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Competition, Regulation and Stability in Sub-Saharan Africa Commercial Banks

By

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Declaration

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Dedication

To the glory of God and to my wife, Angelina Oluwatosin Akande, who put her career on hold to see me through this.

Acknowledgements

Prior to embarking on this journey, I never knew that studying for a PhD is quite a huge project; I apparently had underestimated it. I say thank you Lord for seeing me through this long and painstaking journey. Many people and institutions have supported me on my PhD journey. And so, the journey will not be complete without some words of appreciation. The support of my family was overwhelming and may be difficult to quantify. Not only did they permit me to undertake the program, but also had to endure many hours of loneliness; above all, they ceaselessly supported me through prayers. To my wife and sons, I say thank you for the love, unparalleled support and encouragement.

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Unto the Lord be the glory, great things He has done!!!

Abstract

This study explored the relationship among competition, regulation and stability in the Sub-Saharan Africa region commercial banks. This was targeted at better banking sector management for economic growth at a time when the region is contending poverty and underdevelopment. We implemented this with three distinct objectives, namely; the competitive condition of SSA region commercial banks using Lerner index, the relationship between competition and stability applying Stochastic Frontier Analysis (SFA) and Generalised Method of Moments (GMM), and the interplay among competition, regulation and stability using Panel Structural Vector Autoregressive (P-SVAR) model and Structural Equation Modelling (SEM). The study covered a 10-year period from 2006 to 2015 for a panel of 440 banks; data were collected from 37 countries using Bankscope. We provide evidence consistent with a monopolistic competitive commercial banking market. We also found that competition is detrimental to the stability of banks in the region unless it engenders efficiency. In addition, evidence shows that variations in capital regulation among other regulatory variables employed, has the largest impact on the stability of the commercial banking sectors of the SSA region. While there is no short-term relationship found between capital and competition, results suggest that although stability responds instantaneously to competition, most of the impacts of competition on stability are transmitted via efficiency. Overall, the results show that regulation has a direct influence on competition and has direct and indirect influence on stability, while competition directly and indirectly influences stability. The study reveals that the direct influences are partially mediated by competition as all the paths permitted to be fitted by model fit criteria were found to be significant. Therefore, we conclude that, SSA banking sectors are competitive with strong structural relationship among competition, regulation and stability. Among others, we recommend policies that will sustain and improve the existing competition level while ensuring a balancing act as a decision affecting a variable in the structure will si-

multaneously impact on the others. We contribute to extant literature in the following ways; we estimated bank level competition with larger number of SSA countries; we identified some banks specific factors that determine competition in the banking sectors of the region; we highlighted major risks for consideration in stimulating the regions banking sectors' competition; we measured the extent of efficiency that is associated with competition using SFA and established a transmission from competition to stability through efficiency in the region's banking sectors. In addition, we addressed ways of managing competition, regulation and stability using short run analysis and proposed competition, regulation and stability (CRS) model, and pioneered the application of P-SVAR and SEM in this study area.

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List of Abbreviations

Acronym	Meaning
AIC	Akaike's Information Criterion
AMCON	Asset Management Company of Nigeria
AQLTY	Asset Quality
BCEAO	Central Bank of West African States
BoG	Bank of Ghana
BoM	Bank of Mauritius
BoN	Bank of Namibia
BEAC	Bank of Central African States
BoU	Bank of Uganda
BoZ	Bank of Zambia
BSL	Bank of Sierra Leone
CAR	Capital Adequacy Ratio
CEE	Central and Eastern Europe
CEMAC	Central Africa Economic and Monetary Community
CBE	Commercial Bank of Ethiopia
CBG	Central Bank of Gambia
CBK	Central Bank of Kenya
CBN	Central Bank of Nigeria
CBR	Central Bank Rate
CBS	Central Bank of Seychelles
CEOs	Chief Executive Officers
CFI	Comparative Fit Index
CRB	Credit Reference Bureau
COP	Corruption Perception

Accronym	Meaning
DCPS	Domestic Credit to Private Sector
DSE	Dar es Salaam Stock Exchange
EAC	East Africa Community
ECOWAS	Economic Community of West African States
ECR	Equity Capital Ratio
EU	European Union
FDI	Foreign Direct Investment
FPE	Final Prediction Error
FSDP	Financial Sector Development Plan
GBCs	Global Business Companies
GCR	Global Competitiveness Report
GDP	Gross Domestic Product
GDPG	Gross Domestic Product Annual Growth
GIMAC	Central Africa Cashless Interbank Group
GMM	Generalised Method of Moments
IDPs	Internally Displaced Persons
HQIC	Hannan and Quinn Information Criterion
IRS	Interest Rate Spread
LNG	Liquefied Natural Gas
MIFs	Microfinance Institutions
NBDTFIs	Non-Bank Deposits Taking Financial Institutions
NBFIs	Non-Bank Financial Institutions
NIM	Net Interest Margin
NPLs	Nonperforming Loans
PBT	Profit Before Tax
PSVAR	Pane Structural Vector Autoregressive
PTI	Pre-Tax Income
PVECM	Panel Vector Error Correction Model
RBM	Reserve Bank of Malawi
ROA	Return on Assets
ROE	Return on Equity
RMSEA	Root Mean Square Error of Approximation

Accronym	Meaning
SACU	Southern African Customs Union
SADC	Southern African Development Community
SBIC	Schwarz's Bayesian Information Criterion
SEM	Structural Equation Modelling
SFA	Stochastic Frontier Analysis
SMEs	Small and Medium Scale Enterprise
SRMSR	Standardized Root Mean Square Residual
SSA	Sub-Saharan Africa
SVAR	Structural Vector Autoregressive
TBTF	Too Big To Fail
TLI	Tucker Lewis Index
Translog	Transcendental Logarithm
US	United States
VAR	Vector Autoregressive
WAEMU	West Africa Economic and Monetary Union

Thesis Distribution

Published Articles

- Akande, J. O., & Kwenda, F. (2017). Competition and Stability of Sub-Saharan African Commercial Banks; A GMM Analysis. Acta Universitatis Danubius. Œconomica, 13(2).

- Akande, J. O., & Kwenda, F. (2017). Does Competition Cause Stability in Banks? SFA and GMM Application to Sub-Saharan Africa Commercial Banks. Journal Of Economics And Behavioral Studies, 9(4), 173-186. doi:10.22610/jebs.v9i4.1832

- Akande, J. O., & Kwenda, F. (2017). Competitive Condition of Sub-Saharan Africa Commercial Banks. Studia Universitatis Babes-Bolyai Oeconomica, 62(2), pp. 55-76. doi:10.1515/subboec-2017-0009

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Submitted Articles in Review

- Competition and Commercial Banks Risks in Sub-Saharan Africa Region

Articles Under Development

- An Overview of Sub-Saharan African Financial Sector

- Analysis of Efficiency of SSA Region Commercial Banks: SFA Approach
- Competition, Regulation and Stability of SSA Commercial Banks: A Structural Equation Modelling Approach

Conferences

- PSVAR Analysis of Stability of Sub-Saharan African Commercial Banks, presented at Accounting, Economic and Finance conference, 18–20 September 2017, University of Cambridge, Cambridge, United Kingdom.
- PSVAR Analysis of Stability of Sub-Saharan African Commercial Banks, presented at ESSA 2017 Biennial Conference, 30 August-1 September 2017, Rhodes University, Grahamstown, South Africa.
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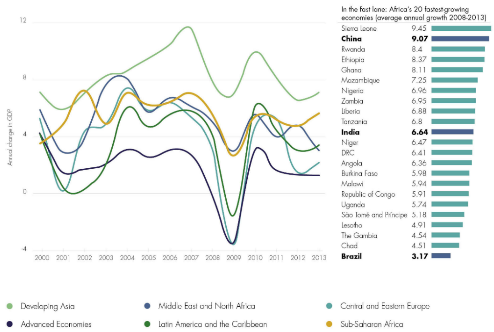
- Does Competition Reduce Stability of Banks? SFA and GMM Application to Sub-Saharan African Commercial Banks, presented at 2017 Annual School Research Day, School of Accounting, Economics and Finance, University of KwaZulu-Natal, Durban, South Africa.

Chapter 1

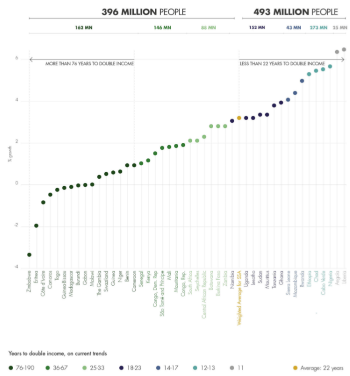
Introduction

Competition, regulation and stability are key components in normal banking business. Maintaining a competitive banking environment without compromising the stability of the system is difficult. This is the situation policy makers and regulators in the financial system of Sub-Saharan Africa (SSA) have found themselves in. The region desperately needs to grow her economies, build infrastructure, grow and process her own food, industrialise and advance in technology, among others (Watkins, 2014). Such growth requires a stable, efficient and a competitive banking system that will stimulate capital formation and distribute funds for optimal application in the economies. The right form of banking requires the right regulations/reforms which have enormous cost implications. However, these costs are not as high as the costs that can be incurred if the banking system fails as a result of non-regulation.

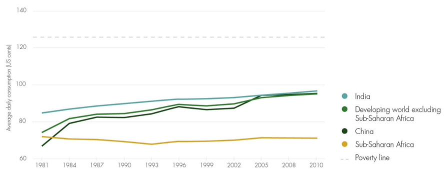
The tale of Africa is that of a continent endowed with enormous wealth yet wallowing in abject poverty, with the better proportion of the population suffering amidst plenty. Growth burgeon by the rich mineral and natural resources makes headline in the media. Unfortunately, as an acceptable measure of progress, this is a far cry from ultimately transforming the well-being of the people. Figure 1.1 below shows clearly this level of disparity. While in the past decade, Sub-Saharan Africa (SSA) has averaged 5% growth rate (Figure 1.1a) with rising average income (Figure 1.1b), poverty indices have as well exacerbated. Figure 1.1c shows average SSA as very poor with mean daily consumption below the poverty line. As a result, most of SSA's poor are far from the US$1.25 daily living threshold (Figure 1.1d). Although poverty rate varies per country as shown in Figure 1.1e, the mapping of poverty in million per country as presented in Figure 1.1f indicates that several millions of people live in penury with Nigeria leading the charade.



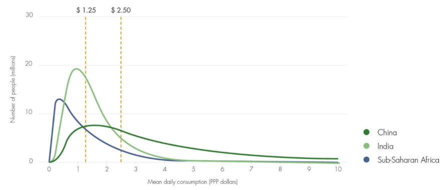
(a) Decades of growth rate



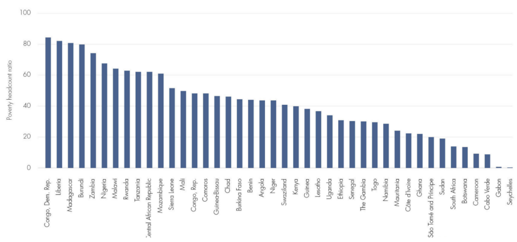
(b) Per capital income growth



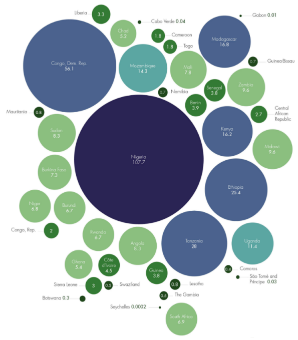
(c) Population living below poverty line



(d) Population below US$1.25 threshold



(e) Poverty rate per country



(f) Poverty mapping, million

Figure 1.1: **Africa Developmental Indices**

Source: Africa Progress Panel Report, 2014

In order to reverse the ugly trend, the region has to be completely transformed. However, a number of obstacles have to be overcome, namely; lack of access to formal finance, weak infrastructure and lack of fund for public investment. Surmounting the problem of access to formal finance is in fact consistent with the arguments of the proponents of *supply-leading hypothesis* (Ang, 2008; Beck, 2013; King & Levine, 1993; Levine, 2005; Patrick, 1966; Schumpeter, 1911, among others) that highlight the importance of financial sector for economic development.

Hence, the agitation for crafting policies that will increase competition in the banking sectors of the region. Competition is good, but as has been argued, has its attendant challenges that could cause financial instability. Caution must then be applied such that the success of increasing competition to achieve access to finance would not mean a problem of instability that will in essence erode the gains of access to finance. The preoccupation of this study is therefore not how competition brings about access to finance, but rather, on the investigation of the implication of competition for stability and how they could be managed by exploring the interplay among competition, regulation and stability in SSA banking sector.

Attempting to make the best of competition without compromising the system's stability is a herculean task. This has elicited arguments in academic research and is particularly a flashpoint for practitioners and regulators alike. Moreover, it could be a lot more challenging coming from the background of an underdeveloped banking and financial system.

1.1 Background of the Study

Competition has attracted attention in banking and finance literature for decades. An extensive body of theoretical and empirical studies has reported the significant role of bank competition in ensuring access to finance (Chen, Ma, & Song, 2010; Clarke, Cull, & Peria, 2006; Love & Pería, 2014; Mudd, 2013; Rice & Strahan, 2010; Tan, 2013), efficiency of the banking system (Mlambo & Ncube, 2011; Ningaye, Mathilde, & Luc, 2014; Pasiouras, Delis, & Papanikolaou, 2009; Pruteanu-Podpiera, Weill, & Schobert, 2008) and bank stability (Ariss, 2010; Beck, De Jonghe, & Schepens, 2013; Fu, Lin, & Molyneux, 2014; Schaeck & Cihák, 2014) in any economy. Competition is good for many reasons; it is an essential force in any economy and encourages firms to be more efficient and provide better allocation of resources. In banking, efficiency should entail lower costs, which should be passed to bank customers in the form of lower bank charges, higher deposit rates and reduced lending costs (Casu, Girardone, & Molyneux, 2015). Essentially, competition in banking improves access to finance, increases overall competitiveness in other sectors of an economy, fosters innovation, enhances quality, widens consumer choice and promotes economic growth (Leon, 2015b).

The banking sector the world over has witnessed significant transformation overtime. The outputs of banks in providing various financial intermediation services are now being produced using fewer but more sophisticated inputs, due to deregulation, globalisation, financial innovation and technological advancements (Tan, 2013). This implies that banking technical efficiency has improved remarkably in the world's financial system. Notwithstanding, a number of financial instabilities in banking systems have also been witnessed arising from moral hazards and agency conflicts among the market players in keeping with the pace of the competition in the system. This has immensely impacted on systemic stability that resulted in financial crises in South East Asia, 1997; Latin America, 1994; Russia, 1998 and most recently the 2007-2009 world financial crisis. This has prompted regulators and stakeholders to call for a rethink of bank regulation (Casu et al., 2015). Consequently, this has increased the level of regulation of banking especially in terms of their capital base (Basel Accords) which saw various countries' regulators adjusting and readjusting their banking sector capital bases to meet the growing challenges facing modern banking.

This study draws on industrial organisation theory of banking competition, efficiency structure theory, theory of contestability, competition-stability views and other empirical work to examine the competition, regulation and stability (CRS) nexus in sub-Saharan Africa (SSA) commercial banks. Economic and financial indicators suggest that SSA is underdeveloped (Jacobsen & Nielsen, 2014; Mbeki, 2005) with financial institutions not supporting the much needed growth as shown in Table 1.1 below. Efforts to stimulate a competitive banking environment via regulation brought about by various reforms have not yielded desired results of efficient banking systems with low operating costs, low interest rate spread and high access to finance, among others. Statistics provide quite a conflicting picture of stability of SSA banking sectors as available data suggests that they are solvent with high profitability, yet with high incidence of non-performing loans. Although there is existing literature on the relationship between regulation and competition as well as competition and stability, such studies are scarce in SSA. Hence the motivation of this study to conduct a SSA investigation that could establish relationship among competition, regulation and stability for financial and economic policy implication.

SSA is underdeveloped and faces critical infrastructural challenges. Moreover, countries in this region share similar features in terms of the nature of their economies. This study captured all SSA countries as far as data could allow. Consideration for data includes availability and integrity as most of the countries have been engrossed in long term economic and political crisis and, in some extreme cases crisis of war, that have resulted in prolonged banking crisis in the decade covered by this study. However, South Africa was excluded from among the SSA countries because of her more advanced and sophisticated banking system (Allen, Otchere, & Senbet, 2011; Senbet & Otchere, 2006) to avoid structural imbalance in the panel data analysis.

The rest of this chapter is structured as follows. The next section provides a general outlook of the banking system of the SSA region which sets out why the study is important to SSA at this time. This is followed by the problem to be studied and the aim and objectives of the study. These are followed by the scope and/or delimitation as well as the contribution of the study. Next are the conceptual and theoretical frameworks of this study. Finally, is the structure of the thesis.

1.1.1 SSA Banking System

The SSA financial system is largely bank-based[1] with grossly underdeveloped capital markets (Abdelkader & Mansouri, 2013). The financial and banking systems in SSA countries remain underdeveloped and laced with inefficiencies. The banking systems are highly concentrated, in some cases dominated by foreign owned banks, and generally inefficient at financial intermediation (Mlachila, Dykes, et al., 2013). In terms of concentration; for instance, in Nigeria the six largest banks held over 90% of the total banking assets in 2015. Likewise, in Angola five banks account for the total assets of the sector, in Botswana four banks account for 85% of banking assets, and 10 banks for 80% of banking assets in Tanzania (Mlachila, Park, & Yabara, 2013). These figures provide a snapshot of the market structure of SSA banking sectors. In most cases, a concentrated banking system is characterised by banks charging uncompetitive high prices for loan and low prices for deposits as currently is the case in most banking sectors of SSA. Concentration gives banks considerable amount of market power while the banking public faces limited choices of banks

[1] A bank based financial system is one that has dominance of banking system. An economy requires a well-developed capital and money markets for an inclusive financial system

and banking products. Hence, efficiency gets eroded and customers' welfare compromised in the absence of competition.

