the Basel I capital ratio.

Bernanke et al. (1991); Furfine (2001); Hancock, Laing, and Wilcox (1995); Haubrich and Wachtel (1993) use various techniques and different definitions of capital ratio to examine whether changes in Basel capital influence portfolio shift, the conclusions from these US studies were similar. That higher capital impact on optimal loan portfolio allocation of banks which contributed to the 1991 credit crunch. For instance, Haubrich and Wachtel (1993) find strong evidence between Basel regulatory capital ratio changes and bank portfolios' shift in the United States. Their study suggested that if a bank finds it difficult to meet its CAR, it can shift away from high risk-weighted loans like corporate loans to government securities having zero risk-weight. Moreover, these studies were done in the era when banks issue debts to achieve minimum capital ratios. Studies from other countries have mixed findings arising from different sample data, time periods, different capital definition variables. Junge and Kugler (2013) findings show that a portfolio shift in response to higher capital is expensive for banks in Switzerland. In the emerging countries, Nachane, Narain, Ghosh, and Sahoo (2000) find that higher CAR did not have a significant portfolio shift for Indian banks, whereas Ashok and Abhiman (2002) found a contrary view for Indian banks. Following the 2008 financial crisis, banks' equity capital has increased considerably following the introduction of Basel III accord to reduce the probability of bank failures (Walter, 2019). However, there are trade-offs between reducing the likelihood of bank failures and how loan is allocated across sectors in the economy (Ambrocio & Jokivuolle, 2018).

Shift in bank portfolio can be described as decisions made by banks to adjust their portfolio loan allocations across different sectors over time, which is affected by risk-weights used to set capital ratios by banks (Ambrocio & Jokivuolle, 2018; Furfine, 2001). The risk weight system on the Basel I, II, and III accords have been identified in the literature to influence banks into portfolio shift. That the risk-weight system disproportionately constrains banks from lending to loans with high risk-weights such as industrial loans, commercial loans, commercial and residential mortgages. Because there is presumption that such loans are risky even when some of the loans are quality loans (Admati et al., 2013; Ambrocio & Jokivuolle, 2018), for these reasons, lending for such loans are relatively expensive. In addition, when banks are failing to meet up with minimum capital, they are motivated to shift their portfolio away from such loans to low risk-weights and government securities that attract zero risk-weights (Abdel-Baki, 2012; Furfine, 2001).

Nevertheless, banks may take on riskier loans when there is a gap in meeting minimum CAR (Dionne & Harchaoui, 2008; Haubrich & Wachtel, 1993; Jablecki, 2009). The empirical literature identifies four reasons banks engage in shift in portfolio (1) to achieve higher CAR (2) lower demand in loans arising from recession (3) more regulatory pressures (4) secular trends (Blundell-Wignall & Atkinson, 2010; Dionne & Harchaoui, 2008; Furfine, 2001; Haubrich & Wachtel, 1993). Furthermore, banks can shift away from certain loans depending on their incentive for risk-taking or the state of their financial situation and business cycle (BCBS, 2010; Noss & Toffano, 2016). For instance, Wells Fargo, the fourth-largest bank in the United States, declared a decline in fee income at the end of the first half of 2018 arising from avoiding riskier loans, which led to lower expected profits and affected the firm's stock price (Brice and Chiacu, 2018). Banks cut back lending in loan categories such as in commercial real estate and auto loans in response to higher CAR such that lending falls in the year following an increase in the regulatory capital (Bridges et al., 2014). But loan growth in most sectors recovers within three years (Bridges et al., 2014).

Studies that consider Basel capital's risk-weights on portfolio shifts from a bank stability point of view find that banks will favor low-risk customers to high risk-customers. Ruthenberg and Landskroner (2008) examine the possible impact of Basel II CAR on the pricing of bank loans for Isreali banks using the internal and standardised Basel II approach accord on loan equation for a bank facing uncertainty in an imperfectly competitive loan market. Their study finds that low-risk borrowers will enjoy a reduction in loan interest rates from large banks. They suggest that large banks retain quality corporate and retail customers (cherry-picking) and will probably adopt the internal approach to achieve target capital (Ruthenberg & Landskroner, 2008). High-risk borrowers will benefit from smaller banks, while the smaller banks will adopt the standardized approach for lack of skilled personnel to adopt the internal approach. Similar to these findings, Bruno et al. (2017) find that smaller banks in Europe take on loans with higher risk-weights as their balance sheet showed a larger share of corporate loans. Furthermore, Derina (2011) finds similar findings for Indonesian banks, suggesting that smaller banks are risk-takers while large banks are risk-averse. The reason identified large banks shift towards loans with lower risk weights to hold less capital. And smaller banks tend to hold more capital. Derina (2011) note that the profitability of banks with high-risk portfolio declined while profits of large banks with low-risk portfolio increased. In Africa, Neethling (2014) show that South African banks did not substitute loans with higher risk weights for loans with lower risk weights to achieve higher CAR because the banks hold capital above the minimum regulatory CAR. This chapter aims to examine the portfolio shift behaviour of banks in Africa to higher CAR.

Contrary to Neethling (2014), Ambrocio and Jokivuolle (2018) evaluate the quantitative impact of higher capital on portfolio shift under the different regulatory regime (risk-based and less risk-sensitive capital). Their study set a ratio of productivity between the riskier and safest sectors in the US manufacturing industry and estimated a welfare loss of adopting higher capital on the assumption all sectors are equally productive. Their findings suggest that risk-based capital distorts credit allocation, favoring safe borrowers than risky borrowers (Ambrocio & Jokivuolle, 2018). Ruthenberg and Landskroner (2008); Ambrocio and Jokivuolle (2018) use probability of default in their loan model; these models do not account for portfolio shifts on loans categories the banks cut lending from. Thus, their loan models did not provide loan categories (such as corporate, credit card loans, commercial mortgage, residential mortgages) banks moved away from/to in response to higher capital. Their study findings could only show behaviour of banks between low risky and high risky borrowers. For instance, in the developed countries, retail and commercial mortgage are long-term loans that require banks to hold down capital for the duration of the loan period, these banks consider real estate loans as safe whereas African banks will not commit to. In the United States, despite the credit crunch of 1990, the banks declined lending from commercial and consumer loans but still retained real estate loans (Bernanke et al., 1991). According to Iwatsubo (2007), Japanese banks still retain mortgage loans in their portfolio, even when asset prices were falling before the Japan 1998 financial crisis. The US and European banks followed a similar pattern before the 2008 financial crisis (Carbó-Valverde et al., 2011). Studies with other estimation models Derina (2011) used partial adjustment model between capital and risk, still did not distinguish between loans Indonesian banks lend to except for conclusion that banks lend more to low-risk weight loans. Studies that examine whether banks shift their portfolio in response to higher capital Haubrich and Wachtel (1993); Nachane et al. (2000); Neethling (2014) using non-regression, simulation, or calibration approach. In respect to determining the impact of changes in Basel capital on portfolio shifts of banks.

Many African banking sectors are lagging in compliance with changes in Basel CAR. However, the banks are not new to regulatory changes as most have undergone major banking reforms in the past. Thus, African banks can evolve to adapting to changes in Basel CAR. This can influence the risk-taking and risk-shift behaviour of the banks to the system of the CAR. On the other hand, the Basel IV accord introduces a wide range of standardized risk weights for loans within class assets rather than assigning a single risk weight to a class asset (BCBSa, 2017; Munoz & Soler, 2017).

4.3.3 Summary and Gap in the literature on Basel CAR and bank lending

The Basel IV introduces, for the first time, a disconnection between risk and capital by eliminating flat single risk weights on class assets (BCBSa, 2017; BCBSb, 2016). For existing Basel CAR, in Africa, there are very limited studies to the best of the researcher’s knowledge that has examined portfolio risk-shift behaviour of banks to changes in Basel CAR. There is a gap in the literature for a need for this study to determine whether higher capital is beneficial for banks in Africa in order to avoid CAR that will further decline lending given that banks in Africa are already characterised with low lending, short-term loans, and excessively liquid arising from fear of non-performing loans. Therefore, it is the goal of this chapter to examine the portfolio shift behaviour of banks in Africa to changes in Basel CAR. Higher CAR is not cheap, because Basel IV capital requirement is new; the literature on Basel IV is rather limited. It raises some questions as to the impact of Basel IV CAR on bank lending. This is the reason why the chapter also examines the impact of Basel IV CAR on bank lending in Africa.

4.4 Methodology for the impact of Basel CAR on bank lending

In order to analyse the impact of changes from Basel III to Basel IV on bank lending in Africa, this chapter presents the different methods to analyse the impact of higher capital on bank lending. The chapter employed a quantitative approach using accounting ratios of commercial banks in Africa that are Basel compliance over the period of 2000-2018 in accordance with literature to analyse the chapter objective and for a robust comparison of the impact of changes from Basel II, III, on bank lending in Africa. This chapter presents the justification for using descriptive ANOVA for portfolio shifts and the reasons for using dynamic panel model, GMM, and ARDL estimation techniques. Thus, this session introduces the data, the variables, the estimation models, and the estimation techniques that are used for the panel regression. It also presents the estimation techniques and the justification for using the techniques. The chapter adapts a quantitative approach with the use of secondary data. The secondary data is a panel data.

4.4.1 Data and sample for the impact of Basel CAR on bank lending

The sample remains the same with chapter 3.

4.4.2 Sample representative bank for Basel CAR and bank lending

The sample representative bank remains the same with chapter 3. The use of representative banks is a common and well-accepted practice in the literature (Giordana & Schumacher, 2017; Gyntelberg, 2018; Swamy, 2018). For a robust comparison, the chapter examines the impact of changes from Basel II, III, on bank lending in Africa.

4.4.3 Model specification for Basel CAR and bank lending

The impact of capital on lending is commonly examined using dynamic panel models (Carbó-Valverde et al., 2011; Kim & Sohn, 2017). The dynamic framework is required to capture the impact of higher CAR on bank lending. Therefore, the chapter used dynamic panel equation for a sample covering 41 commercial banks in Africa. Equation 4.1 presents banking lending as a function of the capital ratio and relevant determinants

$$Loangrowth_{it} = f(Loangrowth_{it-1}, Lev_{it}, Baselcap_{it-1}, Bankspec_{it-1}, Macroeco_t) \quad (4.1)$$

The formula and expected signs of the model variables are presented in Table 4.1.

Table 4. 1: Definition of model variables

Variables	Definition	Formula	Expected sign
$\mathrm{Loangrowth_{it}}$-$\mathrm{L_{it}}$	Bank lending is proxy by Loan growth	Current year total loan minus previous year total loan divided by previous year total loan (percent)	Dependent var
$\mathrm{Loangrowth_{it-1}}$	Lagged loan growth		Positive
$\mathrm{Baselcap_{it}}$-$\mathrm{Cap_{it}}$	Basel IV capital ratios	TCE/RWA	Positive
$\mathrm{Lev_{it}}$	Non-risk leverage ≥4 percent	Tier1 Capital/average total assets	Negative
Roe	Bankspec –Cost of capital	Profit/Total Asset	Negative
Nplta	Bankspec	Non-performing asset/total loan	Negative
Bank size	Bankspec	Quintiles of total assets	Negative/Positive
Deposit to total asset	Bankspec-liquidity	Deposit/Tot asset	Positive
Reporate	macroec		Negative
Gdpgrowth, inflation	macroec	Gdpgrowth and inflation	Positive

Source: Author's own calculation (2020)

$\boldsymbol{L_{it}}$ is proxied by loan growth, which is the percentage change in total loans (Berrospide & Edge, 2010). The chapter lagged loan growth since it is expected that the current loan supply will be affected by the previous loan supply (Carbó-Valverde et al., 2011). $\boldsymbol{Cap_{it}}$ Basel IV capital ratio is defined as tangible common equity (TCE) divided by risk-weighted assets (RWA) according to the Basel III and IV accords (BCBSa, 2017; Yan et al., 2012). The TCE (numerator) consists of common equity, which is made up of common shares, retained earnings, and other reserves. The risk-weighted assets (denominator) consist of risk weight assigned to each category of bank assets in the balance sheet (loans-mortgage, corporate loans, government securities, and interbank borrowing). For a robust conclusion, three Basel capital ratios are considered based on Basel standards (Basel II, III, and IV). $\mathbf{Lev_{it}}$ represents Basel IV simple non-risk leverage ratio. Leverage is expected to have a negative impact on lending because it was introduced to act a back-stop against risk (Gavalas, 2015). Such that either a bank increase capital in order to take on more risk or reduce lending (BCBSa, 2017; Brei & Gambacorta, 2014).

Bank-specific variables: Cost of capital is proxy by the return on equity Roe (Dionne & Harchaoui, 2008; Roulet, 2018). In theory, the higher the cost of equity capital, the more expensive achieving higher capital becomes, which decline lending and ceteris paribus (Dionne & Harchaoui, 2008). The study expects a negative relationship between the cost of capital and loan growth. Bank size- The chapter uses total assets to generate five dummy variables known as size quintiles (Dickerson, Gibson, & Tsakalotos, 1997) to match banks into different sizes to compare observable and unobservable differences on the dependent variable. In the existing literature, bank size is considered an important determinant of bank lending. Quintiles of bank assets are considered for this chapter because, according to (Roulet, 2018), large banks tend to lend few loans to small scale businesses (SMEs); thus, a negative relationship on loan growth is expected. A positive relationship is expected for small banks as they will have a comparative advantage to process information on SMEs. But if large banks can process the information on SMEs through technical expertise, then a positive relationship is expected (Roulet, 2018). Additionally, deposit to total asset is a proxy for bank liquidity available to finance lending (Carbó-Valverde et al., 2011). It is included to examine if liquidity is important for loan growth in Africa. Thus, a positive relationship is expected. Non-performing loans to total assets (Nplta) is lagged because the chapter expects past loan performance to explain current loan performance. A negative relationship with loan growth is expected. The chapter included Gdpgrowth, inflation, and interest rate proxied by Reporate to control for the macro-economic ($macroec_t$) environment that is likely to affect the quality and the performance of bank loan assets in Africa. The inclusion of macroeconomic variables allows the chapter to control for demand effects (Roulet, 2018). An increase in Gdpgrowth increases loan growth; thus, a positive and significant relationship will imply an increase in loan growth. A negative Reporate means an increase in Reporate leads to a decline in loan growth.

4.4.4 Estimation techniques for Basel CAR and bank lending

The objective of this chapter is achieved in two steps. The first step is to examine whether the implementation of higher CAR leads African banks to shift their loan portfolio to less-riskier assets. The chapter employs descriptive statistics and ANOVA to achieve this step. A portfolio shift occurs when banks either move to loans with lower risk-weight assets than loans with higher risk-weight assets or vice-versa. The second step examines the impact of changes in Basel CAR and relevant determinants on bank lending in Africa using dynamic panel models. The chapter uses a dynamic panel model because the lagged dependent variable is included as an explanatory variable. The chapter used similar equation as Kim and Sohn (2017). In a dynamic panel model, the use of Ordinary Least Square (OLS), fixed and random effects estimation techniques become inconsistent estimators because of biases arising from the correlations between lagged dependent variable and the error terms and endogeneity issues (Das, 2019). For these reasons, System Generalised Methods of Moment (S-GMM) developed by Arellano and Bover (1995) and Blundell and Bond (1998) as the estimation technique because it produces reliable results in the presence of a lagged dependent variable. Furthermore, since S-GMM cannot separate short-and long-run impact, the chapter went a step further using Panel ARDL for this purpose. The estimation techniques for the two steps on the chapter objective are explained further below:

- **Analysis of variance (ANOVA)**

ANOVA is used for comparison to establish whether existing Basel CAR constrains or improve bank lending. The comparison examine the shift in bank loans according to bank assets (total loans, commercial loans, consumer loans, credit-card loans, residential mortgage, and commercial mortgage loans) in line with Haubrich and Wachtel (1993). ANOVA is employed over regression analysis because; Firstly, ANOVA does not impose a linear assumption between the Basel capital ratio and the loan assets (Haubrich & Wachtel, 1993). Secondly, ANOVA allows for comparing these effects and how the effects differ on each loan asset category. In addition, ANOVA facilitates the interpretation and the interaction effects of capital between different sizes of banks. The ANOVA tests employed are F-test (parametric test) and the Kruskal-Wallis test (non-parametric test). The F-test is based on the assumption of normal distribution and equal variance about bank loans. The F-test is given as:

$$SS_B = \sum_{g=1}^{G} n_g(\breve{x}_g - \breve{x})^2 \qquad (4.2)$$

$$SS_w = \sum_{g=1}^{G}\sum_{i=1}^{n_g}(x_{ig} - \breve{x}_g)^2 \qquad (4.3)$$

Where $\breve{x}g$ is the sample mean within-group g and $\breve{x}$ is the overall sample mean. And $i = 1, \ldots. n_g$ for groups $g = 1,$ 2,……. G. The *F*-test for the mean equality of group is computed as:

$$F - test = \frac{SS_B/(G-1)}{SS_W/(N-G)} \qquad (4.4)$$

Where N is the total number of observations, G−1 numerator is the degrees of freedom (DOF), and N−G denominator is degrees of freedom under the null hypothesis of independent and identical normal distributed data, with equal means and variances in each subgroup (Welch, 1947). For the F-test's validity and reliability, the chapter must pass one of the F-test assumptions of equal variance (Hamilton, 2003). Where the loan data fails the equal variance assumption, the chapter equally applies the Kruskal-Wallis test because it provides a non-parametric alternative test where equal variance assumptions of the F-test are in doubt (Hamilton, 2003). Therefore, for confirmatory results for all the variables using F-test, a Kruskal-Wallis (KW) test was performed. The KW test is given by the following formular:

$$KW = \left(\frac{12}{N(N+1)}\sum_{J=1}^{K}\frac{R_j^2}{n_j}\right) - 3(N+1) \qquad (4.5)$$

Where N represents the whole number of observations, R_j^2 is the average rank of observations in the jth group, nj is the total number of observations in the jth group, k is the number of periods.

Dynamic panel model (GMM): for capital requirement and bank lending ability

System GMM developed by Arellano and Bover (1995) and Blundell and Bond (1998) also greatly reduce bias for unbalanced panel data with any omitted variables and is best suited where there is a large panel (n) over a relatively small time period (t) (Roodman, 2009). System GMM with forward orthogonal deviation is employed to estimate equation (4.6).

$$L_{it} = \beta L_{it-1} + \eta CAP_{it-1} + \theta Lev_{it} + \rho Bankspe_{it-1} + \delta macroeco_t + Yeardum_t + \alpha_i + \gamma_i + \epsilon_{it} \qquad (4.6)$$

From the GMM model in equation 4.6, Basel capital ratios, cost of capital, and non-performing variables are lagged because the future response to higher CAR can influence bank behaviour today to either decrease loan or increase loan.

- **Panel ARDL model**

From equation 4.6, Basel capital ratios, cost of capital, and non-performing variables are lagged because the future response to higher CAR can influence bank behaviour today to either decrease loan or increase loan. Subsequently, the chapter employs Panel Autoregressive Distributed Lag (P-ARDL) model to capture the short-and long-run impacts of higher capital on lending as these cannot be revealed by the GMM estimation technique. Under the P-ARDL model, the study employs the pooled mean group (PMG), mean group (MG), and dynamic fixed effects (DFE).

PMG estimator provides a way of dealing with homogeneity issues contained in the pool of panel data across countries by constraining the long-run coefficient to be the same but allows the short-run coefficients and the error variances to differ across groups in the short run (Goswami & Junayed, 2006; Pesaran et al., 1999; Simões, 2011). In addition to PMG, alternative panel data estimators such as dynamic fixed effects (DFE) and mean group (MG) to facilitate comparison of the short-run, and long-run findings were employed in this chapter.

The P-ARDL (p, q, q, -------, q) model is expressed as:

$$L_{it} = \alpha_i + \sum_{j=1}^{p} \lambda_{ij} L_{i,t-j} + \sum_{j=0}^{q} \delta_{1,ij} Cap_{i,t-j} + \sum_{j=0}^{q} \delta_{2,ij} Nplta_{i,t-j} + \epsilon_{it} \qquad (4.7)$$

Reparameterization of equation (4.7) using PMG is estimated as:

$$\Delta L_{it} = \alpha_i + \phi_i L_{i,t-1} + \beta'_{1i} Cap_{it-1} + \beta'_{2i} Nplta_{it-1} + \sum_{j=1}^{p-1} \lambda^{*}_{ij} \Delta L_{i,t-j} + \sum_{j=0}^{q-1} \delta^{*\prime}_{i,ij} \Delta Nplta_{i,t-j} + \sum_{j=0}^{q-1} \delta^{*\prime}_{2,ij} \Delta Cap_{i,t-j} + \epsilon_{it} \qquad (4.8)$$

Where L_{it} proxy for loan growth of bank i at time t. i represent banks =1…….N and t represent time period 2000, 2001, 2002, ……2018 and $L_{i,t-1}$ is a lagged dependent variable. Cap_{it} represents Basel IV variables. $Nplta_{it}$ is non-performing loans to explain the effect on bank lending. Cap_{it} represents Basel IV variables.

In terms of the econometric properties of equation (4.6) and (4.8), each coefficient (β, η, θ, ρ δ ϕ λ), captures the impact of the specified explanatory variable on the dependent variable-loan growth, and ϵ_{it} is the error term for bank *i* in year *t*. The Hausman test is employed to test the null hypothesis of the long-run slope homogeneity in the coefficients (Tan, 2009). The Hausman test is used to determine the more efficient estimator among

PMG, MG, and DFE (Blackburne & Frank, 2007). In other words, Hausman tests are carried out for the selection of the estimation techniques for equation (4.8).

In addition, PMG estimation technique is employed for short-and long-run impact on a country-by-country basis. A problem encountered was a lack of sufficient data for some countries, particularly Botswana, Ghana, Mauritius, Morocco, Namibia, Tanzania, Uganda, Swaziland, and Zimbabwe. For these countries, n becomes too small for PMG estimation due to insufficient data to run regression on observations from individual countries represented in the sample. To overcome the problem, these countries were excluded from the individual country analysis. Thus, four African countries with sufficient data to run regression analysis are used to examine country by country impact.

- **Panel unit roots test on Basel IV CAR and bank lending**

The appropriate unit root test and hypothesis remains the same with chapter 3. The unbalanced panel unit root results (see Table 4.3) show that for all variables, the H_0 for a unit root is rejected less than at the 1 percent level of significance (p-values < 0.01). This implies that all variables are stationary at level or I(0), confirming the PARDL can be used to estimate the results.

- **Panel Co-integration test for Basel IV CAR and bank lending**

The study carried out co-integration tests using Kao, Pedroni and Westerlund co-integration techniques and the hypothesis remains the same with chapter 3. See Table 4.4 for the results.

4.5 Results and Discussion on Basel CAR and bank lending

The previous session explained the nature of data, sample size, the estimation model, the chapter variables, the estimation techniques to analyse the data, and the justification for choosing the estimation techniques. This session presents the descriptive statistics of the chapter key variables and presents the ANOVA for portfolio shifts, the regression analysis, and the interpretation and discussion of the results.

4.5.1 Descriptive statistics on Basel CAR and bank lending

Table 4.2 presents the summary statistics of key variables. The annual growth in total loans averages 22.8 percent over the sample period, while the standard deviation (sd) is 55.8 percent. This is an indication of low lending over the sample period. Basel II capital ratio (BII_capratio) showed that the average capital ratio is 16.07 percent, and sd is 5.7 percent. The average mean of 16.07 percent shows that African banks are well-capitalized above the minimum CAR, but the sd of 5.7 percent for BII_cap shows that there are banks in Africa that are below the 8 percent Basel II CAR. For the Basel III capital ratio (BIII_capratio), the mean and sd are 18.2 percent and 7.2 percent, respectively. The average capital ratio of BIII_capratio increased as shown with the sd; however, the banks still fall below the 10.5 percent of Basel III capital requirement. Basel IV capital ratio (BIV_capratio) is a simulated capital ratio using historical data as if the banks had implemented the Basel accord in the sample period, the mean and sd are 19.7 percent and 21.7 percent. The sd of BIV_capratio is above the 10.5 percent requirements. The minimum capital ratio was 1.32 percent average for BIV_capratio; the figures arises because of the low level of equity capital (numerator) of the capital ratio. Thus, this suggests that for some banks in Africa to comply with the higher Basel IV CAR, they will have to raise more equity capital.

Table 4. 2: Summary statistics of key variables

Stats	mean	N	min	max	sd	Variance	skewness
loan_growth	22.845	687	-89.955	640.049	55.796	3113.146	5.209
BII_capratio	16.070	449	5	46	5.724	32.766	1.449
BIII_capratio	18.222	477	2.901	73.807	7.181	51.560	2.174
BIV_capratio	19.731	589	1.320	301.589	21.697	470.750	8.669
dep_totasset	73.545	650	5.947	92.180	11.877	141.055	-1.317
ROE	21.598	722	-76.001	92.900	13.824	191.093	0.348
Lev	11.747	510	2.842	94.125	10.432	108.820	4.989
Nplta	3.574	575	0.029	48.526	4.837	23.400	4.623
Gdpgrowth	4.645	722	-7.652	19.675	2.858	8.171	0.272
inflation	9.083	693	-2.410	32.905	5.184	26.872	1.284
Reporate	5.452	666	-16.307	19.538	5.476	29.986	-0.008

Source: Author's own calculation based on data obtained from Bloomberg databases (2019)

Figure 4.3 presents the lending growth and loan quality of banks in Africa between 2000 and 2018 for banks represented in the sample from 13 African countries. Lending has increased steadily over the past decade. During the period of financial crisis 2007-2009, the African banks had a significant increase in the volume of loans up to the year 2012. The graph shows that although the mean volume of total loans is fairly increasing. But in terms of lending growth, on average, it is declining since 2012, which may affect the banks' performance. There is a need to further analyse the impact of capital and other determinants that may impact bank lending in Africa.

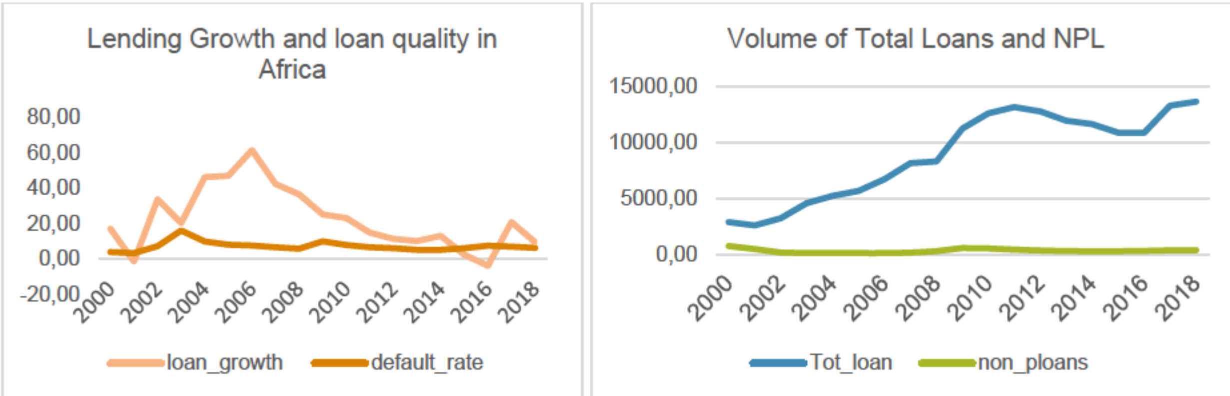

Figure 4. 3: Lending growth rate in Africa 2000-2018

Source: Author's own calculation based on data obtained from Bloomberg databases (2019)

4.5.1.1 Specification test for Basel CAR and bank lending

The chapter conducted specification tests for S-GMM for equation 4.6. Furthermore, unit root tests, and Hausman tests were carried out for P-ARDL estimations for equation 4.8.