Table 1.1: **SSA Countries Finance Indicators Table**

List of Countries	EG	SVG	BCPS	LIR	IRS	NPLTL	RQ	DWCB	BFCB	CBB
Angola	3.9	22	12.6	16	12.5	10.9	–1.2	609	20	12.9
Benin	5.4	0.7	18.7				–0.4	155		3.3
Botswana	4.4	3.9	23.8	9	6.5	3.6	0.6	671	191	9.5
Burkina Faso	4.1	0.8	17.3				–0.2	112		2.3
Cameroon	5.9	2.7	11.2	18.1		11.1	–0.8	65	20	1.9
Central AR	1		8.3	18.1			–1.2	56		0.9
Chad	7.3		4.4	18.1			–1		9	1
Côte d'Ivoire	9	2.4	15.5				–0.8			4.7
Djibouti	5.5	0.1	26.3	13	11.5	11.5	–0.6	130	59	5.6
Equatorial Guinea	–3.1		6.1	18.1			–1.4	336	28	6.5
Ethiopia	9.9	12	18.1	8		31.8	–1.2	137	2	2.9
Gabon	4.3	2.4	10.7	18.1		9.1	–0.5	230	108	10.4
Gambia	–0.2	0.1	12.4	29	12		–0.4			8.8
Ghana	4.2	3.5	13.9			13.8	–0.1	459		6.1
Guinea	–0.3	0	4.6	19			–1	63	16	1.9
Guinea Bissau	2.5	0	5.4				–1.1	60		2.6
Lesotho	2	0.4	13.3	10	7.6	2.5	–0.6	329	65	3.6
Liberia	0.5	0	9.6	13	9.6		–1.3		9	3.7
Malawi	5.7	0.5	10.6	44	31.1		–0.5	237		3.2
Mali	7.2	1.4	19				–0.4	153		5.4
Mauritania	6.4	1.3	22.3	17	11.2	32.7	–0.5	111	48	6.9
Mauritius	3.6	1.4	79.8	9	1.7	4.8	0.7			24.2
Mozambique	7.4	0.8	18.1	15	6.2	7.3	–0.4		60	4.1
Namibia	4.5	1.8	46.7	9	4.5	2.4	0.1	834	245	12.8
Niger	6.9	0.6	9.4				–0.6	42		1.5
Nigeria	6.3	44.1	17.2	17	7.2	15.2	–0.9	648	31	5.6
Rwanda	7		10.3	17		23.5	–0.5	160	33	4.1
Senegal	3.9	1.5	24.1			17.1	–0.2	149		4.6

Table 1.1: **(continued)**

List of Countries	EG	SVG	BCPS	LIR	IRS	NPLTL	RQ	DWCB	BFCB	CBB
Seychelles	2.8	0.2	22.5	12	9.3	5.8	–0.6	1655	226	54.8
Sierra Leone	7	0.1	4.5	19	12.8	20.8	–1	173	16	2.9
Swaziland	2.5	0.3	20.7	9	6.5	7	–0.5	465	111	5.8
Tanzania	7	4.2	9.8	16	6.4	8.8	–0.4		20	2.3
Togo	5.7	0	21.1				–0.8	169		4.6
Uganda	4.5	2.5	10.6	22	10.7	4.2	–0.1	187	19	2.9
Zambia	6	6.4	9	12	3.7	12.5	–0.5		39	5
Continental Average	3.3	8.2	20.8	15.1	10.2	11.7	–0.8	283.8	45.9	7.5

Sources: World Bank, IMF, AFDB, Transparency International, theglobaleconom.com and Author's computations. Where EG is Economic growth as @2014, SVG, savings in $ (2004–2014), BCPS, bank credit to private sector as a % of GDP (2004–2014), LIR, lending interest rate as @2014, NPLTL, nonperforming loans to total loans (2004–2014), IRS, interest rate spread as @2014, DWCB, depositors with commercial banks per 1000 adults as @2014, BFCB, borrowers from commercial banks per 1000 adults as @2014, CBB, commercial bank branch per 100,000 adults, as @ 2014, RQ, regulatory quality (2004–2014).

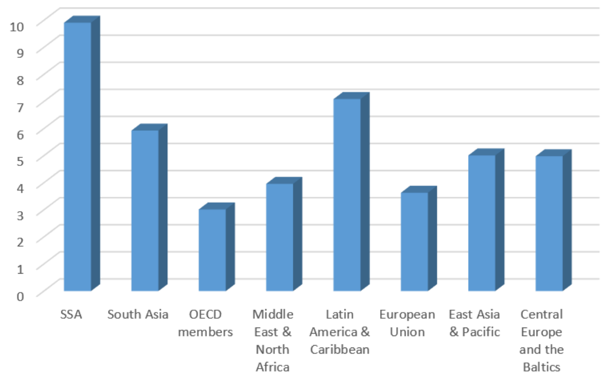
Moreover, most of the banking sectors are relatively small in size and characterised by low loan to deposit ratio. The largest share of assets of most SSA banks is held in the form of government securities and liquid assets rather than financing the real sectors of the economy with deposits mainly government patronage. According to Mlachila, Dykes, et al. (2013) lending is typically short term in nature with about 60% of loans having a maturity of less than a year. Access to finance is among the lowest in the world which is an obstacle to enterprise growth, (WBDI[2]). Domestic credit to private sector as a percentage of GDP averages only about 20.8% (as shown in Figure 1.2), in contrast to East Asia and Pacific countries which average above 90%, as shown in Figure 1.2 below. A survey by the African Progress Panel in December 2014 revealed that two-thirds of adults in SSA do not have a bank account, let alone access to savings and credit. According to

[2]World Bank Development Indicator

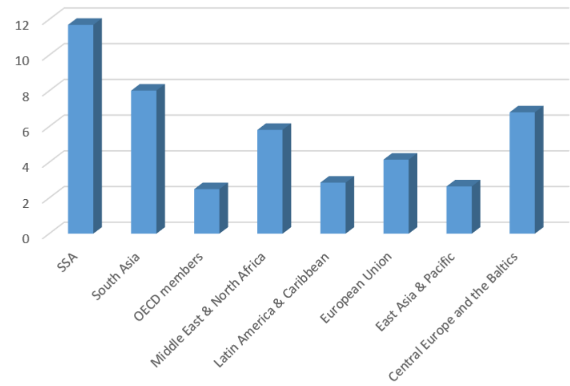
the same report, the SSA banks branch to population ratio is just 3 to 100,000 adults, which is less than half of the level obtainable in South Asia and most other regions of the world, (Figure 1.2). A report by FinScope on East Africa in 2014 showed that over 50% of the population in Tanzania and Rwanda and 30% of Kenya and Uganda are excluded from any formal financial services. According to Africa Economic Outlook report (AFDB, 2015) only about 2% of Burundian population have a bank account. This poses a major problem of access to finance and growth of real sectors of the economies, given an undeveloped capital market with commercial banks holding more than 80% of total banking assets.

High cost of operation is prevalent, which implies high interest rate spread and high service fee level. Interest rate expense averaged over 30.5% in 2014 (with Madagascar, Malawi, Uganda and Gambia reporting as much as 60%, 44%, 22% and 29% respectively, (Table 1.1 above), while overhead cost to total bank assets in SSA ranks among the highest in the world. Interest rate spread is also among the highest as indicated in Figure 1.2 below, and currently in the region of 17% in a number of SSA banking systems. Its consequence is devastating on the performance of loan to private sector for which the average of nonperforming loans (NPLs) as a percentage of total loans over the last decade stood at 20.8%, 17.1%, 32.7%, 31.8% and 23.5% in Sierra Leon, Senegal, Mauritania, Ethiopia and Rwanda respectively (Table 1.1). This is the highest compared to other regions of the world.

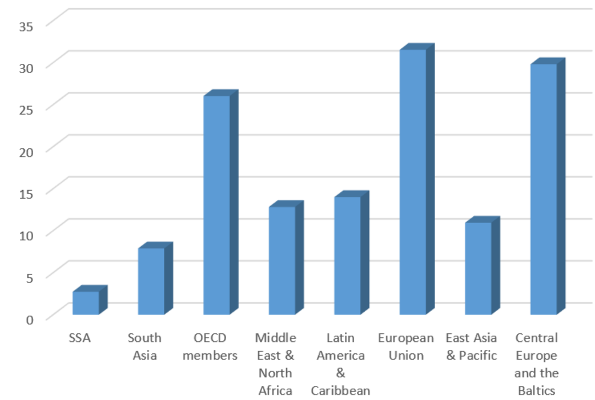
In spite of the forgoing, SSA has relatively very profitable banking system as measured by return on equity (ROE) which is in excess of 20% in Angola, Zambia and Mozambique, 17.4% in Ghana and Tanzania, and average of 10.4% in West Africa Economic and Monetary Union (WAEMU) (Allen, Otchere, & Senbet, 2011; Mlachila, Park, & Yabara, 2013). The banking sectors in SSA are well capitalised with most of the banks having their capital base in excess of the 10% minimum capital adequacy ratio (CAR). Capitalisation plays a significant role in the stability of SSA banking sector. The various reforms implemented post 1980s and 1990s financial crises may have contributed to the relatively stable SSA banking system as only the Nigerian banking system was hard hit in SSA with the 2007-2009 financial crisis that ravaged the world's financial system. Despite that, the increased number of banks following reforms and high level of inefficiency have continued to raise the question of stability resulting in a number of recapitalisation programs across



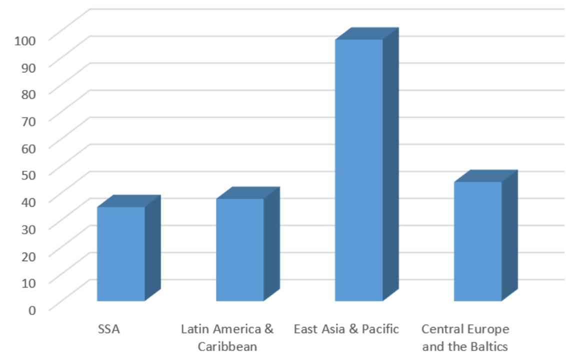
(a) Interest rate spread (lending rate minus deposit rate, %)



(b) Bank nonperforming loans to total gross loans (%)



(c) Commercial bank branches (per 100,000 adults)



(d) Domestic credit to private sector by banks (% of GDP)

Figure 1.2: **SSA Selected Banking Competition Features Compared with Rest of the World**

Source: Author's Estimation from WDI, IMF and AFDB

borders in SSA.

SSA banking sectors witnessed significant reforms which were majorly undertaken in the 80s and 90s, as shown in Table 1.2 below. The main thrust of these reforms was the removal of credit controls, establishment of new refinancing policies through interest rate liberalisation, consolidation and strengthening of the framework for prudential management, privatisation of state owned controlled banks, and deregulation (Senbet & Otchere, 2006). In addition, the reforms also included writing-off NPLs, improved governance, financial sector supervision, recapitalisation and restructuring. These reforms which were relatively similar and mostly linked across SSA countries were introduced to enhance banking systems' stability by increasing the efficiency of banks and promoting competition within the banking system. Despite all these efforts, not much has been done in complying with international regulations in which compliance to Basel II is limited let alone Basel III (as shown in Table 1.3 of subsection 1.8.4 below). Nonetheless, the region has witnessed increased stability; its systemic failure has reduced considerably overtime compared to other regions of the world (Mlachila, Dykes, et al., 2013). But how this can be held up on the region raises a big question in the wake of rising NPLs and the different vulnerabilities that individual countries faced as will be seen later in Chapter 2. Moreover how the regulations have impacted on the level of competition in the light of low financial intermediation, high operating costs, among others is another dimension that this study seeks to unravel. More so that the African continent has the history of non-compliance to rules and regulation as evidenced in the quality of their regulations, as shown in Table 1.1 above.

Table 1.2: **Banking Reforms in SSA Region**

	Reform year	liberalisation	restructuring	privatisation	recapitalisation
Benin	-	1989	-	-	-
Botswana	1991	1991	-	-	-
Cameroon	-	1990	-	1998	-
Côte d'Ivoire	-	1989	-	1999	-
Gambia	-	1986	-	-	-
Ghana	1983	1988	1989	1997	2009
Kenya	1989	1991	-	1989	-
Madagascar	-	1994	-	1999	-
Malawi	1987	1988	1990	-	-
Mauritania	-	1990	-	-	-
Mauritius	1983	1993	-	-	-
Namibia	1992	1991	-	-	-
Nigeria	1987	1987	1990	1992	2004
Tanzania	1985	1991	1991	1994	-
Uganda	1987	1988	-	1996	-
Zambia	1991	1992	-	-	-
Zimbabwe		1991	1991	-	1997

Sources: World Bank privatisation database

Given this background, the African Progress Panel (APP) (Watkins, 2014) opine that coming up with policies and regulations that will engender a well-managed, robust and competitive banking system will improve the economic situation of SSA countries. Moreover, competition-stability views envisaged that a competitive banking system will correct the issues of high operational costs, high interest rate spread, low financial intermediation and their associated costs as well as bring about a stable banking system. However, the trade-off between competition and stability have to be borne in mind in the desirability of a competitive banking system because the recent financial crises have been blamed on excessive competition and deregulation (Fu et al., 2014). It is on this note that this study is proposed with particular focus on commercial banks in SSA banking sectors as commercial banks hold in excess of 75% of the total banking sectors assets (Allen, Otchere, & Senbet, 2011). It tests the competition and stability relationship in SSA banking sectors and analyses the role of regulation in effectuating competition and stability in the banks.

1.2 Statement of the Problem

Banking competition brings about a stable and an efficient banking sector where there is access to finance, low charges and moderate interest rates spread (Ariss, 2010; Chirwa, 2003; Freixas, Rochet, et al., 2008; Kouki & Al-Nasser, 2014; Mugume, 2008). However, service charges and lending rates are extremely high with meagre deposit interest rates in SSA banking sectors (Mlachila, Park, & Yabara, 2013). Moreover, high NPLs threaten the stability of the banks in the region. Despite some of the efforts to regulate the sector these problems have persisted. High costs of banking and lending rates are being identified as factors militating against banking sectors' financial intermediation role. Consequently, service charges are high, financial intermediation is low and high interest rate spreads stifle investment and savings, curtailing the efficient operation of banks in this region, hence their inability to finance SSA countries' developmental goals. These pose enormous challenge to policy makers of addressing competition in banking without sacrificing stability of the sector and require empirical investigation for resolution. This study thus aims at analysing the interaction among regulation, competition and stability in the SSA region commercial banks to explore ways of stimulating competition in banking sectors to support economic growth without incurring the curse of financial system instability that could result from banks fragility owing to excessive competition.

1.3 Aim of the Study

Given the above background, the aim of this study is to evaluate competition in SSA banking sector and how it brings about stability of the banking system in the light of regulations. This will be achieved with the following three specific objectives leading to three complementary papers.

1.3.1 Specific Objectives

The specific research objectives of this study are to;

1. Measure the degree of competitiveness of the commercial banking sectors in SSA countries.

2. Investigate the effects of competition in the banking sector on the stability of banks in SSA countries.

3. Analyse the relationship among competition, regulation and stability within SSA banking sectors.

1.4 Research Questions

This study attempts to provide answers to the following questions in order to actualise the objectives set out in this study;

1. Is SSA region commercial banking sector competitive?

2. What is the effect of competition on the stability of commercial banks in SSA region?

3. Is there a relationship among competition, regulation and stability of commercial banks in SSA region?

1.5 Research Hypotheses

It is necessary to test the following hypotheses to provide answers to the foregoing questions that were posed to achieve our study objectives.

1. Hypothesis one: Given the statistics that abound about how concentrated the banking sectors of SSA region are, we do not expect the commercial banking sector of this region to be competitive. Hence the first hypothesis of the study is that;

- H_{01} SSA region commercial banks are not competitive.

2. Hypothesis two: models of competition and stability around the world have been inconclusive and polarised between two opposing groups, namely, the competition-stability view and the competition-fragility view. Most of the works on these models have been carried out in developed economies where banks are highly developed and sophisticated. The competition-stability view expects an efficient banking for competition to bring about stability. Due to the underdeveloped and less sophisticated nature of the banking systems in SSA region, the study does not envisage an efficient banking system and as such supports the competition-fragility view. To this end, the hypothesis for answering the second question will be;

   - H_{02} Competition causes instability in SSA region commercial banking sectors.

3. Hypothesis three: The main reason for reforms or regulation in the banking industry is to encourage competition and ensure stability of the banking system. Regulation is thus expected to directly and simultaneously influence both competition and stability. An indirect relationship is also expected to be transmitted from regulation to stability through competition based on the subsisting relationship between competition and stability. These provide basis for the third hypothesis of the study, which is as follows;

   - H_{03} A relationship exists among competition, regulation and stability in SSA region's commercial banks.

The outcomes of these tests are expected to proffer solutions to the above questions and ultimately the aim given the specific objectives enumerated.

1.6 Scope/Delimitation of the Study

The focus of this study is on competition, regulation and stability of commercial banks in the SSA region. The study period spans over 10 years from 2006 to 2015. The choice of 2006 is largely influenced by data availability for most of the SSA countries being considered on the Bankscope database compiled by Fitch/IBCA Bureau Van Dijk. Data collected were predominantly bank profile data and mainly from Bankscope to guide against inconsistencies while allowing comparison across countries' different banks. The study focuses only on 37[3] out of the 54 countries that constitute the SSA region.

1.7 Research Contributions

This research is an attempt to empirically test the call by African Progress Panel, for banking regulators to craft policies that will enhance competition in African banking sectors as a means to unlocking African potential for growth and development. SSA region is the most undeveloped region of Africa with the bulk of its population living in abject poverty, hence it became the target for this research. The study contributes to the body of knowledge in numerous ways. First, it contributes to extant literature by extending the frontier of research in banking competition, regulation and stability nexus. It is the first study to consider the trio in the study of banking in SSA. Second, this study uses a large panel data set to consider competition-stability view for a wider range of SSA banking sector than currently reviewed. Needless to say that no existing literature in this area has focused on commercial banks that are the mainstay of the banking/financial sectors of the region. It is the first time SFA will be applied to exogenously study the effects of competition on stability, beside using the model to estimate the level of efficiency associated with competition. Third, the relationship among competition, regulation and stability is analysed in SSA commercial banking system for the first time and with P-SVAR. Moreover, we highlighted major determinants of competition as well as flashpoints in terms of risks for balancing in policy permutation. The study succeeds in expanding the coverage of competitive measure of SSA commercial banking sector. Above all, the findings suggest that right polices targeting capital, liquid assets and the quality of assets of banks will enhance competition without compromising the stability of the banking sector.

Furthermore, we propose Competition-Regulation-Stability (CRS) Model in Figure 1.3 below developed with SEM in Chapter 7 that explains the gap filled in this thesis. This in addition to the P-SVAR model provides insight into the management of these phenomena in the banking system of the SSA region. It is another first in the literature of competition and stability in banking. We employed efficiency variable to mediate between competition and stability. Overall, the Bank CRS model affirms that competition, regulation and stability can be simultaneously managed in the SSA banking sectors to optimise competition

[3]Excluded are countries considered as outlier either based on their level of development, data integrity/availability or they are war ravaged and are without functional banking sectors

without compromising stability. It addresses the extent to which regulation enforcement can impact on competition and stability. Through this model, the impact of competition policies in the banking markets and how effectively it could be better evaluated and assessed. Besides the paucity of some of these studies in SSA countries, it is the first time to our knowledge that this model will be considered.

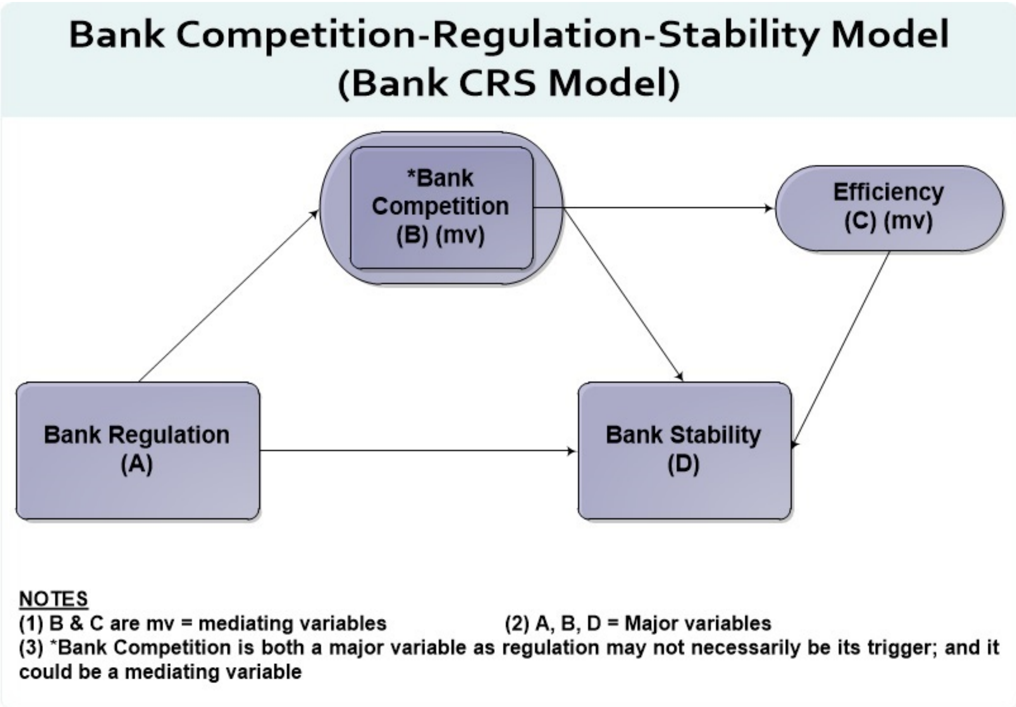


Figure 1.3: **Bank CRS Model**

Source: SEM Result (Chapter 7)

1.8 Description of Study Concepts

In this section, we describe the basic concepts used in this study.

1.8.1 Banking Overview

The role of the banking system in any economy can not be overemphasised. One could devout ages attempting to underscore the place of banking in any economy. Since its inception in the 17th century just as a warehouse for safekeeping of gold and silver for merchants (Lewis, 1992), scholars, experts, business practitioners and academics alike have come up with a deluge of theories, arguments, perspectives and perhaps, empirical evidence as to what indeed constitutes the roles played by banks in an economy. Depending on which part of banking interests an individual, there is quite a lot to explore about its significance. From the private sector perspective, a strand of literature sees banks as 'information providers' (Bhattacharya, 1998; Lewis, 1992), what they referred to as 'social accountant' coming from the vintage position of banks' access to confidential information about their customers to whom they provide credit facilities. Another school of thought also considers banks as 'liquid insurer' (Diamond & Dybvig, 1983), in other words, they provide liquid assets to depositors with uncertain liquidity needs. Yet some other perspectives focus on service banking, wholesale banking, multinational banking, and off-balance sheet banking.

Banks provide financial intermediation, channelling funds from savers to borrowers by offering loans, deposits and payment services; which enable them to function as size, maturity and risk transformers. In other words, they mediate between the surplus and the deficit units of the economy, thus, increase economic efficiency through promotion of better resources allocation. Banks provide deposit services to savers and loan services to borrowers. Depositors require the security of the amount deposited and want to be able to get them on demand. Borrowers, on the other hand lack investment funds and rely on the banks for liquidity. By bridging the surplus and deficit units gap, banks provide surety to depositors of the safety of their liquid assets while making the liquid assets available to the borrowers to leverage on in the form of long-term facilities[4]. In doing this, banks also minimise direct lending cost such as transaction costs and information asymmetry. Typically, deposits have characteristics of being highly liquid, low risk and small in size, whereas loans are large in size, highly illiquid and of larger risk which without the banking systems transformation could not have been useful to the parties. Banks thus make profit by charging an interest rate on the loan that is higher than the ones they pay to depositors.

At the macroeconomics level, deposit liabilities form a major part of nations money supply and are therefore very relevant to governments and central banks for the transmission of monetary policies. Bank deposits create money[5], which increases total money supply in

[4]Lenders will only allow a short term facility at highest possible returns, while borrowers want long-term financing

[5]$Credit\ multiplier = \Delta deposits/\Delta reserves$

the economy. Undoubtedly, a sound banking system has the capacity to boost productivity and improve efficiency with which resources are allocated, providing wider access to the real sector that makes it more productive, efficient and innovative, become more stable and enhance economic growth. Overall, having the banking sector with high market power could hamper the actualisation of all these important roles, as bank concentration could increase intermediation costs, provide incentives for less savings and deposits, thereby driving and rendering the banks inefficient and unstable.

1.8.2 Competition

Competition has been defined in a number of ways. It refers to rivalry among individual business firms, organisations and the likes in pursuance of either market shares or issues that are of common interest. Stigler (1957) defines competition as a rivalry between individual, group or nations and arises where two or more parties strive for something that all cannot obtain. Vickers (1995) points out that rivalry encompasses all sorts of rivalry –market trading, auctions, races, war of attrition, etc., – instrument of rivalry –prices, advertising, research and development, takeover bids, effort levels among others–, objects of rivalry –profits, market share, corporate control, promotion, prices, survival, etc., – as well as types of rivals. Competition is considered imperative for firms' efficiency beside better resources allocation in any economy and for Beck (2008), it is a prerequisite for an efficient banking system.

Competition in the banking industry, like any other industry can be categorised as either perfect, monopolistic, oligopolistic or monopoly. Mankiw and Taylor (2006) described a perfect competitive banking environment as one characterised by large number of banks with identical products, and having low entry and exit costs. Banks here are price takers as market forces determine prices. The main distinction between perfectly competitive banking markets and monopolistic competitive banking market is that the later possesses some control over price and/or product because of associated differentiated products. In the case of an oligopoly market, there are few large banks that are interdependent with significant control over price. At the extreme end is a pure monopoly banking market with one bank that marks the absence of competition and the presence of absolute power.

Competition among banks promotes social welfare as its presence presumes efficiency that translates to lower costs passed on to customers in the form of lower charges, higher deposit rates and reduced lending rates. However, specific banking features like; switching costs, information asymmetry, franchise and charter values, among others, mean that conventional application of competition may not be admissible as the cost of potential instability has to be weighed against the perceived benefits of competition. This is at the core of this study.

1.8.3 Efficiency

Efficiency refers to the level of performance of a firm which could be viewed either in relation to output or cost savings. In the former, few inputs are converted to optimal production output while the later epitomise avoidance of excesses like waste to achieve a desired outcome. Hence the classification as productive (technical) and economic efficiency. Early insight into this field by Koopmans (1951) describes productive efficiency as the point where further output can no longer be achieved without employing more inputs or reducing production of some other outputs. On the other hand, economic efficiency aims to achieve a given output at minimum cost, or use a given input to maximise revenue, or allocate inputs and outputs to maximise profit (Kumbhakar & Lovell, 2003). Technical efficiency hence emphasises the ability to minimise inputs used in a vector of output production or maximise output from a given input vector.

Productivity and efficiency are being used interchangeably but are however different. In terms of production, the production frontier is a representation of the maximum attainable output of a firm from a given input. Thus reflecting the current state of the firm's technology. In the case of technical efficiency, when firms in an industry operate on the frontier, they are technically efficient, otherwise, inefficient. This implies that firms operating inefficiently have the latitude further to the frontier without altering their inputs. In banking, this is developed to measure an efficient frontier from which banks positions are compared. Competition therefore forces banks to become efficient in their operational activities in order to maintain a competitive advantage and outperform their rivals. As Hicks (1935) argued, it makes managers to come out of their shelves. By implication, an efficient banking system is characterised by lower costs resulting in a better financial intermediation functions thereby culminating in lower charges to customers.

1.8.4 Bank Regulation

Regulation in banking encompasses the culmination of reforms, policies and practices that are either enacted or otherwise and become the guiding rules for the proper conduct of the system in the interest of the public. Bank regulation differs from country to country across the world and in SSA countries. However, incidences of global financial malfeasance

Table 1.3: **SSA Financial Sector Supervisory Standards**

	Accounting Standard	Capital Adequacy standard	Deposit Insurance	Assets Classification
Angola	National	No Basel II yet	No	< 90 days
Botswana	IFRS	Basel II in progress	No	90 days
Burundi	IFRS Plan	Basel II in progress	No	> 90 days
Cabo Verde	IFRS	Basel II in progress	No	< 90 days
CEMAC	IFRS Plan	No Basel II yet	Implemented	> 90 days
Comoros	National	Basel II in progress	No	N/A
Congo, Dem. Rep.	National	No Basel II yet	No	90 days
Eritrea	N/A	N/A	No	N/A
Ethiopia	IFRS Plan	No Basel II yet	No	90 days
Gambia	IFRS Plan	No Basel II yet	No	90 days
Ghana	IFRS	No Basel II yet	No	90 days
Guinea	National	No Basel II yet	No	N/A
Kenya	IFRS	Parts of Basel II/III	Implemented	90 days
Lesotho	IFRS	No Basel II yet	No	90 days
Liberia	IFRS	Basel II in progress	No	90 days
Madagascar	National	No Basel II yet	No	90 days
Malawi	IFRS	Basel II	No	90 days
Mauritius	IFRS	Basel II	No	90 days
Mozambique	IFRS	Basel II	No	> 90 days
Namibia	IFRS	Parts of Basel II	No	90 days
Nigeria	IFRS	Basel II in progress	Implemented	90 days
Rwanda	IFRS	Basel II in progress	No	90 days
So Tom and Prncipe	IFRS Plan	Basel II in progress	No	N/A
Seychelles	IFRS Plan	No Basel II yet	No	90 days
Sierra Leone	IFRS	No Basel II yet	No	90 days
South Africa	IFRS	Basel III	No	90 days
South Sudan	National	No Basel II yet	No	N/A
Swaziland	IFRS	No Basel II yet	No	90 days
Uganda	IFRS	No Basel II yet	Implemented	90 days
Tanzania	IFRS	No Basel II yet	Implemented	90 days
WAEMU	IFRS Plan	No Basel II yet	No	> 90 days
Zambia	IFRS	No Basel II yet	No	90 days
Zimbabwe	IFRS	Basel II in progress	Implemented	91 days

Source: Montfort et al. (2016), Pg.41

led to the birth of the Basel Accord with the first sets of standard regulatory principles in 1989 to the latest in 2010. These have been accepted as the common best practices for benchmarking sound operation of the banking sectors across with countries compliance through reforms and acts of parliaments. Table 1.3 above provides overwhelming evidence of greater non adoption of Basel Accords cum basic regulatory tenets and/or some in the process of implementation in most of SSA banking sectors. Progress towards adoption of the Basel's capital adequacy standards has been slow and largely not encouraging. Needless to say that individual countries do strive to pursue regulations that aim to safeguard the soundness of their banking system. Among the main components of the Basel Accord's pillars and by far the most targeted for regulation in banking are, capital, liquidity and asset quality.

1.8.5 Capital Regulation

A bank's capital implies the worth of its net assets, that is, total assets less total liabilities. Often referred in practice as the sum of the paid-up capital and accumulated capital reserves. The role of capital in banking or financial sector is a critical component of regulation. It is important for the protection of depositors and the maintenance of confidence in banks operations, including the underpinning long-term stability and growth. It has been the major element in the pillars of the various Basel Accords and at the center of the various regulatory reforms in various countries. Common measures of regulatory capital in literature according to Casu et al. (2015) are total capital to risk-weighted assets, Tier 1 capital to risk-weighted assets and Tier 1 capital to total assets, also often referred to in empirical studies as equity capital ratio.

1.8.6 Liquidity Requirements

Bank liquidity has serious implications for the credit market. It provides solvency shield to depositors of lending institutions. Liquidity is a measurement of the capacity of banks to respond to their cash and collateral obligations without any impediments on day-to-day operations or risking financial solvency. The introduction of liquidity requirements in Basel III in 2010 is considered one of its main innovations aimed at ensuring that sufficient high-quality liquid assets are available for banks short-term survival without also neglecting long-term bank resilience. There are various short and long term measures of liquidity in literature that are contained in the liquidity ratio.

1.8.7 Asset Quality

Asset quality ratio, also known as the loan loss ratio, measures the ratio of loan impairment charge for the year as a percentage of loans and advances to customers. It relates to the asset side of the balance sheet and is one of the most critical areas in determining the overall condition of a bank. Asset quality has also become a critical component of the Basel Accord, especially as it directly affects the earning capacity of banks. The primary factor affecting overall asset quality is the quality of the loan portfolio and the credit administration program.

1.8.8 Stability

Bank stability describes the soundness of the banking system while financial stability aggregates the stability of key financial institutions and the financial markets in which they operate. It precedes real resource allocation rational decision making for an economy's savings and investments environment. Financial fragility[6] is a displacement of the foregoing resulting in an uncertain situation that causes resources misallocation including unwillingness to contract inter temporally. This has upsetting economic and political effects that makes the maintenance of a stable financial system the preoccupation of the financial authorities.

Stability is often used interchangeably with risk in banking literature. But risks are a culmination of exposures that impact on the soundness of the financial or banking system hence a manifestation of instability. The obvious features of banks stability presupposes sufficient capital to absolve losses, and sufficient liquidity to manage operations and volatility in normal periods. This is often driven by effective regulatory infrastructure, micro-prudential surveillance and public confidence.

1.9 Underpinning Theoretical Review

This section deals with some of the underlying theories within the study area.

[6] Contagion and payments and settlements systems forms the channels for the spread of the fragility.

1.9.1 Theories of Competition

The concept of competition was inspired by Smith (1776), who in his "Wealth of Nation" analysed free competition as an ordering force towards equilibrium. He argued that in the long run, free competition leads to prices being equal to the costs of production. Nonetheless, for Smith, competition is not a state or a situation but a race between competitors to gain market share. It is rivalry that forces prices towards equilibrium of demand and supply. An essential condition for free competition is not the number of rivals but rather individual freedom.

This idea was subsequently developed into two major reviews of competition drawing from the inspiration of Smith (1776); competition as a static state and competition as a process of rivalry. Standard theory refers to the results of competition as a static equilibrium outcome. According to this theory, competition is a static state in which firms cannot overprice and earn abnormal profit. However, other economists, particularly the Austrian school, criticised this static view and retained the central role played by rivalry to define competition.

1.9.2 Competition as a Static State

Cournot (1838) was the first to relate free competition to the result of competition. Cournot defined the ideal of competition not as the process that in the long run tends towards a certain equilibrium position, but rather as the equilibrium position itself. Competition is the situation where price equals the price of production. According to Cournot, the excess of the price over cost approaches zero as the number of producers increases. Bertrand in 1883 criticised this and posited that the relevant strategies for firms are prices and not quantities. Further contributions by Morrison and Chamberlin (1933) and Robinson (1933) to the Cournot Oligopoly theory forms the bedrock of both structural and the majority of non-structural measures of competition. These concept is however challenged by another that focused on the dynamic aspect of competitive rivalry.

1.9.3 Competition as a Process of Rivalry

The Austrian school under Von Mises, Schumpeter and Hayek argued that the traditional neoclassical economists misused the term competition by applying it to a state rather than a process. Competition is viewed not as a static state but as a complex process of rivalry among firms. Therefore, the core of competition is the behaviour of firms in the market. Firms engage in a continuous dynamic process, constantly creating and adopting new products and processes in order to cope with competition. The competition process act as a selection mechanism through the destructive-creation mechanism principles; less efficient incumbents are removed and replaced by more efficient entrants.

According to the Austrian school arguments, a market is competitive when rivals are sufficiently aggressive to give an incumbent incentive to improve in terms of better quality, improved management, etc., in order to maintain its advantage. Inefficient firms are directly sanctioned by consumers while more efficient and innovative companies are rewarded. The role of monopoly and market power is revisited in the Austrian perspective that explained why firms are unable to raise prices over and above marginal cost in a perfect market framework. For the Austrians, the existence of rent is a normal aspect of the competitive process. In a free competitive market, each firms innovate and develop risky strategies in order to gain a competitive advantage over its rivals. Firms that do obtain such an edge temporarily derive static monopoly during the interval before imitating competitors replicate their innovation or supersede it with a more superior one. Successful firms earn temporary monopoly profits as their reward for risky strategies. As a result, a free competitive market is compatible with market power and abnormal profit rates.

1.9.4 The Industrial Organisation Theory

The Chicago industrial organisation approach explains the market structure theory of banking market and clarifies the issue of competitive pricing and market power in the banking industry. They incline towards the view that many markets if not most, approximate perfect competition in the long run, where positive profit is considered transitory since their presence stimulate entry and hence their demise. This explains the effect of banking market features on its equilibrium price and quantity. This approach considers banks as intermediaries buying and selling deposits and loans with their respective technologies and hence prescribe the equilibrium in the banking sector on the basis of the prevailing bank market competition (Freixas et al., 2008). Given the assumptions of perfectly competitive market, it argues that banks in this market must adjust their volume of loans and deposits such that their intermediation margin equals their marginal management cost. Consequently, an increase in the price of deposit will decrease bank demand for deposit and an increase in the price of loan will increase bank supply of loan. This implies lower net interest margin and intermediation costs for competitive banks.

On the other hand, the Monti-Klein model of bank monopoly assumes entry barriers may invalidate the perfect competition assumption in banks and therefore argues that an imperfect competition like the oligopoly model is more appropriate,(Freixas et al., 2008). It describes a monopolist bank as facing a downward sloping demand for deposits and an upward sloping supply of loans given the banks decision variables such as amount of loans, amount of deposits and amount of required reserved (assumed to be given). In addition to a similar assumption as in perfect competition, monopoly banks profit only differs from those of the competitive market by the influence of the quantity of loan and deposits on their prices respectively. Therefore, bank profit under monopoly is the sum of intermediation margin on loan and on deposit less management costs. However, given the elasticity of demand for deposits and the elasticity of supply of loans, monopoly banks profit maximisation is simply the adaptation to the banking sector of the familiar equalities between Lerner index and inverse elasticity (Lerner, 1934). The greater the bank market power on deposit and loan the smaller the elasticity and the higher the Lerner index. This leads to the conclusion that intermediation margins are higher when a bank has a high market power thus providing some background to competition and stability relationship considered in Chapters 4 of this thesis. Monopoly banks set their volume of loans in such a way that the Lerner index equals inverse elasticities, consequently, intermediation margin will adversely affect substitutes to banking products such as access by household to money market for instance.

The Monti-Klein model, however, further argued for the adaptation of monopoly model to imperfect competition between a finite number of banks representing a more accurate description of reality. This explains the oligopolistic and the monopolistic competitive version of the theory. Since the banking industry is not clearly controlled by a unique firm, the practical relevance of the monopoly result could be questionable. The advocated banking markets differ from monopoly in that there exist a number of banks on which the sensitivity of loans and deposits pricing depend, this constitute a proxy for the intensity of competition.

1.9.5 The Theory of Contestability

The arguments of the Austrian school were revitalised by the Chicago school who argued that many if not most markets tend to approximate perfect competition in the long run. Hence, Posner (1979) posits that positive profits are only a temporal occurrence because their existence arouses entry of many firms and hence leads to their exit. A neoclassical formalisation of this idea was given by Perrakis, Baumol, Panzar, and Willig (1982) in the contestability theory. They argued that regulation is irrelevant in a constable market. This is because, when the market is contestable, it satisfies the requirements of static welfare maximisation and potential entry becomes a threat to incumbent market power. The necessary conditions for a contestable market are (i) free entry with no limit; (ii) absolute entry; and (iii) a perfectly reversible entry. In this market, monopoly power is usually short-lived given the strength of market forces. The power of competition is then linked to market contestability, as such unrelated to market structure.

The divergence between the two conceptions of contestability was clarified by Audretsch, Baumol, and Burke (2001). They argued that the analysis remain static in the theory of market contestability as the divergence from long run equilibrium is transitory and focuses on prices. The Austrian school, by contrast, argued that the normal functioning of a competitive market is synonymous with disequilibrium and monopoly power. The reasons why entrepreneurs innovate, or undertake risky market strategy as well as the evolution of economics are however not explicable by the theory of contestability. The major contributions of the Austrian school in terms of dynamic analysis, non-price strategies, etc., were discovered in subsequent development in industrial organisation literature. According to Audretsch et al. (2001), the literature has moved beyond traditional static model and price competition. He however admits that technical change which is the centre of the Austrian dynamic competition is not captured in the evolution of industrial economics from static to dynamic analysis.

Overall, these theories assumed a perfectly competitive market with free entry and exit and the inherent efficiency. However, the existence of friction in banking markets (e.g. entry barriers, information asymmetry) causes the welfare theorem associated with perfect competition not to be directly applicable, thus allowing room for the exercise of market power. However, a healthy degree of rivalry is considered necessary for the dynamic efficiency of the sector; this is the principle that forms the basis of the trend towards fostering greater competition in banking markets all over the world.

1.9.6 New Empirical Industrial Organisation (NEIO)

Various attempts at empirically testing the foregoing theories have brought about a number of empirical models among which are; the structural models and the non-structural models which are based on the traditional and the new industrial organisational theory rooted in the competition as a static state.