S-GMM specification test

A test for serial auto-correlation was carried out for S-GMM to test for the instruments' validity and the absence of serial correlation (Arellano & Bond, 1991). AR1 and AR2 for the validity of the selected instruments; Hansen test for over-identifying restrictions for the absence of serial correlation between the instruments and the error term. Table 4.10 reports the p-values for AR1 and AR2 tests and the Hansen test. The test confirms the validity of the selected instruments. The consistency of the S-GMM estimations was confirmed because there is no second-order serial correlation. The study rejects H_0 in the case of AR (1) but fail to reject H_0 in the case of AR (2) for all the three models in Table 4.10.

Panel unit roots test for P-ARDL

The results of the ADF and PPT unit root test are given in Table 4.3. All the variables are stationary at level using ADF unit root test. The ADF and PPT panel unit root test results for Loangrowth, BIIcap BIIIcap BIVcap, and Nplta show that at level, the p-values are significant at 5 percent. Therefore, the chapter rejects the H_0 and accept H_1. The result shows that the variables are stationary at level, so there is no need for further differencing.

Table 4. 3: Panel Unit root test for African commercial banks in 2000-2018

Variables	**ADF**	**PPT**	**Stationary**
Loan_growth	0.0000	0.0000	I(0)
BIIcap	0.0003	0.0003	I(0)
BIIIcap	0.0000	0.0000	I(0)
BIVcap	0.0000	0.0000	I(0)
Nplta	0.0000	0.0000	I(0)

* *p<0.1, ** p<0.05, *** p<0.001*

Source: Author's estimation based on data obtained from Bloomberg databases (2019)

Panel Co-integration test

Subsequently, this study examines panel co-integration relationship between the loan_growth, Basel capital ratios and Nplta. Table 4.4 presents the results for the Panel co-integration. In this regard, the co-integration tests are significant at 1 percent significance level. The study rejects H_0 of no cointegration and accept H_1. The result provides strong evidence of co-integration relationship among loangrowth, BIIcap, BIIIcap, BIVcap and Nplta.

Table 4. 4 Panel Co-integration test results for loan_growth, Basel capital ratios and Nplta

Kao		Pedroni		Westerlund	
M. Phillips-Perron	-4,4937	Modified Dickey-Fuller t	-9,556	Var. ratio	-4.9554
	(0,0000)		(0,000)		(0,000)
Phillips-Perron t	-12,3943	Dickey-Fuller t	-21,3566		
	(0,0000)		(0,000)		
		Augmented Dickey-Fuller	-10,1794		
			(0,000)		
		Unadjusted modified ADF	-16,3116		
			(0,000)		
		Unadjusted Dickey-Fuller	-23,236		
			(0,000)		

p-values are in bracket

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

Hausman Test for P-ARDL

The Hausman test results chose PMG for Basel II, III, and IV for long-run impact analysis as the more suitable estimation method. The φ_i (error correction coefficients) across PMG, MG, and DFE in Table 4.11 and 4.12 remain significant and negative at all the Basel levels (2, 3, and 4). Indicating the existence of a stable and converging long-run relationship between Basel capital ratios and loan_growth.

4.5.2 Testing for portfolio shift:

4.5.2.1 Testing for portfolio shift: Descriptive statistics

In line with the first step of the research objective, which examines African banks' responses to higher CAR in terms of portfolio shift, the chapter uses descriptive analysis, F-test, and KW test to achieve this objective. Table 4.5 provides the mean value of total loans and loan portfolios of banks in Africa under different Basel levels (Non-Basel compliance, Basel 2, or Basel 3). It aims to determine whether the banks engage in portfolio shifts among the loan categories with compliance to higher CAR. The result showed that total loans and all loan categories increased as the banks moved from Basel 2 to Basel 3. In terms of bank size, South African banks are large in the sample, so to effectively examine portfolio shift of banks from other African countries, the chapter excluded South African banks as an outlier, for which the result is presented in Table 4.6 for descriptive statistics and Table 4.8 for ANOVA.

Table 4. 5: Summary statistics: Portfolio shifts by Basel compliance

Baselcompliance	**Non-Basel**	**Basel 2**	**Basel 3**	**Total**
Tot loan	5475.02	10713.54	49758.15	9400.54
Cash and cash asset	589.28	935.08	2573.58	789.37
interbank asset	752.39	930.25	4289.18	979.16
commercial loan	1613.65	1815.03	10271.91	2253.29
consumer loan	2047.05	3437.00	16180.44	3537.78
Credit card loan	391.69	635.49	3168.43	1413.31
residential loan	4426.94	4703.55	19139.15	6372.95
commercial mortg.	754.06	1438.56	3710.69	1158.61

Mean statistics: Author's own calculation based on data obtained from Bloomberg databases (2019)

The summary results in Table 4.6 after excluding South Africa showed that on average, higher Basel level increased total loans, cash, interbank lending, consumer loans, commercial loans, and credit card loans, excluding residential and commercial mortgage loans. The results suggest other African banks engage in portfolio shifts by reducing lending to the residential and commercial mortgage when the banks implemented Basel II. In addition, change from Basel II to Basel III CAR, these banks further reduced lending to the residential and commercial mortgage. Total loans increased by an average of 130.03 percent when other African banks moved from non-Basel compliance to Basel II CAR. Also, total loans increased by 121.14 percent when banks implemented Basel III CAR. For the latter, even though total loans increased under Basel III, the loan growth declined by 8.98 percent (130.03 percent minus 121.14 percent).

Table 4. 6: Summary statistics: Portfolio shifts by Basel compliance excluding South African banks

Basel compliance	Non-Basel	Basel 2	Basel 3	Total
Tot loan	2116.16	4867.76	10764.78	3011.14
Cash and cash asset	353.00	710.92	834.47	450.68
interbank asset	443.98	403.71	763.07	442.48
commercial loan	863.99	1480.27	2093.74	1075.14
consumer loan	650.71	1019.85	3390.08	850.83
Credit card loan	74.66	34.20	180.41	58.06
residential loan	171.07	71.42	36.18	127.74
commercial mortg.	149.10	183.76	153.36	158.01

Mean statistics: Author's own calculation based on data obtained from Bloomberg databases (2019)

Also, Commercial loans declined by 29.89 percent when other African banks adopted Basel III CAR but consumer loans increased by 175.7 percent. Credit card loans declined to 54 percent under Basel II CAR, but credit card loans increased under Basel III CAR. In summary, change from Basel II to Basel III, resulted in some banks that have implemented Basel III in other African countries (Egypt, Ghana, Kenya, Morocco, Nigeria, and Tanzania) to adjust their loan portfolio. These banks increase consumer loans and credit card loans with a moderate decline in commercial loans but more decline in residential and commercial mortgage.

4.5.2.2 Testing for portfolio shift: ANOVA analysis

To examine the behaviour of banks if they engage in portfolio shift with higher Basel levels, the chapter uses ANOVA (F-test and KW test). Due to outliers in the dataset, the chapter uses a log transformation of the variables. Two hypotheses are formulated and tested using ANOVA (Table 4.7 and Table 4.8). The null hypothesis test H_0: The mean of portfolio shift is the same for banks for all Basel levels, and the alternate hypothesis H_1: The mean of portfolio shift is not the same for banks for all Basel levels.

F-test and KW test results reported in Table 4.7 shows that Tot_loan is significantly different when African banks move from Basel II to Basel III CAR at 1 percent level of significance. This leads to the rejection of the null hypothesis that the mean of portfolio shift is the same. This suggests that banks engage in portfolio shift. In addition, Table 4.7 also shows that for commercial loans, consumer loans, credit-card loans, residential and commercial mortgages are significantly different when African banks move from Basel II to Basel III CAR at 1 percent level of significance, therefore, the null hypothesis of equal mean in portfolio shift across the different Basel levels is rejected. Thus, suggesting that portfolio shifts among commercial loan, consumer loan, credit-card loans, residential and commercial mortgage loans differ between Basel II and III. In summary, the results imply that African banks engage positively in portfolio shift in compliance to Basel higher capital in the observable time period.

Table 4. 7: ANOVA-F-test and KW-test for All African banks

Variables	**F-test**	**P-value**	**Equal variance**	**KW-test**
Tot_loan	59.88	0.0000	0.007	0.0001
Commercial loan	37.47	0.0000	0.000	0.0001
Consumer loan	33.20	0.0000	0.637	0.0001
Credit-card loan	23.60	0.0000	0.000	0.0001
Residential loans	22.35	0.0000	0.003	0.0001
Commercial mortgage	10.12	0.0001	0.662	0.0011

Source: Author's own calculation based on data obtained from Bloomberg databases (2019)

Table 4.8 excluded South African banks to examine whether the African banks (excluding South Africa) engage in portfolio shifts when they move to higher Basel levels. F-test and KW-test results reported in Table 4.8 shows that there is a significant difference in Tot_loan when African banks move from Basel II CAR to Basel III CAR at 1 percent significant level. The chapter rejects the null hypothesis of equal mean. In this scenario, using summary statistics in Table 4.6, where total loans increased in Basel 3 model, the loan growth declined by 8.98 percent, thus suggesting that the higher the Basel CAR, the higher the total loans but the lower the loan_growth.

For commercial loans, the study rejects the null hypothesis. This suggests that African banks engage in portfolio shifts for commercial loans with higher Basel levels. Using the result in Table 4.6 in conjunction with the result in Table 4.8 for commercial loans, it is observed that higher Basel level decrease commercial loans. One possible reason for this decline is that African banks adopt selective Basel compliance; as such, there is no true equity capital to support loans. Higher Basel capital increases the capital level of banks, which should increase lending, but instead, the banks struggle to comply with minimum capital, as such affect lending for commercial loans. The implication is that enhancement of supervisory powers of regulatory authorities to ensure that banks have adequate capital creates stability and increases lending.

Table 4. 8: ANOVA-F-test and KW-test excluding South African banks

Variables	**F-test**	**Prob**	**Equal variance**	**KW-test**
Tot_loan	24.37	0.0000	0.069	0.0001
Commercial loan	19.02	0.0000	0.001	0.0001
Consumer loan	1.52	0.2205	0.618	0.5168
Creditcard loan	7.41	0.0022	0.091	0.0018
Residential loans	2.06	0.1328	0.004	0.5985
Commercial mortgage	1.34	0.2652	0.349	0.1726

Source: Author's own calculation based on data obtained from Bloomberg databases (2019)

For consumer loans, residential and commercial mortgages, the result of the F-test and KW-test are greater than 5 percent significance level; therefore, the null hypothesis of equal mean cannot be rejected. The result suggests that African banks do not engage in portfolio shifts for consumer loans, residential and commercial mortgage when banks comply with higher Basel levels. One possible reason is that lending to these categories of loans by African banks is low. In contrast, the results reported in Table 4.8 shows that there is a significant difference in credit card loans when African banks move from Basel II to Basel III CAR because they are statistically significant at the 5 percent level of significance. This leads to the rejection of the null hypothesis of equal mean. This suggests that banks engage in portfolio shifts with higher Basel levels.

In summary, the findings show that compliance with higher Basel CAR will have a different impact on bank loans in selected African countries, as shown in the summary statistics and the ANOVA tables. Other African banks, excluding South Africa, will move towards less risky assets with higher Basel CAR, such as consumer and credit card loans. The banks reduce their lending towards commercial loans, residential and commercial mortgage loans. In individual African countries, institutional frameworks may affect the banks to easily move away from residential and commercial mortgage toward loans with less risk-weight. Also, the lack of special purpose vehicles for securitisation activities may limit other African banks to lend towards residential and commercial mortgages. Consumer, corporate, and credit card loans are usually short-to medium-term loans, while residential and commercial mortgages are long-term loans. Securitisation provide an additional source of liquidity for banks allowing banks to convert illiquid loans to liquid funds to finance more illiquid long-term loans (Loutskina, 2011). However, many African banks have not embraced securitisation. In addition, most African banks are yet to fully comply with Basel II or III CAR except for South Africa. These factors may explain why other African banks engage in loans with low-risk weight and reduce loans with high-risk weights.

Furthermore, this chapter regressed the impact of capital and other determinants on loan_growth. Firstly, Table 4.9 presents the correlation between the key variables (logged). Roe shows a significant positive correlation with the loan_growth, indicating that banks with more cost of capital (equity) experience higher bank lending. The correlation between BIIcap, BIIIcap, and BIVcap on loan_growth is, however, not significant. Only Roe, leverage Gdpgrowth and Nplta show significant correlation with loan_growth. Other variables have a weak correlation with loan_growth. According to Chalermchatvichien et al. (2014), the spearman rank correlation result has to be interpreted with caution as it does not account for other factors (unobservable effects) that can impact loan growth. These other factors are controlled for in the regression analysis employed in the chapter. Multicollinearity is a problem that arises if some or all explanatory variables are highly correlated with another. There was no variable dropped due to multicollinearity in the regression analysis.

Table 4. 9: Spearman rank correlation for Basel CAR and bank lending

	Loan_growth	**Roe**	**BIIcap**	**BIIIcap**	**BIVcap**	**leverage**	**deptotasset**	**Gdpgrowth**	**Reporate**	**npl**	**inflat**
Loan_growth	1.000										
Roe	0.143***	1.000									
BIIcap	0.098*	0.023	1.000								
BIIIcap	-0.041	0.110**	0.695***	1.000							
BIVcap	-0.001	0.180***	0.635***	0.771***	1.000						
leverage	0.111**	0.020	0.769***	0.587***	0.626***	1.000					
deptotasset	-0.044	0.069*	-0.095**	-0.186***	-0.271***	-0.270***	1.000				
Gdpgrowth	0.323***	0.229***	0.209***	0.097**	0.238***	0.175***	0.019	1.000			
Reporate	0.000	0.095**	0.287***	0.210***	0.346***	0.250***	-0.071*	0.169***	1.000		
Nplta	-0.110***	-0.310***	0.094**	0.051	-0.001	0.069*	0.061	-0.007	-0.115**	1.000	
inflat	0.016	0.099***	0.036	0.142***	0.142***	0.048	-0.040	0.142***	-0.188***	0.102***	1.000

Source: Author’s calculation based on data obtained from Bloomberg online database (2019)

* *p<0.1,* ** *p<0.05,* *** *p<0.001.* . *,**,*** indicates significance at the 10 percent, 5 percent, and 1 percent level, respectively.

4.5.3 Regression analysis for Basel CAR and bank lending

This session presents S-GMM, and P-ARDL results on the impact of changes in Basel CAR on bank lending in Africa estimated using dynamic panel models in equation 4.6 and equation 4.8 for the full sample using unbalanced panel data. The session first presents the results for S-GMM estimation on Basel capital ratios, bank-specific, and macroeconomic factors that can affect bank lending in Africa and account for unobservable effects using year dummies. Thereafter, the results of the short-and long-term impact of higher CAR on bank lending in Africa using PMG, MG, and DFE estimation techniques are presented.

4.5.3.1 System GMM results on Basel CAR and bank lending

Given that equation (4.1) is a dynamic panel model, justification for the use of S-GMM has been motivated in session 4.4.4. For the reasons presented, Equation (4.6) is estimated using the two-step system GMM with forward orthogonal deviation, and the result is presented in Table 4.10 on the impact of changes in Basel CAR and other determinants on loan growth. The validity of the model is evaluated using specification test explained after Table 4.10.

Table 4. 10: System GMM with FOD for Basel CAR and bank lending in Africa

Variables	Basel 2	Basel 3	Basel 4
	Loan_growth	**Loan_growth**	**Loan_growth**
L.loangrowth	0.117	0.171**	0.173
	(0.161)	(0.085)	(0.145)
BIIcap	1.119**		
	(0.453)		
L.BIIcap	-0.191		
	(0.514)		
BIIIcap		-0.237	
		(0.321)	
L.BIIIcap		0.325	
		(0.362)	
BIVcap			-0.608***
			(0.182)
L.BIVcap			0.603***
			(0.179)
_Isize_2	0.029	0.141	-0.028
	(0.214)	(0.332)	(0.278)
_Isize_3	0.335	0.114	-0.05
	(0.206)	(0.306)	(0.213)
_Isize_4	0.511*	0.185	-0.092
	(0.265)	(0.362)	(0.202)
_Isize_5	-0.216	0.101	-0.067
	(0.139)	(0.379)	(0.233)
Leverage	-0.725***	0.062	0.146
	(0.125)	(0.249)	(0.217)
Roe	-3.775**	0.263	-0.109
	(1.762)	(0.332)	(0.386)
L.Roe	1.592*	-0.96	0.288
	(0.835)	(1.083)	(1.324)
deptotasset	-1.023*	0.678	0.389
	(0.532)	(0.927)	(0.476)
Gdpgrowth	-0.178*	-0.035	-0.117
	(0.107)	(0.110)	(0.072)
Reporate	-0.086**	-0.096	-0.02
	(0.039)	(0.074)	(0.061)
L.Nplta	-0.155***	-0.070**	-0.039
	(0.045)	(0.034)	(0.024)
Inflat	-0.074	-0.093	-0.169**
	(0.112)	(0.145)	(0.082)
N	352	363	372
AR1	0.001	0.008	0.004
AR2	0.327	0.483	0.327
Hansen	0.998	0.999	0.51

*Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001* Source: Author's calculation based on data obtained from Bloomberg databases (2019)

The results in Table 4.10 shows that Lagged loangrowth is not persistent across the three Basel levels. The lagged loangrowth under Basel 2 and Basel 4 models is not significant but under Basel 3 model, lagged loangrowth is positive and significant to loan_growth at the 5 percent level of significance. Regarding the impact of higher Basel CAR on loan growth. The coefficient on BIIcap is positive and significant at the 5 percent level of significance, implying a higher CAR increases loan_growth in the years BIIcap was implemented. BIIIcap is not significant. Basel 4 model reports the results of simulated BIVcap. BIVcap is negative and significant, while lagged BIVcap is positive and significant at the 1 percent level of significance. The results imply that BIVcap negatively impacts current bank lending, but the positive coefficient on lagged BIVcap suggests that banks increase lending in the subsequent period or future.

Size is an important determinant of banks' ability to provide and diversify loans while aiming to achieve higher regulatory CAR. The quintiles of size (lsize 2, 3, 4 & 5) were intended to capture the importance of large banks having the ability to increase equity capital and provide more loans relative to smaller banks for each Basel level. For banks in the fourth quintiles under Basel 2 model, size is significant at 10 percent. Suggesting that banks in the fourth quintiles created more loans. Size under Basel 3 and Basel 4 model has no significant impact on loan_growth, suggesting that bank size has no significant impact on bank lending in Africa under Basel 3 and 4 model.

Leverage and Roe have a negative and significant impact on loan_growth under Basel 2 model, but they are not statistically significant under Basel 3 and Basel 4 models. Deptotasset has a negative and significant impact on loan_growth under the Basel 2 model at the 10 percent level of significance, but it has no significant impact on loan_growth under Basel 3 and Basel 4 models. Nplta is negative and significant at 1 percent and 5 percent significance levels under Basel 2 Basel 3 models, respectively but not significant under Basel 4 model. Nplta was lagged because non-performing loans for the previous year can influence bank decisions to lend in the current period. The higher the Basel level, the lower the Nplta. Gdpgrowth, Reporate, and inflation rate have a negative impact on loan growth in Basel 2 model. Gdpgrowth, Reporate, and inflation rate are not significant under Basel 3 and 4 models.

4.5.3.2 P-ARDL results: Basel CAR and bank lending

The long-run impact of implementing Basel CAR cannot be revealed by GMM estimation. Table 4.11 and Table 4.12 presents PMG, MG, and DFE results for the short-run and long-run impact of higher Basel CAR on bank lending in Africa. Table 4.11 presents PMG, MG, and DFE results for the short-run and long-run impact of higher Basel CAR on bank lending in Africa together with the Hausman specification test. The error correction term (ECT) in Tables 4.10 shows that there is co-integration among the panel variables as indicated by the negative and significant coefficient on ECT across all models in Table 4.11 and 4.12. Indicating the existence of a stable and converging long-run relationship between Basel capital ratios, Nplta, and loan_growth.

Table 4. 11: Results for PMG, MG and DFE on Basel CAR and bank lending

	PMG			MG			DFE		
	Basel 2	Basel 3	Basel 4	Basel 2	Basel 3	Basel 4	Basel 2	Basel 3	Basel 4
	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth
Long run									
BIIcap	0.255***			0.004			0.007		
	(0.032)			(0.012)			(0.004)		
BIIIcap		0.197***			0.005			-0.004	
		(0.017)			(0.021)			(0.002)	
BIVcap			0.175***			-0.005			-0.003
			(0.050)			(0.007)			(0.002)
Nplta	0.081***	0.05	0.161	-0.043	-0.052	-0.045**	-0.014*	-0.008***	-0.007**
	(0.004)	(0.047)	(0.206)	(0.033)	(0.054)	(0.020)	(0.008)	(0.003)	(0.003)
Short run									
ECT	-1.241***	-1.096***	-1.261***	-1.241***	-1.096***	-1.261***	-1.124***	-1.125***	-1.124***
	(0.128)	(0.055)	(0.069)	(0.128)	(0.055)	(0.069)	(0.045)	(0.041)	(0.035)
BIIcap	-0.314***			0.002			0.008		
	(0.037)			(0.014)			(0.005)		
Nplta	-0.132***	-0.105**	-0.264***	-0.031	-0.051	-0.060**	-0.016*	-0.009***	-0.008**
	(0.042)	(0.045)	(0.033)	(0.044)	(0.045)	(0.029)	(0.009)	(0.004)	(0.004)
BIIIcap		-0.215***			0.001			-0.004	
		(0.016)			(0.013)			(0.003)	
BIVcap			-0.229***			-0.008			-0.003
			(0.014)			(0.007)			(0.002)
_cons	5.670***	5.284***	6.137***	5.670***	5.284***	6.137***	5.123***	5.319***	5.308***
	(0.595)	(0.279)	(0.347)	(0.595)	(0.279)	(0.347)	(0.219)	(0.197)	(0.176)
N	418	457	497	418	457	497	418	457	497

Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

PMG Results

The PMG results imply that BIIcap, BIIIcap, and BIVcap have a negative and significant impact on loan_growth in the short run and a positive and significant impact on loan_growth in the long run. Nplta is negative and significant across the Basel levels in the short run. In the long run, Nplta became insignificant with higher Basel levels under Basel 3 and 4 models. These suggest that higher Basel levels will help African banks achieve quality loan assets and increase lending in the long run because they can better assess the creditworthiness of their borrowers. In the long run under Basel 2 model, Nplta has a positive and significant impact, implying that non-performing loans were still an issue for some banks under Basel 2 model just because they adopt selective compliance.

MG and DFE Results

For MG, BIIcap, BIIIcap, and BIVcap have no significant impact on loan_growth in the short and long run. Nplta has a significant but negative impact on loan_growth under Basel 4 model both in the short and long run. The Hausman test was performed between MG and PMG estimator; the test confirmed PMG as the more efficient estimator. Using DFE, Basel capital ratios have no significant impact on loan_growth in the short and long run. Still, on DFE, Nplta has a significant but negative impact on loan_growth across Basel 2, 3, and 4 models in the short and long run. According to Tan (2009), the DFE estimation method is the opposite extreme of the MG estimation method, which restricts both the long-and the short-run coefficients. In other words, the DFE estimation method assumes that the panel data for multiple countries is pooled as a single entity. Therefore, each explanatory variable has a common coefficient without the coefficients of individual countries. In particular, the restrictions on short-run effects are not consistent with economic intuition. As shown in the DFE estimation results in Table 4.11, the Basel capital ratio and loan_growth have a long-run correlation, and the long-run coefficient is insignificant. Hence, the long-run effect is not stable, possibly owing to the DFE estimation restrictions. The Hausman test was performed between MG and DFE estimators. The Hausman test confirmed selects DFE as the more efficient estimator.

Table 4. 12: Results for PMG for Basel CAR and lending-Individual country analysis

	Nigeria			**Egypt**			**South Africa**			**Kenya**		
	Basel 2	Basel 3	Basel 4	Basel 2	Basel 3	Basel 4	Basel 2	Basel 3	Basel 4	Basel 2	Basel 3	Basel 4
	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth	Loan_growth
Long run												
BIIcap	0.195***			0.232***			0.267***			0.196***		
	(0.066)			(0.023)			(0.040)			(0.024)		
Nplta	0.177***	0.162*	0.240***	-0.165**	0.034	0.144	0.128*	0.547***	1.118***	0.197***	0.066***	0.078***
	(0.039)	(0.095)	(0.031)	(0.074)	(0.046)	(0.204)	(0.070)	(0.125)	(0.256)	(0.030)	(0.024)	(0.019)
BIIIcap		0.157***			0.239***			0.132***			0.203***	
		(0.054)			(0.020)			(0.020)			(0.047)	
BIVcap			0.123***			0.335***			0.054			0.203***
			(0.022)			(0.060)			(0.050)			(0.014)
Short run												
ECT	-0.834***	-0.800***	-0.944***	-1.418***	-1.392***	-1.291***	-1.037***	-1.066***	-1.040***	-1.143***	-1.142***	-1.321***
	(0.123)	(0.093)	(0.114)	(0.142)	(0.171)	(0.138)	(0.117)	(0.073)	(0.061)	(0.132)	(0.069)	(0.141)
BIIcap	-0.114			-0.276***			-0.303***			-0.214***		
	(0.074)			(0.043)			(0.055)			(0.022)		
Nplta	-0.104	-0.155***	-0.237***	-0.023	-0.29	-0.347***	-0.143***	-0.578***	-1.204***	-0.229***	-0.096***	-0.136***
	(0.082)	(0.021)	(0.027)	(0.218)	(0.181)	(0.116)	(0.054)	(0.037)	(0.080)	(0.027)	(0.014)	(0.018)
BIIIcap		-0.119***			-0.270***			-0.191***			-0.239***	
		(0.019)			(0.049)			(0.020)			(0.017)	
BIVcap			-0.131***			-0.417***			-0.089***			-0.294***
			(0.024)			(0.068)			(0.023)			(0.039)
_cons	3.098**	3.588***	4.659***	6.261***	5.842***	6.146***	5.149***	5.536***	5.177***	5.154***	5.515***	6.718***
	(1.274)	(0.516)	(0.697)	(0.876)	(1.038)	(0.964)	(0.625)	(0.332)	(0.415)	(0.540)	(0.392)	(0.885)
N	99	98	119	57	67	68	86	90	93	95	106	116

*Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001.*

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

Table 4.12 presents PMG results for country by country potential impacts of Basel IV CAR on the impact in four African countries as a better estimator over MG and DFE on the grounds of better precision, according to Pesaran et al. (1999). The short-and long-run regression was done for countries with sufficient bank data (Nigeria, Egypt, Kenya, and South Africa). Its relevance is to re-estimate the models in Table 4.11 for individual African countries in the sample. The error correction term (ECT) in Table 4.12 shows that there is co-integration among the panel variables in the long run.

Nigeria, BIIcap has no significant impact on loan_growth in the short run while in the long run, BIIcap has a positive and significant impact at 1 percent significance level. Nplta in Basel 2 model was insignificant but negative and significant at 1 percent in the long run. Also, Nplta has a positive and significant impact on loan_growth in the long run. In Egypt, there is a significant and negative impact of BIIcap, BIIIcap, and BIVcap ratios on loan growth in the short run, but a positive impact exists in the long run. Nplta has no significant impact in Basel 2 and 3 models but a negative and significant impact on loan growth in Basel 4 model in the short run. In the long run, Nplta has a negative and significant impact on loan growth in Basel 2 model at 5 percent significance level.

South Africa results show a negative impact of capital ratio on loan_growth in the short run across the Basel levels. In the long run, BIIcap and BIIIcap have a positive and significant impact on loan_growth at 1 percent significance level. BIVcap will have no significant impact on loan_growth in the long run. Nplta have a negative and significant impact on loan_growth across the three Basel levels in the short-run and in the long-run positive and significant impact. South African banks are well-capitalised above the minimum Basel III CAR. The result is not surprising given that South African banks' excessive capital ratios are not a reflection of risk exposure but rather for regulatory compliance. For Kenya banks, BIIcap, BIIIcap, and BIVcap have a negative impact on bank lending in the short run and a positive impact on bank lending in the long run across all Basel levels. Nplta has a negative and significant impact on loan_growth across the three Basel levels in the short-run and in the long-run positive and significant impact.