The structural model was pioneered by Hicks (1935)'s quiet life hypothesis (QLH) that says monopoly power encourages inefficiencies because it relieves managers from competitive pressure and conclude that increased concentration reduces efficiency. This became the first work to find a link between market structure and efficiency and has been further interpreted as market power theories of structure-conduct-performance (SCP), the relative market power and efficiency theory.

Proponents of the SCP hold the belief that concentration is anti-competition, reduces collusion costs and results in excessive profit. The SCP market power hypothesis by Bain (1956) linked concentration and entry barriers to margin and profit. This hypothesis relates performance to firm structure and describes structure as being the number of firms, size, entry condition, and concentration level while they relate performance to profit, growth, market share, efficiency and market progress. Researches in banking have used profit (return on assets (ROA), return on equity (ROE)), price (loan rate, deposit rate) as proxies for performance; meanwhile, conduct was to be inferred by the nature of firm structure as it was difficult to measure with structure impacting on performance. Relative market power (RMP) using individual market share as proxy variable for market power believes that large banks can exploit their market power to charge uncompetitive high prices. Smirlock, Gilligan, and Marshall (1984) and Shepherd (1983) opine that performance differences here can be explained by superior efficiencies.

The efficiency theory is often referred to as the efficiency structure hypothesis (ESH) and is further categorised into x-efficiency (ESX) and scale efficiency (ESS). ESH proposed an opposing argument to QLH, that more often than not efficiency is gained through size which in turn results in higher profits (Demsetz, 1973). ESH further postulates that positive structure and performance relationship should not necessarily be attributed to collusion forces but rather to efficiency. Larger firms tend to operate more efficiently, because efficient banks have lower costs which accounts for their high profits. Therefore, it is efficiency that enhances high market share which eventually could result in concentration. It can thus be argued that if all firms operate on the same level of efficiency, average profit will be low. Similar to this is the ESS which emphasises economies of scale. It extends the efficiency structure theory by attributing efficiency to better management and improved technology which are believed to facilitate operation at a more efficient scale resulting in lower unit costs and consequent high profit. As such, the ESS proponents argued that more concentrated firm/banking sector will tend to be more profitable on the average with higher market share. Efficiency theorist argued that regulation will penalise an efficient firm, since it is assumed profit is associated with structure, whereas correlation between concentration and profitability is the result of the underlying relationship between efficiency and profitability.

The failure to measure conduct in the SCP is identified as the main weakness of the structural model. Furthermore, empirical research based on SCP often found the anticipated relationship between structure, conduct and performance as often very weak in terms of statistical significance. Thus, questions whether concentration indicators can really be interpreted as a competitive behaviour motivated the non-structural model.

The non-structural model originated from the new industrial organisation literature which is based on the empirical observation of conduct as a way to evaluate how firms set their prices and quantities. The Lerner index discussed further in subsection 1.9.7 was proposed by Lerner (1934) as a model for measuring bank level competition. Panzar and Rosse (1977) and Panzar and Rosse (1987) developed a model of oligopolistic, monopolistic and perfectly competitive market and derived a concise statistic known as the Panzar-Rosse statistic or H-statistic to differentiate them. Their model assumes that market power depends on the extent to which changes in factor prices reflect on revenue, in other words, the relationship between firm level revenue and variation in factor prices of production. Although it is based on the empirical observation of firms' behaviour, it does not map into a range of oligopoly concepts as robust as the Lerner index, and fails to incorporate long run structural adjustment, say Agoraki, Delis, and Pasiouras (2011).

Other non-structural models include conjectural variation approach (Bresnahan, 1982; Iwata, 1974; Lau, 1982) which prescribes the extreme cases of perfect competition and monopoly, where a monopoly has no rival and firms are too small to take notice of each other under perfect competition. It is a model for determining market power based on demand, cost and interdependence of market participants; it emphasises that firms should take into consideration competitors' reaction when setting prices and outputs. The degree of competitiveness is measured based on the ability of any firm to charge its price above the marginal cost, hence competition depends on the interdependence between market participants. The more the market power the more the deviation from competitive pricing and consequently the lower the level of competitiveness in the market. In another non-structural bank competition modelling approach, Boone (2008b) developed a competitive measurement indicator that has come to be known as the Boone indicator. The idea here is to measure market power on the assumption that competition enhances performance. He argues that relative profit difference thrives within a competitive environment that enables an efficient bank (with lower marginal cost) to increase its market share and profit. Market share is influenced by efficiency, which validates the efficiency structure hypothesis which foregrounds the idea that the more competitive a banking sector is the better for efficient banks while the less efficient ones get punished as their profits get eroded. It has been faulted for ignoring bank size (Schiersch & Schmidt-Ehmcke, 2010) and assuming that efficiency improvement will enable banks to increase market shares without decreasing prices.

Persistence of profit by Mueller (1977, 1986) which focuses on profit dynamics as a way to measure the market power of banks is yet another non-structural model. He believes that the extent to which a bank's level of profit converge with the long run values reflects the degree of competitiveness in the market. The slower the speed of adjustment the stronger the persistence of profit then the more the market power. The standardised profit rate is used as the measure which is the difference between firms actual profit rate and the average industry profit for a given year. It proposes that if entry and exit are sufficiently free to eliminate any abnormal profit, then all firm profit rate will tend to converge rapidly towards the same long run average value. But where existing firms are able to prevent imitation and/or block or perhaps delay entry, normal profit will persist year on year and difference in firms long run average profit may be sustained indefinitely. Among the highlighted models, the Lerner index is used in this study for its strength in estimating bank level competition. The Lerner index is considered in the next subsection below.

1.9.7 The Lerner Index

The Lerner index is used as a competition measure in banking; it was the brain child of Abraham Ptachya Lerner, a Russian-born British Economist, in 1934. In Lerner (1934)'s work on the concept of monopoly and the measurement of monopoly power, the economic implication of monopoly and its social cost are explained. He measured competition as the inverse of elasticity of demand, describing it as the difference between price and marginal cost divide by price, and representing the extent to which market power allows firm to price above marginal cost (Berger, Klapper, & Turk-Ariss, 2009).

The Lerner index theoretically derived its roots from static oligopoly theory. Assuming a Cournot model in an industry with one product, such that P is the market price of product Q and q_i the quantity produced by firm i. Then firm i's profit can be maximized given the following expression:

$$\underset{q_i}{max}\left[P\left(Q\right)q_i - C\left(q_i, \psi_l\right)\right] \tag{1.9.1}$$

where q_i represents production quantity by firm i, Q, aggregate production, i.e, $Q = \sum_{j=1}^{J} q_i$, $P(Q)$ equals market price and $C\left(q_i, \psi_l\right)$ denotes the total cost with ψ_l the vector of employed production factor prices by the firm. Lerner (1934) therefore proposes the measure of market power, known as the Lerner index, as follows;

$$LI_i = \frac{P(Q) - C'_{q_i}\left(q_i, \psi_l\right)}{P\left(Q\right)} \tag{1.9.2}$$

where $C'_{q_i}\left(q_i, \psi_l\right)$ represents the marginal cost of firm i. The index ranges from 0 to 1 with the extreme cases representing perfect competition and monopoly respectively.

The Lerner index has been appraised for locating competition between monopoly and perfect completion (Rojas, 2011), reflect the role of elasticity of demand in determining firms markup and the fact that firms competitive behaviour can be computed at any point in time (Demirguc-Kunt & Pería, 2010). Bikker and Spierdijk (2008) criticized it for the difficulties in identifying the required data for computing price and cost on the bank balance sheets making proxies for them often debatable. Nonetheless, the Lerner index is popular as a measure of competition in literature (Aboagye, Akoena, Antwi-Asare, & Gockel, 2008; Amidu, 2013; Beck et al., 2013; Guevara & Maudos, 2011, among others), and adjudged one of the best two measures of competition by (Liu, Molyneux, & Wilson, 2013b).

1.9.8 Banks Efficiency Framework

The Measurement of efficiency began with Farrell (1957)'s description of a simple firm efficiency measure that is able to accommodate multiple inputs (Coelli et al., 2005). Farrell (1957) classified efficiency of firms as technical and allocative efficiencies. The latter being the optimal usage of input given price and technology. The combination of these two makes up the measurement of economic efficiency measured in two basic approaches; the input-oriented measure and the output-oriented measure.

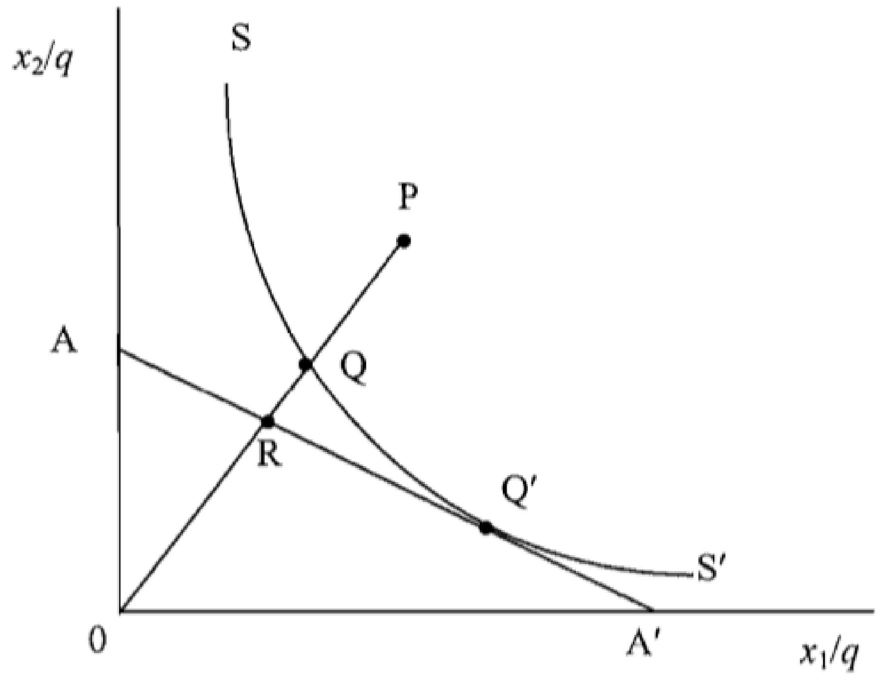


Figure 1.4: **Input-Oriented Measure Technical and Allocative Efficiency**

Source: Coelli et al. (2005), Pg.52

For input-oriented measures, assuming a constant return to scale (CRS) with banks using two inputs (X_1 and X_2), following the concepts of Farrell (1957), then banks technical efficiency, TE, can be measured in Figure 1.4 with the Isoquant, *SS'*. Such that banks using quantities of inputs at P to produce a unit of output is technically inefficient to the amount of input percent of QP/OP[7].

Hence, banks TE is measured as;

$$TE = OQ/OP \tag{1.9.3}$$

Since TE values range from 0 to 1, *equation (1)* is expressed as $1-QP/OP$. Thus gives the indicator of TE of a bank, with 1 denoting fully technically efficient bank corresponding to point Q in Figure 1.4

Therefore, banks input-oriented TE measure is given in terms of input-distance function $\delta_i(x,q)$ as;

$$TE = 1/\delta_i(x,q) \tag{1.9.4}$$

Where $TE = 1$ and $\delta_i(x,q)$ since fully technically efficient bank is on the frontier.

Given that banks' cost (interest rates) of mobilising funds (deposits) is known, their cost efficiency can be measured. Assuming n equals the vector of bank deposits (input) prices and m stands for the observed deposit prices at point P in Figure 1.4, i.e., point of technical inefficiency, then $\hat{m}$ and m^* are input vectors associated with fully technically efficient point Q; and cost-minimising input vector, *Q'*, respectively.

Therefore,

$$CE = \frac{n'm^*}{n'm} = OR/OP \tag{1.9.5}$$

where, CE is the cost efficiency.

Where the price of deposits, which is represented by the isocost line *AA'* in the figure is known, the banks allocative efficiency (AE) can be estimated using isocost line as;

$$AE = \frac{n'm^*}{n'\hat{m}} = \frac{OR}{OQ} \quad TE = \frac{n'\hat{m}}{n'm} = \frac{OQ}{OP} \tag{1.9.6}$$

Where RQ denotes the reduction in production cost given that production is allocatively (and technically) efficient at *Q'*, as against being technically but not allocativelly efficient

[7]Represents the amount the percentage by which input has to be reduced to be technically efficient.

(AE) at Q.

CE is thus the combination of the measures as;

$$CE = TE \times AE = \frac{OQ}{OP} \times \frac{OR}{OQ} = \frac{OR}{OP} \tag{1.9.7}$$

Note that both CE, TE and AE range between 0 & 1.

The output-oriented efficiency measure is different from the input-oriented measure because it explores how to increase output quantities proportionately without varying the input quantities used. The reverse is what input-oriented measure of efficiency is concerned with. Again, given the CRS assumption, banks output-oriented efficiency measures is modelled assuming banks production involves two outputs (q_1 & q_2) and a single input (X). The unit production possibility curve *ZZ'* in Figure 1.5 represents technology in two ways, where point A stands for an inefficient bank.

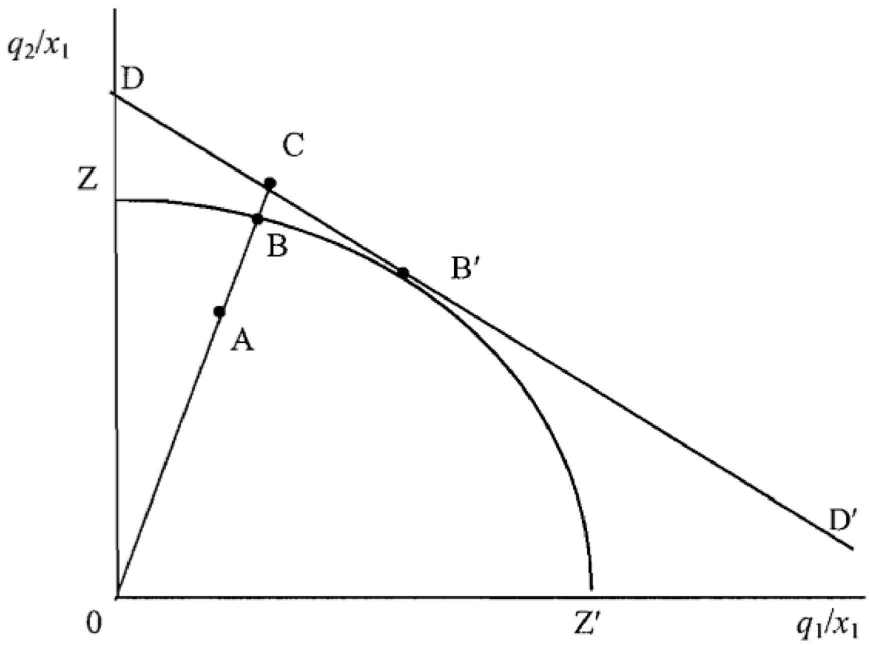


Figure 1.5: **Input-Oriented Measure Technical and Allocative Efficiency**

Source: Coelli et al. (2005), Pg.55

Given that AB is technical inefficiency representing the quantities by which banks outputs could be increased without additional input, then the output-oriented TE measure is given as,

$$TE = \frac{OA}{OB} = \delta_o(x, q) \tag{1.9.8}$$

Where $\delta_o(x, q)$ equals output distance function at observed input vector x and output vector q.

Hence, revenue efficiency can represent any observed output price vector p defined by line *DD'* in Figure 1.5. The revenue efficiency (RE) is expressed as;

$$RE = \frac{p'q}{p'q^*} = \frac{OA}{OC} \tag{1.9.9}$$

Where q and q^* are observed output vectors of banks at point A and RE vector at point *B'*.

Assuming bank's interest incomes on its loans and other outputs are known, then the isorevenue line, *DD'* defines the AE and TE measures thus;

$$AE = \frac{p'\hat{q}}{p'q*} = \frac{OB}{OC} \quad TE = \frac{p'q}{p'\hat{q}} = \frac{OA}{OB} \tag{1.9.10}$$

Where $\hat{q}$ TE production vector at B. For all total revenue efficiency measures;

$$RE = TE \times AE = (OA/OB) \times (OB/OC) = OA/OC \tag{1.9.11}$$

All measures range from 0 to 1.

Notice that in both measures, AE has been measured from cost-minimising and revenue-maximising point of views rather than profit maximising which normally include the combination of both perspectives which are accommodated in different ways using data envelopment analysis (DEA) or stochastic frontier analysis (SFA) that are both equally used in literature (Balk, 1998; Chung, Färe, & Grosskopf, 1997; Chung et al., 1997; Kumbhakar, 1987).

1.9.9 Bank Fragility

The assessments of fragility in the banking system is based on the two-sides of their statement of financial position (balance-sheet). On the liability side, fragility is rooted in the prisoners' dilemma theory. This is predicated on Diamond and Dybvig (1983)'s arguments of loss of public confidence in banks that result in bank run. The basis being the interaction between banks' assets and liabilities maturity tenors, that is, short-term liquid deposits and long-term illiquid loans. In principle, banks are stable without instantaneous and simultaneous withdrawals by depositors of their funds. Where deposit is stable, banks will possess adequate liquidity to cope with depositors withdrawal demands and still be able to make a margin from investing excess liquid assets in high return illiquid assets to offset fluctuations. Any disruption in this normal course of banking business normally heightens deposits liquidation, in which case, all depositors move their funds. The consequence is banks' capital get eroded as they have to dispose their illiquid assets at losses to meet withdrawals demand, resulting in failure.

On the assets side fragility usually results owing to the problems of asset quality arising from disaster myopia, herd behaviour, negative externalities and preserve incentives. Knight (2009) explained disaster myopia as one whose possibilities of occurrence is an unmeasured uncertainty with a risk that can not be understandably measured actuarially. It is a situation in which financial disaster is viewed to seldom occur, such that it is difficult if not impossible to employ actuarial probability to predict future occurrence. Banks hence rely on financial authority to salvage such looming adversity especially where it is quite big with monumental effects on the financial institutions. According to Davis (1995), herd behaviour is a manifestation of irrationality or acting rationally in condition of uncertainty. It relates to the different aspects of loan disbursement that become problematic. Customers are advanced loans not according to their credit worthiness but on the reference that other banks have extended loans to them. Banks in most cases assume that because of the involvements of many banks authorities will be inclined to bailout if problems arise with loan disbursement. Perverse incentive occur where management tends to behave less cautiously in financial decision making process because of preserve incentive system. Ross (1973) viewed this as a principal-agent problem in which the structure of management compensation scheme generates suboptimal management performance. In negative externalities, banks increasingly transfer their decision making costs to their customers. This occurs mostly in banking because of the relative meagre capital cushion to its total assets compared to other industries.

Moral hazard is principally the cause of principal-agent problem and negative externalities as information asymmetry explains more generally the bias leading to banking instability, aggravated by competition. Disaster myopia is often encouraged by market power such that creditors failing to account for the worse outcomes of their loan-pricing decisions get more competitive than those taking them into consideration, making the later either leave the market or push price into line. Meanwhile, credit decision is not effectively disciplined by the disadvantage of negative results because they disguise to influence the healthy behaviour of credit disbursement. Imperfect information publicly available to creditors makes it much more difficult for them to assess the strength of the banks compared to those of other industries. The difficulty of assessment is perceived as indicative of the fragility of the system as against other institutions with similar business structures.

1.9.10 Competition and Stability Models

Studies that have considered competition and stability align towards two strands of theoretical and empirical literature; competition-stability and competition-fragility views. The competition-stability found that the efficiency that comes with competition helps to stabilise the banking system. The fragility view, however, found that risk appetite is associated with competition which results in instability hence advocated a considerable market power. Put more succinctly, these two opposing hypotheses relate bank competition to stability.

The traditional competition-fragility theory argues high competition in banking causes banks to forfeit their market powers, culminating in declining profitability. Hence they become aggressive to invest in riskier portfolios as a way to recoup the financial losses. Therefore, the proponents of this view posit that this risk-taking behaviour will erode banking system's stability. On the contrary, the competition-stability theory emphasises the potential positive effects that competition has for the stability of the banking system. Accordingly, Boyd and De Nicolo (2005) considering the assets side of banks' balance sheets argue that the risk-shifting effects of banks market power in less competitive market is the ultimate cause of instability in banks as their loan portfolio riskiness rises. Martinez-Miera and Repullo (2010) concur with this view but however added that the higher interest rate charged improve the bank's profitability, that is, the margin effect and, as such, presented a U-shaped argument in the competition and stability relationship. As we would see further in Chapter 4, both theories and empirical evidence have been conflicting and inconclusive on these arguments.

1.10 Structure of the Thesis

There are eight chapters in this thesis. Chapter 1 has provided the motivation for the study with the problems of the study, the research objectives, the contributions of the study, and the conceptual and theoretical frameworks. In Chapter 2 is the review of the financial sectors of the SSA region with particular attention to the features of the banking sectors of the countries included in the study. Chapters 3, 4, 5, 6 and 7 take an essay form, each having their literature reviews, methodology and empirical analysis. Specifically, Chapter 3 assesses the level of competitiveness of the commercial banking sectors of SSA region including determining some of the bank specific variables that influence the level of competition. Chapter 4 presents the competition and stability relationship and Chapter 5 the relationship between competition, efficiency and stability. Chapter 6 brings competition, regulation and stability together in a short-term structural model analysis. For robustness and for the purpose of model building, Chapter 7 modelled competition, regulation and stability relationship and with a long run perspective. Chapter 8, the last chapter, contains the summary, conclusions and recommendations. Limitations of the study as well as suggested future research area are also included in this chapter.

Chapter 2

SSA Region Banking Sectors Review

2.1 Introduction

The preceding chapter provided the background to the study, the motivation of the study, the research problem and research questions. In this chapter, we provide an overview of the financial sectors of the SSA Countries in order to provide further insights into the nature of the banking systems in terms of competition and the nature of threats to stability cum developments in regulations.

Similar to the trend across the globe, the banking systems in the SSA region have witnessed some remarkable growth, especially in terms of total assets. Apparently, some banking sectors in the region have however shown a much stronger level of growth than others owing to continuous reforms and improved financial sector policies. Since the 1980s, financial reforms in many SSA countries have significantly contributed to development and efficiency of their banking sectors. As a result, bank credit to private sector has improved, risk management of commercial banks has also improved and capital bases have strengthened. Most SSA banking systems were resilient to the 2007/2009 global financial crisis. Mobile banking expansion and the emergence of regional banking groups are among the notable changing landscape of banking in the region, that are considered healthy for competition in national banking sector although not without their attendant regulatory and supervisory challenges. The reforms and economic growth not withstanding, most

SSA banking sectors are still underdeveloped, with low and inefficient intermediation with marked concentration. Hence, the region lags behind its world counterparts in terms of financial depth and access. Meanwhile, provision of credit to the private sectors constitutes the most important way that banks could support poverty alleviation strategies.

In terms of macroeconomics, there are striking similarities across countries of the region and especially within the notable subregional economies. The region has witnessed remarkable economic growth in the past two decades, averaging in excess of 5% year-on-year[1], and still persisting with the exception of few countries like Nigeria and Chad in recession. This growth was supported mainly by booming commodity prices as most countries in the region are endowed with natural resources (IMF Report). This explains why they are mostly vulnerable to external shocks and having to most times depend on aids and remittances to fund their national budgets. Despite gains in economies, poverty is widespread ranging from about 23% of national population in Djibouti to 85% in Liberia except for Uganda and Mauritius that have less than 20% of their population living in abject poverty at 19.3% and 8% respectively. Inflation figures have been relatively low, averaging less than 3% among West African Economic and Monetary Union (WAEMU), less than 5% in Southern African Development Community (SADC) with the exception of Botswana and Malawi which both account for over 10%, 5% in East Africa Community (EAC) with Ethiopia having well above the subregional average while it is averagely high among members of the Economic community of West African States (ECOWAS), in the range of 6-17%.

The rest of this chapter reviews the current state of the banking system in the region based on the countries considered in this study with the summary of the reviews presented in Appendix A.

2.2 Banking Sector by Country

This section attempts the review of the banking sector of the SSA countries whose banking sectors are included in this study. Information used in this review were synthesised largely from the reports, statistical databases and bulletins of AFDB, WDI, IMF, CIA-World

[1] Authors approximation of WDI, IMF and AFDB Statistical data

Fact Book and the national statistical body of the respective countries.

2.2.1 Angola

Angola's banking sector has grown in the past decade, witnessing the increase of commercial banks from nine to 23 of which two are privately owned and three managed by the state. The growth in the banking has been due to economic expansion and increasing foreign interest that was fuelled by the peace accord and oil boom. The banking sector is dominated by five largest banks holding in excess of 79% of the total banking sector assets. Although credit to the private sector has been growing post war, it witnessed decline during the 2007-09 crisis. Yet, fewer than 10% of the population have access to banking facilities with unfriendly conditions not conducive for lending and having only few businesses applying for loan facilities. Nonetheless, the profitability of the banking sector is good with ROE consistently in excess of 20%, relatively low nonperforming loans (NPLs) cum a well capitalised sector with capital adequacy nearly twice the minimum 10% requirement by national regulation at above 19%. Even though the banking regulatory environment is improving and embracing transparency norms, they are locally crafted and not aligned to international regulations like the Basel Accord, International Accounting Standard Board (IASB), among others.

The non-diversification from the oil dominance pose risk of exposure to bad loans to banks as oil sector is linked to manufacturing and service industries such that any downside in the energy sector as witnessed in the global decline in the oil price may spell doom for the banking sector. This has continually been the potential for instability for Angola's banking system that calls for urgent redress.

2.2.2 Benin

Benin belongs to the common central banking system of WAEMU, the Central Bank of West African States (BCEAO). The financial system remains underdeveloped and vulnerable, curtailing credit to private sector with low quality of banks portfolio. This is worsened by a weak business environment and financial infrastructure that limit lending to private sector including a frail judicial system that is unable to defend contract enforcement. Meanwhile, the banking system dominates the financial sector accounting for about 90% of the total assets as the banks total worth are up to 62% of GDP as at June, 2015

(AFDB, 2015). There are 12 commercial banks in the country holding 12.4% of the total assets of the sub-region's commercial banking sector. Of the 12 banks, the four largest are Pan African banks, one controlled by foreign holding company and three owned by Nigerian banks. The banking system is characterised by high interest rates with conservative lending processes resulting in only few firms having access to credit. Furthermore, there is high NPLs, currently at about 22% and above WAEMU's average of about 17%. This has resulted from their vulnerability to government lending. Government has huge arrears due to the banks. Consequently, the liquidity ratio defined as the ratio of liquid assets to short-term liabilities is as low as under 25%. Moreover, high operational costs in the banking sector and heavy reliance on lending to government and their clients mean low profitability; the ROE and ROA are currently estimated at about 2% and 1% respectively. Capital adequacy ratio is just above the 8% minimum regional average at 8.8%. Stress test by IMF reveals that the banking sector is facing credit risk concern stemming from poor loan portfolio quality, vulnerability to external shocks and weak judicial system, among others.

Despite no immediate threat of financial fragility, the increasing concern for credit risk, shocks to terms of trade with trading partners, rising NPLs and weak judicial system that could mean that the financial system is sitting on a time bomb. These have to be urgently addressed for a viable and competitive banking system.

2.2.3 Botswana

Botswana's economic success is not without a well regulated and developed banking sector that is dominated by commercial banks numbering 11 at the end of 2014. According to the IMF, commercial banks dominate the deposit market with an average of 98% market share and account for 89% share of total sector loan over the past decade. The sector is greatly concentrated, with four largest banks holding an excess of 81% of the total sector assets. It is also well-capitalised as banks have to comply with a minimum of 15% capital adequacy ratio and 7.5% minimum Tier 1 capital and as such have maintained capital over and above these requirements with as high as over 20% in most cases over time. Tied to this is that the banking system is highly liquid and thus supports the high credit growth rate in the economy which even though sluggish in 2009 has since picked up. Moreover, the banking system according to Dyke (2013) has a well-diversified credit portfolio with loans to private sectors accounting for 43% of the total credits in 2011, for instance. The Botswana's banking system is also considered profitable having return on equity prior to 2009 in excess of 40% per annum and in spite of the 2007/09 financial crisis effects was 19.1% in 2014. Furthermore, NPLs have declined after they peaked at 6.1% in 2010 to about 2% in 2014.

The business-friendly environment and good governance notwithstanding, Botswana still remains predominantly dependent on natural resources most of which remained untapped. It is hoped that the growing competitiveness of the banking sector with its attendant lowering interest rate may assist in further opening up the economy and enhance the diversification and privatisation efforts of the government in these regards.

2.2.4 Burkina Faso

As one of the members of WAEMU having a common central bank, the BCEAO and common banking system, Burkina Faso' financial system is dominated by commercial banks, with 12 commercial banks and five financial institutions accounting for about XOF2,283 billion (approximately US$3.7 billion) which is 13.2% of the total assets of banks in the region. The banks are dominated by multinationals and Pan African banks that holds over 90% of their total assets. Other notable features of the system include concentration as the three largest banks own close to 50% of the sector total assets. The sector is also well-capitalised with the ratio of regulatory capital to risk weighted assets estimated to about 12.4%. However, it is confronting exposure to exogenous shocks affecting the commodity prices. This makes issues of stability a cause for concern even though asset quality has improved with NPLs on the decline from 15.8% in 2008 to 10.2% in June 2016. There are high interest rates, ranging between 10% to 12% as well as low access to banking services put at 7% of the population despite reforms instituted in 2009 to decentralise the financial system.

Notable challenges include ongoing exposure to external shocks arising from changes in commodity export prices, vulnerability to fluctuations in rain, political instability in the country and the sub-region and lack of export diversification including openness to international trade. All these put in perspective will continue to determine the well-being and future of the banking sector in Burkina Faso.

2.2.5 Cabo Verde

Cabo Verde has a small and established financial system with improved product and service offering and banks at the forefront of high-tech banking practices. The financial landscape is dominated by banks with little financial sector activities outside the banking system. The banking sector itself is dominated by Portuguese private capital, consisting of onshore markets of five commercial banks and offshore market with eight international banking institutions out of which lending activities are concentrated in the three largest banks. The banks are generally sound though susceptibility has worsened with the 2007/09 financial crisis. Onshore banks are well-capitalised as capital adequacy stood at 12% as at 2010, but liquidity remain low with liquid assets to total assets at 15.6%. Profitability and asset quality also deteriorated in the wake of the 2007/09 financial crisis, evident in their ROE and ROA in spite of high number of branches per 100,000. In addition, NPLs have increased tremendously, rising from 10% to 13% in between 2008 and 2010; however, they dropped to 5.5% in 2010-11. Credit to private sector has also declined, from an average of 18% in the 2000s; it has been dropping since 2007 having peaked at 40% shortly before the crisis. Credit to private sector then fell to 10% at the end of 2010, zero in 2013 and even negative thereafter. This has been attributed to slow growth in both business and consumer credit. The deceleration in credit to private sector coincided with decline in economic growth.

Diaspora deposits[2] account for 37% of total deposits of banks and growing over 5% year-on-year for which the attraction has been high onshore interest rates. This makes banks highly vulnerable to any destabilisation in such capital flow thus leave much for consideration in this area.

2.2.6 Cameroon

Cameroon is a key player in the Central African Banking Systems accounting for over US$6 billion in loans and advances. Specifically, Cameroon to date has 13 licensed commercial banks with foreign banks subsidiaries dominance (mainly from Europe and other Africa countries) that represent 38% of the total bank assets in the Economic and Monetary Community of Central Africa (CEMAC) (AFDB, 2015). Besides the commercial banks, there are 500 micro-finance banks with other four specialised financial institutions.

[2]Deposits by citizens abroad

The banking landscape is highly concentrated with the three largest banks accounting for over 50% of the share of the loans and deposits markets and holding more than 70% of the banking sector total assets. Banking loans market has witnessed growth in the last few years which average over 35% as a result of increased borrowing by companies partaking in public investment projects. Yet, there is low banking penetration as according to Mlachila, Park, and Yabara (2013), less than 5% of adults has access to formal financial and/or banking services. This outlook becomes more glaring as commercial bank branch per 100,000 adults was 1.9 in 2014.

There is rising concern of financial fragility in the banking sector as stress test by IMF shows that less than 50% of banks in Cameroon comply with solvency ratio requirements with capital shortfalls as a percentage of GDP amounting to 45%, as capital requirement continues to decline and number of banks maintaining less than the minimum capital requirement increasing. These raise questions for concern on the level of stability of the banking system that also borders on gross non-compliance with prudential guidelines. IMF reports indicated that two banks violated on large exposure in 2009, increased to four and nine in 2010 and 2011 respectively. This increased the spate of fragility coupled with undiversified credit risk that is concentrated in the country's national oil refinery. The position is also worsened by weak enforcement of creditors right that has exacerbated the risk of lending to the private sector, leading to rising level of NPLs with increasing number of banks facing insolvency resulting in the surge of the loan loss provisioning that has recently increased up to 97% of gross NPLs. This is also reflected in the quality of assets with the consequent impacts on ROA that have declined considerably down from 1.1% in 2007 to 0.8% in 2014, even though ROE increased from 12.08% to 21.8% in the same period, with high interest rates spread in excess of 8% (AFDB, 2015; IMF, 2016). Liquidity as an average of liquid assets to total assets is in excess of 35%, explained by low loan to deposit ratio that is grossly below 50% with more than 75% of lending at the short-term end of the market.

Government launched the Central Africa Cashless Interbank Group (GIMAC) in 2012 to deal with financial services access. However, the challenges of a weak regulatory framework and the absence of viable restructuring plan to solve high incidence on NPLs still subsist.

2.2.7 Central Africa Republic

CAR has the smallest financial system among the members of CEMAC. The financial system is underdeveloped and plays a limited role in supporting economic growth in the country. It comprises four commercial banks, 11 microfinance institutions (MFIs), two insurance companies and a social security fund. With the absence of capital market, the financial system is dominated by the banking sector with commercial banks holding 93% of financial sector total assets representing 2% of CEMAC region total banking assets (AFDB, 2015). Banking activities are inhibited by weak market infrastructure, zero legal, judicial, prudential and regulatory framework. Economic and security challenges limit access to financial services concentrating bank branches and infrastructure in the capital city. Consequently, financial intermediation is among the lowest around the world averaging 11% of GDP over the study period with only about 1% of the population having a bank account and 0.5% with an outstanding credit facility; in addition to low banking penetration with high interest rates at over 15% in the study period. These translate to poor credit portfolio as ratio of NPLs to total loans is over 30% with provisions in the region of 52%. This credit exposure is worsened because lending is mainly to the public sector and at the short-term end of the market.

The landlocked geographical location, highly unskilled labour, poor transportation system, legacy of misdirected economic policies and political insecurity have continued to be the bane of economic and financial development. There is an urgent need to improve access to credit by putting in place legal and judicial system to serve commercial needs, increase capital and reduce NPLs as well as diversify credit portfolio that currently concentrate in the public sector to reduce sovereign risk exposure of banks.

2.2.8 Chad

The financial system of Chad is among the least developed in the CEMAC region; weak, limited in depth, with low monetisation and having total assets amounting to 12% of GDP which is less than the CEMAC average of 19% (AFDB, 2015). The financial system is dominated by commercial banks, consisting of eight commercial banks, two insurance companies, two pension funds and over 200 MFIs. The total assets of the commercial banks account for 6.5% of CEMAC region banking total assets with XAF497 billion in assets (approximately US$0.8 billion. The banking sector is as well concentrated with three foreign commercial banking owning over 65% of the total assets of the sector. The banking system has improved overtime, as a result of the reforms undertaken in the 1990s to streamline lending practices and improve NPLs volumes. The reforms also saw the privatisation of three largest government owned banks. Marred by informal financial services, limited regulation and supervision, the banking sector offers a limited range of financial products with most loan at the short-term end of the market. Resulting in low financial intermediation resulting in limited access to financial services as on the average over the study period, only about 2.1% of adults are bank depositors and just 0.3% are banks borrowers. Although payment and clearing mechanism as well as loan reporting are fairly developed, vulnerabilities still remains in the system arising from insufficient on-site supervision, high credit concentration, lack of depth, fragility and judicial system disorder. Fragility is largely due to government oil related risk, being almost the sole banks' client either directly or indirectly in the country.

Poor credit portfolio is a major exposure of the banking sector in the Chadian economy that must be addressed with relevant regulations and reforms that will enhance diversification.

2.2.9 Côte d'Ivoire

Côte d'Ivoire's financial system is quite competitive consisting of 23 commercial banks, 72 credit unions and financial cooperatives and 10 microfinance institutions (MFIs). The sector is dominated by a sound banking system, although the post electoral crisis in 2011 affected its operation; during which all foreign banks were closed. Despite this setback, the banking sector is still the largest in WAENU accounting for 27.3% of the total assets of the sub-region's banking sector. Banks, which are either foreign subsidiaries of French and Nigerian banks or owned by the government and other investors are expanding in networks with branches up at 600 in 2014 from 473 in 2010 (AFDB, 2017). The banking sector is regulated by BCEAO, concentrated with the four largest banks holding 48.8% of deposits and 56.9% share of the loan market. The banking assets grew 15.4% year-on-year in 2011 up from the previous growth rate of 12% in 2007, however, credit to the economy declined from 51.7% to 46.0% within 2010 and 2011 due to post election crisis that also saw an increase in NPLs that rose by 58.7% year-on-year in the same period. Estimates reveal that 64.8% of total loans are in the short-term end of the market, deposits serving as the main source of funding grew to 74.4% in 2011 from 70.9% in 2010. The banking system also experienced stable interest rates due to pegging of CFA franc to Euro that has saved the impact of fluctuation in currency on the interest rates. As a result, interest rates spread is consistently moderate at 3.3% as at 2011. Banks are also relatively well-capitalised with capital adequacy ratio at 13% in 2011 but remain exposed to credit risk arising from bank's reluctance, NPLs and legacy issues, making provisioning to be high at 64.5% in 2010 for instance. Côte d'Ivoire's banking sector is profitable but the profitability is fluctuating due to NPLs and competition from new entrants; ROE was about 10.8% in 2010 up from 4.8% in 2007.

The regulatory environment indicates weak compliance with prudential banking regulation requiring more resources to be allocated to banking supervision (World Bank, 2017). Moreover, there is need to push for a sound credit risk management framework given the high rate of NPLs. Other challenges still remain; political fragility, lack of collateral and good credit assessment framework limiting access to finance by small businesses and individual that required credit. Furthermore, the absence of credit reference bureau to evaluate borrowers and share credit information worsens credit market and heightens NPLs.

2.2.10 Djibouti

Djibouti has a shallow financial system, without a capital market and is dominated by commercial banks. It is important to note that the banks represent the growing proportion of the financial sector contribution to GDP. The banking sector is concentrated with 11 commercial banks of which two largest banks account for about 85% of total deposits. Access to finance is enhanced by money transfer services that are currently expanding due to policy directed at opening up the banking sector to facilitate loan provision while improving financial intermediation (World Bank, 2017). Besides, entry of foreign financial institutions put together, pushed domestic credit to reach 20% in 2011 of which credit to private sector constitutes over 80%. Banks remain profitable as the policy of account holding is increasing deposits post 2007/09 financial crisis. Lending increased even though still limited as the ratio of credit to deposit rose to 41.6% in 2009 from 29.5% in 2006. However, lending faces high exposure because enforcement of right of creditors is weak including the absence of comprehensive Know Your Customer (KYC) procedures on potential and existing customers. This makes commercial banks loan portfolio to deteriorate with rising NPLs estimated at 22% as at June 2015.