There is empirical evidence that the Basel IV capital ratio will have a positive and significant impact on loan growth in Africa as a whole and in the individual African countries in the long run, except for South African banks. Also, the implementation of the Basel IV capital ratio will have a negative and significant impact on loan growth in the short run in Africa as a whole and the individual countries.

4.5.4 Discussion of findings on Basel CAR and bank lending

The chapter's objective was to examine the impact of changes from Basel III to Basel IV CAR on bank lending ability of banks in Africa. The objective was achieved in two steps. The first step was to determine whether changes in Basel CAR led to portfolio shift for African banks using descriptive statistics and ANOVA. The second step was to determine the impact of changes in Basel CAR and other determinants on bank lending. The chapter establishes that African banks engage in portfolio shifts to meet higher CAR. The result is consistent with Haubrich and Wachtel (1993). Their study finds strong evidence between Basel regulatory capital ratio and bank portfolios' shift in the United States and Ashok and Abhiman (2002) for Indian banks. It was established that total loans of African banks increased with higher Basel level that is from Basel II to Basel III, but the increase in total loans arise from the banks increasing lending to loan categories such as consumer loans while cutting back lending in other loan categories such as mortgages and commercial loans to achieve higher CAR. In contrast, South African banks engage in portfolio shift by reducing total loans, consumer loans, residential and commercial mortgage while increasing lending to commercial loans and credit-card loans in compliance to Basel III CAR (see Appendix A in session 4.7). The result for South African banks is inconsistent to Neethling (2014) who found that South African banks do not engage in portfolio shift because they are capitalized above minimum CAR. Neethling (2014) results stopped in 2013, the year Basel III capital was implemented in South Africa, so its results are true for South African banks' behaviour under Basel II. The results of the portfolio shift for African banks do not conform to the Modern Portfolio Theory. That a firm attempts to maximize its expected return on a portfolio of assets for a given level of portfolio risk. Instead, the African banks' behaviour to portfolio allocation is based on avoidance of falling below minimum regulatory capital to avoid regulatory penalties. For these reasons, African banks decline lending to loans with high-risk weights to improve their capital ratios. According to Waithaka (2013), such behaviour occur for banks with low capital which limit ability of such banks to grow slower than well-capitalized banks. Also, there are African banks with adequate capital but are not effectively utilized accordingly contrary to the premise that well-capitalized banks have more capacity to expand and diversify loan assets. These results exposes the inefficiency of regulatory authorities in many African countries that adopt selective Basel CAR. That their loan growth was slower while countries like South Africa, Nigeria, and Egypt that fully enforced the implementation of Basel II and Basel III benefited in an increase in loan growth.

On the impact of changes in Basel capital level requirement on bank lending, BIIcap has a positive and significant impact on loan growth as expected, but the change from BIIcap to BIII capital has no significant impact on loan growth. The finding is consistent with Ljung and Schennings (2018) findings that Basel III has no impact on bank lending for Swedish banks. Furthermore, simulated BIVcap have a negative and significant impact on loan growth in the current period but could have an increasing effect in the subsequent period. The negative coefficient on BIVcap is supported in literature Cosimano and Hakura (2011) for banks in advanced countries, Šutorova and Teply (2013) for EU banks where an increase in Basel CAR led to a decline in bank lending. The results further reveal that the negative impact of the simulated BIVcap will be only in the short run. The result indicates that implementing higher CAR in Africa negatively impacts bank lending in the short run and a positive impact on bank lending in the long run. The result is consistent with Kim and Sohn (2017) and Karmakar and Mok (2015). These studies posit that higher capital will increase loan growth in the US banks in the long run but inconsistent with Cosimano and Hakura (2011) findings showing that higher capital will reduce loan growth in the long run. Also, lagged loan growth is not persistent across the three Basel levels. Lagged loan growth has a positive and significant impact on loan growth when banks implemented Basel III CAR. The result is consistent with Carbó-Valverde et al. (2011) for Spanish banks that current loan growth is positively affected by lagged loan growth. Furthermore, since African banks engage in portfolio shifts to meet higher CAR, this could be a reason for a positive and significant impact of lagged loan growth on current loan growth in Basel 3 model.

It is expected that leverage is negative to act as a backstop to constrain banks from financing more loans against available capital (Brei & Gambacorta, 2014; Psillaki & Georgoulea, 2016). The results for leverage imply that African banks tend not to take on more risk with higher capital. This is because the African banks' equity capital is not proportionate to their risk exposures because many African countries adopt selective compliance with Basel CAR. As a result, there is a lot of unutilized capital, not generating returns for equity or asset through interest income generated from increased lending. Size is used to compare the relevance of large banks, medium-sized, and small banks on loan growth. The result shows that loan growth is not affected by bank size under any of the Basel levels. This implies that the size of the bank does not influence the volume of lending or loan diversification. The result is consistent with Naceur and Kandil (2009) for Egyptian banks that higher capital increased size but did not increase bank lending. Therefore, bank size has no significant impact on bank lending in Africa.

The chapter expects that increase in CAR will increase the cost of capital and reduce loan growth. Roe proxy for cost of capital, negatively impact on loan growth under Basel 2 model. This is consistent with Naceur and Kandil (2009) in Egypt, Nkopane (2017) in South Africa, and Gavalas (2015) for European banks. The result is inconsistent with Carbó-Valverde et al. (2011) that the cost of capital positively affects loan growth for Spanish banks. But as the banks moved to BIIIcap which requires higher equity capital, Roe became insignificant implying that since equity capital is expensive, the banks rely on retained earnings to increase capital for BIIIcap than to incur the cost of capital via issuing of shares, which would have been passed on to bank customers (Cohen, 2013; Ross et al., 2008).

Regarding the liquidity of African banks, the chapter expected a positive impact on loan growth. However, the negative and significant relationship in Basel 2 and insignificant impact of liquidity on loans under Basel 3 and 4 model, suggests that loans are low in Africa because banks are not utilizing liquidity for lending purposes. This is inconsistent with Carbó-Valverde et al. (2011) findings for Spain, they show that liquidity increases loan growth. This explains why the banks are excessively liquid (Asongu & Odhiambo, 2018). This may be due to low capital because capital is loss-absorbing, which allows the banks to cover for losses (Gabriel, 2016). As a result, a well-capitalized bank will grant loans based on their proportion of deposits. For lagged Nplta result implies that the past and current non-performing loans negatively affect loan growth, which is an additional cost to the banks. The result is inconsistent with Gavalas (2015) that found that non-performing loans have an insignificant impact on banks in Europe. However, as African banks move from Basel II to Basel III CAR, the weight and significance of non-performing loan declined, which show the reducing effect of BIIIcap on non-performing loans. Furthermore, BIVcap, Nplta tend to effectively tackle the non-performing loans challenge in the observed African banks. This is consistent with Admati et al. (2013), who concluded that higher CAR may be costly for banks but will improve bank decisions against poor lending.

The chapter expected a positive impact of Gdpgrowth and the negative effect of Reporate on lending. The macroeconomic conditions in Africa negatively affected loan growth under Basel 2. Gdpgrowth may affect loan asset quality (Michalak & Uhde, 2012). Despite Gdpgrowth affecting loan asset, Gdpgrowth under Basel 3 and 4 model have no significant impact on loan growth. Because of additional capital buffers provided in Basel III and IV accords against business cyclicality. The effect of inflation may be subject to if banks anticipate inflation or not. Basel III introduces additional capital buffers, leverage ratios to protect banks from adverse macroeconomic conditions that African banks can benefit from if they implement higher Basel CAR.

For country-by-country analysis, the impact of higher Basel capital varies from one country to another. The cross-country results show that change from BIIIcap to BIVcap will impact loan growth in the long run. BIVcap has a positive and significant impact on

African banks' loan growth in the long run. Nevertheless, the result shows that change from BIIIcap to BIVcap in Nigeria lead to 3.3 percent decline in loan growth in the long run. In Egypt, the change from BIIIcap to BIVcap lead to a 4 percent increase in loan growth in the long run. While South Africa, BIVcap has no impact on loan growth in the long run. Lastly, for Kenya, the impact of the change from BIIIcap to BIVcap on loan growth remains unchanged. According to Cosimano and Hakura (2011), the variation among the countries is as a result of factors such as the elasticity of loan demands, loan interest rates, and bank net cost of raising equity, which contribute largely to the variation across countries. The African environment factors such as macroeconomic factors, political instability, institutional and regulatory developments contribute largely to banks' ability in different African countries to increase lending. Furthermore, non-performing loans remain statically significant on loan growth for Nigeria, Kenya, and South Africa in the long run across the Basel levels. But Egypt is statically insignificant under Basel 3 and 4 models.

Contrary to the static trade-off theory and M & M theory, compliance to Basel IV higher CAR negatively impacts bank lending in Africa in the short run. As a result, causing bank portfolio shifts. Because of the Basel IV risk-weight system, the banks will be forced to retain credit-worthy borrowers to avoid holding high capital for borrowers with bad credit records. The advantage of Basel IV bucket risk-weight will increase the credit assessments of banks. However, smaller banks will still be left with high-risk borrowers. Although African banks' risk-taking is still low, the introduction of a non-risk leverage ratio to complement higher CAR will check risk-taking of smaller banks to have adequate capital or be forced to reduce lending.

4.6 Conclusion for Basel CAR and bank lending

The chapter uses simulated historical data for Basel IV over the period 2000 and 2018 to create representative bank as if such banks had complied with Basel IV capital under certain assumptions since Basel IV is yet to be implemented. Few past studies as discussed in the literature have used sample representative banks to achieve their objectives. Firstly, this chapter examined whether changes in Basel CAR led to the shift in portfolio of banks in Africa. The result presented strongly suggests that African banks engage in portfolio shift with higher Basel levels. The lending behaviour of the African banks with higher Basel CAR increases general understanding of the effects of bank regulations in African commercial banks. Portfolio shift with changes in Basel CAR led to credit crunch in the United States in 1991. Portfolio shifts affect banks overall risk, performance and therefore the economic growth. In summary, higher Basel CAR increased the capital ratio of the banks in Africa and increased the total loans in volume even though loan growth declined.

Secondly, this chapter presented discussion of the main findings on the impact of changes from Basel III to IV CAR on bank lending. The result shows that the implementation of Basel IV CAR negatively impact bank lending in Africa using S-GMM. Further analysis that separated short-run impact from long-run impact showed that such a negative impact on loan growth is limited to the short-run as higher capital will have a positive impact on loan growth in the long run. In order for banks to drive economic growth in Africa, deliberate government policies have to be put in place to provide an enabling environment for the banks to effectively carry out their obligations, which will contribute to economic growth. Thus, complying with Basel IV CAR will help African banks to achieve financial deepening and increase bank lending. In Africa, regulators in countries like South Africa and Egypt have implemented Basel III CAR. On the other hand, in countries such as Nigeria, Kenya, and Tanzania, some banks adopted Basel III based on their cross-border activities. Thus, compliance to Basel III CAR may be selective compared with countries that the regulatory authorities enforce Basel compliance. Nevertheless, non-performing loans reduced significantly with higher Basel levels. Higher Basel CAR is beneficial to African banks. To achieve higher Basel capital in Africa, bank regulators in African countries should implement the higher Basel standards over a medium-term period to allow banks to prepare to prevent any macroeconomic costs from loan reductions in the short term. Overall, the potential impact of Basel IV CAR for lending is satisfactory, and consequently, it should be embraced with caution.

4.7 Appendix A for Basel CAR and bank lending

Table A 1: Summary Statistics: by categories of Basel compliance (Country)

Basel compliance	**Egypt**			**South Africa**			**Nigeria**		
	Non-Basel	Basel 2	Basel 3	Non-Basel	Basel 2	Basel 3	Non-Basel	Basel 2	Basel 3
Tot loan	2923.254	3264.545	11582.2	34178.01	91655.11	75753.74	2452.712	5091.724	7351.638
Cash and cash asset	277.6557	261.7797	972.4016	2646.706	4038.777	3732.977	912.2924	1932.525	2853.994
interbank asset	527.1017	578.6374	2575.215	3722.252	8345.662	6933.766	1162.683	717.3159	836.5532
commercial loan	1310.803	1102.445	4289.616	7191.638	6724.802	16194.03	1249.233	2643.627	5450.762
consumer loan	734.6542	336.8243	1051.168	11097.36	35464.24	22975.32	164.8663	276.7983	164.5272
Credit-card loan	86.52983	50.12396	180.4116	1501.302	2639.776	3467.226	3.4505	8.5417	.
residential loan	64.28334	97.97076	36.18087	12437.97	31338.3	21049.45	57.60142	26.33417	.
commercial mortg.	.	.	.	3425.969	13359.12	6720.738	234.0107	237.5952	431.1762
	Kenya			**Ghana**			**Tanzania**		
Basel compliance	Non-Basel	Basel 2	Basel 3	Non-Basel	Basel 2	Basel 3	Non-Basel	Basel 2	Basel 3
Tot loan	834.9901	2208.176	2714.35	368.6519	400.9385	347.2446	720.377	1851.508	
Cash and cash asset	115.6073	277.3808	685.9238	115.861	152.989	150.6345	244.5252	382.6742	
interbank asset	60.5807	126.831	164.449	142.5428	172.7601	34.02178	142.7674	139.031	
commercial loan	686.3451	1373.747	2208.885	236.6185	261.0567	194.5355	336.1927	310.255	
consumer loan	129.5339	226.5463	505.1999	11.86639	.	119.0044	298.5533	201.2082	
Credit-card loan	.	5.566125	.	.	.	.	.	.	
residential loan	8.234323	60.89166	.	.	.	.	.	.	
commercial mortg.	96.57275	244.7641	.	17.80758	.	53.67738	20.25326	17.68081	

Mean statistics: Author's own calculation (2020)

CHAPTER FIVE

IMPACT OF BASEL IV CAR ON SECURITISATION AND PERFORMANCE OF COMMERCIAL BANKS IN AFRICA

5.1 Introduction to Basel IV CAR and securitisation

This chapter discusses the third objective relating to the Basel CAR, securitisation activities, and performance for securitising banks in Africa. Due to lack of sufficient data from other African countries on securitisation activities, this objective uses South Africa commercial banks to represent banks in African countries. South African commercial banks still provide some light on the effect of Basel IV CAR on securitisation for African countries. Securitisation has been used as a tool for bank funding, liquidity, risk management, and performance for over two decades (Casu, Clare, Sarkisyan, & Thomas, 2013). However, securitisation activities were negatively affected by the recent financial crisis, which led to stricter regulations of banks' off-balance-sheet activities (BCBSa, 2016).

Nevertheless, securitisation activities from commercial banks in Africa are low. South Africa is the leading market in securitisation Africa. This chapter examines the possible impacts of the Basel IV CAR on securitisation activities and the performance of commercial banks in South Africa. The chapter used aggregated financial data of selected South African commercial banks to create a sample representative projection as if the selected banks had implemented the Basel IV CAR between 2002 and 2018. The simulated data were analysed and compared to Basel III data using panel data analysis under certain assumptions while holding other conditions constant. The chapter is divided into four sections. Not all banks engage in securitisation arising from complexities involved in the securitisation process. Thus, banks that originate securitisation are referred to securitizing banks in this chapter. The first section introduces the discussion on Basel IV and bank securitisation. Subsequently, the second section presents the theories and empirical literature on Basel CAR and securitisation. Next, the third section presents the research methodology, variables, and estimation techniques used to measure Basel CAR and securitisation. The last section presents the results and explains the discussions and implications of Basel IV CAR on securitisation activities and the performance of securitising banks in Africa.

5.2 Basel IV and securitisation activities

Securitisation involves the pooling together of traditional class assets of banks (mortgage loans, commercial loans, credit card loans), bundling and selling in units by another entity known as special purpose vehicle (SPV) to investors in the securitisation market to secure immediate liquidity (Jablecki, 2009). The securitisation process gave banks liquidity support and encouraged banks to lend more for profit while enabling banks to keep low CAR against risk exposures from the trading book (Affinito & Tagliaferri, 2010; Bakoush et al., 2019). Consequently, banks can use the securitisation process to take risks to hold unduly low capital reserves that are not commensurate with their risk exposures. This was observed among certain United States (US) banks and was among the factors that led to the 2008 global financial crisis (Balin, 2008). Rapid developments in the securitisation markets in the developed countries since the early 1970s have altered the banks' traditional roles of originating and holding loans to originators and distributors of loans to investors as profits shrunk from the traditional banking (Kara, David, & Ongena, 2011; Loutskina, 2011). By the end of 2006, the combined outstanding amount of securitised assets on mortgage and asset-backed securities in the US alone stood at \$10.7 trillion from \$2.9 trillion in 1996 (Sarkisyan, 2011). Since the 2008-2009 financial crisis, securitisation activities have declined globally and many banks reported huge loan write-downs (Jiangli & Pritsker, 2008; Nkopane, 2017), with various degree of intensity according to each country exposure to some of the main drivers of the financial crisis such as securitisation (Chen, Liu, Opong, & Zhou, 2017; Jiangli & Pritsker, 2008). According to the Federal deposit insurance corporation in the United States, between 2009 and 2016, 491 banks failed in the United States only, costing \$1.375 trillion loss (Federal Deposit Insurance Corporation, 2019). According to Loutskina (2011), despite the decline in securitisation activities after the 2007/08 financial crisis, the securitisation market activity by volume exceeds the size of the US economy's corporate bond market.

Implementation of Basel I and Basel II in Europe and the USA increased securitisation activities substantially even though securitisation have technically being a possibility since 1948 (Jablecki, 2009). In African countries, the volume of securitisation transactions from commercial banks is still low. The complicated nature of originating securitisations from banks and the restrictive regulatory environments may have contributed to the slow growth of securitisation activities from African banks. Basel II's implementation forced South African banks to increase their risk conservation management. It declined securitisation activities from the commercial banks while non-financial firms continued to enjoy growth in securitisation transactions in the same South African securitisation market (Prinsloo, 2009; The Banking Association South Africa, 2019; White, 2011). Kenya, the largest economy in East Africa, has a regulatory framework to support commercial banks to originate securitisation since 2007, but no single securitisation has been issued (Munene, 2010; Mutegi, 2016). Mortgage financing is increasing; however, Kenyan banks seek other alternatives to source additional funds to meet the increasing demand for mortgage loans. The Kenyan banks have the ability to originate securitisation, but the lack of special purpose vehicles and lack of credit rating agencies are hindering the origination of securitisation in Kenya (Munene, 2010; Yanga, 2018). In African countries, available information on securitisation activities originated from financial and non-financial institutions between 2000 and 2018 show a total of 62 mortgages in Egypt, 7 mortgages in Tunisia, 3 mortgages in Nigeria and 948 mortgages in South Africa (Bloomberg, 2019). These figures show that the volume of securitisation originating from commercial banks in Africa is still low.

South Africa is a leader with securitisation from financial and non-financial originators in Africa (Bloomberg, 2019). The South African securitisation market was not adversely affected by the 2008 financial crisis because of the strong national financial compliance and securitisation regulations (Mokatsanyane, Muzindutsi, & Viljoen, 2017; Prinsloo, 2009), which prevented ill-conceived securitisation practices experienced in the countries experiencing the negative effects of the financial crisis. In addition, South African banks that engage in securitisation are diversified and highly capitalized (Moyo & Firer, 2008; Nkopane, 2017). In spite thereof, securitisation activities from commercial banks in South Africa declined in the same year of the global financial crisis, while non-financial institutions entering into the securitisation market in South Africa continued to grow (Bloomberg, 2019). White (2011) attribute the cause of decline to the implementation of the Basel II accord in 2008, which forced South African commercial banks to implement conservative risk management measures. As a result, the upgrade in risk management according to one of the three pillars of Basel II led to fewer securitisation activities from the South African banks than the banks in developed markets (Prinsloo, 2009; White, 2011).

The Basel Committee on Bank Supervision was established in 1974, and since its inception, it has established a series of regulations on capital and liquidity requirements commonly known as Basel Accords. The first Basel accord is known as Basel I introduced in 1988, followed by Basel II in 2004, Basel III in 2009-10 and the latest accord- Basel IV in 2016 with its implementation date set to be in the year 2022 with the aims of increasing bank resilience, promoting financial stability and restoring stakeholders' confidence (BCBS, 2009; BCBSa, 2017; Munoz & Soler, 2017). The Basel IV accord introduce the standardization of risk weighted assets for comparability and reliability of capital ratios (BCBSa, 2017; Munoz & Soler, 2017). In addition to the Basel IV CAR, the Basel Committee also introduced a new securitisation framework (STC) in 2016 in an attempt re-establish securitisation activities to support loans provisions from banks and improve in banks' access to funding through securitisation as it was before the financial crisis (BCBSa, 2016). STC is expected to eliminate the overly complex securitisation process and limit the use of credit rating agencies in existence (BCBSa, 2016).

South Africa is a Basel member country, and in principle, Basel member countries are obliged to comply with the changes in the Basel CAR (Beck et al., 2019). South African banks were not affected by the recent financial crisis of 2008 due to their strong compliance with Basel regulation; however, securitisation activities from commercial banks declined from 2008 as conservative risk measures of Basel II were adopted (The Banking Association South Africa, 2019; White, 2011). It is a matter for further research whether Basel IV will improve or deteriorate South African banks' securitization activities. This research investigates the impact of Basel IV on securitisation activities and performance of securitising banks in South Africa if adopted.

5.3 Literature review for Basel IV and securitisation

Banks can choose to retain loans on balance sheets till they are fully repaid or transform them into marketable securities for immediate liquidity via securitisation (Ambrose et al., 2005). Furthermore, avoidance of holding capital for loans, additional source of fee income is considered a catalyst for the growth in securitisation activities of banks (Ambrose et al., 2005; Jablecki, 2009). The securitisation exposure of banks leading to the 2008 financial crisis, led to the introduction of capital charge for securitisation exposure from originating banks (BCBSa, 2016; Mpundu, Petersen, Mukuddem-Petersen, & Gideon, 2013). This section presents the existing theories and findings from empirical studies on the relationship between Basel capital and securitisation and the performance of securitising banks.

5.3.1 Theoretical explanation of securitsation

Early theoretical work suggested that securitisation provided a means for transferring and reducing credit risk and allowed banks to specialize in activities that they have no comparative advantage (Diamond, 1984; Greenbaum & Thakor, 1987; Hess & Smith, 1988; Pavel & Phillis, 1987). A bank may be able to use securitisation to improve its performance by lowering funding costs, improved credit risk management, and enhanced profitability (Casu et al., 2013). Proponents of securitisation, governments, and banks believe that securitisation helped improve bank performance (Goddard, Liu, Molyneux, & Wilson, 2013). Securitisation is important to the banks because it enables banks to take on more risk, improve liquidity positions of banks by allowing banks to convert illiquid loans to liquid funds. It can also be used as a tool to meet minimum CAR known as regulatory capital arbitrage (Jablecki, 2009; Loutskina, 2011). Other benefits of banks engaging in securitisation are for lowering the cost of capital, reducing bank risk exposure, and increasing bank loan portfolios (Sarkisyan, 2011; Uzun & Webb, 2007). Securitisation in itself was not the problem of the 2008 financial crisis but rather the agency conflict, moral hazard effect on lender screening, and asymmetric information problems inherent in the origination and distribution of observable riskier loans (Bubb & Kaufman, 2014; Frame, 2018). According to Frame (2018), low-documentation mortgages performed better during the financial crisis where the lenders were affiliated with the issuers or where the originator has reputational capital at stake than low-documentation mortgages with acute asymmetric information problems.

5.3.1.1 Capital arbitrage theory

One of the theories that explain securitisation is the regulatory capital arbitrage, in addition to the capital arbitrage theory in session 3.3.1.3, Jablecki (2009) states that banks engaging in securitisation for capital arbitrage is dependent on a given country's institutional framework. The regulatory capital arbitrage theory and reputation hypothesis predict that banks securitise quality loans with less risk and retain risky loans in their books (Bakoush et al., 2019; Dionne & Harchaoui, 2008). Also, Keys, Mukherjee, Seru, and Vig (2010) used an industry-rule of thumb that loans below a certain score. For example, 620 are more difficult to securitise to suggest banks securitise quality loans. However, the 2008 financial crisis exposed the quality of loans that were being securitised. Banks securitised their most problematic mortgage loans (Casu, Clare, Sarkisyan, & Thomas, 2011; Casu et al., 2013).

5.3.1.2 History of securitisation

Securitisation has its origin from the US arising from the development of secondary mortgage markets and mortgage backed securitisations in the 1970s (Loutskina, 2011;

Styger & Saayman, 2003). There arose demands for securities as American investors bought into the mortgage securitisations in the 1970s, and asset backed securitisation in the 1980s (Bakoush et al., 2019; Styger & Saayman, 2003). Securitisation also spread to Europe, Asia, Australia, and South America in the 1980s (Styger & Saayman, 2003).

Regulatory constraints prevented asset-backed securities trading in Switzerland and Austria (Styger & Saayman, 2003). Germany and the Netherlands has a strong banking system and well-developed structures for securitisation market but there was weak demand for securitisation (Styger & Saayman, 2003). Before the 2008 financial crisis, Germany amended its laws, which resulted in demand for asset-backed securities with auto securitisation with the highest demand (Baker & Frankfurt, 2017). Between 2006Q1 and 2010Q1, The Netherlands has the largest outstanding securitisation, followed by Spain and Germany (Carbó-Valverde et al., 2011).

The securitisation market in Latin America is small due to highly regulated environment and under-development of the capital markets and contributed to the slow growth of securitisation activities in the market (Styger & Saayman, 2003). Mexico strengthened its regulatory framework, contributing to the development of asset-backed securities in their local market (Styger & Saayman, 2003). In Brazil, factors such as high-interest rates and spreads, legal and structural constraint makes the Brazilian banks less motivated to securitise (Ngwu, Bavoso, & Chen, 2017). In Australia, favourable regulatory framework facilitated the growth of securitisation market. The US remains the largest issuance of securitisation worldwide, followed by Europe (Bakoush et al., 2019; Styger & Saayman, 2003). In Africa, securitisation is still low. In Nigeria, the government started making policy move in 2015 to establish the regulatory framework on securitisation in financing illiquid loans in the local capital market to increase loan financing from banks (Securities & Exchange Commission, 2015). As at the year 2019, only three asset-backed securities have been issued. Kenya has regulatory laws for securitisation; however, there is no special purpose vehicle (Mutegi, 2016). Kenyan banks hold more than 1 billion Kes ($9.2 million) in their balance sheets instead of converting the loan mortgages into marketable securities for immediate liquidity, increasing further issuance of loans (Munene, 2010).

Securitisation itself is not a problem (Frame, 2018), however regulatory constraints can hinder the growth of securitisation as discussed further in the next session.

5.3.1.3 History of securitisation in South Africa

The first securitisation in South Africa was issued in 1989 (Mokatsanyane et al., 2017). A year after, the first securitisation regulation was implemented in August, 1990 (Moyo & Firer, 2008; Prinsloo, 2009; White, 2011). The securitisation regulation placed constraints leading to slow growth on securitisation activities up till December 2001 (Mokatsanyane et al., 2017). An amended securitisation regulation was introduced in 2001. Thus, the constraints on securitisation activities were removed by the South African Reserve Bank. The amendment contributed to the growth of securitisation activities within the country (Prinsloo, 2009; Van Vuuren, 2012; White, 2011). According to Styger and Saayman (2003), a strong legal framework, favorable demand-supply conditions, government-backed guarantees are factors that contributed to the growth of securitisation activities in South Africa. South Africa Home Loans says that the South African securitisation model ensures that the Originator and the special purpose vehicle have significant interest in the loan securitised, ensuring that high quality of assets is bundled up into the pool of loans being securitised. Despite the mechanism in place to protect investors’ interests in the securitisation, issuance of securitisation from commercial banks declined from 2008 due to adoption of Basel II. According to Prinsloo (2009), less than 7 percent of South African banks loan assets are securitised.

5.3.1.4 The securitisation process

“Securitisation” means the issuance of loans or securities backed by a pool of assets (Securities & Exchange Commission, 2015).

Step 1: Bank (originator) makes a loan to the borrower (Styger & Saayman, 2003)

Step 2: The loan is held up until the bank has sufficient volume of loans to securitise. The bank bundle up the loans into an asset pool. Securitisation's success depends on the originator's ability to provide new assets of a similar or better quality on an on-going basis (Styger & Saayman, 2003).