Continuous exposure to external shocks in addition to weak corporate governance and judicial procedures for enforcement of contracts constitute a major exposure for the banks with the absence of capital market unable to complement banking sector's capital formation drives.

2.2.11 Equatorial Guinea

The country's financial system is small, relatively underdeveloped with fairly limited capital market but sound. The constraints of limited access to finance, low consumer credit facilities and high interest rate spread hinder entrepreneurial activities. The banking sector dominates the financial system with four commercial banks that represent about 16% of total CEMAC banking assets and are mainly subsidiaries of international banks (AFDB, 2015). Ongoing development in the sector with the collaboration of government hope to enhance issues of access to finance. The banking sector is characterised by high interest rates spread that have curtailed access to credit facilities (IMF, 2016). As at 2011 only 30 of 1000 adults are bank borrowers when as much as 259 of 1000 are depositors of bank. Notably, recent competition in the banking sector has largely driven down real lending rates.

The major source of exposure of the banking system is that lending is targeted at government contractors and public infrastructural projects which are at the short-term end of the market. Moreover, the reliance on oil has continued to make the economy vulnerable to external shocks each time there are issues with global oil prices.

2.2.12 Ethiopia

In Ethiopia, public banks account for 67% of the total assets and 55% of the total loans and advances of the financial system of the country that is underdeveloped but now growing in leaps and bounds. It is dominated by the banking sector that is domesticated with no foreign participation. By 2013 there were 19 commercial banks, 16 of which are privately owned with government owning the largest bank. The largest commercial bank is the Commercial Bank of Ethiopia (CBE) representing 70% of the sectoral total asset as at 2012. The banking sector is generally sound but with excess liquidity and plagued with most of the issues that bedevilled the regional banks, that include, a weak regulatory framework, poor financial infrastructure, an absence of product diversification and low financial education (World Bank, 2017). Financial intermediation is as well low having one bank per about 40,000 people in 2013-14; which indicates poor access to finance. Meanwhile, the 2005 IMF Financial Sector Capacity Building project, meant to improve the bank balance sheet and credit to the private sector, has to some extent addressed some of the issues, as ratio of NPLs improved considerably from 20% in 2010 to 10% in 2011 with an average increase in private credit and financial assets.

The financial system is largely unliberalised as it runs a close system with government owned banks dominating the landscape. The implication is grievous for competition in the system that may hamper the much desired development including the potential exposure of the banking sector.

2.2.13 Gabon

The financial sector in Gabon is shallow and characterised by low financial intermediation. It is dominated by the banking sector that is predominantly commercial banks. There are nine commercial and one development banks that represent 21% of the total banking assets of CEMAC. The composition of the commercial banks indicate that two of the nine are owned by the state. The banks are highly concentrated with three largest banks holding about 80% of sectoral total assets (AFDB, 2015). There is also limited access to finance given that 131 per 1000 hold a deposit account while 73 out of 1000 are bank borrowers. Although the banking system is highly liquid, credit is limited with high interest rates and short-term repayment terms when companies seek for loans plus the fact that banks are extremely prudent in granting loans resulting in low lending activities.

Hence, the potential for the growth of banks is constrained coupled with the small size of non-oil sector component of the economy as the oil sector is financed by large syndicates of international banks.

2.2.14 Ghana

Ghana's financial system consists of 26 commercial banks, 135 rural community banks and 49 non-financial institutions including; savings and loans, leasing and mortgage firms as well as 402 credit unions and financial cooperatives among other informal deposits taking outfits. Out of the 26 banks, 11 are locally owned. The top five banks control the markets share with 45.6% of industry assets, 29.0% of loans and 43% of deposits as at 2011 (Mlachila, Dykes, et al., 2013). Banking total assets grew at an annual rate of 28.2% within 2007-11 so that by 2011 the total assets stood at US$13.39 billion as a result of economic expansion, emergence of oil and gas sector and regulations driving capital raising programs. The growth in assets however was not matched by credit as the ratio of loan to total assets declined over the same period from 52.4% to 38.5% and by 2016 growth in credit to private sector slowed from 36.3% in 2015 to 9.0%. According to IMF report, financing opportunities on the local market are limited due to the high interest rates on bank loans, which are generally higher than 25% given that the bank average lending rate was up to 32.7% as of June 2016, from 27.5% in the same period in 2015. However, widening interest rates spread has increased interest income as deposits continue to dominate the funding of banks, for instance, ratio of deposit to total assets increased from 66.0% in 2008 to 74.3% in 2011. Asset quality declined considerably during the 2007/09 financial crisis that saw an increase in NPLs from 6.4% to 16.8%, caused mainly by defaults from indigenous private enterprises. This has elicited increased loan loss provision standing at 7.9% in 2016 from 5.1% of gross loans the previous year. Banks remain solvent despite the declining quality of assets with capital adequacy ratio increasing from 14.8% to 19.1% during 2001-10 while ratio of regulatory capital to risk-weighted assets remained 16% even as at 2016 which is over and above the national minimum requirements of 10% (IMF, 2017). This is not without the recapitalisation efforts undertaking within the last decade in the banking system. The conservative approach to lending by banks boosts liquidity, resulting in declining loan to assets ratio as banks direct more of their assets to investments in government short-term securities. The ratio of liquid fund to liabilities rose from 41.6% in 2008 to 62.1% in 2011 while liquid fund to assets increased from 37.3% to 53.3% over the same period. The banks also remain profitable despite the global financial crisis that saw a deep in ROE to 17.4% which also is partly due to a surge in shareholders' fund arising from recapitalisation and increased to 29% by June 2015; even though declined to 23% in February 2016, it remained strong.

There were also a number of regulatory developments in the banking sector. Recently, the Banking Act of 2002 and the new regulations in 2016 enhanced the powers of the Bank of Ghana (BOG) to supervise and provide regulatory oversights on banking activities. In addition, the recapitalisation efforts have continued to support a stable and strong banking system. Nonetheless, the banks are still relatively small in size and the rising interest rates have continually provided a barrier to the much-needed financial intermediation and a major source of exposure to the system as well.

2.2.15 Guinea

The financial system is small and dominated by the banks, specifically the commercial banks. It consists of 13 commercial banks, six deposits-taking MFIs, six insurance firms, among others. There are quite a number of reforms being pursued to improve the financial systems among which are payment system modernisation, addressing credit and liquidity management issues, and increased monitoring and regulation of banks. The banking system is not also immune from the common challenges that other banking sectors in the region faced, ranging from low financial intermediation, incidence of NPLs, high interest rates spread, exacerbated by near absence of capital market whose investors are almost 80% commercial banks (IMF, 2017). The future of banking in the country will be largely influenced by how far ongoing reforms could be effected, restructuring of fiscal imbalance, diversification to reduce the vulnerability of the economy to external shocks as well as curtailing the re-emergence of the deadly Ebola Virus.

2.2.16 Guinea-Bissau

Guinea-Bissau, a member of WAENU having common commercial banks, BCEAO, with common banking system, has a small financial system dominated by a poorly developed banking sector that holds only about 0.8% of the sub-region's total banking assets (AFDB, 2015). The financial system has five commercial banks holding 94% of the total assets financial sector assets and 18 licensed MFIs. It is characterised by high interest rates, conservative lending processes that limits lending to a few firms. There is high NPLs as the ratio of NPLs to capital stood at 41.2% in 2016 even though down from 65.2% in 2015 (IMF, 2016). As a result, authorities undertook a controversial takeover of two commercial banks NPLs that are worth up to 5.5% of the total GDP in an attempt to improve bank balance sheets and open up the space for private sector credit. The bailout saw a decrease in NPLs from 25.7% in 2014 to 6.2% and 5.6% in 2015 and 2016 respectively, reflecting the decline in provision witnessed in 2016 and 2015 at 4.2% and 8.9% respectively from 19% in 2014. Therefore, the private sector credit picked post bailout and is growing at an annualised rate of 18% though still remain low at 11% of GDP compared to 25% in WAENU and 28% in SSA region. Most banks are barely making profits - ROA, 2.9% in 2013-15 and declined to 2.8% in 2016. Even though ROE showed a promising outlook at 17.5% in 2014-15 and down to 16.5% in 2016, excluding benefits from bailout suggest a dire need for restructuring in the sector. However, the banking sector remains sound and fairly liquid, capital to risk-weighted asset is at 19% as well as capital to assets is 16.8% in 2016 above statutory requirements, while liquid assets to short-term assets remain 35% 2015-16. Interest rates spread is also seen to be low and stable over 2013-16 at 4.5%.

Strained fiscal activities due to political instability and suspension of budget support by donors continue to put constraint on the economic outlook. NPLs is forecast to rise post intervention where the needed structural changes are not addressed in addition to the non transparent mode of the intervention that has continued to raise uncertainty within the system. The way these play out will impact of the banking system in the near term.

2.2.17 Kenya

Kenya has the most developed banking and financial system in the East African Community (EAC). The financial system consists of 43 commercial banks, one mortgage company, 14 money remittance providers, three credit reference bureaus and 66 other financial institutions that include MFIs at the end of 2015. It has the fourth largest banking sector in the SSA region and the main regulator of the deposit-taking institution and the commercial banks is the Central Bank of Kenya (CBK). The banking sector is concentrated with six top banks holding an average of 54.4% of the total market share of banking assets even though it is open to foreign competitors with the presence of eight foreign banks as at June 2014. Although, the ratio of capital to total risk-weighted assets reduced to 18.9% from 20.5% and having CAR of 12%, liquid assets dropped to 38.7% from 41.2% respectively in 2015 from 2012, profitability increased by 5.3% from 32% ROE and 3.7% ROA in 2012. Overall, the banks are liquid, well-capitalised and profitable (AFDB, 2015; IMF, 2017; World Bank, 2017). Recent liberalisation, reforms and restructuring, among other factors, impacted the private sector's credit as a percentage of GDP which increased from 26% to 38% within 2002-11 and has continued to grow rapidly in recent years but still limited in resources allocation to the country's optimal capacity especially with interest rate spread at 9.8% as per 2012 estimates. Furthermore, the repeal of the Banking Act in August 2016 that capped lending rates to a maximum of 4% in excess of Central Bank Rate (CBR) reduced interest rate thereafter to 13.84% from 16.75%. The heightened CBK supervision, plus the introduction of tighter new credit facilities appraisal, coupled with stricter monitoring of credit portfolios have reduced NPLs from 10.9% in 2007 to 5.4% in 2011 and further to 4.8% in 2012.

Even though economic and financial forecasts do not pose any stability challenge to the banking system in the near term, significant challenges in the banking sector still remain. The depth of the banking sector and intermediation remain low with a lot of room for improvement in regulation; all these put together if not properly addressed could pose a danger in the near future to the banks.

2.2.18 Lesotho

Lesotho's financial system is small and underdeveloped. It consist of four commercial banks and various other financial institutions including MFIs and non-banking financial institutions. The banking sector is very liquid, concentrated and linked to the economy of its main trading partner, South Africa. The three largest banks are South African Banks holding an excess of 90% of sectoral assets limiting access to finance as only 41% adults are bank borrowers and 341 of 1000 adults are depositors during the period under review (AFDB, 2015). Liquidity ratio is about 82% at the end of 2014 with credit to deposits just 41% in 2011 up from 35% in 2010. The banks are also well-capitalised and profitable; however, lack of competition in the market causes a relatively high interest rates spread even though ratio of NPLs to gross loans improved from 4% in 2009 to 2.9% in 2011.

Lesotho's economy has been a mere appendage of those of South Africa. Therefore, the major challenge that the country faces is that it will continue to be vulnerable to external shocks which also keep the banking sector highly exposed.

2.2.19 Liberia

The financial sector in Liberia is fairly diversified consisting of nine commercial banks, 20 MFIs, one micro-finance deposit-taking institution among other financial and NBFIs. The banking sector is open to foreign competitors as seven out of the nine commercial banks are foreign owned. There is low access to finance as the commercial banks' roles in the economy are limited, serving mostly established businesses in the capital city and few main towns and generally providing trade-credit on short-term basis to the service sector (World Bank, 2017). There are currently four commercial banks branches per 100,000 adult's population growing very slowly since 2010, 60% of which are concentrated in the capital city, Monrovia. The banks are less profitable as they have been struggling with low profitability for sometimes now despite high interest rates spread. This is partly attributable to limited lending opportunities, poor asset quality that requires high provisioning with weak lenders protection including absence of money market. ROA and ROE have been consistently below 1% since 2010 and even negative in 2013.

The bane of the Liberian economy has been the continued low global commodity prices, post-Ebola decline in official aid inflows. Besides, the costly judicial process and weak contract enforcements makes banks risk averse, limiting business opportunity, poor infrastructure and weak communication, among others, affecting the viability of the banking system, thereby exposing them to default and high operating costs.

2.2.20 Malawi

Malawi's financial sector is improving. Though shallow, it has remained stable as it is not integrated to the global financial system. It consists of 13 licensed commercial banks and other financial institutions that are regulated by the Reserve Bank of Malawi (RBM). Financial inclusion rates strengthened at 54% in 2013 up from 45% in 2008 despite high cost of credit with lending rates as high as 25% in 2013 and the bulk of credit going to government and its agencies (Mlachila, Dykes, et al., 2013). Commercial banks though concentrated are well-capitalised and profitable. Robust prudential regulations help to limit banks' exposure to net-foreign exchange and ensured low NPLs as well. There is a very low private sector credit at 14.2% in spite of having the ratio of credit to deposit at 70.9% as of 2010. Access to credit is an enormous challenge especially to the small and medium scale enterprises (SMEs) as only about 19% of the population have access to the use of banking services.

The vulnerability to climate change as it continues to rely on agriculture and fiscal management challenges that have scuttled access to the much needed aid are the biggest challenges of the economy which do have their ways of impacting negatively on the financial sector.

2.2.21 Mali

A member of WAENU with common central bank, BCEAO, having a shallow financial system with low financial intermediation and limited access to finance. The financial sector consists of 13 licensed commercial banks with two financial institutions having total assets of about 12.5% of subregional banking total assets (AFDB, 2015). It is characterised by high interest rates, conservative lending processes with few firms having access to credit. Out of the commercial banks, 11 are foreign owned holding over 80% of the total assets of the sector, and concentrated with five banks accounting for two-thirds of the total assets and 70% of deposits. Also, five of the banks are partly owned by the government holding minority shares in four and majority shares in one. Bank loans are targeted mainly at government and its agency that also provide the deposits substantially. Several reforms have been undertaken that include recapitalisation and privatisation. The government has also made efforts at creating schemes to guarantee commercial banks loans in order to encourage long and medium term credit to the private sector as lending has been at the short end of the market in spite of banks being liquid.

Economies especially in the WAENU subregion have continued to range from being vulnerable to external shocks in prices to weak judicial systems and institutions as well as undiversified products that have various implications for the banking system.

2.2.22 Mauritania

Mauritania's financial sector remains shallow, concentrated in the urban area and characterised by low credit to private and household with limited access to finance and high cost of funding as bank loans and deposits represents less than 12% of GDP. It consists of 12 commercial banks and two other financial outfits that are not fully integrated into the global financial system (AFDB, 2015). Commercial banks serve merely 4% of the population even as banking dominates the financial sector with 88% of the sector held by the commercial banks with the country's five largest banks combined reserves estimated at about \$100 million as at 2013 (IMF, 2017). The banking sector is well-capitalised but less competitive despite the presence of foreign banks. The central bank of Mauritania regulates the banks and has championed major repeals of regulations and legal frameworks in the recent past that include, minimum capital requirements, regulations and lending policies as well as measures to enhance a competitive banking system.

Economic risks still remain a recurring decimal, dependence on foreign aid and investments, insecurity in the neighbouring Mali, poor infrastructure and institutional capacity and human capital.

2.2.23 Mauritius

Mauritius boasts of a well-developed financial system with necessary financial infrastructure that is sound and profitable. It was ranked first in Africa and 39th in the world in terms of microeconomics and macroeconomics foundation of national competitiveness by Global Competitiveness Reports (GCR) in 2014. In addition, Mauritius also ranked 26th in the world for financial deepening based on improved access to different modes of financing and financial services. The financial system is dominated by the banking sector holding a total assets that is about 330% of the GDP at the end of 2014 and accounting for over 94.2% of the total assets of the sector during the same period. The banking system is characterised by openness to international banks with a sound and safe regulatory framework. There are 20 commercial banks in the financial system having 56% foreign ownership, 32% large domestic banks and the rest 12% other domestic banks as at 2015. The banks are concentrated with four largest banks holding 56.5% of the share of total assets, profitable, though declining, and liquid, well-capitalised with capital adequacy above the 10% regulatory minimum. Specifically, by 2015 the CAR was in excess of 17% as regulatory capital to risk-weighted assets stood at 17.6%, ROA at about 1.1% in 2015 down from 1.4% in 2012, and ROE stood at about 11.4% in 2015 down from 18.1% in 2012 while liquid assets ratio, that is, a ratio of liquid assets to total assets rising from 19.1% in 2012 to 25.1% in 2015 (IMF, 2017; World Bank, 2017). There is the history of past decades of built-up bank lending that increased from 70% in 2004-05 to its current level of 100% of GDP having peaked at 110% in 2013 (Mlambo & Ncube, 2011). Credit boom causes deterioration in asset quality as NPLs began to rise with provisioning not keeping to pace as in 2015 un-provisioned NPLs reached 17% of the bank capital. NPLs to gross loans rose from about 3.6% in 2012 to 5.7% in 2015. The Bank of Mauritius (BOM) regulates banks and other financial institutions that include non-bank deposit taking financial institutions (NBDTIs), foreign exchange dealers and money changers.

The banking system however, is not without its challenges. Presently, more than 90% of banks' assets and liabilities exposure to global business companies (GBCs) and non-residence are estimated to be in foreign currency. This in addition to the deteriorating quality of assets arising from rising NPLs and falling profitability with the inability to intensify expansion to other markets as the markets are currently viewed as over-saturated pose a threat to the future of banks and the financial systems of Mauritius.

2.2.24 Mozambique

The financial system is small, shallow and lack depth but growing with intermediation deepening as bank branches now reach rural settlements and sub-urban areas. It is characterised by limited access to credit as the private sector and individuals find it difficult to access credit which is often at high costs. This is further complicated especially in the rural areas by the lack of collateral as land leases are not admissible for collateral purposes. The financial system is dominated by the banking sector having 18 commercial banks. Four are foreign majority owned holding in excess of 90% of sectoral total assets. Ownership of these four banks consist of two Portuguese banks, one South African bank and one subsidiary of Barclays, a British banking group (AFDB, 2017). Banks have the risk of asset concentration and according to an IMF 2011 stress test report, any default in each bank's largest borrowers will be catastrophic to the CAR of the sector as primary borrowings stand at 65% of banks regulatory capital. However, the banks are profitable with ROE in excess of 20% since 2002, NPLs consistently relatively low and the sector remains well-capitalised holding capital in excess of 8% minimum requirements. Major challenge thus continues to be that of poverty and undiversification especially as it affects the credit portfolio of banks.