Step 3: The bank originates the bundled loans to sell directly in the securitisation market or transfer the bundled loans to the issuer (SPV) (Styger & Saayman, 2003). Special purpose vehicle (SPV) "means a legal entity formed with the exclusive purpose of acquiring and holding certain assets for the sole benefit of noteholders in the ABS, such that the noteholders have acquired nothing but undivided interests in the asset pool" (Securities & Exchange Commission, 2015, p. 4).

Step 4: The issuer issues the bundled loans (asset-backed or mortgage-backed securities) to investors. The MBS/ABS are registered according to the regulatory framework in the respective country of issuance. The SPV structure must be isolated such that SPV is insulated from events that happen to the originator, such as bankruptcy or credit risk exposures do not affect the underlying assets (BCBSa, 2016; Styger & Saayman, 2003). The SPV pays the originator for the loans and simultaneously selling the certificates to investors. A credit rating agency rates the securities issued by the SPV. The ratings reflect the quality of the securitisation, which influence its sale to investors.

Step 5- A servicer is appointed to provide administration duties for the duration of the issue (Styger & Saayman, 2003). Its fiduciary duties entail cash collection on the underlying assets, management of debtors' arrears, and investors relationship management (BCBSa, 2016; Styger & Saayman, 2003).

Step 6-The borrower is instructed to make payments to the servicer and direct all inquiries to the servicer. Additional parties involved in the process include legal counsel, assisting in the legal documentation and interpretation of the applicable laws, and an external credit enhancer (Styger & Saayman, 2003).

5.3.1.5 The new securitisation framework

The emergence of securitisation as a financial tool by the banks after the introduction of Basel I accord to avoid holding higher CAR above the regulatory minimum, rendered Basel I accord outdated and inadequate to protect banks against credit risk (BCBSb, 2004). The BCBS introduced a securitisation framework for the first time in November, 2004 detailing the regulatory capital requirements on securitisation exposures (BCBSb, 2004). The framework provided operational requirements for recognizing risk transfer and no explicit capital charge for securitisation exposures except if such securitisation transaction resulted in an increase in equity capital referred to as “gain on sale” to be deducted from Tier1 (BCBSb, 2004). In addition, the framework provided capital charge for other parties in the securitisation process, excluding the originating banks. The lack of explicit requirements in the 2004 securitisation framework under Basel II accord gave banks more advantage, especially in developed countries. To continue increasing securitisation exposure without adequate capital to protect the banks against such risks.

The complex structures in the securitisation process, lack of transparency in the securitisation process, and reckless practice of securitisation by managers without adequate capital cover are some of the significant problems to the 2008 financial crisis (Buiter, 2008; Chen et al., 2017). The recent financial crisis has shown that the securitisation market depends heavily on markets’ perceptions (Kara et al., 2011). The revised securitisation framework (2016) is aimed to simplify the capital standards for securitisation exposures. The framework introduces more transparent disclosures in securitisation transactions to restore credibility among stakeholders (BCBSa, 2016). However, higher capital requirement is the main focus of the new securitisation framework for banks trading book. But, it introduces a clearer and simple securitisation approaches for banks, eliminating the overly complex securitisation processes (BCBSa, 2016). In addition, the STC framework, Basel III and Basel IV CAR is an attempt by the Basel Committee to re-establish securitisation activities to support loans provisions from banks and for improvement in banks’ access to funding through securitisation as it was before the financial crisis (BCBSa, 2016; Mpundu et al., 2013). This can be a motivation for more banks to securitise provided they are ready to comply with higher capital and transparent disclosures in the securitisation process. The new securitisation framework eliminates the reliance on external ratings and enhances the risk sensitivity of the securitisation by allowing adjustments for maturity (Chabanel, 2017). Currently, South Africa is the leading country in Africa for securitisation transactions but its volume of securitisation is far low compared with the developed countries. Therefore, it is important to examine how the combination of a simpler but standardised securitisation framework and a new Basel IV capital framework will affect securitisation and performance of banks.

5.3.2 Empirical literature on Basel CAR, securitisation and performance

Securitisation is the most financial innovation used by banks to achieve capital arbitrage, additional source of funds, diversify risk (Ghosh, 2018). The use of securitisation provides an opportunity for governments in jurisdictions to support the development of securitisation markets to improve the liquidity and financial capabilities of banks which in turn enhances the development of the entire financial sector and their economies (Ngwu et al., 2017). The chapter presents a review of the empirical literature on the relationship between Basel CAR, securitisation and the performance of securitising banks.

5.3.2.1 Impact of Basel CAR on securitisation activities

The traditional function of bank capital is to protect depositors’ funds against losses (Robinson, 1941). In this context, higher Basel CAR are meant to prevent bank failures and ensure that banks' risk exposures are adequately protected by adequate amounts of capital (Dionne & Harchaoui, 2008; Kargi, 2011). Changes in Basel CAR may impact bank behaviour to securitise particularly banks in the developed countries. Because the banks use securitisation to source additional funds as profits from traditional banking are saturated (Bakoush et al., 2019; Barbour, Norton, & Slover, 1997). Many studies on securitisation examine the impact of securitisation on risk-taking and resilience of the banks. For instance, Bonner, Streitz, and Wedow (2016) examined the effect of securitisation on bank loan supply for the period 2001 and 2013 from Eurozone banks. Their study obtained data on banks that issue asset-backed securitisation and covered bonds over time. Using FE panel regression, they find that securitisation positively impact bank lending before the 2008 financial crisis in Europe. Their study did not find evidence that securitisation increased bank risks for banks in the Euro area (Bonner et al., 2016).

On the contrary, Michalak and Uhde (2012) examine the impact of securitisation on bank soundness using 743 cash and synthetic securitisation transactions issued by 55 listed banks in Western Europe and Switzerland between 1997 and 2007. Using a RE model, their study finds that securitisation negatively impacts bank profitability and banks' financial soundness. That securitisation negatively affected the resilience of the banks (Michalak & Uhde, 2012). Observation from the two previous studies (Bonner et al., 2016; Michalak & Uhde, 2012) reviewed with contrary results but from similar Euro area is that these studies focused on selected classes of securitisation transactions performed by banks which may have led to different conclusions. There are different types of securitisations banks originate. Moyo and Firer (2008) identified four classes of assets that banks can securitise. They include Asset-Backed Securities (ABS), Residential Mortgage-Backed Securities (RMBS) such as home loans, Commercial Mortgage-Backed Securities (CMBS) such as commercial property loans and CDO which include Collateralised Loan Obligations (CLO), corporate debts and bank loans. Others include Credit card receivables, equipment leases, trade receivables, vehicle loans or leases and other consumer loans such as student loans fall within the asset-backed securities (Moyo & Firer, 2008). Furthermore, assets that are easy to securitise are those with structured cash flows. Casu et al. (2011) state that the impact of securitisation on bank risks depends on the underlying assets being securitised. Therefore, not having adequate representation of all the types of securitisation transactions issued by banks in the sample within the sample period may not reflect the impact of securitisation on banks.

On the frequency of issuance of securitisation transactions from banks, Moyo and Firer (2008) state that the rate at which bank engage in securitisation is largely dependent on demand for loans versus the amount of available bank deposits. Styger and Saayman

(2003) examine the impact of securitisation on small bank liquidity in South Africa and find that securitisation positively impacts banks' liquidity position provided it's done on a continuous basis. Studies on the link between securitisation and Basel capital ratio are very limited. Uzun and Webb (2007) use logistic regression to find the likelihood that a US bank will engage in securitisation in terms of their tier1 capital and total capital ratio. Their findings suggest that size is an important determinant for banks to securitise. Furthermore, their study uses FE to examine the impact of securitisation on capital ratios. The study finds that securitisation is negatively related to bank capital ratio (Uzun & Webb, 2007).

Similarly, Dionne and Harchaoui (2008) examine the relationship between bank capital, securitisation, and bank risk-taking using data from Canadian banks between the period of 1988 and 1998. The study seeks to answer question of how securitisation affects capital ratio and how securitisation affects bank risk-taking. The FE estimation technique was employed, and the result suggested that securitisation activities negatively impact the capital ratios of banks in Canada. In addition, their results found a positive relationship between securitisation and risk-taking. Furthermore, Cardone-Riportella et al. (2010)'s study for Spanish commercial banks for the period of 2000 and 2007 also held that banks with less regulatory capital will have a greater incentive to securitize its loan assets. These empirical results suggest that capital ratios declined with higher securitisation activities for US, Canadian and Spanish banks.

Nevertheless, studies from emerging economies such as Kasse-Kengne (2018) from South Africa examined whether Basel II and Basel III CAR drive commercial banks to securitise to achieve lower capital (capital arbitrage). The study using four top commercial banks for the period 2008 and 2015 and ordinary least square to analyse found that securitisation has a negative impact on South African regulatory capital ratios. However, the immediate cashflow from securitisation was used to expand their loan portfolios. In summary, there is very few literatures on bank capital and securitisation activities. The findings in the empirical literature discussed above find that securitisation activities declined banks' capital ratios. The objective of this chapter differs from the existing studies. After the 2008 financial crisis, securitisation declined. Given the introduction Basel IV CAR and the securitisation framework, this chapter seeks to examine the potential impact of the new securitisation framework and Basel IV CAR on securitisation activities of banks in Africa. Furthermore, the next session discusses the empirical literature on the link between securitisation and bank performance.

5.3.2.2 Impact of Basel CAR on the performance of securitising banks

Bank performance is the ability of a bank to generate sustainable profits. A bank's profit strengthens its capital position and enables bank to re-invest its retained earnings to improve future profits (Carbó-Valverde et al., 2011). US banks in the 1970s utilized securitisation when the channels for profit-making were shrinking as well as to finance the rising demand for home finance in the 1980s (Bakoush et al., 2019; Styger & Saayman, 2003). Ghosh (2018) examine the impact of securitisation on performance, leverage capital, and risks on first-time securitizers in the US between 2001 and 2016. Using data on 5491 banks, the study finds that securitisation significantly increases bank profits and leverage capital. Similarly, Bakoush et al. (2019) find that securitisation can positively impact bank performance through four different transmission channels.

Sarkisyan (2011) examine the effects of securitisation on the performance of first timer securitisers for US commercial banks using data from 2001 and 2008. The study was interested in theoretical assumptions that securitizing banks should have lower cost of funding, lower credit risk exposure, and higher profits than banks that do not originate securitisation. A propensity score matching approach which is a non-parametric approach was employed as the study chose to know what would have happened to the performance of the securitisers if they had not engaged in securitisation. The study also builds a control group from non-securitisers. They found that although securitizing banks tend to be more profitable but with higher credit risk and higher cost of funding compared to non-securitising banks. Therefore securitizing banks seem not to outperform matched non-securitising banks giving rise in funding costs and higher credit risk (Sarkisyan, 2011).

Conversely, Casu et al. (2013) also studied first timer securitizers in the US with propensity matching scores and provide empirical findings that securitisation does not improve bank performance, although securitising banks are profitable banks. Additionally, Bannier and Hänsel (2008) analysed the collaterised loans obligations (CLO) transactions by European banks for the period 1997 and 2004. Their study employs logit regression to answer the question of what drives banks into securitisation. The findings show that the more likely a bank is to issue CLO, the higher its assets, risk and the lower its performance. This was also supported by the finding of Cardone-Riportella et al. (2010) that securitisation did not improve the performance of Spanish banks, the second-largest issuance of securitisation in Europe after the UK. They show that liquidity and the search for improved performance motivated Spanish banks to become involved in securitisation. As a result, they concluded that Spanish banks use securitisation to improve their efficiency ratios.

In addition to the above, the effect of securitisation on banks' profits can be either positive or negative (Jiangli & Pritsker, 2008). The direct and positive effect on profitability is anticipated as securitisation provides banks with more options to increase their loan portfolios, liquidity to fund new investment opportunities for expansion and reduce credit risk, which may lead to more expected profits (Ambrose et al., 2005; Castellani, 2018; Jiangli & Pritsker, 2008; Sarkisyan, 2011). The indirect and negative effects of securitisation could lower the profitability of certain banks if there is more competition among the originators of securitized loans. This may depress banks' spreads in originating those types of loans and thereby reducing banks' profitability (Cardone-Riportella et al., 2010; Casu et al., 2013; Jiangli & Pritsker, 2008). Sarkisyan (2011) explains that the effect of securitisation on bank performance may not show on first-time securitisation but on a continuous basis. Krainer and Laderman (2014) showed that one of the reasons banks securitize is for the fee income on securitized assets, which can improve bank net interest income. From the literature reviewed, securitisation may not impact bank performance if securitising banks are not engaged in a variety of securitisation activities. Also from the literature, it requires more than one-time securitisation or continuous securitisation to influence bank performance (Styger &

Saayman, 2003). Literature is yet to be conclusive on banks using securitisation to improve the overall bank performance. Based on the risk appetite hypothesis, banks with relatively superior performance are more likely to actively engage in securitisation transactions (Cardone-Riportella et al., 2010). This chapter contributes specific empirical evidence to existing literature by evaluating the potential effect of Basel IV and the new securitisation framework of 2016 on securitisation and bank performance.

5.4 Methodology on impact of Basel CAR on securitisation

The analysis of the impact of bank capital on securitisation activities and the performance of securitising banks is achieved in two parts. Firstly, the chapter examine the impact of Basel CAR on securitisation activities of commercial banks in Africa. Secondly, the chapter considers the impact of securitisation activities on the performance of the banks that engage in the origination of securitisation transactions. The chapter uses securitisation ratio, bank-specific ratios, and macroeconomic ratios according to literature to analyse the chapter objective. It presents the justification for using random (RE) and fixed effect (FE) estimation techniques. This session presents the data and justification for the sample period, the approach in calculating the securitisation exposures, the chapter variables, and the estimation techniques that are used to analyse the chapter objectives. The chapter involved the analyses of panel secondary data, its interpretation, and drawing inference.

5.4.1 Data and sample for the impact of Basel CAR on securitisation

The objective is to examine the potential impact of Basel IV CAR on securitisation activities, and the performance of securitising banks in Africa. Securitisation activities from commercial banks in Africa are low. Due to lack of sufficient data from other African countries on securitisation activities, this objective uses South Africa commercial banks to represent banks in African countries. South African commercial banks still provide some light on the effect of Basel IV CAR on securitisation for African countries. South Africa is the leading market in securitisation in Africa with data availability.

Panel data of annual observations for South African commercial banks that originated securitisation from 2002 to 2018 are considered for this chapter. Following Giordana and Schumacher (2017), sample representative bank is constructed from the panel data for each commercial banks involved with originating securitisation as if these banks had implemented the Basel IV CAR since the year 2002. Then analyse the sample bank simulated data in comparison to actual data using multiple regression analysis to examine the possible impact on securitisation under certain assumptions while holding other conditions constant. The chapter examines the potential impact of the new Basel IV CAR on securitisation and performance of banks originating securitisation using sample representative bank. Annual financial data are sourced from the Bloomberg database and the banks' annual financial reports, while securitisation data are sourced from The Banking Association of South Africa. The securitisation data sourced from The Banking Association were limited to 2002 to 2016. because it enables the chapter to capture the performance of the securitisations at least two years after from their date of origination. Therefore, each of the securitisation transactions issued within 2002 to 2016 was followed through from the date of origination to December 2018 consistent with (Ambrose et al., 2005) to analyse the effect of securitisation issued on the performance of securitizing banks.

Macroeconomic data are sourced from the McGregor database and the Reserve Bank of South Africa. During the sample period, 30 securitisations were originated from five commercial banks (ABSA, FNB, Nedbank, Investec and Standard Bank). The selected banks accounted for more than 90 percent of the South African banking industry total assets (Sadien, 2017). Accounting ratios and bank-specific ratios selected for the chapter (see Table 1) are key performance measures widely used in literature (Ombaka & Jagongo, 2018). Other banks in Africa engaged in securitisation, but were excluded due to insufficient information on the securitisation transactions such as annual securitisation outstanding, tranche and ratings on the exposure.

5.4.2 Incorporation of the revised securitisation framework into capital ratio

The South African commercial banks securitize diversified loans-mortgage and non-mortgage loans. The non-mortgage loans securitized are auto loans, credit card receivables, equipment leases, and trade receivables amongst others, while mortgage loans securitized residential home loans, commercial properties and real estate (Bloomberg, 2019).

The chapter incorporated securitisation exposure into the Basel IV capital variables according to the Basel IV CAR, while the securitisation exposure was calculated using the simple transparent and comparable (STC) framework of 2016. A single securitisation transaction issued by commercial banks has different tranches and ratings. In accordance to the STC framework, risk weights are assigned to each tranche based on the tranche ratings to measure the securitisation exposure on each bank securitized assets (BCBSa, 2016). The securitisation framework of 2016 provides standardized, internal and external approaches to calculate risk-weights to determine a given bank securitisation exposure (BCBSa, 2016). However, SEC-ERBA (external rating-based approach) can only be used due to the availability of information on ratings and tranches on all issued securitisations by the commercial banks in South Africa to measure securitisation exposures. To avoid using interpolation for calculation of exposure on securitisation with tranche maturity below five years and above one year as specified by the Securitisation framework (BCBSa, 2016), all securitisation, originating from the sampled banks, with a minimum of 5 years' tranche maturity were considered. According to the STC framework, the most senior tranche within a securitisation transaction is treated as a senior tranche in the calculation of RWA even where there are several tranches that share a similar rating in the same transaction (BCBSa, 2016).

5.4.3 Model specification for the impact of Basel CAR on securitisation

The chapter examined the potential impact of Basel IV CAR on securitisation and bank performance. This chapter adopted methodologies of similar studies (Bakoush et al., 2019; Dionne & Harchaoui, 2008). Following Giordana and Schumacher (2017), this chapter makes assumptions to simulate the banks' balance sheets as if they had complied to Basel IV requirements starting from 2002 to 2018. Based on the simulated data, the chapter analysed the sample bank and compared with actual data (Basel II and III) to examine the impact of changes in Basel levels on the dependent variables (sec_{it} and π_{it}). The first model tested the potential impact of Basel IV on securitisation activities of commercial banks in South Africa.

$$sec = f[Cap, \mathrm{lev}, Bankspe, macroec]$$

$$sec_{it} = \beta_1 + \beta_2 Lev_{it} + \beta_3 Cap_{it} + \beta_4 Bankspe_{it} + \beta_5 macroec_t + \acute{\theta} Year_i + \epsilon_{it} \qquad (5.1)$$

The chapter controlled for year effects by introducing year dummies $(Year_i)$. β, θ are coefficients of the model that capture the effects on the dependent variable, and ϵ_{it} is the error term for bank *i* in year *t*. sec_{it} proxy by the outstanding amount of securitised assets divided by total loans (Bakoush et al., 2019). Casu et al. (2011); Chen et al. (2017); Dionne and Harchaoui (2008) proxy securitisation ratio as outstanding securitised assets/total assets. Since banks transform portion of their non-saleable loans and backed by underlying assets of such non-saleable loans, it was appropriate to use total loans as a denominator of securitisation ratio (sec_{it}) for the chapter as shown in Table 5.1.

Table 5. 1: Definition of model variables

Variable	Definition	Formula	Source
sec	Securitisation ratio	Outstanding sec asset/Total loans	Bakoush et al. (2019)
π	ROE	Profit after tax/Total equity	Gabriel (2016)
Lev	Non-risk leverage	Tier1Capital/average-total assets	BCBSa (2017)
Cap	Basel IV capital ratios	$\frac{\text{Tangible common equity}}{\text{Risk} - \text{weighted assets}^{5}}$	BCBSa (2017)
Loan ratio	Bankspe	Loan/Deposit	Cardone-Riportella et al. (2010)
Nplta	Bankspe	Non-performing asset/total loan	Cardone-Riportella et al. (2010)
Reporate	macroec		Michalak and Uhde (2012)
Gdpgrowth	macroec	Gdpgrowth rate	Bakoush et al. (2019)

Note: expected sign for Lev, Cap, Loan ratio and Nplta is negative

Cap_{it} is the Basel IV capital requirement. Starting from Basel III, the formula TCE/RWA should be used as a key capital ratio variable (BCBSa, 2016, 2017; Yan et al., 2012). The RWA takes into account securitisation exposures of banks that engage in securitisation. The composition of RWA in Basel IV introduced a wide range of standardized risk weights for risky and less risky loans within a bank's class assets. Consequently, risk-weights were assigned to individual loan assets from the list of rating bucket provided in Basel IV CAR depending on the bank's risk exposure rather than assigning a single risk weight to class asset in Basel II and III. Since there may be different risks within the same risk class assets (BCBSa, 2017; Munoz & Soler, 2017).

Lev_{it} is defined according to Basel III=$\frac{Tier1\ capital}{avg.total\ assets}$≥3 percent. For global systemic banks (G-SIB) the leverage ratio was increased to 4 percent in Basel IV accord. Leverage is a

[5] Assumptions made in the calculation of RWA-denominator of the capital ratio: Bank assets used in the calculation of RWA are assumed to be AAA. Commercial loans are assumed to be investment grade. Securitisation exposure incorporated into the calculation of RWA use STC criteria of the revised Basel securitisation framework. Some information may not be available using Standardised approach to calculate securitisation exposure, therefore External rating approach is employed. Basel IV requires banks to hold capital for securitisation exposures (Chabanel, 2017).

non-risk weighted leverage ratio used as an independent risk-assessment to act as a back-stop to capital ratio and to limit bank exposure to risk (BCBSa, 2017; Brei & Gambacorta, 2014). It is intended as a simple transparent measure to complement and re-enforce the capital ratio for the purpose of financial resilience and market discipline (Baldo et al., 2018). In addition, leverage ratio is intended to discourage banks from under-estimating and under-reporting risks in their balance sheet and off-balance sheet exposures like securitisation (Baldo et al., 2018).

Bank-specific variables ($Bankspe_{it}$) include Loan-Deposit ratio, a proxy for liquidity ratio. A higher ratio suggests a less liquid bank that may choose securitisation to boost its liquidity position (Cardone-Riportella et al., 2010). Nplta is a proxy for Credit risk transfer. This chapter included Gdpgrowth and interest rate proxy (Reporate) to control for the macro-economic ($macroec_t$) environment that may affect the quality of bank assets and consequently may influence origination of securitisation and performance of the securitizing banks (Bakoush et al., 2019; Michalak & Uhde, 2012). Gdpgrowth is an improved measure of business cycles fluctuation instead of inflation (Bakoush et al., 2019). Gdpgrowth and $\mathrm{Reporate}$ may implicitly affect bank asset quality, while the effects of inflation may be subject to banks anticipating for inflation or not (Michalak & Uhde, 2012).

To examine the impact of securitisation on the performance of commercial banks involved in originating securitisation in South Africa, the following model is used in accordance with similar studies (Dionne & Harchaoui, 2008).

$$\pi = f[Cap, \mathrm{lev}, sec, Bankspe, macroec]$$

$$\pi_{it} = \beta_1 + \beta_2 Lev_{it} + \beta_3 Cap_{it} + \beta_4 Bankspe_{it} + \beta_5 sec_{it} + \beta_6 macroec_t + \dot{\theta} Year_i + \epsilon_{it} \quad (5.2)$$

where π_{it} is the profitability of the securitizing bank *i* at time *t* as measured by return on equity (ROE). Changes in Basel levels require increased capital through increase in equity. As a result, the chapter employed ROE as a measure of performance. ROE remains a reflection of profits realised on bank assets for a given capital structure

(Gabriel, 2016). For robustness sake, the chapter also used ROA as an alternative performance measure. Cardone-Riportella et al. (2010) and Uzun and Webb (2007) explain that large banks securitize than smaller banks due to smaller banks' inability to finance fixed costs associated with initiating the securitisation process. As a result, bank size is paramount for banks to securitize. This chapter did not control for size as the selected commercial banks, according to Kasse-Kengne (2018) are the top banks in South Africa and are not significantly different in size. The chapter employed fixed and random effect models to estimate equations (5.1) and (5.2) for the reasons that securitisation is an endogenous variable. This means that banks do take decisions to take back securitised loans into their balance sheet (Jiangli & Pritsker, 2008). In addition, the success of past issuance of securitisation does not determine current or subsequent securitisation activities. Therefore, the chapter employ static regression models (fixed and random estimation techniques).

5.5 Results and discussion on Basel CAR, securitisation and performance

The results and interpretations of the estimated models are presented in this section. Firstly, the preliminary descriptive analyses are first presented, followed by the FE and RE results and specification tests.

5.5.1 Descriptive statistics for Basel CAR and securitisation

Table 5.2 presents the descriptive statistics of the key variables. The non-performing assets to total loans ratio (Nplta) showed that 3.8precent of bank loans on average are bad debt. This is an indication of the good quality of loans. The loan deposit ratio showed that on the average, South African banks have high loan to deposit ratios, but, on average, they rely on their own deposits to issue loans to their customers. The maximum loan deposit ratio in Table 5.2 is 165.902, which showed that certain banks in the dataset within the sample period have a loan to deposit ratio above 100. This suggest that such banks may rely on other sources of funding such as securitisation to fund loans to customers and to maintain liquidity.

Table 5. 2: Summary statistics of key variables

Variable	Mean	Std. Dev.	Min	Max	Observations		
Sec	1.173	1.061	0.039	5.381	N	=	64
Lev	6.384	1.641	3.083	9.419	N	=	52
Loan_Deposit	91.849	29.194	60.413	165.902	N	=	80
BIVcap	11.220	6.436	2.796	33.591	N	=	80
BIIIcap	12.739	3.655	2.901	21.057	N	=	75
BIIcap	10.099	6.996	0.174	21.123	N	=	74
Gdpgrowth	2.809	1.871	-1.538	5.604	N	=	80
Repo_rate	7.730	2.305	5.017	12.133	N	=	80
Nplta	0.038	0.018	0.006	0.078	N	=	57

Source: South African Banking Association online database (2019)

Table 5.3 shows the frequency of securitisation each originating bank issue per year. It shows that over 75 percent of the banks issue one securitisation, while two banks out of five banks in the sample issued 3 securitisations in a given year. This shows that origination of securitisation transactions from commercial banks in South Africa has been low over the years. Styger and Saayman (2003) list two conditions for securitisation growth in South Africa: (1) regulations that favour securitisation and (2) existence of strong demand and supply of securitized assets. These banks are well capitalized above the Basel III minimum CAR (Nkopane, 2017). Consequently, there is opportunity for the commercial banks to increase origination of securitisation for additional liquidity and to generate more loans within the safety of the regulations.

Table 5. 3: Frequency of securitisation per bank per year

Number of securitisations	Freq.	percent	Cum.
1	17	77.27	77.27
2	3	13.64	90.91
3	2	9.09	100
Total	22	100	

Source: South African Banking Association online database (2019)

Specification test for Basel CAR, securitisation, and performance

The chapter conducted Pesaran and Frees tests for fixed and RE models to measure the H_0 *of* no cross dependence against the H_1 of cross dependence among the variables. For equation 5.1 results in Table 5.4, H_0 *of* no cross dependence is rejected. However, Frees cross dependency test shows that the calculated test is less than critical values, which indicates failure to reject the H_0 *of* no cross dependence. Since the Pesaran test have a cross dependency with a high correlation of 0.46 (FE) and 0.56 (RE), which conflicts with Frees test, the RE is an efficient and consistent estimator as confirmed by the Hausman test for equation 5.1. For the results of equation 5.2 in Table 5.5, the Pesaran test rejects the H_0 of no cross dependency (p<5 percent). However, the presence of cross dependency is weak, given average absolute correlation of 0.37 (FE) and 0.34 (RE). A further test using Frees shows that there is no cross dependency under FE, and this is confirmed by the Hausman test. As a result, the FE model is considered to be a consistent and efficient estimator for equation 5.2.

5.5.2 Regression analysis for Basel CAR, securitisation and performance

The chapter applies REs (RE) and FEs (FE) models to estimate equations (5.1) and (5.2). The Hausman tests selected RE for equation (5.1) (securitisation) and FE for equation (5.2) (performance). Tables 5.4 and 5.5 present the results of the RE and FE, respectively. Robustness checks were conducted by substituting ROE with ROA to see the effect of changes in Basel CAR on the performance of originating banks. However, the results of both measures are similar as a result of which the latter are not reported. The chapter examines the effect of CAR (under three Basel levels IV, III, II) on the securitisation activities of SA banks by estimating equation 5.1 with results presented in Table 5.4.

Table 5. 4: Results of CAR and securitisation (REs)

Basel level	**IV**	**III**	**II**
	Sec	**Sec**	**Sec**
Lev	-0.337***	-0.289**	-0.339**
	(0.114)	(0.132)	(0.145)
Loan_Deposit	-0.034***	-0.021*	-0.014
	(0.011)	(0.012)	(0.012)
BIVcap	0.547***		
	(0.143)		
BIIIcap		0.209**	
		(0.103)	
BIIcap			0.087
			(0.08)
Gdpgrowth	-0.381	-0.151	-0.041
	(0.435)	(0.499)	(0.522)
Reporate	-0.314	-0.395	-0.31
	(0.386)	(0.455)	(0.476)
Nplta	-58.534***	12.536	9.183
	(22.047)	(16.739)	(17.521)
_cons	4.977*	4.028	4.715
	(2.876)	(3.428)	(3.608)
N	43	43	43

*Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001*

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

5.5.2.1 Interpretation of the results: Securitisation

The results from Table 5.4 show that simulated BIVcap has a positive and significant effect on securitisation at 1 percent level of significance. Similarly, the BIIIcap also has a positive and significant effect at 5 percent level of significant while BIIcap has no significant effect on securitisation. The calculated non-risk weighted leverage ratio is significant and negative across the three models at 1 percent and 5 percent significance level respectively. The $Bankspe$ variables (Loan-deposit and Npal) are found to have significant negative effects on securitisation. The macroeconomic variables had no impact on securitisation.

Table 5. 5: Results of securitisation and bank performance (FE)

Basel level	**IV**	**III**	**II**
	ROE	**ROE**	**ROE**
Lev	0.852	1.314**	0.627
	(0.636)	(0.496)	(0.629)
Loan_Deposit	-0.035	-0.091	0.005
	(0.076)	(0.06)	(0.068)
BIVcap	2.536*		
	(1.369)		
BIIIcap		1.887***	
		(0.426)	
BIIcap			0.701**
			(0.3)
Gdpgrowth	0.362	1.039	0.738
	(0.759)	(0.854)	(0.656)
Reporate	1.291*	0.287	0.572
	(0.707)	(0.627)	(0.419)
Nplta	-206.98	-171.083*	-131.795
	(128.065)	(91.194)	(111.286)
Sec	0.738	-0.445	0.277
	(1.068)	(0.883)	(1.053)
_cons	-7.131	5.416	4.848
	(17.219)	(8.348)	(13.779)
N	43	43	43

*Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001* Source: Author's calculation based on data obtained from Bloomberg databases (2019)

5.5.2.2 Interpretation of the results: ROE

Results of the effects of securitisation on bank performance, Table 5.5, show that a simulated BIVcap, BIIIcap and BIIcap have positive and significant effects on ROE at 10 percent, 1 percent, and 5 percent significant levels, respectively. Loan-deposit ratios have no significant impact on the performance of banks that engage in securitisation. Similarly, macroeconomic variables have no significant impact on ROE under Basel 2 and 3 model. Although securitisation has a positive effect on the performance of banks under Basel 4 model, the effect is not significant under any Basel level.

In essence, one cannot see the effect of securitisation on ROE under Basel 3 and Basel 4 model. Suggesting that securitisation activities do not significantly drive bank performance. This finding was consistent with Bannier and Hänsel (2008) and Uzun and Webb (2007) that securitisation may not have a direct impact on the performance of securitising banks, but it may impact on performance through a number of indirect channels. However, the change in the securitisation coefficients from negative under Basel 3 to positive under Basel 4 model shows the strength of BIVcap to effectively protect banks from securitisation exposure as suggested by the new securitisation framework.

5.5.3 Discussion of findings for Basel CAR, securitisation and performance

From the result, when South African banks adopted Basel II regulations for the first time, the Basel capital had no significant impact on securitisation. As the banks moved from Basel II to Basel III, securitisation activities were significantly influenced by capital ratios. Specifically, the change from Basel III to Basel IV may increase securitisation in South Africa by 4 percent, ceteris paribus. The findings are contrary to Uzun and Webb (2007) and Dionne and Harchaoui (2008)’s study that capital ratio negatively impacts securitisation activities in the US and Canada. Based on the results, the implementation of Basel IV may further increase securitisation activities in the South Africa banking sector. The positive coefficient on BIVcap suggest that the commercial banks may take on more risk with higher CAR. The calculated non-risk Basel leverage has a negative impact on securitisation as expected because the leverage ratio introduced by BCBS in Basel III and IV is to act as a back-stop against risk. The counter effect of the leverage ratio is an enabler for banks to increases capital if they want to take additional risk above their available capital or reduce risk exposure if they are not ready to increase capital against their risk (BCBSa, 2016, 2017; Munoz & Soler, 2017).

The negative effects on loandp and Nplta suggest that liquidity for expansion of loans may not be the main driver of securitisation in the South African banks. Overall, the results revealed that tighter CAR increase securitisation activities for banks in South Africa under Basel IV. However, the increase in securitisation activities under Basel IV does not translate into higher profits for commercial banks. In other words, the implementation of Basel IV securitisation framework may have no significant impact on banks' performance that engage in securitisation in Africa. The implication is that the banks may have to engage in securitisation for motives other than having profit as a primary motive.

5.6 Conclusion on Basel CAR, securitisation and performance

The chapter analyses the potential impact of proposed Basel IV CAR on securitisation and performance of commercial banks involved in securitisation in South Africa, using historical financial data. The chapter firstly conclude that more stringent Basel IV CAR have a positive and significant impact on securitisation activities of banks in South Africa. One can expect a negative impact to control for risk, but the positive result suggest that higher Basel CAR will increase securitisation activities and may simultaneously increase bank risk-taking. Secondly, securitisation have no impact on performance of securitising banks. This could have been caused by the high cost of originating securitisation such as payment of interest to investors, issuance costs, rating agency, legal costs, and other related floatation costs, which may not increase profits of originating banks. Securitisation can enhance the performance of banks through indirect channels, according to certain literature. In conclusion, higher CAR of Basel IV is expected to have a significant increase in securitisation activities, but there is no evidence of securitisation improving the performance of securitizing banks. Nevertheless, securitisation can improve the performance of securitizing banks in the long term if securitisation is done continuously.

According to the Basel Committee, the aim of the new securitisation framework is to re-establish securitisation activities within an adequately capitalized regulatory environment. A clearer and simple securitisation approach for banks introduced by the revised securitisation framework of 2016 can be a motivation for more banks to securitize provided they are ready to comply with more stringent CAR and transparent disclosures in the securitisation process. The elimination of the reliance on credit rating agencies introduced by the revised securitisation framework of 2016 (Chabanel, 2017) may reduce the cost of originating securitisation, which may increase the performance of banks that engage in securitisation. Observation of non-banking sector data from Bloomberg (2019) showed that there is growing successful origination and execution of securitisation transactions in the South African securitisation market, indicating that there are investors available to buy securitized assets. As a result, it will be beneficial for South African banks to implement Basel IV CAR and the revised securitisation framework of 2016 to further ensure that the banks are adequately protected from securitisation exposures while increasing securitisation activities. This chapter contributes to literature by investigating the probable effect of the proposed Basel IV on the securitisation and performance of the South African Banking sector. This chapter recommend the adoption of the new Basel regulation by the South African commercial banks, as it is expected to stimulate liquidity and mitigate credit risk through increased securitisation activities. Subsequently, there is no evidence to support the effect of Basel IV implementation on the performance of securitising banks, but a more detailed long-run analysis may provide different results. Consequently, future studies can employ more advanced forward-looking models to examine whether Basel IV can improve performance of securitising banks in the long run.

CHAPTER SIX

DETERMINANTS OF CAPITAL ADEQUACY ON THE RESILIENCE OF COMMERCIAL BANKS IN AFRICA

6.1 Introduction to Basel CAR and resilience

After a financial crisis, the regulators and decision making authorities usually ask questions about what can be done to strengthen the resilience of the banking system (BCBS, 2009; Parrado, 2016). More specifically, are the existing capital regulations adequate to promote banking sector stability. What else is needed? Coming up with a clear response to these two questions is a good starting point for implementing any strategy aimed at gradually strengthening the resilience of any banking system. As regard the first question if existing capital regulation is adequate to promote financial stability. The globalization and expansion of financial services to the growing international trade have created more inter-connectedness of the banking industry globally. This creates the need for increased and standardized banking regulations to improve banking regulations for bank regulators in their jurisdiction (Parrado, 2016). A standardized regulation is needed for healthy competition, capital adequacy, effective banking supervision, cross-border banking supervision, and avoidance of unintended costs such as regulatory arbitrage. Implementing the Basel I and Basel II accord was crucial to accomplish good regulation and supervision but was not enough to establish financial stability.

Following the 2008 financial crisis prompted renewed interest in banking regulations where bank regulators ask what else is needed to safeguard the global banking system (Parrado, 2016; Triki et al., 2017). This led to a broad consensus that further regulations for higher capital are important to strengthen the resilience of banks (Chiaramonte & Casu, 2017; Roulet, 2018). This necessitated the revision of the Basel II framework to provide a foundation for a resilient banking system that will help avoid the build-up of systemic vulnerabilities in the financial system (Gabriel, 2016). As a result, it led to the introduction of the Basel III accord (BCBS, 2009). The Basel III accords take care of systemic risk to ensure that a bank failure does not affect an entire banking sector's stability and potential economic impact that banks do not take into account in their decision-making (Walter, 2019). To further increase the resilience of banks, the Basel Committee introduce the Basel IV accord to standardize the calculation of capital ratios (BCBSa, 2017). A resilient banking system is a strong system that is not prone to crisis or failures, which can withstand and recover quickly from difficult positions (Bui, Scheule, & Wu, 2017). A resilient bank is important for banking system stability, s regulator’s dilemma (Oughton, 2017). Also, a resilient banking system enhances competition among banks via different banking models and reduces the probability of bank failures (Oughton, 2017; Roland Berger, 2017). Literature argues that higher capital increase the resilience of banks because it serves as a cushion to absorbs unexpected losses (Chiaramonte & Casu, 2017; Walter, 2019). The objective of this chapter is to analyse the impact of higher Basel CAR on the resilience of banks in Africa.

Banks are the lifeline of any economy. For an economy to be stable and strong, it is important for the banking sector to be stable (Oughton, 2017). As a result, banking sectors in most economies are highly regulated to prevent incidences of bank failures (Chiaramonte & Casu, 2017). Banks that are Basel I and II compliant in the developed countries were hit by the 2008 financial crisis, while banks in the African countries were not worse hit. However, the financial crisis had major constraints on exports from African countries, which indirectly affected the African banks (Sanusi, 2010). In the developed countries in 1970s, as a result of increasing cross-border flow of capital and integration of the financial markets, required a global regulatory framework aimed at promoting the stability of the international financial system (Jablecki, 2009). This led to the introduction of the Basel I accord, later Basel II accord. The banks realised that falling below the regulatory CAR will either attract penalty cost resulting in reputation losses or reduce lending resulting in loss of income or to raise additional capital. Neither options are cheap (Jablecki, 2009). The implementation of the Basel I accord contributed to an increase in banks’ capital ratios, it also created capital arbitrage (Jablecki, 2009). Capital arbitrage is a technique where banks can restructure their balance sheets to achieve higher lending, meet minimum regulatory capital and profits. In developed countries, bank failures arise as a result of circumventing the Basel CAR. Avoidance of CAR resulted in innovative banking models away from traditional banking model of deposit-loan to transforming illiquid loans to marketable loans to increase lending using new types of synthetic financial instruments (Jablecki, 2009; Roland Berger, 2017; Walter, 2019). These developments saw a rapid growth in securitisation which increased bank risk exposures unaccounted for in capital ratios causing regulatory failure, in addition, surge in asset prices that are unsustainable, increased bank lending which altered credit screening of borrowers leading to accumulation of losses (Sanusi, 2010), threatened the resilience of banks in the developed countries in the pre-2007/08 financial crisis. In contrast, many African banks are also not resilient. They are characterised by bank failures, fragility, poor corporate governance, poor asset quality, lack financial depth as a result of capital inadequacy and non-compliance to changes in Basel regulations (Sanusi, 2010; Triki et al., 2017). These factors above create the emergence of weak banks in Africa that cannot compete, limited in provision of lending to small businesses and corporates, prone to distress and failures. For instance, three banks collapse in Kenya in 2015 as a result of management incapacity to effectively assess the bank credit risks (Gathaiya, 2017). Eight banks collapse in Ghana between 2016 and 2018 as a result of capital inadequacies, declining asset quality, ineffective regulatory supervisions (Benson, 2019). Three banks were distressed but bailed out in Nigeria in 2016 as a result of capital inadequacies (Sanusi, 2010). With frequent bank failures and distress, the resilience of a banking system becomes crucial for regulators in African countries for the growth and sustainability of their economy (Gathaiya, 2017; Sanusi, 2010). Since Basel III and IV accords were introduced following the 2008 financial crisis that occurred in the developed countries, this chapter questions the impact of a stronger regulatory capital on the resilience of banks in Africa that were not worse hit by the financial crisis. It questions whether higher capital will increase the resilience of banks in Africa.

Furthermore, globalization, complexities of international trade, and growing interconnectedness in the global banking system, there is a need to examine whether tighter regulations can be beneficial for African banks. Studying Africa is of particular interest for policy purposes because of African bank regulators' conservative approach to changes in Basel regulations. If African banks are lagging in compliance with higher CAR, banks from other countries with strong banking regulations will compete favourably at the expense of local banks. According to Roland Berger (2017), Basel IV could favor a more capital-market based financing model such that banks source for equity and liquidity from the capital market as in the United States instead of deposits from customers. However, this can take much time to materialize in Africa given the level of developments in African capital markets for banks to raise equity, but a capital-market based financing model will increase loan supply for economic growth.

The essential reasons underlying Basel higher CAR are to reduce the probability of bank failure, an important factor in fostering financial stability and protecting the economy (BCBSa, 2017). Unfortunately, there can be a trade-off in the higher Basel CAR between the promotion of banking stability and fostering economic growth (Bui et al., 2017; Tchana Tchana, 2012). For instance, using common equity to achieve higher CAR is more expensive for banks (Walter, 2019). Higher equity capital is associated with higher funding costs because investors require higher returns than debt holders (Bui et al., 2017). An increase in equity capital may hurt the shareholders of the bank because of the dilution of shares and issuance costs resulting in a reduction in the return on equity (Admati et al., 2013).

Alternatively, banks may take on higher risk to generate higher return on equity so that shareholders can have adequate returns on their investments. Consequently, this may increase lending rate, which, in return, reduces volumes of loans (Bichsel & Blum, 2004; Gabriel, 2016). Banks play significant roles in the functioning of the real economy (Gyntelberg, 2018). Thus, bank failure due to lack of quality regulatory framework will have negative impact in the economy. However, in trying to achieve a resilience banking system, what will be the impact of the proposed changes in Basel IV on resilience of banks in Africa if implemented? In Europe, small and medium firms rely on European banks providing over 76 percent of all their financing, while in the United States, firms rely on the banks to provide 27 percent of all their financing (Roland Berger, 2017). The high contribution of bank funding in Europe is due to global banking activities that account for more than half of the European total assets (Roland Berger, 2017). As a result of the 2008 financial crisis, the European government introduces Basel III CAR as a strategy to strengthen the resilience of banks in the region to reduce the probability of bank distress and failures even though bank failures are extremely low compared with the United States (Chiaramonte & Casu, 2017). In Indonesia, the government passed a law on financial system crisis prevention and mitigation in 2016 to prevent and better respond to bank failures (Triggs, Kacaribu, & Wang, 2019). In the law, Indonesian banks are expected to have recovery plan, which details how each bank’s bail-out arrangements will be in the event of a crisis (Triggs et al., 2019). This law's relevance is to make the Indonesian banks accountable and responsible to bear their losses rather than public monies because the country has a long history of banks bail-outs as a result of negative capital and fraudulent bank management.

The resilience of African banks constitutes the current chapter's focus because new wave of Basel IV regulations is being considered while Basel III is being implemented in the developed countries. However, only Egypt, Mauritius, Morocco, Namibia, and South Africa have implemented Basel III in Africa. Thus, African banks are lagging in compliance with changes in Basel CAR. Lack of adequate regulations limits the potentials of the banks to tap into the opportunities of the populous continent, increases cost of lending as a result of high non-performing loans, and competition among the banks is limited. Also, this chapter on the resilience of African banks is motivated by the lack of African banks’ not fully integrated into the global banking system due to inadequate banking regulations operated in most African countries. African banks are also characterised by bank failures and fragility despite opportunities for revenue growth in traditional banking (Chironga et al., 2018). In addition, the possible benefits and cost of adopting new Basel CAR on bank resilience are unknown because Basel IV CAR is set to be adopted in 2022. Consequently, this chapter attempts to ascertain how the Basel IV CAR would have impacted banks' resilience in Africa as if the Basel IV CAR had been implemented in the sample period. Focusing on a sample of commercial banks in Africa over the period of 2000-2018, the chapter aims to answer the following questions: (i) to what extent is the resilience of commercial banks in Africa affected by the determinants of capital adequacy such as management efficiency, asset quality, earnings, liquidity, sensitivity to market risk and macroeconomic factors (Gdpgrowth, inflation, and Reporate) and (ii) how will the introduction of a new Basel IV assist in improving banks' resilience in African countries? To answer these questions, this chapter uses two measures to capture bank resilience Z-score and CAMELS. In addition, the estimation techniques employed are descriptive statistics, logistic regression, and fixed-effect model.

This chapter starts with a brief introduction of the importance of higher capital on bank resilience, followed by the background on the impact of Basel levels on bank resilience. The second section presents the theoretical and empirical literature on bank capital and resilience. The third section presents the methodology, the measures of bank resilience employed, the estimation models and variables, followed by the estimation techniques. The last session presents the results for descriptive statistics, logistic regression, and fixed-effect model, in addition, the session presents the discussions and implications of Basel IV and other determinants on the resilience of banks in Africa.

6.2 Background on the impact of Basel CAR on bank resilience

Banks are in the business of taking risk, but because of the essential role banks play in providing financial services in an economy, they are obliged to hold an appropriate level of capital as a cushion against unexpected losses (Lotto, 2016; Stolz, 2002). Risk-taking by banks, if successful, makes banks profitable. Otherwise, it may affect the stability of the banks in the form of distress, bail-outs sometimes leading to failures causing loss of depositors funds and other losses with adverse effects on the economy as evidenced by the 2008 financial crisis (Chalermchatvichien et al., 2014). When a bank is in distress, its CEO and managers can decide to inappropriately take more risk if they expect not to be held accountable for excessive risk-taking (Abdrahamane et al., 2017; Hardy, 1998). As a result, problems that could otherwise be contained become magnified. Consequently, the bank runs into difficulties, thus leading to systemic banking crisis where the problems in one bank can spread through the banking system as a result of bank interconnectedness in the financial system and into the entire economy (Caprio & Klingebiel, 1999; Hardy, 1998; Nkopane, 2017). System resilience refers to the ability of the financial system to withstand and recover from losses should they occur (Bui et al., 2017). Higher capital has been provided as a tool to increase the resilience of banks against bank risk exposure (BCBS, 2009). Apart from the 2008 global financial crisis, there are episodes of systemic banking crisis in other countries in the world that resulted in significant losses to the economy (Caprio & Klingebiel, 1999; Walter, 2010). In North Cyprus, the bankruptcy of five banks led to a banking crisis, which resulted in over 50 percent Gdpgrowth loss in the year 2000 (Gunsel, 2007). In addition, there was the European exchange rate currency crisis between 1992/93, the Latin American financial crisis of 1994/95, which started in Mexico due to excessive capital flight, which is also a currency crisis (Hardy, 1998). There was also the East Asia financial crisis of 1997 in Indonesia, Korea, Thailand, Malaysia, and Philippines (Hardy, 1998; Mishkin, 1999). The East Asia crisis was caused by financial liberation and excessive lending growth, foreign capital inflows into the emerging countries beyond what the banking system could handle and beyond what the banking supervisors could monitor (Mishkin, 1999). Excessive lending on the part of the banks created a rise in non-performing loans and deterioration of banks' balance sheet which resulted into the East Asia financial crisis (Mishkin, 1999). The East Asian crisis led to systemic risk costing losses to some investors globally. This led to the amendment of Basel I accord, which incorporated market risk to provide CAR to protect banks against currency and price risks that banks could be exposed to during their trading activities. Such risks include exchange rate risk, interest rate risk, traded debt securities, equities, and commodities because (BIS, 2018; Hardy, 1998).

The International Monetary Fund (1998, p. 1) defines "a banking crisis as a situation where bank runs and widespread failures induce banks to suspend the convertibility of their liabilities or which compels the government to intervene in the banking system on a large scale." Bank failure can be defined as a situation where a bank or many banks are closed due to financial difficulties (Gunsel, 2007). Furthermore, bank failures have systemic costs not entirely borne by the banks (Ljung & Schennings, 2018). As a result, the regulators have prioritised higher CAR to ensure the resilience in the banking system

(BCBSa, 2017; Chiaramonte & Casu, 2017; Walter, 2010). A bank's resilience is in the ability of such a bank’s capital to absorb losses or recover from unexpected losses should they occur. It also relates to the quality and quantity of capital adequacy compliance (Bui et al., 2017; Rachdi, Trabelsi, & Trad, 2013). In this context, the goal of higher CAR by the Basel committee of banking supervision is to increase bank resilience.

Regulatory authorities use CAR as the most acceptable regulatory instrument necessary for the resilience of the banking system to minimize the probability of bank failures (Leventides & Donatou, 2015; Lotto, 2016; Stolz, 2002). For example, in Europe, the number of bank failures is relatively low compared to bank failures in the US, and some European countries did not experience bank failures. Still, there were a number of distressed banks that had state interventions or mergers (Chiaramonte & Casu, 2017). The 2008 global financial crisis prompted regulatory authorities in Europe to revise the existing regulatory framework to incorporate Basel III capital and liquidity requirements to improve financial stability with the aim to reduce insolvency risk (Chiaramonte & Casu, 2017; Roulet, 2018). According to Roulet (2018), the changes in CAR would require banks to strengthen their capital position by restricting the balance sheet composition for funding stability. Large banks fail because of insufficient capital reserves in the US and Europe, while smaller banks fail because of liquidity issues (Chiaramonte & Casu, 2017).

African countries are not left behind in this regard; Egypt and South Africa regulatory authorities enforced higher CAR to strengthen their banking system (Naceur & Kandil, 2009). BCBSa (2017) states that the aim of introducing Basel IV CAR is to strengthen the resilience of banks further and to reduce the probability of banking failures. The evaluation of the implication of higher capital requirements for the resilience of the African banking system cannot be over-emphasized. Banks in African countries operate in a volatile economic environment characterized by political instability, war, inflation, exchange rate crisis, high-interest rates, which can diminish bank asset quality (Dipatane, 2012). In addition, the African banking system is characterised by banking failure arising from capital inadequacy, non-performing loans, bad debt, amongst others (Dipatane, 2012). Between the 1980s and 1990s, many African governments implemented capital regulations to restructure their banking systems (Beck & Cull, 2013; Hardy, 1998). The reforms led to the emergence of strong deposit financial institutions to support private sector developments and risk-sharing among banks (Nyantakyi & Sy, 2015). However, many regulatory authorities in Africa still use Basel I CAR when regulatory authorities in other regions have already implemented Basel III (Nyantakyi & Sy, 2015). The weak regulatory environment limited the integration of African banks into the international financial market, although it protected the banks from the 2008 financial crisis (Beck & Cull, 2013; Soile-Balogun, 2017).

However, the lack of implementing changes in Basel CAR limits the ability of the African banks to provide financial services to the entire population. There is also increased non-performing loans, high liquidity due to fear of lending, short-term loans, high cost of operations eroding profits, and low capital (Andrianova et al., 2015; Beck & Cull, 2013). The weak regulatory environment presents high credit risk for banks in Africa, and the banks will be limited in pursuing financial innovations. According to Beck and Cull (2013), African banks are less efficient and financial services more expensive than banks in other comparable developing regions in the world. High loan loss provisions increase the interest rate on loans and increase the cost of financial services and operating costs from bad debts (Andrianova et al., 2015; Beck & Cull, 2013).

The history of systemic banking crisis in Africa between 1980s and 1990s in countries such as Benin Republic, Burkina Faso, Cameroon, Congo, Central Africa Republic, Chad, Kenya, Senegal, Tanzania, Mauritius, Mozambique, South Africa, Togo, and Zambia, was felt in the economy. These countries had significant losses to Gdpgrowth at an average of ten percent minimum (Beck & Cull, 2013; Caprio & Klingebiel, 1999). Most regulatory authorities restructured their banking system after these financial instability crises, but the regulations are not updated with changes in banking and risk exposures (Beck & Cull, 2013). In South Africa, the collapse of Saambou bank in 2002 led to seven more bank failure within a month after (Havemann, 2019). In addition, between 2002 and 2003, five more banks failed within a year, and twenty-two banks got de-registered by the Reserve bank (Havemann, 2019). The banks were exposed to unsecured lending with high non-performing loans. Also, for Saambou bank, long-term depositors with information about the bank risk exposures chose not to roll-over their deposits after expiration. As a result, the banks needed more liquidity to stay afloat because of continued deposit outflows, but its request got declined; eventually, the bank failed (Havemann, 2019). In April 2003, the regulators in South Africa made changes to the quality and quantity of capital held by the banks. By 2004, consultation for the implementation of Basel II CAR started. By January 2007, a trial for the banks to implement the Basel II CAR one year ahead of the official implementation date was effected. With all these changes, only one bank failure was recorded between 2003 and 2014 (Havemann, 2019).

Nigeria witnessed a series of systemic bank failures with significant losses to the economy between the periods of 1994 to 2003 (Okoye et al., 2017). Capital inadequacy, low liquidity and high non-performing loans were the major causes of bank failures (Okoye et al., 2017; Soludo, 2006). More than forty-five banks failed in the period of 1994-2006 (Nigeria Deposit Insurance Corporation, 2020). The intervention of the Central Bank of Nigeria to recapitalize the banking sector in 2004 for two years of 2004-2006 was a major step to eliminate fragile banks, which increased the size and the resilience of the banking system (Okoye et al., 2017; Soludo, 2006). Although the Nigerian banking system has not experienced bank failure as by 2020, since 2006, it is not without the Central Bank of Nigeria bailing out more than five banks in 2009. In 2009, the government provided the distressed banks $2.56 billion as capital to the undercapitalized banks and merged banks to protect the confidence in the Nigerian banking system (Sanusi, 2010). For this reason, Nigerian banks need further re-capitalization to consider Basel's higher CAR like South Africa and Egypt.

The recent banking crisis in Ghana is another case where seven banks failed between 2017/18 for failing to meet minimum capital ratios due to unethical lending, falsified balance sheet, and high non-performing loans (Benson, 2019). Kenya is another African country that recently experienced three large bank failures, between 2015 and 2016, because of high non-performing loans, poor risk management, capital inadequacy, weak regulatory environment, lack of supervisory powers, and poor corporate governance

(Gathaiya, 2017). According to Gathaiya (2017), the interest rate on loan in Kenya is as high as twenty-eight percent per annum and contributed to non-performing loans, leading to some of the bank failures. Given that some countries in Africa lag in compliance with changes in higher Basel CAR, there is a history of bank distress and failure in the African banking system. There is a need to improve the resilience of African banking systems. Therefore, this chapter aims to examine the impact of Basel IV CAR on resilience of banks in Africa. The objective is achieved by using bank specific variables known for measures of resilience in literature and compare these measures on African banks under changing Basel levels (II, III, and proposed Basel IV).