2.2.25 Namibia

Ranked 46 out of 148 countries in the world by GCR in 2014 for financial market development, the Namibian financial system is very developed with the banking sector services quite developed and competitive. It has a large and stable financial sector that is dominated by NBFIs with banks accounting for only 40% of sectoral total assets and banking sector assets about 68% of GDP. Banks are concentrated and are five in numbers, three of which are South African owned, one locally owned plus 11 other foreign-owned commercial banks as at 2011 (Allen, Otchere, & Senbet, 2011; Mlambo & Ncube, 2011). The banks are well-capitalised and profitable, with regulatory capital to risk-weighted capital at 15% in 2016 from 14.4% in 2013, ROA at about 2.9% in 2016 from 3% in 2013 having peaked at about 4.6% in 2015. Likewise, ROE peaked at about 55% in 2015 up from about 33% in 2013 and currently at 37%. Banks also have high credit quality with low NPLs, having liquidity ratio of 12.5% in 2014 in excess of 10% regulatory minimum. Credit to private sector was at 12% in 2016 down from about 14% in 2013 while growth in banks loan have been in the double digits in the last decades exacerbating households indebtedness and buoyant housing prices. The banks also have high risk of asset concentration with the financial sectors owning more than half of government debts. The financial system is regulated by the Bank of Namibia that is striving to establish a sound regulatory framework.

The linkages between banks and NBFIs financials and ownerships including foreign affiliations increase the complexity of the financial system making it increasingly difficult to assess the capital and liquidity adequacy of individual institutions. The prospect of the banking sector will depend on how much more inclusive the economy is, given unequal income distribution, plus high household debts indicating formally banked population are already highly indebted hence requiring diversification and upward movement in the society.

2.2.26 Niger

One of the eight members of WAENU with common central bank, BCEAO, Niger has a financial system that lacks depth with underdeveloped capital market dominated by banks and government. It consist of 10 banks and one financial institution accounting for 5% of regional banking total assets. The banking sector is concentrated having four largest banks holding 90% of sectoral total assets, shallow, still low at development and dominated by foreign banks (AFDB, 2015). Like other WAENU financial sectors, it is characterised by high interest rates, conservative lending processes with only few firms having access to finance. The ratio of credit to the private sector as a percentage of GDP was estimated at

15.4% in 2015 while depositors with commercial banks per 1000 adults were 43.9 in 2014. The banks appear well-capitalised and efficient especially when compared to other banking sectors in the subregion. The capital adequacy ratio was above regulatory threshold of 8% in 2016 as regulatory capital to risk-weighted assets fluctuated within 13.5% to 15.1% for the periods 2011-16. NPLs is high at 18.1% of total loans in 2016 having peaked at 19.6% in 2011 and declining thereafter to 15.5% in 2014, the slight increase to the current value are a cause for concern. It is also fairly profitable with ROE of 16.2% in 2012 up from 7.3% in 2011 and ROA of 1.8% in 2012 from 1.0% in 2011. The banks liquid assets are also declining with the figures at 22.4% of total assets in 2013 down from 33.3% in 2011. The banks credit portfolio is concentrated and tilting towards the government. Such rising exposure to the public sector could generate financial risks to the banks and inhibit growth.

2.2.27 Nigeria

The financial system of Nigeria is among the largest in Africa in capital base, quite developed and consists of Central Bank of Nigeria (CBN) as the apex and regulatory bank, Deposits Money Banks (DBMs) and other NBFIs. The financial system underwent major transformation with banking sector recapitalised and regulations enhanced following the 2007-09 financial meltdown having through gone a round of consolidation in the periods 2004-06. The banking system consists of 20 commercial banks down from 89 in 2004 and the banks remain adequately capitalised. CAR is above statutory minimum as regulatory capital to risk-weighted assets stood at 17.5% in 2015 about the same position in 2011 at 17.9%. However, there are concerns about the rising NPLs and the declining liquidity in the banking sector as increasing NPLs and reduced credit worthiness of borrowers indicate vulnerability that could hamper credit to private sector (Mlachila, Dykes, et al., 2013). As borrowers become more leveraged with foreign exchange exposures, banks get exposed to changes in external liquidity and exchange rates. Liquid assets to short term liabilities that were at 30.1% in 2011 and fell to 15.8% in 2015, likewise, liquidity ratio now stand at 10.7% as against 25.4% in 2012. Despite the taking over of banks NPLs by the creation of Asset Management Company of Nigeria (AMCON) in 2009 that reduced the NPLs that were as high as 16.7% on the average between 2004-10 to less than 5% in 2012, NPLs have begun to rise and at 5.2% in 2015 up from 3.5% in 2012. Hence, has taken its toll on banks profitability as there was only a marginal improvement in the last half decade given ROA at 2.5% in 2015 from 2.3% in 2012 while ROE declined from 21.1% in 2012 to 20.7% in 2015 despite high interest rates spread of 24% on the average over the periods.

The declining liquidity, deteriorating asset quality together with the prevailing economic challenges pose ongoing risk to credit quality and put pressure on capital adequacy and liquidity of the system thereby constraining the capacity of the banks to grant private sector credit in the near to medium term.

2.2.28 Rwanda

The financial system is moderately developed with the banking sector dominating the landscape having 67.6% of the industry total assets by 2013-14 and with the total assets of the banking sector as a percentage of GDP 29.2% in 2012. It comprises 10 commercial banks among which six have foreign ownership, four MFIs, one development bank and one cooperative bank. The banking system is concentrated but competition in key markets, with top three banks holding an excess of 50% of sectoral assets. It is liquid, well capitalised, profitable and quite regulated. However, some of these key financial sector soundness fundamentals are plummeting in value and is raising some concerns. Regulatory capital to risk-weighted assets were estimated at 20.7% in June 2016 down from 23.3% in March 2015. The asset quality is also declining as NPLs as a ratio of gross loan increased to 7% in the 2nd quarter of 2016 from 6.3% in the 1st quarter of 2015. Likewise, liquidity though above the regulatory minimum of 20% is declining as liquid assets to total deposits were 42.8% in 2016 from 54.2% in 2013-14. Furthermore, profitability declined given ROA and ROE in 2013-14 at 2.1% and 12.1% compared to 1.7% and 9.2% in 2016 respectively (IMF, 2016). Suffice to say that the solvency ratio is above the statutory minimum of 15%. It is also worth noting that significant progress has been made in reforming and modernising the financial system and/or the banking sector with the development of mobile and agency banking having the potential to transform the current business models of banking.

2.2.29 Senegal

Senegal is one of the eight members of WAEMU having a common central bank, BCEAO. Like other members of the subregion, Senegal's financial system is plagued with high interest rates, conservative lending process with few firms having access to credit. Nonetheless, the depth of financial system has improved overtime with credit to economy reaching 30% of GDP and higher than in most WAEMU countries, but it is relatively short-term in nature and directed towards oil, trade and food. The financial system consists of 27 institutions that are providing credit to the economy, 23 of which are well-capitalised banks having significant foreign ownership (AFDB, 2017). Banks dominate the financial sector with about 90% of the total assets of the sector. The banking sector is concentrated with top five banks holding 66% of assets and 79% of deposits. As at 2012, only about 1.5 million of the population have bank accounts corresponding to about 10% level of penetration posing challenges to financial services provision especially to the rural populace that account for about 58.5% of the country's total population (World Bank, 2017). The banking sector is sound but the concentration of lending and the level of NPLs poses a key concern. NPLs have only marginally declined to 18.9% in 2016 from about 20% in 2010-14 with lending concentrating in services, commercial and industrial activities sector which could make financial system exposed to firm and sector-specific shocks especially given the level of asset quality. Key features show that regulatory capital to risk-weighted assets increased to 16.7% in 2015 from 13.8% in 2008 while capital to total assets declined from 9.1% to 8.5% during the same period, ROA and ROE declined over the periods, from 1.4% and 13.0% to 1.0% and 11.9% respectively, while liquidity ratio increased with liquid assets to total assets rising from 31.7% to 54.7%

The key challenges of lending concentration, high NPLs and declining features are pivotal to the soundness of the financial systems and need closer monitoring and attention.

2.2.30 Seychelles

Seychelles has developed into a reputable offshore financial center on the African continent with a financial sector that grew at the rate of 4.5% during 2014 and consists majorly of banking sector, having a nascent insurance and pension fund institutions and only introduced security exchanges in 2012. The financial system is regulated by the Central Bank of Seychelles (CBS) and the financial services authority. The banking sector consist of nine commercial banks as at 2014 with high foreign presence and is well regulated, capitalised and liquid (AFDB, 2017). The regulatory capital to risk-weighted assets were 25.2% in 2016 from 26.7% in 2012, asset quality is relatively high and improving though it needs to be closely monitored at 7.8% in 2016 down from 9.3% in 2012, while liquid assets to short-term liabilities declined to 55.2% in 2016 from 58.1% in 2012. The sector is also very profitable with ROA at 3.8% in 2016 up from 3.1% in 2012 and ROE, 34.8% in 2016 from 29.8% in 2012. Recent liberalisation reforms implemented have improved private credit growth but still remain low at 25% of GDP despite ample liquidity. A major concern in the banking system is the quality of assets in addition to growing liquidity.

2.2.31 Sierra Leone

Sierra Leone's financial system consists majorly of the banking and insurance sectors. The banking system was restored having been destroyed during the 1991-2002 civil war. The financial system embarked on comprehensive reforms in 2008 to strengthen supervision, enhance competition, access to credit and payment system as well as jerk up minimum capital requirements. In spite of this, the sector is constrained by high financing cost, concentration and limited access to credit by the private sector. There are 13 commercial banks that are highly capitalised but with soundness concerns due to high incidence of NPLs especially with the two large state-owned banks. The banking system is dominated by state-owned banks that are in poor shapes. Banks are suffering from high NPLs and exposure to large borrowers. Such a scenario prompts the Bank of Sierra Leone (BSL) to strengthen bank supervision in other to address the issues of high non-compliance with prudential guidelines. The banking sector is also concentrated with three largest banks accounting for 54% of the total banking assets. It is riddled with high interest rates spread at 11%. Low efficiency is limiting banks from performing their key roles in the private sector credit that is now below 5% of GDP and declining. This is worsened with high shares of loan going to five largest borrowers making access to finance by businesses nearly impossible (IMF, 2017). The problem of poor governance, effects of Ebola outbreak and the crisis of NPLs in the banking sector made asset quality and capital buffer to deteriorate in the recent years. NPLs doubled in the two years preceding 2015 and as at June 2015 has accounted for over 40% of gross loans. The sector is liquid but also deteriorating with 24.4% liquidity ratio in 2015 down from 41.3% in 2011.

BSL needs to urgently address banks' balance sheets quality and strengthen supervision to stem the spate of banks flouting prudential guidelines. Concentration of banking assets in five largest borrowers makes the banks even more vulnerable to shocks in any of the borrowers.

2.2.32 Swaziland

Swaziland has a small financial system with NBFIs that is growing fast in recent years and dominating the financial landscape. The financial sector is tied to that of South Africa reflecting the economic ties between the two countries. The financial sector is a part of Swaziland's development strategy that is aimed at restoring banks' solvency, making the stock exchange more independent of government and exploring the potential to become an offshore financial center. The banking sector has four commercial banks. It is highly concentrated with three of the four banks accounting for 85.5% of sectoral total assets, which are owned by South African banking institutions. Banks are well-capitalised, liquid and the financial soundness indicators indicate a sound banking system. The total capital ratio as at 2013 was above 8% national regulatory minimum at 24.4%, Tier 1 capital decline from 77.5% to 21.5% but still above 4% regulatory minimum while regulatory capital to risk-weighted assets was 22.4% in 2015 down from 23.0% in 2010 (AFDB, 2017; IMF, 2017). Banking assets increased by 16.6% during 2012-13 with liquidity ratio about statutory minimum of 20% for commercial banks at 28.1% with liquid assets to short-term liabilities declining from 18% in 2010 to 12.4% in 2015. Some of the banks have relatively high NPLs with high credit concentration to large borrowers and having unitary business models including high levels of concentration on both sides of the balance sheet. Asset quality shows a large exposure to capital at 94.9% in 2015 as NPLs to gross loan increased to 6.4% in 2015 from 3.5% in 2011. However, the banks are profitable with ROE of 30.9% in 2015 from 28.7% in 2010 and ROA of 4.6% in 2015 from 3.4% in 2010.

The steep fall in SACU receipts and drop in commodity prices pose solvency and liquidity risk to banks. In addition, increasing links between banks and NBFIs that is now dominating the financial landscape is potential greater risk to the financial stability of banks.

2.2.33 Tanzania

Tanzania's financial system is shallow though it has witnessed some improvement in terms of development in recent years, and has been able to contribute 40.9% to GDP at the end of December 2014 with the sector dominated by the banks holding 70% of sectoral total assets in 2014. The banking system is small and inefficient, limiting access to finance but it is expanding with growth of 11.4% in 2015%. There are 45 banking institutions with foreign ownership of 48% of banking industry total assets that are sound overall but with wide variations within the system (AFDB, 2015). The presence of foreign banks brought in competition that is now resulting in significant efficiency and financial services quality. The banking system is also concentrated with three largest banks controlling 64% of market shares. Series of reforms were introduced by the government for financial sector development that translate to new regulations; the Bank and Financial Institution Act, the Capital and Security Act and the Bank of Tanzania Act, bringing about the creation of Dar es Salaam Stock Exchange (DSE). The banking sector is sound with core capital adequacy ratio at 20.0% in 2016 up from 17.9% in 2013. Liquid assets are above statutory limit of 20% with liquid assets to short-term liabilities at 36.2% in 2013 and increased marginally to 36.6% in 2016. The sector is characterised by relatively high interest rates though credit to private sector as a percentage of GDP has grown overtime with 16.% in 2016 up from 13.9%% in 2013. The concentration of credit in the hands of large borrowers has increased the sector's vulnerability with the banking sector being exposed to personal loans and crop financing. This has affected the quality of assets that is declining with NPLs net of provision to total assets rising from 15.6% in 2013 to 18.8% in 2016. Furthermore, the sector is profitable reflecting the hike in interest rates with ROA at 3.5% in 2016 up from 2.5% in 2013 and ROE 18.2% in 2016 from 12.8% in 2013.

The prospect of the banking sector will anchor on how well reforms can institute right to property and instigate further growth in the economy. Moreover, declining asset quality must be closely monitored.

2.2.34 The Gambia

The financial system of Gambia consists of 13 commercial banks and 11 insurance companies. Commercial banks dominate the financial sector and are mainly foreign owned. The banks grew rapidly in recent years during 2007-10 due to competition from the increased number of banks and foreign direct investments (FDI) inflows. Adequately well-capitalised and liquid, with risk-weighted capital adequacy ratio in excess of the threshold of 8% set by the Financial Institution Act 2003 at 27.1% in 2011 (IMF, 2017). The banking system is sound with quality of assets improving as NPLs ratio declined from 14% in 2011 to 7% in 2012-13. The Central Bank of Gambia (CBG) embarked on measures to ensure solvency and stability that include, establishment of credit reference bureau (CRB) in July 2009, recapitalisation during 2010-12, as well as the revision of the supervisory processes among others. However, recent government fiscal imbalance culminated into holding substantial high cost, domestic debt, estimated at 46% of GDP that is undermining the stability of the financial sector.

2.2.35 Togo

Another member of WAEMU having common central bank, BCEAO, Togo's financial system consist of 12 commercial banks and two financial institutions accounting for 7.7% share of WAEMU financial sector total assets (AFDB, 2015). Like other subregional members, the financial system is characterised by high interest rates, conservative lending process with few firms having access to credit. Although financial depth has improved over the past decade, the degree of financial intermediation in terms of the structure of loan terms and loan portfolio diversification is still limited. The Togolese financial sector is competitive with a significant numbers of foreign banks that account for 66% of system's total assets as at 2016. The banking system is sound overall but financial conditions vary with banks as some of the banks' soundness have weakened, resulting in declining declining solvency and assets quality indicators while profitability and liquidity also suffering. Solvency is slightly above the 8% threshold with the risk-weighted CAR at 8.9% in 2015 down from 11.7% in 2011. Large exposure to single creditor is a significant vulnerability point with exposure increasing as the banks credit concentrate on infrastructural projects. Moreover, there is widespread flagrant defiance of prudential guidelines with banks taking excessive risk as competition intensifies. Hence NPLs ratio of gross loans has worsened at 15.6% in 2015 up from 10.9% in 2011. Profitability outlook has dampened as ROA falls to 0.9% in 2014 from 2.0% in 2011, even though ROE improved from 13.6% in 20111 to 19.4% in 2014. Liquid assets to total assets were at 41.7% in 2015 up from 33.4% in 2011.

2.2.36 Uganda

Uganda is characterised by a small financial system that is dominated by the banking sector. It consisted of 26 commercial banks as at the end of 2014 and are generally considered to be sound and moderately liquid. Risk-weighted CAR was at 23.2% in 2015 up from 20.2% in 2012, which was considered to be more than double the minimum requirement. Liquid assets as a ratio of total assets was 44.2% in 2015 from 39.8% in 2012 while profitability is moderate but declining with ROA of 2.5% in 2016 down from 2.7% in 2012 while ROE was 15.6% in 2015 from 18% in 2012 (IMF, 2017). The financial system is growing, continuously improving as credit assets grew by 201% during 2013-14. Mobile money financial services are also developing with about 40% registered users thus improving access to formal financial services. Although sound, its financial intermediation role is weak, constrained by high operating costs, low credibility of policies and insufficient competition resulting also in high interest rates spread of about 22% during 2012-15 on the average. However, the recent stress test by the Bank of Uganda (BoU) indicates that banks are generally positioned to absorb specific shocks of increased NPLs, large deposits withdrawals and currency depreciation, suggesting that credit, liquidity and foreign exchange risks are largely well-contained. But there is the concern of loan portfolio concentration of which the default of largest borrowers will hurt capital, low rate of NPLs provisioning at 55% with over dollarisation having about half of loan portfolio denominated in dollars. The regulatory body is the Bank of Uganda.

2.2.37 Zambia

The financial system is small and undeveloped consisting of a banking system that is profitable and well-regulated. It comprises of commercial banks, NBFIs, pension funds, insurance firms and capital market regulated by the Bank of Zambia (BoZ). There were 20 commercial banks by 2015, four of which account for 65% of total assets and 13 foreign owned with 69% of sectoral total assets. The banks are well-capitalised. By the end of 2014, the total CAR was 23.8% more than twice the 10% statutory minimum and also profitable with ROE in excess of 20%. Nonetheless, the system is low in financial intermediation as according to the 2009 FinScope report more than 62.7% of the population has no access to finance; this has been worsened by high interest rates averaging 20% and generally the low confidence from the public. Which made the financial services sector to contribute less than 15% to GDP during 2011-12 and thereafter. Excess liquidity also arose from the inability of banks to extend credits to the under-serviced area of the economy. The financial system has benefited immensely from having proper financial regulatory framework achieved by the financial sector development plan (FSDP) that was started in 2004 (World Bank, 2017). The aim was to set up a stable, sound and market based financial institution that will provide support for the much needed resource mobilisation for growth sustenance and diversification of the economy. In 2012, the BOZ embarked on the recapitalisation of the banking sector from the then US$2.4 million for both local and foreign banks to the new US$20 million for local and US$100 million for foreign banks respectively. This was aimed at maintaining a stable banking system that will propel the right environment for economic growth.

2.3 Summary

This chapter provides a highlight of the background of the countries whose banking sectors are included in this study. The specific profile of the countries captured are based on macroeconomics, financial and banking sector reviews. Resources for this review drew heavily on the AFDB, WDI, IMF, CIA-World Fact Book and the national statistical body of the respective countries. As noted in Chapter 1, this review provide evidence that SSA region is predominantly poor with underdeveloped financial and banking system - dominated by commercial banks. While statistics showed relatively profitable and sound banking systems overall, key challenges of exposure to fragility in most of the banking system remain. Such challenges largely result from weak regulation, concentration of assets portfolio with exposure to government or individual organisation borrowers among others. A lot still has to been done in areas of institution strengthening, diversification and ultimately disentangling the region from being appendages to developed nations and heavy reliance on aid.