6.3 Review of literature on Basel CAR, distress and bank resilience

Bank resilience is an essential factor of a sound and stable financial system (BCBSa, 2017). Adequate capital increases the ability of banks to absorb unexpected losses and manage all kinds of risk to reduce the probability of bank failures (Hoffmann, 2011; Mamatzakis & Bagntasarian, 2019). Risk such as credit risk (loans, loan defaults, bad debts), interest rate risk (increase in the interest rate on bond), market risk (securitisation, stock prices, collaterised debt obligations-CDOs), operation risk (day-to-day operations) (Hofbauer, Klimontowicz, & Nocoń, 2017). The literature review section has two subsections. The first subsection deals theoretical literature, while the second section presents a review of empirical studies on bank capital, distress, and resilience.

6.3.1 Theoretical review on Basel CAR and bank resilience

The relevant theories to explain the possible impact of higher capital on bank resilience is moral hazard behaviour and deposit insurance. However, this section starts with explanations of reasons why banks hold capital before discussing these two theories.

6.3.1.1 Reasons banks hold capital

Banks are usually unwilling to increase their capital levels. This is because capital, above what a bank is voluntarily willing to hold in response to regulatory requirements, constitutes an external constraint on bank activities (BCBS, 1999a). In theory, external interference however little could harm business activities for its short-run performance and possibly affect its long-run viability (BCBS, 1999a). Nevertheless, banks may hold capital over the minimum regulatory requirements to reduce the possibility of the bank being subjected to regulatory penalties or supervisory intervention or the need to raise additional capital or reduce bank assets at short notice (Lotto, 2016; Pettersen, 2014). When a bank becomes subject to penalties or supervisory intervention because of an unexpected decline in its regulatory capital ratio below the required minimum, such bank incurs direct and indirect cost such as cost of issuing new shares, which can decrease the bank's value (Lotto, 2016; Pettersen, 2014). In turn, these factors lower the probability of bank failure and its associated bankruptcy costs (Pettersen, 2014). Furthermore, a well-capitalised bank can be better positioned to source funds quickly and exploit unanticipated investment opportunities that may increase bank profitability (Lotto, 2016; Pettersen, 2014). Whereas a poorly capitalised bank may lose such unexpected investment opportunities or increased loan demands to well-capitalized competitors. In Africa, many banks fall below minimum capital because of not implementing the changes in Basel CAR. In addition, poorly capitalized banks are prone to financial distress (Jheng, Latiff, Keong, & Chue, 2018). However, in countries complying with changes in Basel CAR such as South Africa, the regulatory and supervisory powers of the regulators are enhanced to monitor the banks effectively, as a result, the banks avoid to fall below the regulatory capital minimum which may be beneficial for other African countries.

6.3.1.2 Moral hazard behaviour

Moral hazard refers to bank managers' adverse incentive to take excessive risk without the fear of losing depositors and creditors funds than they would have taken without the safety net (Benston, 1995). The government safety net is the government guarantee provided to depositors and sometimes to bank creditors that their deposits or funds will not be lost in the event of a bank collapse (Benston, 1995). Bank failures may have negative externalities, resulting in loss of depositors’ funds; thus, they cause disruptions in the economy. In this regard, where the banking system fails to provide insurance against uncertain events, the governments usually undertake safety nets to protect the financial system for stability, which reduces the social cost of financial crisis as the social benefits outweigh the costs (Cordella & Yeyati, 2003; Pauly, 1968). However, the main question is what is the tradeoff between moral hazard cost and social cost?

The literature argues that government safety nets such as bail-out and deposit insurance schemes create moral hazard problems. That the banks tend to have low capital buffer, and take excessive risk in reckless manners because they know that others will bear their consequences. The government bails them out; thus, promoting the moral hazard problem (Benston, 1995; Umar & Sun, 2016). Government bail-out on distressed banks increases public intervention costs, which can continue to motivate banks to additional risk-taking (Shavell, 1979; Tanda, 2015). Contrary to these arguments, Cordella and Yeyati (2003) motivated that proper government interventions can reduce moral hazard problems if government intervene in distressed banks during periods of adverse macroeconomic conditions as against period of crisis. In addition banks will have access fee charged for bail-out. Abdrahamane et al. (2017) examine the impact of government regulation on bank risk and performance of banks in Mali. Their study finds that banks risk appetite is higher when government blanket guarantee schemes with lower capital requirements are enforced. But the banks have low-risk appetite when government blanket guarantee scheme with high CAR is enforced. Umar and Sun (2016) did not find moral hazard problems for Chinese banks. From the foregoing and according to Mamatzakis and Bagntasarian (2019) the moral hazard hypothesis proposes a negative relationship between capital and resilience of banks.

6.3.1.3 Deposit Insurance

Deposit insurance adopted by regulatory authorities for banks in their jurisdiction aims to minimize risk and eliminate moral hazard problems (Ngalawa, Tchana, & Viegi, 2016). However, the modern banking system of risk-taking that features deposit insurance and other government intervention contribute to increase bank risk-taking incentives, increase the likelihood of a bank failure, and produce unwanted effects in the whole financial system and the economy (Boyd & De Nicolo, 2005; Tanda, 2015). Earlier literature Pauly (1968) and Shavell (1979) note that the solutions to moral hazard problems will be for deposit insurers to observe bank risks directly. And to ensure proper risk evaluation with correct deposit insurance pricing, which can eliminate the excessive risk-taking to reduce moral hazard problems (Stolz, 2002). Contrary to these studies, Flannery (1989) points out that there will arise a problem when the insurer cannot observe bank risks directly to correctly price deposit insurance. Furthermore, mis-priced deposit insurance limits bank ability to generate profits and may increase the probability of bank failures. As a result, deposit insurance is not solution to moral hazard problems.

Tanda (2015) provides that capital requirement plays an important role in bank decisions on capital and risk levels. Over the years, regulatory CAR has undergone transformation due to the introduction of new Basel regulations, especially the post-financial crisis accords. Thus, calling for new research as some earlier findings may no longer be applicable. Following the 2008 financial crisis, the Basel III and IV regulations impose stricter CAR and higher leverage ratios for global systemically-important banks (G-SIB) to limit excessive risk-taking of banks (Adesina & Mwamba, 2016; BCBSb, 2016; Tanda, 2015). Given that higher capital aim to reduce the moral hazard problems. But higher capital can increase the cost of loans. In Africa, interest rate on loan is already high, such that further increases in interest rate on loan can increase default rate. However, many banks in Africa struggle with capital adequacy, which can increase bank failure. Therefore, it is important to examine the impact of higher capital on African banks' resilience based on their current operations and characteristics to enable the chapter to arrive at a robust conclusion on the benefit of higher capital on the resilience of banks in Africa.

6.3.2 Empirical literature review on Basel CAR, distress and resilience

Bank resilience is the ability of a bank to absorb unexpected losses should they occur (Bui et al., 2017).

6.3.2.1 Empirical studies on the impact of Basel CAR on bank resilience

In literature, capital has been a valuable regulatory tool used by regulators and policymakers to strengthen the financial stability and resilience in the banking system (Chiaramonte & Casu, 2017; Hossain et al., 2018). It is undisputed that all else being equal, a bank's probability of default declines with its level of capital (Bichsel & Blum, 2004). The existing literature suggests that well-capitalised banks performed better during the 2008 financial crisis (Sahut & Mili, 2011). And such banks continue to perform in the post-financial crisis and also have the ability to lend more and are better absorb risk (Cohen & Scatigna, 2016; Tabak et al., 2011). Furthermore, well-capitalised banks are in a better position to absorb. In addition, well-capitalised banks tend to be more cautious in their investment decisions

There are disagreement about higher CAR improving the resilience of banks (Admati et al., 2013; Stolz, 2002). On the one hand, equity capital represents the stake a bank will lose in the event of insolvency; therefore, the incentive of a bank may be to lower its risk at higher capital levels. On the other hand, it is argued that capital is expensive (Perrone et al., 2015). That higher capital through issuing of shares will dilute shares and may reduce expected return on equity. Thus, to generate adequate returns on equity and to maximise shareholders wealth, banks may be forced to increase their investment in risky portfolios to generate higher returns on their risk assets the higher the capital (Bichsel & Blum, 2004; Boyd & De Nicolo, 2005; Stolz, 2002).

Changes in higher CAR can influence bank risk; the new Basel CAR III adequately links capital to bank risks (BCBSa, 2017; Gueyié, Guidara, & Lai, 2019; Walter, 2019). Examining the link between bank capital and resilience, Bui et al. (2017) find that a moderate increase in Basel CAR is adequate for the resilience of banks in Australia. That banks which hold capital above the minimum regulatory requirements are able to absorb loan losses efficiently. Chiaramonte and Casu (2017) find that Basel III higher capital and liquidity requirements play a role in reducing the probability of failure only for large banks in Europe. In developing countries, higher Basel CAR increase bank resilience through the reduction of probability of default risk Mamatzakis and Bagntasarian (2019) and Sahut and Mili (2011) for MENA countries; Hossain et al. (2018) for BRICS countries and Banerjee and Majumdar (2017) for UAE. But, too many regulatory restrictions may hinder the functions of banks (Banerjee & Majumdar, 2017; Bouheni et al., 2014).

Contrary to the studies above, Bichsel and Blum (2004) find that higher capital has no significant impact on default risk for Swiss banks. In addition, since the inception of Basel regulations in 1988, the quality of capital is improved in Basel III and IV. Also, the Basel IV CAR has more risk coverage (BCBSa, 2017; Walter, 2010). In addition, Basel III improved micro-level supervision (Walter, 2010). Furthermore, in Africa, countries such as Nigeria, Egypt, and South Africa benefited from improving their banking system's stability when their regulators enforce Basel II CAR. Also, the banking sector is growing; thus, there is a need to incorporate a broader regulatory framework for a stable banking system in long run to reduce the probability of bank failures, hence the relevance of this study. Moreover, Gueyié et al. (2019) find that in-spite of Canadian banks adhering to changes in Basel CAR, reshuffling of bank activities towards the changes in CAR did not reduce their capital ratio but the regulations adequately links their capital allocation with their risk-taking.

6.3.2.2 Empirical studies on measures of resilience

A number of literature on capital and resilience have focused on risk measurement indicators to capture the impact of higher capital on resilience (Klomp & Haan, 2012; Rachdi et al., 2013; Sahut & Mili, 2011). These measures are classified into three different models to measure resilience. The structural models such as Black Scholes model, individual-level reduced form models such as Z-score and the use of accounting ratios and lastly portfolio reduced form models such as the use of market data (Altman, Iwanicz-Drozdowska, Laitinen, & Suvas, 2017; Hao, Zhang, Carling, & Alam, 2009). The structural models require simulations Hao et al. (2009), and the use of the portfolio-reduced models requires market data that may not fully capture bank characteristics (Altman et al., 2017). According to Nurazi and Evans (2005) each model has advantages and disadvantages. Nurazi and Evans (2005) conclude that no single model is superior to the other models. That each model can be useful in certain conditions and under certain assumptions (Nurazi & Evans, 2005). However, recent literature argued that the individual level reduced-form models are reported to perform better to capture the properties of bank risk (Altman et al., 2017; Boďa & Úradníček, 2016).

The individual reduced form model can use multiple risk measures to answer research objectives. However, some studies use one-dimensional risk indicators to examine capital and resilience relationships amongst are Chalermchatvichien et al. (2014); Munir, Salwa, and Bustamam (2017); Rachdi et al. (2013). The findings from these studies are not similar. Studies vary from countries arising from sample characteristics, regulatory and institutional differences. Klomp and Haan (2012) questioned studies that employ one-dimensional risk indicators to measure bank risks like Z-score, non-performing loans, capital ratios, or credit ratings that one measure may not capture the banking risk. Klomp and Haan (2012) use factor analysis with 25 CAMEL indicators for measures of bank stability. Their study had to adopt a cut-off point to choose between more variables or more observations. For this reason, it is therefore relevant to choose relevant risk measures that can be used to answer the chapter objective on bank stability.

Z-score is a measure of distance to default that reflects a bank's probability of insolvency or probability of failure (Adesina & Mwamba, 2016; Laeven & Levine, 2009). Z-score is used to measure the financial health of a bank and how close such a bank is to bankruptcy. A bank is bankrupt when its losses deplete its equity capital (Adesina & Mwamba, 2016; Mamatzakis & Bagntasarian, 2019). Studies that use Z-score as a measure of resilience such as Adesina and Mwamba (2016) for South Africa; Giordana and Schumacher (2017) for Luxembourg banks; Chalermchatvichien et al. (2014) for East Asia banks find that Basel III CAR have positive and significant impact on bank resilience as well as significantly reduce the probability of default risk. Adesina and Mwamba (2016) conclude that their positive findings suggest that banks with lower common equity capital have high probability of insolvency. Subsequently, Giordana and Schumacher (2017) state that all banks would have seen a decline in their default risk during a crisis episode if they had previously complied with Basel III requirements. In addition, that well capitalised Luxembourg banks tend to be more cautious in their investment decisions with higher CAR (Giordana & Schumacher, 2017). The existing literature suggests that a bank's probability of default declines with higher capital. It was also found that Basel III CAR for resilience will be more effective for countries with economic developments (Chalermchatvichien et al., 2014). This chapter aims to examine the potential impact of Basel IV CAR on the resilience of banks in Africa, given that African banks have the opportunity for revenue growth in the African continent but are limited due to capital inadequacies and fragility amongst other factors such as volatile macroeconomic environment.

In addition to Z-score, some studies use capital, asset quality, management, earnings, liquidity, and sensitivity to market risk (CAMELS) as a measure of resilience. CAMELS rating can be used as an assessment of a bank's financial health by the regulatory authorities and as a measure for financial distress detection (Munir et al., 2017; Sahut & Mili, 2011). CAMEL was initially adopted by the US bank regulators in 1979 for uniform rating of US banks to predict bank distress (Boateng, 2019). Studies that have use CAMELS in literature Boateng (2019); Rizvi et al. (2018) to examine the financial performance of banks in Ghana and India. In addition, Nurazi and Evans (2005); Sahut and Mili (2011) use CAMELS as a prediction for bank distress or failure. In this context, it is a useful supervisory and regulatory tool for bank regulators (Boateng, 2019). Furthermore, CAMELS analysis can be used to manage risk effectively. A bank with declining CAMELS rating is a distressed bank (Boateng, 2019). The management of such bank will be faced with making strategic decisions to improve the distressed bank (Klomp & Haan, 2012; Munir et al., 2017). Adequate bank regulation consistently reduce risk in high-risk in OECD countries (Klomp & Haan, 2012).

6.3.2.3 Summary of empirical literature on Basel CAR and bank resilience

Bank failure predictors include low asset quality (high non-performing loans), low profitability, low capital, aggressive loan growth, and excessive reliance on short-term funding (Chiaramonte & Casu, 2017). Studies on the possible impact of CAR on bank risk-taking and resilience remain inconclusive, especially with the proposed implementation of Basel IV. The contributions of this chapter are two-fold. First, the chapter extends Giordana and Schumacher (2017) and Adesina and Mwamba (2016), who studied the potential effect of Basel III CAR on bank resilience in Luxembourg and South Africa. Following the sample period of their studies, the CAR has undergone a revolution due to the introduction of new Basel IV regulations. Since the Basel IV CAR requires tangible common equity, different risk weightings in the calculation of RWA, and standardization of RWA calculation, this chapter deviates from the existing studies by focusing on the possible impact of Basel IV CAR on the resilience of banks in Africa. The chapter results would offer key insight to policymakers and regulators on the implication of Basel IV for bank resilience in the African context. The chapter explored the new CAR, which is the finalization of Basel III but widely referred to as "Basel IV." Motivated by African banks' lack of inclusion in the global banking system and its fragility despite opportunities for revenue growth in traditional banking as identified by Chironga et al. (2018) and possible benefits and cost of adopting new Basel CAR. Basel IV is set to be adopted in 2022. The full impact of Basel IV will be unknown for a number of years.

However, the chapter can attempt to ascertain how the Basel IV CAR influence bank risk-taking and resilience as if the Basel IV CAR had been implemented in the sample period.

6.4 Methodology on Basel CAR and bank resilience

This session's focus is to use dataset and methodology to provide answers to how Basel IV impacts the resilience of commercial banks in selected African countries. Several measures have been employed in the empirical literature to capture bank resilience (Chiaramonte & Casu, 2017; Hossain et al., 2018; Sahut & Mili, 2011). Notable amongst these measures is the Z-score and CAMELS rating system. The two measures are relevant to the chapter to examine how the impact of changes in Basel CAR strengthens the resilience of African banks. This section introduces the data, the variables, the estimation models, and the estimation techniques used to examine the determinants of capital adequacy on the resilience of African commercial banks. It also presents the justification for using the selected techniques.

6.4.1 Data and Sample on Basel CAR and bank resilience

The data and sample size remain the same as chapter 3. The dataset enables the chapter to observe the resilience of commercial banks under different Basel levels. This will enable the chapter to reach a conclusion if Basel IV CAR improves the resilience of banks in Africa. The annual data on the dependent variable Z-score is collected from Bloomberg and S&P Capital IQ database. Z-score is employed because it considers risk-based capital ratios incorporated in its calculation, enabling this chapter to access the impact of different Basel CAR on the resilience of banks in Africa. Furthermore, the chapter seeks to answer the question of to what extent is the resilience of commercial banks in Africa affected by the determinants of capital adequacy. CAMELS rating system will be used to answer the question. In addition, macro-economic conditions are controlled for using Gdpgrowth, Reporate, and inflation. CAMELS is used because it is used as a predictor of bank failure (Nurazi & Evans, 2005). The result from each variable in the CAMELS will enable the stakeholders in African banks to identify which variables to focus on to strengthen bank resilience. The CAMELS data are obtained from Bloomberg and S&P capital IQ database. Two different resilience measures are employed to achieve this objective namely Z-score and CAMELS. They are explained further below.

6.4.2 Measures of bank resilience

There are many resilience measures for predicting the probability of bank failures, such as structural models, market-based risk models (portfolio reduced models), and individual reduced models (Hao et al., 2009; Nurazi & Evans, 2005). Market-based risk models rely on market data. In addition, individual reduced models rely on accounting data (Altman et al., 2017). Accounting data is a good reflection of a bank performance, and individual reduced models use accounting ratios that are easy to calculate in contrast to market-based risk measures (Lepetit & Strobel, 2015). From the individual reduced models, this chapter employs two measures of risk namely, Z-score and CAMELS are alternative measures mostly used in the prediction of bank failures and resilience (Giordana & Schumacher, 2017; Nurazi & Evans, 2005). The other risk measures include loan-loss reserves, non-performing loans to total loan ratio, amongst others (Adesina & Mwamba, 2016). There are reasons for the selection of each of the two measures are discuss in subsequent sections.

6.4.2.1 CAMELS as a measure of bank resilience

CAMEL is an acronym stated as (C-Capital adequacy measured by equity to total asset ratio, A-asset quality measured by non-performing loan/total asset, M-management efficiency measured by cost/income, E-bank earnings measured by ROA, ROE and NIM, L-liquidity measured by loan to deposit ratio and loan-growth (Kasse-Kengne, 2018; Munir et al., 2017; Sahut & Mili, 2011). The United States banking regulators first introduced CAMEL rating in 1979 as an internal measure to access the health of financial institutions in bad performance (Munir et al., 2017). In 1996, the sensitivity to market risk was added into CAMEL to become CAMELS (Munir et al., 2017). CAMELS is a rating technique based on ratio analysis of the financial statements together with an onsite examination by the regulatory authority to estimate the probability of bank distress (Boateng, 2019). Analysis of CAMELS rating system is good for financial statements comparative for the past, present, and future bank stability (Munir et al., 2017). CAMELS can predict and distinguish banks that are in potential distress from banks with improved resilience (Sahut & Mili, 2011). For this reason, in this chapter, CAMELS is used to access commercial banks' resilience in Africa to determine whether banks that comply to higher Basel capital improve their CAMELS ratings. CAMELS is measured using ratios of capital adequacy, asset quality, management efficiency, earnings, liquidity, and sensitivity, which are discussed further in section 6.4.3.1. While Z-score examines the impact of changes in Basel CAR on the resilience of banks in Africa. Consequently, for this chapter, the findings from the two resilience measures will complement each other to provide a robust conclusion on the impact of higher capital on resilience of banks in Africa.

6.4.2.2 Z-score as a measure of bank resilience

Z-score is a measure for predicting bank failure or distress and is a common measure for bank resilience (Chalermchatvichien et al., 2014; Laeven & Levine, 2009). Z-score measures the extent a bank-level of capital can cover losses arising from variability in returns without becoming bankrupt (Giordana & Schumacher, 2017). A higher Z-score indicates more stability (Bonner et al., 2016). Many studies such as Adesina and Mwamba (2016); Chalermchatvichien et al. (2014); Giordana and Schumacher (2017), among others have to employ Z-score in examining the resilience of banks. In addition, its widespread use in the banking and financial stability literature is due to its relative simplicity and the fact that it is easy to calculate using only accounting information (Chalermchatvichien et al., 2014; Lepetit & Strobel, 2015). Z-score is relevant to examine whether higher CAR reduces the probability of bank failures in Africa. For the reason that it incorporates equity capital in its calculation discussed in detail in section 6.4.3.2

6.4.3 Estimated model for Basel CAR and bank resilience

The impact of capital adequacy on the resilience of banks is examined using static panel models for a sample covering 41 commercial banks in Africa. The specific model to achieve the current objective can be presented as:

$$Y_{it} = f(Baselcap_{it}, Lev_{it}, Bankspec_{it}, Macroeco_t) \qquad (6.1)$$

Where Y_{it} represents proxy for bank resilience (Z-score). The explanatory variables represent determinants of capital adequacy that can influence the resilience of banks in Africa. $Baselcap$ represents Basel IV capital ratio, and Lev represents non-risk leverage ratio. $Bankspec$ represents the bank-specific ratios which include a proxy for bank size, measured using total asset quintiles; Loan-Deposit ratio, a proxy for liquidity ratio; and Nplta, a proxy for the ratio of non-performing asset/total asset. $Macroeco$ controls for the macroeconomic variables that can affect the stability of a bank (Oino, 2018). $Macroeco$ include- Gdpgrowth, interest rates and inflation rates of individual countries.

6.4.3.1 Modelling the determinants of capital adequacy on bank resilience: CAMELS

The aim of Basel IV higher CAR is to improve the resilience of banks. To study Basel higher CAR's impact on the resilience of commercial banks in Africa, the chapter uses a Logistic regression model following Chiaramonte and Casu (2017) and Sahut and Mili (2011). The logistic regression enables the chapter to examine whether compliance to Basel capital improves the resilience of commercial banks in Africa using bank-specific variables suggested by CAMELS ratings. The CAMELS ratings are important to estimate the probability of bank distress in other words measure the resilience of banks (Sahut & Mili, 2011). The CAMELS ratings measure the resilience of banks using banks that are in compliance with Basel (Basel compliance) and banks that are not in compliance with Basel (non-Basel compliance). This enables the chapter to understand whether higher capital improves the resilience of the banks in Africa. The chapter employs logistic model because the dependent variable is a binary outcome that compares the resilience of banks that are in compliance with higher Basel CAR against banks that are non-Basel compliance. A non-Basel compliance bank refers to a bank that is yet to adopt at least Basel II CAR. Pooled logistic regression models have been widely used in the literature to examine the resilience of banks. Studies that use this model are Chiaramonte and Casu (2017); Nurazi and Evans (2005); Sahut and Mili (2011) among others. Logistic regression allow the model to be flexible without restrictions (Nurazi & Evans, 2005). The Logistic regression model is expressed as:

$$Y_{it} = \beta_0 + \sum_{j=1}^{k} \beta_j X_{itj} + u_{it} \tag{6.2}$$

$$Y_{it} = \begin{cases} 1 \; if \; bank \; is \; non-Basel \; compliance \\ 0 \; otherwise \end{cases} \tag{6.3}$$

Where Y_{it} represents the binary variable. β_j represents the coefficient of the independent variables X_{it} . X_{it} represents the explanatory variables -CAMELS and macroeconomic variables. The study control for macro-economic effects. u_{it} is the error term. The logistic regression model maximizes the logarithm of the likelihood of banking distress (Chiaramonte & Casu, 2017).

$$Log \left[\frac{Non - Basel \; compliance = 1}{Basel \; compliance = 0} \right] = \beta_0 + \sum_{j=1}^{k} \beta_j X_{itj} \tag{6.4}$$

Model 6.2 tests separate hypothesis for each element of CAMELS X_{it} . In other words, it tests the Ho of no relationship between CAMELS (capital adequacy, asset quality, management efficiency, earnings, liquidity, and sensitivity to market risk) and resilience, respectively. In order to use logistic regression, the chapter creates a dummy variable for Y_{it} separating the banks into two groups. The first group are the banks in compliance with Basel II and III CAR, and the second group are non-Basel compliance banks. The dependent variable Y_{it} is a binary outcome that takes the value 1 where a bank i have not adopted at least Basel II CAR (non-Basel compliance banks) and 0 otherwise (Basel compliance banks). CAMELS measures are defined below:

Capital adequacy determines how well a bank can cope with unexpected shocks in its balance sheet (Sahut & Mili, 2011). It is measured by a ratio of total equity to total asset (ETA). For CAMELS ratings, this chapter considers ETA instead of risk-weighted Basel capital ratio. It is not influenced by the risk-weighting system of the regulatory requirements; thus, it captures the highest quality of equity capital in each bank in the sample (Tanda, 2015). In addition equity to total assets have been used in CAMELS ratings to predict the probability of bank distress (Nurazi & Evans, 2005; Sahut & Mili, 2011). The higher the capital adequacy, the higher the resilience of banks should be (Hossain et al., 2018). Capital adequacy is expected to be negatively related to the probability of bank distress and positively related to resilience (Gunsel, 2007; Nurazi & Evans, 2005). A higher capital adequacy ratio indicates sufficient capital to adequately cover for unexpected losses, which is the aim of Basel higher CAR (BCBSa, 2017).

Asset quality is a measure of the bank's degree of financial stability (Boateng, 2019). A bank's resilience becomes threatened when its asset quality declines (Sahut & Mili, 2011). Asset quality is measured by non-performing loan/total asset (Nplta). Asset quality is a reflection of the efficiency of bank's credit decision (Boateng, 2019). African commercial banks follow traditional banking model of deposit to lending function. Banks operating with a traditional model, credit risk is the main source of risk (BCBSa, 2017; Tanda, 2015). Loans have the highest default risk in assets of banks, generally called non-performing loans (Chiaramonte & Casu, 2017; Gathaiya, 2017). Continuous increase in non-performing loans deteriorates the asset quality of banks (Gathaiya, 2017). It simultaneously increases bad debt to be written off from the banking books, which in turn, reduces a bank's value. Hence, the higher the non-performing loan ratio, the more it reduces resilience (Chiaramonte & Casu, 2017; Gunsel, 2007). Therefore, a negative relationship is expected.

Management efficiency is measured by efficiency ratio proxy by cost to income ratio. It is usually difficult to measure the quality of bank management. However, management efficiency is critical to the going concern of a bank (Boateng, 2019). As a result, the more efficient a bank is the higher its resilience (Sahut & Mili, 2011). Therefore, a low cost to income ratio indicates better management efficiency in controlling operating expenses (Chiaramonte & Casu, 2017; Gunsel, 2007). A higher cost to income ratio will increase the probability of bank distress, in other words, reduce bank resilience.

Earnings is the most important performance measurement required for bank survival and growth (Geroski & Jacquemin, 1988; Gunsel, 2007). It indicates banks' ability to generate appropriate returns to expand, pay dividend to shareholders, retain competitiveness, and increase capital through retained earnings (Boateng, 2019). Earning measures in banks include return on assets (ROA), return on equity (ROE), and net interest margin (NIM). The higher the bank earnings, the lower the probability of bank distress. Therefore, earnings are expected to negatively correlate with bank distress, but a positive relationship with resilience is expected.

Liquidity is the ability of a bank to meet unexpected demand from depositors and borrowers (Boateng, 2019). Liquidity is measured by loan to deposit ratio and loan_growth (Sahut & Mili, 2011). A high liquidity ratio can either positively or negatively impact the resilience of banks. A higher loan to deposit ratio can boost depositors' confidence in a safe bank on the one hand. On the other hand, a higher loan to deposit ratio may reduce the ability of a bank to meet the claims of depositors and signal that the bank is in distress (Gunsel, 2007; Sahut & Mili, 2011). A higher loan_growth increases the risk of banks, which can increase the probability of bank distress, but a higher loan_growth can also increase the profitability of banks, in which higher profits increase a bank buffers against distress (Gunsel, 2007). Therefore, the impact of loan_growth on resilience is not certain.

Sensitivity to market risk, also referred to as interest rate risk, is measured by net interest income to total income (netintinc). It measures how resilient the bank assets are to changes in market conditions such as interest rates, exchange rates, commodity prices, and equity prices can affect banks' earnings, which can affect the resilience of banks (Boateng, 2019). A negative relationship is expected between sensitivity to market risk and the probability of bank distress (Kasse-Kengne, 2018; Munir et al., 2017; Sahut & Mili, 2011).

6.4.3.2 Modelling the determinants capital adequacy on bank resilience: Z-score

The aim of Basel IV higher CAR is to further improve the resilience of banks. This section explains the use Z-score to achieve the chapter objective. In line with Hossain et al. (2018), the chapter examine the resilience of banks using regression model 6.5.

$$Z-score_{it} = \beta_1 + \beta_2 Lev_{it} + \beta_3 Cap_{it} + \beta_4 Bankspe_{it} + \varphi' macroec_t + \acute{\theta} Year_i + \epsilon_{it} \tag{6.5}$$

Where $Z-score$ is

$$Z-score = \frac{CAP+\mu ROA}{sd(ROA)} \tag{6.6}$$

Where CAP Basel IV capital ratio. μROA is the mean of return of asset, and $sd(ROA)$ is the standard deviation on ROA. Banks with high Z-score are considered to be more stable and resilient (Hossain et al., 2018). Capital ratios are part of the Z-score calculation. In addition, following that this chapter compares the resilience of banks with changes in Basel CAR, three Z-score models are generated for different Basel levels Basel II, III, and IV. Zscore2 represents Z-score calculated using Basel II CAR. While Zscore3 represents Z-score calculated using Basel III CAR. Then Zscore4 represents Z-score using simulated Basel IV CAR. Since the Basel IV capital ratio is not yet implemented, but the chapter examines its potential impact on resilience, Zscore4 is calculated using historical bank data. Also, Zscore4 represents the hypothetical Z-score calculated using Basel IV CAR in line with studies such as (Giordana & Schumacher, 2017). Subsequently, the result of Z-score4 will be compared to Zscore2 and Zscore3 to provide whether Basel IV will improve the resilience of banks in Africa.

Table 6. 1: Definition of variables in equation 6.5

Variable	**Definition**	**Formula**	**Expected sign**
$\mathrm{Z-score}$	Resilience	Cap+roa/sd(roa)	Dependent variable
Lev	Non-risk leverage	Tier1/avg-assets	Negative
Cap	Basel IV capital ratios	Tangible common equity/RWA	Positive
$\mathrm{Bankspe}$ size	Bank size	Quintiles of total assets	Positive
$\mathrm{Bankspe}$ Loan ratio	Loan-Deposit	Loan/Deposit	Negative
$\mathrm{Bankspe}$ Nplta	Non-performing loan		Negative
$\mathrm{macroec}$ Repo_rate	Govt interest rate to banks		Negative
$\mathrm{macroec}$ Inflation	Inflation rate		Negative
$\mathrm{macroec}$ Gdpgrowth	Real Gdpgrowth	Gdpgrowth rate	Negative

After the calculation of the three zscores2, zscores3, and zscores4, the Z-score are logged using [Ln(1+Z-score)]. Adesina and Mwamba (2016); Laeven and Levine (2009) advocated for using log of the Z-score over the use of simple Z-score based on the latter is heavily skewed, and the former is not. Lepetit and Strobel (2015) state that simple Z-score are meaningfully defined on the interval [0, ∞], limiting estimation techniques that can be used when the simple Z-score is used as a dependent variable. The log of Z-score is meaningfully defined on the interval [-∞, ∞], that is, outliers have been removed, thus making it unproblematic in standard regression analysis (Lepetit & Strobel, 2015). The chapter expects that higher CAR increases the resilience of banks.

Lev ratio- apart from the changes in Basel CAR, the introduction of non-risk weighted leverage ratio in Basel III and further increase of leverage ratio in Basel IV for G-SIBs target different sources of risk according to Giordana and Schumacher (2017) by preventing banks from build-up of leverage in the balance sheet. The leverage ratio is included to see the potential impact of Basel III and IV regulations on resilience. The leverage ratio is countercyclical for inverse of capital ratio. According to Brei and

Gambacorta (2014), leverage ratio is counter-cyclical while capital ratio is cyclical. In boom times the leverage ratio constrains the banks from taking excessive risk, thereby forcing them to maintain adequate capital or curb lending. The impact of leverage on resilience will depend on the level of bank capital. If a bank have a high leverage ratio, this can suggest that the capital level is low and can contribute to a bank distress.

$Bankspe_{it}$- include: size. Bank size is expected to increase the resilience of banks. Large banks are expected to be more diversified and have economies of scale advantage, which reduces the risk of default and improves resilience (Tanda, 2015). Liquidity ratio is proxied using loan_deposit ratio. A high loan_deposit ratio implies that bank is exposed to high liquidity risk (Hossain et al., 2018). Basel III and Basel IV accord introduce liquidity coverage ratio (LCR) and net stable funding ratio (NSFR) for liquidity risk. To calculate LCR and NSFR, the chapter need access to banks detailed information on high-quality liquid assets. In addition, a large majority of the African banking system in compliance to Basel III CAR are yet to implement the liquidity rules compared to the US and EU (Chiaramonte & Casu, 2017). As a result, there is unavailability of data for African banks to calculate LCR and NSFR. Therefore, liquidity risk will be proxied using loan/deposit ratio and non-performing loan/total assets in line with Adesina and Mwamba (2016). Credit risk transfer- proxy by Nplta- is the ratio of non-performing asset/Total assets. For improved resilience, the chapter expects liquidity risk to negatively impact resilience. The chapter control for macroeconomic variables that are likely to affect the resilience of banks. Macroeconomic variables ($macroec_t$) include Gdpgrowth, inflation and interest rate proxy by Repo rate according to Chiaramonte and Casu (2017); Sahut and Mili (2011). The chapter expect a negative relationship on resilience of banks in Africa. This chapter employs fixed effects and random effects estimation techniques to examine the impact of capital adequacy on resilience of commercial banks in Africa in line with Hossain et al. (2018) for equation 6.6. In addition, Hausman test is used for specification test to select between FE or RE. PMG, MG and DFE under Panel ARDL could not be applied as the dataset for the Z-score became smaller for this estimation technique to run.

6.5 Results and Discussion on Basel CAR and bank resilience

Having explained, in the previous section, the nature of data, sample size, the estimation model, the chapter variables, the estimation techniques to analyse the data, and the justification for choosing the estimation techniques. This session presents the descriptive statistics of the chapter key variables, the logistic regression for CAMELS and fixed and random regression for Z-score model. Lastly, the interpretation and the discussion of the results are presented.

6.5.1 Descriptive statistics for Basel CAR and bank resilience

6.5.1.1 Descriptive statistics: CAMELS analysis

Table 6.2 below reports summary statistics for CAMELS variables. Table 6.2 examine whether compliance to Basel capital increases the resilience of African banks using CAMELS indicators. The commercial banks are grouped into Non-Basel compliance and Basel compliance banks. The sample of banks covers 13 African countries for the period 2000-2018. The column labeled Non-Basel compliance banks include banks that are yet to adopt either Basel II or III. The column labelled Basel compliance includes banks that have adopted Basel II or Basel III. For example, South African banks in 2008 implemented Basel II CAR and in 2013, implemented Basel III CAR. South African banks will fall under Basel compliance but will take the value of zero in the years before the adoption of Basel II CAR. Results in Table 6.2 suggest that compliance with Basel CAR increased the resilience of the banks. The average minimum capital represented by equity to total asset ratio (ETA) increased from 0.180 to 5.130. The maximum ETA of 23.896 compared to ETA of 785.98 suggests that higher capital increased the total assets of the African banks that implemented Basel CAR. Asset quality improved when banks complied with Basel CAR. Nplta declined by 11.3 percent when African banks implemented Basel capital. This suggest implementation of Basel higher capital requirement tend to increase the asset quality of banks.

Table 6. 2: Summary of CAMELS for African Banks Resilience

Variable								
		Non-BaselCompliance Banks			Basel Compliance			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
ETA	14.942	45.054	0.180	785.984	12.356	3.894	5.130	23.896
Nplta	3.724	5.529	0.029	48.526	3.301	3.215	0.033	25.051
loan_growth	28.492	62.767	-89.955	640.049	9.659	30.715	-50.525	168.692
cost_income	61.143	21.816	-167.844	242.034	60.746	15.665	22.288	141.561
loan_deposit	84.130	46.090	7.939	574.305	101.073	51.661	29.692	300.753
netintinc	5.919	7.420	0.349	77.417	5.368	2.877	1.931	16.726
NIM	29.304	14.770	-42.964	92.306	28.098	12.612	-33.778	78.415
ROE	22.838	15.273	-76.001	92.900	18.513	8.568	-21.100	46.360
ROA	2.906	3.936	-4.811	41.002	2.423	1.483	-1.300	7.900

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

Management efficiency is yet to improve since the cost to income ratio is still high for banks that comply with Basel CAR. Although there is an average decline of 0.6 percent, the high operating cost may be as a result of the environments the African banks operate in. The results show that African banks are still challenged with efficient management staff.

Basel compliance banks have higher liquidity, as shown from loan_deposit ratio. Both loan and deposit of banks increased but the increase in loan_deposit ratio did not increase loan_growth. Firstly, the compliance to Basel CAR increases a bank's discipline that avoids careless lending that may contribute to increase in non-performing loans. Secondly, compliance limits banks from lending so much with little capital. These reasons may have slowed down loan growth even though loan volume increased. The earnings of banks that are Basel compliance on the average decreased. NIM, ROE and ROA decreased on the average by 4.1 percent, 18.9 percent, and 16.6 percent, respectively. Generating income, the banks were slightly affected for NIM, but the decline in ROE and ROA have more to do with strategic management decisions of the banks to use higher capital to generate more returns on equity and assets of the banks. The management efficiency of banks in Africa needs more competency in order to use higher capital to generate higher earnings within the regulatory best practices. For sensitivity, netintinc of banks declined by 9.3 percent when banks complied with Basel CAR. This shows that the earnings of banks declined with compliance to Basel CAR suggesting that the banks became sensitive to interest rate environment and market factors. Alternatively, banks take effective decisions before engaging in market activities when banks comply with Basel regulations, as a result, declined the netintinc.

6.5.1.2 Descriptive statistics: Z-score model

Table 6.3 and Table 6.4 presents the summary statistics of three Z-scores under the three different Basel capital ratios, Basel II, III, and IV. The three Z-scores enable the study to examine how the Z-score would potentially evolve when the sampled African banks adhere to different Basel capital ratios, according to Giordana and Schumacher (2017). Z-score2 represent Z-score calculated using Basel II CAR. Z-score3 represents z-score calculated using Basel III CAR and then Z-score4 using Basel IV CAR. The higher the Z-score ratio away from zero, the better the bank resilience, and the farther away such banks are from bankruptcy (Chalermchatvichien et al., 2014). There is a Z-score benchmark to classify banks into stable, caution, or distressed. Z-score of <1.81 represents a bank in distress while between 1.81 and 2.99 represents the “caution zone”. A Z-score of over 3 represents a bank with safe balance sheet (Chiaramonte & Casu, 2017).

Table 6.3 presents the summary statistics of the dependent variables without and with log form. z-score2, z-score3 and z-score4 are the log form using [Ln(1+Z-score)] for the purpose of regression analysis. On the average, the result of the pooled data shows that African banks in compliance to Basel II CAR are on the average relatively in the caution zone as the Z-score2 average is 2.62. Notwithstanding, higher CAR increased the z-score rating from 2.62 in Basel II to 5.8 in Basel III and further to 6.3 in Basel IV. Moving from

Basel II to Basel III, the resilience of banks in Africa moved from caution zone to stable zone.

Table 6. 3: Z-score descriptive statistics

stats	Z-score2	Z-score3	Z-score4	Log of Z-score	z-score2	z-score3	z-score4
mean	2.6250	5.8317	6.2790		0.8620	0.8895	0.9312
N	449	477	589		449	477	591
min	0.4546	1.2925	0.8239		0.6341	0.5542	0.4752
max	11.6918	22.3009	89.7891		1.1413	1.2709	1.6711
range	11.2372	21.0083	88.9651		0.5071	0.7167	1.1961
sd	2.5440	2.1275	6.4284		0.0768	0.0863	0.1522
variance	6.4718	4.5262	41.3245		0.0059	0.0074	0.0232
skewness	0.767	2.1738	8.6691		0.557	0.2154	0.481

Source: Author’s calculation based on data obtained from Bloomberg databases (2019)

Table 6.4 presents the summary statistics of three Z-scores for capital ratios, Basel II, III and IV for individual African countries represented in the sample. The table results show that banks from Botswana, Egypt, and Namibia have Z-score2 of <1.81. The Z-score average values show that bank distress occurred relatively frequently from these countries. While Ghana, Kenya South Africa, and Tanzania have mean Z-score2 less than 2.99 representing a caution zone. Morocco, Uganda, Nigeria and Zimbabwe have Z-score2 of above 3 represents that the banks are more stable and on the safe zone under Basel II. The resilience of all the banks in the sample increased under Z-score3 with a slight increase in resilience under Z-score4. However, Morocco is still on the cautious zone in Z-score4 model, the size of the banks in terms of total assets may be a reason for the low Z-score performance according to Altman et al. (2017). The improvement in the Z-score from Basel III upward can be explained by higher CAR according to Giordana and Schumacher (2017).

Table 6. 4: Summary statistics: Z-score mean by categories of country

country	Z-score2	Z-score3	Z-score4
Botswana	0.718	5.343	5.392
Egypt	0.627	6.008	4.268
Ghana	2.080	6.147	8.537
Kenya	2.869	6.044	6.333
Mauritius	.	4.716	6.019
Morocco	3.133	2.823	2.140
Namibia	0.479	5.432	5.567
Nigeria	4.413	6.655	7.171
South Africa	2.265	5.052	6.570
Swaziland	.	5.687	6.676
Tanzania	2.698	6.122	5.489
Uganda	4.927	6.005	7.701
Zimbabwe	4.388	8.882	8.245
Total	2.625	5.832	6.279

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

6.5.1.3 Specification test for Basel CAR and bank resilience

. Robustness test for Basel CAR and bank resilience

Robustness checks were performed using ordinary least square regression to estimate equation 6.5 to examine the consistency of the results on the impact of Basel capital ratios on resilience of banks in Africa. The results is presented in Table 6.8. The Basel capital ratios remain positive and significant on Z-score at 1 percent significant level across the three Basel models. Overall, the OLS results remain similar and consistent with the fixed-effect model in Table 6.7.

. Hausman test for Basel CAR and bank resilience

The Hausman test was carried out to select the appropriate model to estimate equation 6.5 between random (RE) and fixed effect (FE) models. Ho: RE is preferred HI**:** FE is preferred. The Hausman test selected RE for Basel 2 and Basel 3 model. At the same time, FE model was chosen for Basel 4 model. The chapter selected FE model to interpret the result for equation 6.5. Nevertheless, the result for RE is also presented in the Table 6.8

Hausman test for FE and RE effect

Hausman test	**Basel II**	**Basel III**	**Basel IV**
	p-value=0.5238	p-value=0.0000	p-value=0.0000
Decision	Fail to reject Ho	Reject Ho	Reject Ho

6.5.2 Regression Analysis: Z-Score and CAMELS Results

The descriptive statistics show some patterns such as capital adequacy, asset quality, and loan_deposit ratio improved with Basel compliance. However, earnings, management efficiency, loan_growth, and sensitivity declined for Basel compliance banks. Z-score also increased with higher Basel level. Nevertheless, further analysis is required as the descriptive analysis is not sufficient to examine whether compliance to Basel capital increase the resilience of African banks. This section presents the results obtained using the estimation techniques for equation 6.2 and equation 6.5.

6.5.2.1 Logistic regression results: CAMELS

The logistic regression results are presented in Table 6.5. The dependent variable is a binary outcome. Where 1 represents banks that are non-compliance with at least Basel

II and 0 otherwise. 0 represents banks that comply with either Basel II and/or Basel III CAR. The CAMELS variables are not logged as the odd ratios become difficult to interpret.

Table 6. 5: Results for Logistic regression

	Basel compliance
ETA	-0.132*
	(0.068)
Nplta	0.026
	(0.045)
loan_growth	-0.002
	(0.006)
cost_income	-0.006
	(0.022)
loan_deposit	0.012***
	(0.004)
Netintinc	-0.001
	(0.105)
ROE	-0.038
	(0.036)
ROA	0.502**
	(0.238)
NIM	-0.045
	(0.036)
Gdpgrowth	-0.119
	(0.075)
Reporate	0.098**
	(0.039)
Inflation	0.066*
	(0.034)
_cons	1.801
	(2.518)
N	389
Year effects	Yes

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

*The dependent variable is the non-Basel compliance and Basel compliance banks that takes value of 1 when a bank is non-Basel compliance in time t and 0 when a bank is compliance to Basel II and/or Basel III CAR. Odd ratio are presented. Standard errors are in parentheses. The superscripts * denotes coefficients *p<0.1, ** p<0.05, *** p<0.001, respectively, and positive and negative signs on odd ratios represents signs for coefficients.*

The section runs the estimation model 6.2 to examine the impact of compliance to Basel capital ratios on bank resilience using CAMELS and macroeconomic variables. ETA is a significant determinant of bank resilience in Africa at 10 percent significance level. The odds of higher equity capital among non-Basel compliant banks are 13.2 percent less than the corresponding odds for banks that are Basel compliant. This suggests that the odds of resilience for non-Basel compliant banks decrease by 13.2 percent. The negative relationship confirms that lack of Basel compliance reduces the resilience of banks. The result is consistent with the empirical findings of Bui et al. (2017); Chiaramonte and Casu (2017) show that increases in CAR play a role in reducing the probability of failure. For asset quality, Nplta is not a significant determinant of the resilience of commercial banks in Africa. This is inconsistent with Chiaramonte and Casu (2017) findings indicate that Nplta is a significant determinant of bank failure and distress in Europe. Their study findings suggest that an increase in Nplta increases bank distress. Nevertheless, the findings in Table 6.5 indicate that the odds of Nplta among non-Basel compliant banks is 2.6 percent times the corresponding odds for African banks that are Basel compliance. The result suggests that compliance with Basel CAR will reduce the non-performing loans.

Liquidity is expected to have a positive or negative impact. Loan_growth is not a significant determinant to explain the resilience of banks in Africa. The odds of loan_growth among non-Basel compliant banks are 0.2 percent times less the corresponding odds for loan growth among African banks that are Basel compliant. Still on liquidity, the odds of high loan_deposit ratio are 1.2 percent times the corresponding odds for African banks that are Basel compliant. Loan_deposit is positive and significant at 1 percent significance level. A higher loan_deposit reduces the liquidity of banks, thus increasing the bank runs which increases the probability of bank distress and reduces the resilience of non-Basel compliance banks. The result is consistent with Sahut and Mili (2011) that high loan_deposit ratio has a positive relationship on the probability of bank distress for banks in MENA countries. That high loan_deposit ratio makes the banks less able to withstand unexpected deposit withdrawals. For management efficiency, cost to income ratio is not a significant determinant of resilience. The odd of cost to income ratio are 0.2 percent less the corresponding odds for banks that are Basel compliant. The result is consistent with Chiaramonte and Casu (2017) that find that cost to income ratio is insignificant in determining banks' resilience in Europe.

For earnings, ROE is not a significant determinant of resilience. The odds of return on equity are 3.8 percent less than the corresponding odds for banks that are Basel compliance. This suggests that banks that are Basel compliant have higher ROE than non-Basel compliance banks. ROA has a positive and significant at 5 percent significance level. The odds of return on asset are 50.2 percent times the corresponding odds for banks that are Basel compliance. This suggests that non-Basel compliant banks generate more returns on assets than banks that are Basel compliant. NIM has no significant impact on resilience. The odds of higher net interest margin for non-Basel compliant banks is 4.5 percent less than the corresponding Basel compliant banks. In terms of earnings, the result suggests that the implementation of Basel CAR increases the income generating ability of banks in terms of NIM, which also increases ROE and affects ROA. In addition, observations from the Tier1 capital ratios in the sample, many African banks have equity capital disproportionate to the level of risk undertaken. As a result, equity capital is not efficiently utilised to generate adequate returns on assets.

Sensitivity risk results shows a negative and insignificant relationship on bank distress. A negative relationship was expected to increase the resilience of banks. This suggests that the higher the net interest income, the lower the probability of bank distress, and the higher the banks' resilience. The result is consistent with Sahut and Mili (2011) findings that net interest income has no significant impact on resilience for MENA countries. The odds of sensitivity risk is 0.1 percent less than the corresponding odds for Basel compliant banks. African banks operate traditional banking model of deposit-loan model, less market activities such as obtaining financing from capital markets; as a result, sensitivity risk may be low. With new Basel III and IV CAR, the traditional banking model for African banks can change to the capital model of those obtained in the developed countries where liquidity are sourced from capital markets using instruments such as securitisation.

Macroeconomic variables-Gdpgrowth is not a significant determinant. However, the odds of the impact of Gdpgrowth is 11.9 percent less than the corresponding odds for Basel compliant banks. The result suggests that African banks that are non-Basel compliant, during economic boom, such banks are limited to take advantage of revenue opportunities compared with banks that are Basel compliant. Reporate is 9.8 percent times the corresponding odd for Basel compliant banks. Inflation is 6.6 percent times the corresponding odds for Basel compliant banks.

For macroeconomic variables, according to Chiaramonte and Casu (2017) a high Gdpgrowth and a negative inflation rate is expected to signal a more stable macroeconomic environment to relatively reduce bank distress. The results show that the inflation rate has a positive and significant impact on bank distress, consistent with Chiaramonte and Casu (2017). Therefore, the result indicates that banks in Africa operate in volatile and unstable macroeconomic environments, affecting banks' resilience. For Reporate, according to Sahut and Mili (2011), a positive relationship is expected to signal that in a worsening economic environment, the higher the non-performing loans, the higher banks need to borrow funds to write-off the bad loans, which in turn increases the distress of banks. The results in table 6.5 show that Reporate has a positive and significant impact on bank distress. This suggests that non-Basel compliance banks in Africa are affected by macroeconomic variables compared to Basel compliant banks.

In summary, ETA, loan_deposit, ROA, Reporate, and inflation are important determinants for the resilience of banks in Africa. Nplta, loan_growth, cost_income, netintinc, roe, nim and Gdpgrowth have an insignificant impact. According to Nurazi and Evans (2005), banks should focus on the variables to increase the resilience of banks. Banks that are non-Basel compliant had ETA less than banks that are Basel compliant. As a result, such banks are limited for revenue opportunities to support economic growth as shown with negative Gdpgrowth and will have more bank runs than Basel compliant banks during worsening economic conditions as shown with the Reporate. Compliance to higher Basel CAR will increase the resilience of commercial banks in Africa.

6.5.2.2 Regression results: Z-score

This session presents the regression analysis results for Z-score model for equation 6.5. The chapter first presents the spearman rank correlation in Table 6.6 to check for the correlation pattern among the variables in equation 6.5 according to Adesina and Mwamba (2016); Chiaramonte and Casu (2017); Hossain et al. (2018). Table 6.7 presents the regression results using fixed and random effects. Thereafter, the chapter presents the interpretation of the regression analysis. The spearman rank correlation in Table 6.6 shows that Z-score variables have a strong and moderate correlation with other independent variables. Loan to deposit ratio has a significant and negative correlation with Z-scores (dependent variables) and Basel capital ratios. ROE is negatively correlated with z-score2, although not significant.

ROE became significantly and positively correlated with z-score3 and z-score4 under Basel III and IV capital regime. Nplta has a weak correlation with z-score4. BIIcap, BIIIcap, and BIVcap are positively correlated and statistically significant with the z-scores (dependent variable). According to Chalermchatvichien et al. (2014), the spearman rank correlation matrix results have to be interpreted with caution as they do not take into account several factors that can influence banks' resilience.

Table 6. 6**:** Spearman Rank Correlation for Basel CAR and bank resilience

	z-score2	**z-score3**	**z-score4**	**ROE**	**BIIcap**	**BIIIcap**	**BIVcap**	**leverage**	**loandp**	**Nplta**	**Gdpgrowth**	**inflation**	**Reporate**
z-score2	1.000												
z-score3	0.682***	1.000											
z-score4	0.637***	0.716***	1.000										
ROE	-0.024	0.106**	0.214***	1.000									
BIIcap	1.000***	0.682***	0.637***	-0.024	1.000								
BIIIcap	0.682***	1.000***	0.716***	0.106**	0.682***	1.000							
BIVcap	0.634***	0.732***	0.955***	0.197***	0.634***	0.732***	1.000						
leverage	0.752***	0.582***	0.635***	-0.065	0.752***	0.582***	0.627***	1.000					
loandp	-0.225***	-0.265***	-0.473***	-0.225***	-0.265***	-0.439***	-0.001	1.000					
Nplta	0.196***	0.164***	0.007	-0.296***	0.196***	0.164***	0.027	0.148***	0.109*	1.000			
Gdpgrowth	0.151***	0.092*	0.220***	0.249***	0.151***	0.092*	0.208***	0.118***	-0.333***	-0.045	1.000		
inflation	0.143***	0.168***	0.170***	0.097*	0.143***	0.168***	0.139***	0.137***	-0.301***	0.084*	0.155***	1.000	
Reporate	0.202	0.113	0.331	0.080	0.202	0.113	0.302	0.176	-0.322	-0.094	0.172	-0.172	1.000

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

The chapter went a step further to examine the impact of Basel capital requirements and on the resilience of commercial banks in Africa using Z-score as a measure of resilience in a panel regression. The regression results for equation 6.5 estimated using random effects (RE), and fixed effects (FE) models. The Hausman test was carried out test the efficiency and consistency between the FE and RE estimators. The RE and FE results are similar on the impact of Basel capital requirements on resilience of banks. The FE results are presented in Table 6.7. The RE regression results is reported in the Table 6.8.

Table 6. 7: The impact of Basel CAR on resilience: Z-score (FE result)

	Basel 2	**Basel 3**	**Basel 4**
	Zscore	Zscore	Zscore
BIIcap	0.243***		
	(0.001)		
BIIIcap		0.249***	
		(0.001)	
BIVcap			0.244***
			(0.002)
_Isize_2	-0.002**	-0.002**	-0.004**
	(0.001)	(0.001)	(0.002)
_Isize_3	-0.003***	-0.003***	-0.004*
	(0.001)	(0.001)	(0.002)
_Isize_4	-0.002	-0.003**	-0.005*
	(0.002)	(0.001)	(0.003)
_Isize_5	-0.001	0.000	-0.003
	(0.002)	(0.002)	(0.004)
leverage	-0.001	-0.002*	0.000
	(0.001)	(0.001)	(0.002)
loandp	-0.002**	-0.002**	0.003
	(0.001)	(0.001)	(0.002)
Nplta	0.000**	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Gdpgrowth	0.000	0.000	0.000
	(0.000)	(0.000)	(0.001)
inflat	0.000	-0.002***	-0.002
	(0.001)	(0.001)	(0.001)
Reporate	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
_cons	0.230***	0.216***	0.217***
	(0.005)	(0.005)	(0.011)
N	429	452	455
R-squared	0.9963	0.9968	0.9932

*Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001*

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

Table 6. 8: The impact of Basel CAR on resilience: Z-score (RE and OLS result)

Random effects				**OLS**			
	Basel 2 Zscore	Basel 3 Zscore	Basel 4 Zscore		Basel 2 Zscore	Basel 3 Zscore	Basel 4 Zscore
BIIcap	0.243***			BIIcap	0.245***		
	(0.001)				(0.001)		
BIIIcap		0.249***		BIIIcap		0.250***	
		(0.001)				(0.001)	
BIVcap			0.242***	BIVcap			0.238***
			(0.002)				(0.002)
_Isize_2	-0.002**	-0.002***	-0.004**	_Isize_2	-0.002***	-0.004***	-0.007***
	(0.001)	(0.001)	(0.002)		(0.001)	(0.001)	(0.002)
_Isize_3	-0.003***	-0.003***	-0.003	_Isize_3	-0.002***	-0.004***	-0.004**
	(0.001)	(0.001)	(0.002)		(0.001)	(0.001)	(0.002)
_Isize_4	-0.002	-0.002*	-0.004*	_Isize_4	-0.002***	-0.002***	-0.004*
	(0.001)	(0.001)	(0.003)		(0.001)	(0.001)	(0.002)
_Isize_5	-0.001	0.000	0.000	_Isize_5	-0.002**	-0.002*	-0.005**
	(0.001)	(0.001)	(0.003)		(0.001)	(0.001)	(0.003)
leverage	0.000	-0.002**	-0.001	leverage	-0.001	-0.002***	-0.005***
	(0.001)	(0.001)	(0.002)		(0.001)	(0.001)	(0.002)
loandp	-0.001	-0.001	0.005**	loandp	0.002***	0.003***	0.015***
	(0.001)	(0.001)	(0.002)		(0.001)	(0.001)	(0.002)
Nplta	0.000***	0.000***	0.000***	Nplta	0.000***	0.000***	0.001***
	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
Gdpgrowth	0.000	0.000	0.000	Gdpgrowth	0.000	0.000	0.001
	(0.000)	(0.000)	(0.001)		(0.000)	(0.000)	(0.001)
inflat	0.000	-0.001**	-0.001	inflat	0.000	0.000	0.005***
	(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Reporate	0.000	0.000	0.000	repo_rate	0.000	0.000	0.000*
	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
_cons	0.228***	0.213***	0.221***	_cons	0.220***	0.207***	0.222***
	(0.005)	(0.005)	(0.011)		(0.005)	(0.006)	(0.015)
N	429	452	455	N	429	452	455
R-squared	0.9962	0.9967	0.9929	R-squared	0.9975	0.9976	0.9937

*Standard errors are in parentheses * p<0.1, ** p<0.05, *** p<0.001.*

Source: Author’s calculation based on data obtained from Bloomberg databases (2019)

The capital variables are increased according to Basel II, Basel III, and Basel IV requirements. This enables the chapter to examine how the changes in Basel capital requirements affect the resilience of banks in Africa. The results in Table 6.7, BIIcap, BIIIcap, and BIVcap are positive and significant at 1 percent. The result shows that an increase in capital from Basel II to Basel III, the Z-score (resilience) increased by 2.5 percent. The results show that an increase from BIIIcap to BIVcap led to a 2 percent decrease in the Z-score (resilience).

Nevertheless, the resilience of the banks under Basel 4 model is higher than Basel 2 model. The result suggests that higher capital requirements increase the resilience of banks in Africa. The results are consistent with Hossain et al. (2018) findings that higher capital requirements positively impact on banks' resilience. The result is also in line with Giordana and Schumacher (2017) and Adesina and Mwamba (2016). The chapter expected bank size to have a positive impact on resilience. The quintiles of size (Isize 2, 3, 4 & 5) were intended to capture the expectation that large banks have the ability to diversify, enjoy economies of scale, which reduce risk and increase resilience relative to smaller banks. Size has a negative and significant impact on resilience in Africa. Size has negative and significant impact on resilience in the second and third size quintiles under Basel 2, 3 and 4 model. Size is negative and significant in the fourth quintile under Basel 3 and 4 model. But insignificant in fifth quintiles across the three Basel levels. There was no significant impact of Isize5 (large banks) on resilience in Africa. But the negative and significant impact on Z-score models for small (Isize2) and medium (Isize3 & 4) banks suggests that size contributes to bank distress in Africa. The results are consistent with Chiaramonte and Casu (2017) findings that size is positively correlated with the probability of bank distress.

Leverage is not significant under Basel 2 and Basel 4 model. Leverage has a negative and significant impact on resilience under Basel 3 model. The results are inconsistent with Hossain et al. (2018) findings that leverage has a positive and significant relationship on Z-score in BRICS countries. However, leverage ratio was expected to be negative to act as a backstop to constrain banks from financing more loans against available capital

(Brei & Gambacorta, 2014; Psillaki & Georgoulea, 2016). Such that to finance more loans, banks will either increase capital buffers or leverage ratio increases. Loandp has a negative and significant impact on resilience under Basel 2 and Basel 3 model at the 5 percent level of significance. Loandp has no significant impact on resilience under Basel 4 model. The negative and significant impact for Basel 2 and 3 models suggest that less liquidity risk increases the resilience of banks in Africa and vice versa. A negative impact is expected for Nplta on resilience. However, Nplta have positive and significant relationship. The result suggests that an increase in non-performing loans increases the probability of bank distress in Africa. Macroeconomic effect, Gdpgrowth is not significant across the Basel levels. Inflation is negative and significant at 1 percent significance level under Basel 3 model. Reporate is not significant. In summary, the positive and significant impact of all the Basel capital ratios on Zscore show that banks with higher capital are able to absorb risk exposures.

6.5.3 Discussion of results for Basel CAR and bank resilience

The chapter's objective was to examine the impact of capital adequacy on the resilience of commercial banks in selected African countries. The objective was achieved using two risk measures for proxy of resilience. The first risk measure was CAMELS ratings defined as Capital adequacy, Asset quality, Management quality, Earnings, Liquidity, and Sensitivity risk. The aim was to examine whether compliance to Basel capital requirements impact the resilience of African banks using CAMELS indicators. The chapter employs Logistic regression because the dependent variable was a binary outcome to enable the chapter to examine whether compliance to Basel capital requirements impact the resilience of banks in Africa. The second risk measure uses Z-score model to examine the impact of changes in Basel capital requirements and other determinants on the resilience of banks in Africa.

The ETA results establish that lack of compliance to Basel capital requirements reduces the resilience of banks in Africa. Higher capital is relevant to absorb unexpected losses that could otherwise lead to bank failure. African banks are characterised by bank fragility and failures (Triki et al., 2017). In this context, the essential reason underlying Basel higher capital requirements is to reduce the probability of bank failure, an important factor in fostering bank stability and protecting the economy (BCBSa, 2017).The result is consistent with Adesina and Mwamba (2016); Chiaramonte and Casu (2017); Giordana and Schumacher (2017) that higher capital requirements increase the resilience of banks. The implication of these findings for African banks, banks that are not Basel compliant will not have adequate capital to cover for loan losses; such banks are limited in their operations to carry out investment activities. Moreover, capital inadequacy explains why many African banks only provide short-term loans. Banks in countries like Tanzania, Ghana, Kenya are lagging in compliance with Basel capital requirements. Thus, they are limited in provision of long-term loans such as residential and commercial mortgage loans. African countries such as South Africa, Mauritius, and Egypt with compliance to Basel II and III accords have good loan diversification for short, medium, and long-term loans. Also, their banking system is stable.

Furthermore, the results find that banks that are not Basel compliant are affected by liquidity, earnings, and macroeconomic factors than banks that are Basel compliant. The result shows that Basel compliant banks are more liquid, generate more net interest margin and returns on equity to shareholders. Thus, suggesting that compliance to higher capital requirements increases banks' earning capacity, which results in increased retained earnings and higher capital to protect against loan losses. Nevertheless, from the results, African banks that are Basel compliant have management efficiency still an issue. Also, the return on assets of Basel compliant banks in Africa was less and loan growth is low. However, Basel compliant banks tend to be less prone to macroeconomic factors. For policymakers and regulatory authorities, implementing higher capital requirements should complement credit policies to stimulate banks to lend more. Credit policies such as credit bureau for assessing borrowers' credit score, low-interest rate environment that reduces cost of loans and non-performing loans, securitisation laws to enable banks access liquidity through the marketing of their book loans, higher equity capital and stable macroeconomic environment should be addressed to promote resilience of banks in Africa.

Still on impact of higher capital on resilience for banks, the persistent positive impact of higher capital on Z-score for BIIcap, BIIIcap, and BIVcap, suggest that higher capital requirements increase the resilience of banks in Africa. Secondly, the comparison of the results across the three Basel levels shows that, there was a slight increase in bank resilience when banks move from BIIcap to BIIIcap. The percentage increased in resilience was 2.5 percent. Using the historical data to simulate Z-score4 as if banks had complied with Basel IV capital requirements, BIVcap will also increase the resilience of banks but at a declining rate. How will the introduction of a new Basel IV assist in improving banks' resilience in African countries? The implication of the findings is that the adoption of BIVcap has the same impact on resilience of African banks as under Basel 3 model. Based on the findings, it is suggested that bank regulators adopt the Basel IV accord for other reasons, such as eliminating the internal approach in calculating capital ratios, enhanced supervisory powers, and additional requirements for G-SIBs.

For leverage ratio, the negative results suggest that compliance to Basel III leverage ratio in addition to the capital ratio will contribute to increased resilience of African banks. Leverage ratio is counter-cyclical thereby forcing banks to maintain adequate capital or constrain risk (Brei & Gambacorta, 2014). The findings show that bank size contributes to fragility and distress in Africa. The total assets of African banks are low; thus, many African banks fall into small and medium-sized banks. Compliance to Basel higher capital requirements will increase the total assets of banks. Nigerian banks total assets increased with compliance to Basel II capital requirements, so also South Africa with compliance to Basel II and Basel III capital requirements.

For Basel compliant banks, the results suggest that African banks need to fund their liquidity risk to increase the resilience of the banks. At the current state, African banks have high loan to deposit ratio. Higher loan to deposit ratio increases the probability of bank distress and reduces resilience. Nevertheless, banks need to increase risk-taking for profitability. The introduction of LCR and NSFR in Basel III regulations from BCBS (2013) provides matching liquidity for banks to fund liquidity risk, which could reduce bank distress in addition to higher capital, which can be beneficial for the African banking system. Furthermore, Nplta contributes to the probability of bank distress in Africa. Most African countries adopt selective Basel compliance. For instance, the Basel II risk management principles that South Africa implemented alongside Basel II capital ratios contributed to a decline in non-performing loans. In summary, the positive and significant impact of all the Basel capital ratios on Zscore show that based on the African banks' characteristics and current historical data for the sample period of 2000 and 2018, it increases the banks' resilience and reduce the banking distress or failures.

6.6 Conclusion

The bank distress that requires government bail-out and recent bank failures in Africa as presented in the introduction of the chapter requires regulatory authorities to be driven to implement changes in Basel capital requirements to increase the resilience of banks yet many regulatory authorities in African countries are lagging in the compliance with changes in the Basel regulations citing that the requirements are not relevant for the African settings. However, regulatory authorities in African countries such as South Africa and Egypt continue to embrace changes in Basel capital requirements and have already implemented Basel III capital requirements. The probability of bank failure significantly reduced for South Africa banking sector since the introduction of Basel II and further Basel III. Despite the South African banks' exposure to securitisation risk that caused the 2008 financial crisis, the banks were unaffected due to the implementation of Basel II risk management principles. In addition, the aim of Basel III and IV regulations by the Basel committee is to improve the resilience of banks. For these reasons, the chapter examined the impact of capital adequacy on the resilience of banks in Africa using historical data from the period 2000-2018 and two risk measures as a proxy for resilience.

The empirical findings show a positive relationship between capital adequacy and resilience. These findings are consistent with the fact that banks whose capital ratio is low would tend to have distress, while higher capital requirements increase banks' resilience to prevent banking distress. The benefit for African banks to implement higher Basel levels is that it reduces the probability of bank failures and fosters bank stability and, more importantly, increases the capital adequacy of these banks to enable African banks to take on more risks to support growing African economies. For banks to take on more risk to support African growing economies, regulatory authorities and policymakers need to agree to implement changes in Basel capital requirements to eliminate moral hazard problems where banks operate with low capital buffers causing distress and failures that have negative consequences in the economy. Also, implementing higher Basel regulations empowers regulators' supervisory functions to adequately monitor banks like South African Reserve banks. Although BIVcap coefficient has a positive and significant impact on resilience, however, based on the result that change from Basel III to IV declined Z-score by 2.4 percent, it is recommended that banks in Africa should embrace the Basel IV capital requirements with caution.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

The Basel regulations originate from the uniformity of banking regulations initially from the G-10 countries, which has grown to become global international principles and standards used by regulatory authorities from many countries in the world. Nevertheless, many African banks are lagging in compliance with the changes in Basel CAR. African banks have the opportunity for revenue growth in a populous continent but are constrained due to capital inadequacy, non-performing loans, fear of lending, inadequate supervision, and fragility. The finalisation of Basel III in 2016, referred to as Basel IV accord, introduces a wider catalog of risk-weights for different risk exposures, simplicity, standardization, and comparability of banks capital ratios, to further increase the resilience of banks. Understanding the potential impact of Basel IV CAR on the performance, securitisation, lending, and resilience of banks in Africa is important since Basel higher CAR aims to lower the probability of bank failure, which may ultimately increase economic activities. At the same time, higher Basel CAR through common equity tends to be expensive for banks and can impact the performance of banks and the ability to lend. The aim of the study was to analyse the potential impact of Basel IV CAR on the performance and resilience of commercial banks in Africa. To achieve the objectives, the study simulated Basel IV capital ratio using historical data by creating sample representative banks as if the selected banks had implemented Basel IV CAR for the period 2000 and 2018.

7.2 Summary of key findings

Firstly, the study analysed the potential impact of Basel IV CAR on the performance of commercial banks in Africa in chapter 3. Findings from the random effect model show that Basel IV positively impact the performance of banks in Africa. The implication for African banks is that Basel IV CAR requires the restructuring of capital ratio calculation; therefore, if a bank successfully implements Basel III CAR, Basel IV will start to yield an increase in return on equity. Nevertheless, it is noted from the findings that changes in Basel CAR have more impact on the performance of banks using the return on assets and net interest margin compared to return on equity. The mixed results using different measures of performance may imply that African banks are not particular about generating higher returns to shareholders, the higher the equity capital. Or African banks do not use equity capital to achieve higher Basel CAR. The results suggest that the banks are more particular in asset management and efficiency than shareholders' wealth creation for banks in Africa. Furthermore, the findings of PMG show that Basel IV CAR has a negative effect on the performance of banks in the short run but a positive and significant impact in the long-run. The long-run positive impact for African banks may be due to the high-interest rate environment the banks operate in.

Secondly, the study analysed the impact of changes from Basel III to proposed Basel IV CAR on bank lending ability in Africa in chapter 4. Findings show that African banks engage in portfolio shifts to meet higher CAR. The findings suggest that African banks increase lending in loan categories such as consumer loans with low risk-weights and cutting back on lending to other loan categories such as corporate loans with high-risk weights or long-term loan like the residential mortgage and commercial mortgage to comply with existing Basel II and III higher CAR. In contrast, South African banks in compliance with Basel III CAR engage in portfolio shift by reducing total loans, consumer loans, and commercial loans. But increased lending to residential and commercial mortgage and credit-card loans. Basel IV wider risk-weights, it creates a disconnection between risk and capital, such that banks will attract quality borrowers rather than engage in portfolio shifts to achieve higher CAR. The findings of PMG showed that higher capital would have a negative impact on loan growth in the short run, but in the long run, higher capital will have a positive impact on loan growth. Other determinants have no significant impact on loan growth under Basel III and Basel IV. Non-performing loans reduced significantly with higher Basel levels. The implication of the result is that higher CAR may be costly for African banks in the short run but will improve bank decisions against poor lending. The result shows that Basel II, III, and IV's adoption has a positive and significant impact on bank lending in the long run.

Thirdly, the study analysed the potential impact of Basel IV CAR on securitisation activities of commercial banks in Africa in chapter 5. The findings show that Basel IV capital will have a positive and significant impact on securitisation activities of banks in Africa. Conversely, it was found that securitisation has no impact on the performance of securitizing banks. This could have been caused by the high cost of originating securitisation such as payment of interest to investors, issuance costs, rating agency, legal costs, and other related floatation costs, which may not increase the profits of originating banks. Securitisation may enhance the performance of banks through indirect channels. In conclusion, it is expected that higher CAR of Basel IV has a sizeable increase in securitisation activities, but the performance of securitising banks could increase in the long term with multiple securitisation activities from commercial banks in Africa.

Fourthly, the study analysed the impact of capital adequacy on the resilience of banks in Africa using two risk measures as a proxy for resilience in chapter 6. The findings show that higher capital increases the resilience of banks in Africa. The findings show that the Basel IV capital ratio has a positive impact on resilience but change from Basel III to IV show a 2.4 percent decline in Z-score. It is recommended that banks in Africa should embrace the Basel IV CAR with caution. In summary, the implementation of higher Basel CAR in an attempt to reduce banking failures and improves the resilience of banks affected the performance of banks negatively in the short run but, in the long run, improve bank performance. In addition, non-performing loans declined as banks transitioned from lower to higher Basel level. The study submits that the short-run results are closely related to static trade-off theory, that increase in capital above a set optimal capital level reduces the performance of banks as a result of cost constraints of issuing equity.

7.3 Achievement of the study objectives

The aim of the study was to examine the potential impact of Basel IV capital requirements on the performance and resilience of banks in Africa. To achieve this aim, multiple regression analyses, namely fixed effect, the System GMM, ANOVA, ARDL, and Logit regressions were utilized to conclude the objectives, the summary of the methodologies are as follows:

The first objective of the study analysed the potential impact of Basel IV CAR on the performance of commercial banks in Africa using random effect models and P-ARDL in chapter 3. Random effect was employed to examine Basel capital ratios, bank-specific and macro-economic impact on performance. In addition, the chapter employed P-ARDL (PMG, MG and DFE) model to capture the short-and long-run impacts of Basel CAR on the performance of banks in Africa. The justification for using P-ARDL model is that static panel estimations such as fixed and random effects estimations usually cannot distinguish between short-run and long-run impact of Basel CAR on performance

The second objective analyzed the impact of changes from Basel III to proposed Basel IV CAR on bank lending ability in Africa using ANOVA, System GMM and P-ARDL in chapter 4. The second objective was achieved in two steps. The first step examined whether the implementation of higher CAR leads African banks to shift their loan portfolio to less-riskier assets. ANOVA is used for comparison to establish whether existing Basel CAR constrains or improve bank lending to commercial loans, consumer loans, credit-card loans, residential mortgage, and commercial mortgage loans. ANOVA is employed over regression analysis because; firstly, ANOVA does not impose a linear assumption between the Basel capital ratio and the loan assets. Secondly, ANOVA allows for comparing these effects and how the effects differ on each loan asset category. The second step examined the impact of changes in Basel CAR and relevant determinants on bank lending in Africa using dynamic panel models. The dynamic panel models is required to capture the impact of higher CAR on bank lending because the lagged dependent variable is included as an explanatory variable. In a dynamic panel model, the use OLS, fixed and random effects estimation techniques become inconsistent estimators because of biases arising from the correlations between lagged dependent variable and the error terms and endogeneity issues. For these reasons, S-GMM was employed as the estimation technique because it produces reliable results in the presence of a lagged dependent variable. Furthermore, since S-GMM cannot separate short-and long-run impact, the study went a step further using Panel ARDL for this purpose.

The third objective analyzed the potential impact of Basel IV CAR on securitisation activities of commercial banks in Africa using fixed and random effects in chapter 5. The study employed fixed and random effect models for the reasons that securitisation is an endogenous variable. This means that banks do take decisions to take back securitised loans into their balance sheet. In addition, the success of past issuance of securitisation does not determine current or subsequent securitisation activities. Therefore, the objective was achieved using static regression models (fixed and random estimation techniques).

The fourth objective analyzed the impact of capital adequacy and other determinants on the resilience of banks in Africa using logistic regression and fixed-effect model estimation techniques in chapter 6. CAMELS rating and Z-score were employed as measures of resilience. The study employed logistic regression because the dependent variable is a binary outcome to compare the resilience of banks that are in compliance with higher Basel CAR against banks that are non-Basel compliant. For the purpose to determine whether compliance to Basel capital improves the resilience (CAMELS ratings) of commercial banks in Africa. The fourth objective was also achieved using fixed effect model to examine the impact of capital adequacy on resilience (Z-score) of commercial banks in Africa

7.4 Conclusions

The summary of the overall results shows that Basel IV CAR ha a positive and significant on the performance of the banks in Africa in the long run. Overall, the potential impact of Basel IV CAR on lending is satisfactory. The African banking sector needs tighter capital requirements for the more efficient and profitable banking sector capable of providing loans to companies and households. For securitisation, it will be beneficial for African countries to embrace the revised securitisation framework of 2016. It is expected to stimulate liquidity and mitigate credit risk through increased securitisation activities. Although, there is no evidence to support the effect of Basel IV implementation on the performance of securitising banks, a more detailed long-run analysis may provide different results. Consequently, future studies can employ more advanced forward-looking models to examine whether Basel IV can improve performance of securitising banks in the long run. The empirical findings show a positive relationship between capital adequacy and resilience. These findings are consistent with the fact that banks whose capital ratio is low would tend to have distress, while higher capital requirements increase banks' resilience to prevent banking distress. It would be beneficial for regulatory authorities in Africa to implement Basel IV CAR to increase these banks' resilience to support a growing African economy and reduce bank failure due to capital inadequacies. It is suggested that if Basel IV be implemented, regulatory authorities should allow banks to adopt the higher Basel levels over a medium-term period. This may reduce the negative impact of the regulatory requirements, especially on smaller banks. In conclusion, the study's findings reveal that Basel IV CAR will be beneficial to the African banks as it has a positive impact on the performance (return on equity, return on assets and net interest margin), lending, securitisation and resilience of the African banks. Basel IV CAR will also increase African banks' capital adequacy to enable these banks to take on more risks to support growing African economies. It is recommended that banks in Africa should embrace the Basel IV capital requirements with caution.

7.5 Policy Recommendations

The purpose of higher CAR is to reduce the probability of banking crises (BCBSa, 2017; Gavalas, 2015), which is prevalent in Africa. But it poses the question of what will be its effects on the performance, lending, securitisation, and resilience of banks especially for banks in Africa where lending is currently low and costly, with high net interest but poor performance. Basel IV is proposed to be implemented in 2022,[6] while most African banks lag behind in implementing existing Basel CAR. The findings provide insight for African banks and regulatory authorities as to the implementation of the proposed new Basel IV framework or not. To achieve higher Basel capital in Africa, bank regulators in African countries should implement the higher Basel standards over a medium-term period to allow banks to prepare to prevent any macroeconomic costs from loan reductions in the short term.

The benefit for African banks to implement higher Basel levels will reduce the probability of bank failures, non-performing loans, and foster bank stability. More importantly, it increases the capital adequacy of these banks to enable African banks to take on more risks to support growing African economies. For banks to take on more risk to support African growing economies, regulatory authorities and policymakers need to agree to implement higher Basel CAR to eliminate moral hazard problems where banks operate with low capital buffers causing distress and failures that negatively affect the economy. Also, implementing higher Basel regulations empowers regulators' supervisory functions to monitor banks like South African Reserve banks.

A clearer and simple securitisation approach for banks introduced by the 2016 revised securitisation framework is to re-establish securitisation activities within an adequately capitalized regulatory environment that can be a motivation for more banks to securitize. It will be beneficial for African banks to implement Basel IV CAR and the revised

[6] Revised to 2023 due to COVID I9(BCBS, 2020)

securitisation framework of 2016 to ensure further that the banks are adequately protected from securitisation exposures while increasing securitisation activities. In summary, it is expected that a higher CAR of Basel IV has a positive and significant impact on banks' performance in Africa in the long run. However, it is recommended that banks in Africa should embrace the Basel CAR with caution.

7.4 Limitation to the study

Basel IV CAR is still new and has not been implemented. The study simulates a new sample bank balance sheet with a focus on the effects of the risk-weighted asset of Basel IV on the performance of banks. Historical actual financial data of selected African banks are used to create Basel IV CAR under certain assumptions to examine the potential impact on the performance of banks in Africa. While this approach have been used in literature, future studies can employ more advanced forward-looking models to examine whether Basel IV can improve bank performance in the long run.

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APPENDICES

Appendix A: Additional tables

Appendix A 1: List of Banks from the African countries represented in the sample

Bank_name	Freq.	percent	Cum.
Absa Group Ltd	1	2.44	2.44
Access Bank Plc	1	2.44	4.88
Attijariwafa Bank	1	2.44	7.32
Barclays Bank of Botswana	1	2.44	9.76
Barclays Bank of Kenya Ltd	1	2.44	12.2
Capitec Bank Holdings Ltd	1	2.44	14.63
CBZ Holdings Ltd	1	2.44	17.07
CFC Stanbic Holdings Ltd	1	2.44	19.51
Co-operative Bank of Kenya l	1	2.44	21.95
Commercial international ban	1	2.44	24.39
CRDB Bank Plc	1	2.44	26.83
Diamond Trust Bank Kenya Ltd	1	2.44	29.27
Ecobank Ghana Ltd	1	2.44	31.71
Ecobank Transnational Inc	1	2.44	34.15
Equity Group Holdings Plc	1	2.44	36.59
FBN holdings Plc	1	2.44	39.02
FCMB group Plc	1	2.44	41.46
Fidelity bank Nigeria	1	2.44	43.9
First National bank Botswana	1	2.44	46.34
Firstrand Ltd	1	2.44	48.78
Firstrand Namibia ltd	1	2.44	51.22
Ghana Commercial Bank	1	2.44	53.66
Guaranty Trust Bank	1	2.44	56.1
Housing & Development Bank	1	2.44	58.54
Investec Ltd	1	2.44	60.98
KCB Group Ltd	1	2.44	63.41
MCB Group Ltd	1	2.44	65.85
National Bank of Kuwait	1	2.44	68.29
Nedbank Group Ltd	1	2.44	70.73
Nedbank Swaziland Ltd	1	2.44	73.17
NMB Bank Plc	1	2.44	75.61
Qatar National Bank	1	2.44	78.05
Stanbic Bank Uganda Ltd	1	2.44	80.49
Standard Bank Group Ltd	1	2.44	82.93

Standard Chart Bank Botswana	1	2.44	85.37
Standard Chartered Bank Ltd	1	2.44	87.8
Sterling Bank	1	2.44	90.24
Suez Canal Bank	1	2.44	92.68
Union National Bank- Egypt	1	2.44	95.12
United Bank for Africa Plc	1	2.44	97.56
Zenith Bank Plc	1	2.44	100
Total	41	100	

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

Appendix A 2: Quintiles of Bank total assets as at year 2018

Bank size			
Quintiles	Freq.	percent	Cum.
1	3	7.5	7.5
2	9	22.5	30
3	8	20	50
4	10	25	75
5	10	25	100
Total	40	100	

Source: Author's calculation based on data obtained from Bloomberg databases (2019)

Appendix C: Ethical Clearance

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

8 October 2020

Miss Damilola Tope Oyetade (213574014)
School Of Acc Economics&Fin
Westville

Dear Miss Damilola Tope Oyetade,

Protocol reference number: 00008748
Project title: The potential impact of Basel IV requirements on performance and resilience of commercial banks in Africa

Exemption from Ethics Review

In response to your application received on 3 October 2020, your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW.**

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

PLEASE NOTE:
Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours sincerely,

[redacted] 8 October 2020

Prof Josue Mbonigaba
Academic Leader Research
School Of Acc Economics&Fin

UKZN Research Ethics Office
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Website: http://research.ukzn.ac.za/Research-Ethics/

Appendix C: Ethical Clearance

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I take this opportunity of wishing you everything of the best with your study.

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Prof Josue Mbonigaba
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Apendix D: Language editing report

Linda Scott

Editing Services

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EDITING REPORT

TO:	**Damilola Oyetade; Prof. Paul-Francois Muzindutsi**
DATE:	**03 November 2020**
DOCUMENT TITLE:	**The potential impact of Basel IV requirements on performance and resilience of commercial banks in Africa**

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