Chapter 3

Competitive Condition

3.1 Introduction

The starting point of policy on stimulating competitiveness in banking sectors of the SSA region is the awareness by policy makers and regulators alike of the subsisting competitive nature of the banking environment. This will inform the right approach to fathom the possible way forward. Chapter 1 presented the motivation for this study and the specific features of SSA banking systems were reviewed in Chapter 2. This chapter assessed the degree of competitiveness and the bank-specific factors that drive competition in the region. The level of competition and its determinants will help to gauge competition impacts on stability and how well regulation has helped shape the relationship. These will be explored in the chapters that follows.

Competition has attracted attention in banking and finance literature for decades. An extensive body of theoretical and empirical studies has reported the significant role of bank competition in ensuring access to finance (Chen et al., 2010; Clarke et al., 2006; Love & Pería, 2014; Mudd, 2013; Rice & Strahan, 2010; Tan, 2013). Mlambo and Ncube (2011); Ningaye et al. (2014); Pasiouras et al. (2009); Pruteanu-Podpiera et al. (2008) have also argured that competition engenders the efficiency of the banking system. Yet some other scholars have associated bank competition with the stability of the system (Ariss, 2010; Beck et al., 2013; Fu et al., 2014; Schaeck & Cihák, 2014). As noted in Chapter 1, Casu et al. (2015) state that competition is good for many reasons; it is an essential force in any economy, it encourages firms to be more efficient and provides better allocation of resources. In banking, efficiency should entail lower costs, which should be passed onto consumers in the form of lower charges, higher deposit rates and reduced lending costs (Casu et al., 2015). Essentially, competition in banking improves access to finance, increases overall competitiveness in other sectors of an economy, fosters innovation and increases quality, widens consumer choice and promotes economic growth (Leon, 2015b). As is the trend across the globe, SSA countries have witnessed quite a number of reforms in their financial sectors that are predominantly banking in nature in the last two and a half decades. The thrust of these reforms has been the opening up of the financial system for competition to engender a robust banking system that is capable of harnessing the potentials of the region for economic growth (Senbet & Otchere, 2006). The main reforms which are homogeneous across the region include recapitalisation, liberalisation, privatisation, deregulation, removal of credit controls, establishment of new refinancing policies and relaxing of indigenisation policies among others. The region has made some good progress from these reforms but whether they have translated to the much anticipated competitive banking environment, is still to be seen. According to Mlachila, Dykes, et al. (2013), the SSA banking system is highly concentrated and generally inefficient in financial intermediation. Basic indices of a competitive banking system like cost of banking, service charge, interest rates spread, interest costs, among others, are very high in this region compared with other regions of the world. The African Progress Panel in 2014 rose from the understanding that stimulation of competition will help to bridge interest rates spread that stifle savings and investments and consequently drive the needed economic growth in the region. How informed is this assertion? Is the SSA banking sector truly uncompetitive and how best should competition be stimulated?

The essence of this chapter is then to investigate the competitiveness of the SSA commercial banks[1] and consider at bank level the drivers of competition. This becomes imperative because, the starting point of devising a good policy is for policy makers and regulators alike to know how competitive is the banking system and the likely drivers of the competition in response to existing regulations and policies that have been put in place in order to forge the possible way forward. This study contributes to extant literature in developmental finance as being the first to our knowledge that has comprehensively investigated the competitive condition of the banking sector of the region using the Lerner index that

[1]Commercial banks account for more than 70% of the region's banking sector Allen, Otchere, and Senbet (2011)

is capable of analysing bank level competition. Available literature has only focused on few individual countries in the region and in doing so focused on just the banking market competition, more so as a component of studies' variable. This regional analysis of bank level competition is particularly necessary in the face of the increased tendencies towards regional integration. Also, to the best of our knowledge, no study has explored the determinants of competition for the region as well. Our study revealed that, while there are pockets of market power within a number of individual banks in the region, the market as a whole is monopolistically competitive and thus highly contestable. We also found the size of banks and the level of their capital, among others, to play vital roles in helping banks gain competitive advantage.

The rest of this chapter is structured as follows. Section 3.2 lays out the review of previous literature on competition especially how it affects the banking system. This includes theories and empirical literature. The study's methodology is considered in Section 3.3, then the analysis of results Section 3.4 and finally Section 3.5 contains the chapter summary.

3.2 Review of Literature

The efficiency, stability of a banking system and access to finance relate to the level of competitiveness of that banking sector (Fu et al., 2014; Love & Pería, 2014; Mudd, 2013; Ningaye et al., 2014; Schaeck & Cihák, 2014). Hence the need for a competitive banking system. But quite a number of reasons account for imperfection in the banking sector and the fact that the conventional application of competition may not be admissible. These reasons include regulatory requirements - charter value and capital requirements, existence of double market where a bank may want to create monopoly, for instance, in the loan market and compete in the asset market, among others. The imperfections however do not suggest that the productive efficiency benefits of competition do not apply in the banking sectors. In this section, we review a range of underpinning theories of competition in the banking system and the empirical models that explain this banking phenomenon.

3.2.1 Theoretical Literature Review

Smith (1776) in his work on 'Wealth of Nations' laid the foundation of the concept of competition, where he analysed free competition as an ordering force towards equilibrium.

He considered competition as a rivalry that in the long run forces price to equal the cost of production. This concept subsequently birthed two major reviews of competition, namely; competition as a static state and as a process of rivalry. The Cournot oligopoly theory formed the basis of the static state view. Cournot (1838) defined the ideal of competition as an equilibrium condition because the price of costs approaches zero as the number of producers increases. According to this standard theory, competition is a static state in which firms cannot overprice and then earn abnormal profit. Competition as a process of rivalry was a product of the Austrian school under Schumpeter, Hayek and Von Mises who criticised the static state theory with the argument that the traditional neoclassical economists misused the term competition by applying it to a state instead of a process. They view competition as a complex process of rivalry between firms and related the core of competition to the behaviour of the firms in the market. This school's perspective maintained that a market is competitive when rivals are sufficiently aggressive to give an incumbent incentive to improve (lower price, better quality, etc.), in order to maintain its advantage. Competition thus acts as a selection mechanism through the destructive creative principle in which less efficient incumbents are removed and replaced by more efficient entrants.

The Chicago School Industrial Organisation approach to market structure theory extended these theories and argued that many if not most markets tend to approximate perfect competition in the long run. According to Posner (1979), positive profits in competitive markets are considered transitory since their presence stimulate entry yet result in their demise. Perrakis et al. (1982) formalised this idea with the theory of contestability which states that markets behave competitively in the absence of entry and exit barriers. They argued that in a contestable market, regulation is unnecessary as the threat of entry will both restrain incumbent market power and satisfy the requirement for static welfare maximisation. Market forces ensure that monopoly power will usually be short-lived such that the intensity of competition is unrelated to market structure but linked to market contestability. In contrast, the Austrian school argues that disequilibrium and monopoly power are the normal functioning of competitive markets. The constability theory has a major impact on the conduct of competition policies and provides a framework to unify industrial organisation that is applicable in a wide range of industrial markets. Abdelkader and Mansouri (2013) argued that an efficient industrial market pricing environment results from the threat of potential competition due to free entry and costless exits. The threat of potential competition guarantees an efficient banking system regardless of the existing players in the market (Dietsch, 1993). The empirical works of Claessens and Laeven (2004) found relevance of contestable market theory with a number of banks and the level of market structure in their study of 50 countries' market structure. However, Northcott et al. (2004) among others found that the existence of regulation that promotes competition determine the workings of the theory.

Overall, most of these theories assumed a perfectly competitive market with free entry and exit. However, the existence of friction in banking markets (for instance, barriers to entry and information asymmetry, among others), mitigates the direct application of the welfare theorem that is associated with perfect market, thus allowing room for the exercise of market power. Meanwhile, a healthy degree of rivalry is considered necessary for the dynamic efficiency of the sector, the principle that is at the basis of the trend towards fostering greater competition in banking markets across the globe.

Various attempts to test the foregoing theories have brought about a number of empirical models. The fact that the neoclassical conception poses some clear testable hypotheses explains the two strands of literature dominating the empirical measurement models in banking competition study, the structural and the non-structural models which are based on the traditional and the new industrial organisation theory that are rooted in the competition as a static state. The structural model includes the structure conduct hypothesis (SCP), relative market power (RMP) and efficiency structure hypothesis (ESH). Structural models, (Chirwa, 2003; Shepherd, 1983; Smirlock, Gilligan, & Marshall, 1986), except ESH that found a reverse causality between structure and performance (Amidu, 2013; Demsetz, 1973), argued that structure causes performance. Non-structural models such as Lerner index (Lerner, 1934), Panzar-Rosse H-statistics (Panzar & Rosse, 1977, 1987), conjectural variation (Bresnahan, 1982; Iwata, 1974; Lau, 1982), Boone indicator (Boone, 2008a, 2008b) and persistence of profits (Mueller, 1977, 1986) constitute the new empirical industrial organisation (NEIO), introduced in a number of attempts to collect empirical evidences on the nature of competition by observing conduct directly (a shortcoming of the structural models). The Lerner index (Lerner, 1934), which is found to be consistent with the industrial organisation theory is employed in this study. It measures market power as the difference between price and marginal cost expressed as a percentage of price. The market power of a bank is identified by the disparity between the bank's price and its marginal cost. The price and marginal cost should be equal in perfect competition but will be at disequilibrium in an imperfect competitive market environment. A wide disparity between price and marginal cost is an indication of high market power. The Lerner index is hence a measure of the extent to which a bank is able to charge price above its marginal cost.

The theoretical foundation of the Lerner index is rooted in static oligopoly theory (Cournot model). Although the index has been around since in the mid-30s, its application in banking is relatively recent due to the inability to econometrically estimate price and marginal cost. Two approaches have been developed to surmount this, the production and intermediation approaches. The production approach considers banks' sole activities as servicing its account holders. Banks in this case offer a number of financial services such as savings and credit by mobilising labour and physical capital (Heffernan, 2005). Klein (1971), Monti (1972) and Sealey and Lindley (1977) used the intermediation approach as an alternative with the argument that banks intermediate between depositors and borrowers. Under this approach, it is believed that a bank employs labour and physical capital to attract deposits which are used to fund loans. Labour, physical capital and deposits are considered as inputs and proxy as costs while bank output is defined as total assets or total loan proxing as the price respectively. To the extent that prices are not directly observable, researchers use balance sheets and income statements to infer prices. The marginal cost is estimated in two ways. The first is by estimating the average variable costs, defined as the total variable costs divided by the total assets or total income. This method according to Casu et al. (2015) has the advantage of being straightforward but lacks in accuracy. The second approach requires the estimation of a cost function which is usually a translog cost function with a single output (total assets) and three input prices (deposits, labour and physical capital) based on the intermediation approach, (Beck et al., 2013; Berger et al., 2009).

On the related theory for the determinants of competition in the banking sectors, the study draws mainly on the structure component of SCP framework. This corresponds to the number of banks in the industry which react to variables such as competition and regulation that are endogenous to the industry. SCP assumes competition affects performance, hence the degree of concentration of banks in the market affects the competitive condition of the banks. According to Nabieu (2013), this is premised on the fact that the more the concentration in the market structure, the more likely it is to produce more effective collusion. Various forms of proxies have been adopted in literature to account for concentration in the banking system, among which are HHI, CR_n and size, among others.

3.2.2 Empirical Literature Review

A number of studies have empirically attempted to measure banking competition by averaging the individual Lerner indices. Weill (2013) analysed the evolution of bank competition measured with the Lerner index for the EU banks between 2002 and 2010 and obtained an index for all 27 EU countries ranging from 12.20% to 20.34%. This represents a highly competitive banking environment, but revealed a less improved competitive EU banking system compared to an earlier period of 1994 to 2004 conducted by Carbó, Humphrey, Maudos, and Molyneux (2009) with an index ranging from 11% to 22%. De Guevara, Maudos, and Pérez (2007) observed an average of 20.45% for Spanish banking system between 1986 and 2002. Likewise, Maudos and Solís (2011) found that the Mexican banking system between 1993 and 2005 was monopolistically competitive. Furthermore, Agoraki et al. (2011) in a study of 13 Central and Eastern European (CEE) countries between 1998-2005; Ariss (2010), 60 developing countries including 14 African countries, 1999-2005; Amidu (2013), 55 developing countries inclusive of 22 African countries, 2000-2007; Beck et al. (2013) 79 countries between 1994-2009; Fu et al. (2014), 14 Asian countries between 2003 and 2010; Berger et al. (2009), 23 industrialised countries, 1999-2005; employed the Lerner index as a proxy for competition in their various studies and found varied degree of market imperfection in the banking markets considered.

Only few empirical studies have measured competition of the banking soectors in the African region following the era of carrying out sweeping banking reforms. Specifically, Kouki and Al-Nasser (2014) on the implication of competition in 31 African countries with focus on deposit money banks (DMBs), used Lerner index to compute their competition variable and found index waving between 58% in Sudan and 74% in Mauritania with an overall average of 62.21% between 2005 and 2010. This study captured Africa as a continent without taking cognisance of the peculiarity of the SSA region. Other specific country studies sighted were those of Abdelkader and Mansouri (2013) for the period 1999-2003 and Simpasa (2011) between 2004 to 2008 both in Tanzania and Ajisafe and Akinlo (2013) in Nigeria for the period 1990-2009 for which all the authors employed PR H statistics. While Abdelkader and Mansouri (2013) found monopoly condition in the Tanzania banking market for the periods considered, Simpasa (2011) found a condition of oligopoly for later periods up to 2008 in Tanzania, suggesting an evolution in the competitive condition of Tanzania. Ajisafe and Akinlo (2013) however, found monopolistic competition in the banking market of Nigeria.

We found just (Hussain & Mustapha, 2010) in literature who have considered the determinants of banking competition using banks' specific variables in European Union banking sector including some Latin American countries. Their study covered the period 2000 to 2008 and with a panel OLS regression they found that banking market structure depends on the characteristics of the industry. They showed that net interest margin (NIM) and return on assets (ROA) are negatively related to competition while equity capital ratio (ECR) shows a positive relationship.

The foregoing discussion therefore constitutes the gap that our study fills by measuring the competitive condition of 37 SSA countries commercial banking sectors for the periods of 2006 to 2015 using the Lerner index that is capable of measuring individual bank level competition in the short run and on year-on-year basis. Besides, to the best of our knowledge, no study in this region has explored the bank specific factors that drives bank competition.

3.3 Methodology

A competitive banking environment drives efficiency, access to finance and stability (Casu et al., 2015). The goal of bank under competition according to the industrial organisation theory is to manage its volume of loans and deposits such that its corresponding intermediation margin equals its technology (Freixas et al., 2008). In other words, competitive banks induce savings by offering high deposit rates, as well as lower their real interest rates for loan to sell more; moreover, the contestable market theory argues that potential competition is enough to drive an efficient pricing banking system. The case is however different for a monopoly bank that is facing a downward sloping demand for deposits and an upward sloping supply for loan, giving it the power to charge very high price for loans and at same time low price for deposits. These suggest that for SSA to harness its potential for growth, its banks must be competitive to mobilise its savings and investment capabilities. It has been argued that SSA developmental aspiration will be unlocked once issues of competition in SSA banks is addressed (Watkins, 2014). Then the question is, how competitive is SSA commercial banks?

3.3.1 Model Specification

To answer the question of how competitive SSA commercial banks are, this study will compute the bank level competition index of SSA commercial banks using the Lerner index[2] This method has been widely used in literature and in some studies of the degree of competitiveness of African banking sectors, Aboagye et al. (2008) in Ghana, for one country study of SSA and Kouki and Al-Nasser (2014) for a panel of 31 countries in Africa.

This study adopts the Lerner index because among its contemporaries, it is one of two most superior competition measures following the outcome of the correlation of all indicators by Liu et al. (2013b). In addition, the index allows for short term estimation and so can be used to compute competition of the banking market at any point in time, (Agoraki et al., 2011; Amidu, 2013; Ariss, 2010; Berger et al., 2009; Fu et al., 2014; Kouki & Al-Nasser, 2014). Finally, it is theoretically sound because it helps to locate the degree of competition between perfect competition and monopoly (Berger et al., 2009; Rojas, 2011). The Lerner index has a number of criticisms; there are divergent views on the estimation of price, for instance, while Casu and Girardone (2006) favoured both the traditional and non-traditional activities for price measurement, Molyneux, Lloyd-Williams, and Thornton (1994) and Bikker and Haaf (2002) among others considered just the traditional loan deposits services, this could result in the variation of Lerner index. In addition, it has been argued that the index ignores risk that formed a major part of the costs of banks and the attendant effect would mean an inflated index (Tan, 2013). However, research has supported the use of both the traditional and non-traditional bank activities in price

[2]For the purpose of hindsight, H statistics (Panzar & Rosse, 1987), Boone indicator (Boone, 2008a) conjectural variation approach (Iwata, 1974), persistence of profit (Mueller, 1977) are other alternative methods that could be used.

determination because of the increase in non-interest income overtime in banking (Ajisafe & Akinlo, 2013). Morever, studies that have adjusted the Lerner index to risk found results that are not fundamentally different from the conventional Lerner index. Liu et al. (2013b) did a correlation analysis of results of competition measurement models and found that the Lerner index is one of the two most valid measures of bank competition. To this extent, the Lerner index approach which is modelled going forward is considered plausible for this study.

Given that the optimal output, QTY_i, of banks i, $i = 1, \cdots, N$ *at time t*, is at the point where marginal cost, MC_i, equals its marginal revenue, MR_i, the ratio of the difference between the price, P_i, and the marginal cost, MC_i, on price is the Lerner index denoted as LI_i and expressed algebraically as shown in *equation (3.3.1)*, (Flamini, Schumacher, & McDonald, 2009).

$$LI_i = \frac{P_i - MC_i}{P_i} \tag{3.3.1}$$

Where P_i is the estimate of average price of bank production in country i which is proxied by the ratio of bank total revenue to total assets (Berg & Kim, 1994; Berger et al., 2009; Carbó et al., 2009; Fernández & González, 2005; Shaffer, 2004). To estimate MC_i, the first derivative of translog cost function[3] with respect to QTY_i is computed. The inability to econometrically estimate marginal cost account for the recent application in literature of Lerner index that has been known among economist since the mid-1930s. Marginal cost is extracted from the cost function through a translog approach.

The translog cost function, used generally in finance (Berger et al., 2009; Kouki & Al-Nasser, 2014) is an expression of a specific production model which for this study is assumed to be specified as the translog production function[4]. The name translog stands for transcendental logarithmic, in other words, translog cost function is a second-order Taylor series expansion of banks cost in natural logarithm. The general form of Taylor series expansion for functions involving more than one variable is given by the expression

[3] Another way to estimate cost function is the average variable cost expressed as the ratio of total variable cost to total asset or total income. Although this seems a simpler and straight forward approach, it has been argued to be inaccurate.

[4] Some other common production functional form include; linear, Cobb-Douglas, quadratic, normalised quadratic, constant elasticity of substitution and generalised Leontief functions.

below;

$$T(x_1,...,x_d) = \sum_{n_1=0}^{\infty} ... \sum_{n_d=0}^{\infty} \frac{(x_1-a_1)^{n_1}...(x_d-a_d)^{n_d}}{n_1!...n_d!} \left(\frac{\delta^{n_1+...+n_{df}}}{\delta x_1^{n_1}...\delta x_d^{n_d}}\right)(a_1,...,a_d)$$

$$= f(a_1,...,a_d) + \sum_{j=1}^{d} \frac{\delta f(a_1,...,a_d)}{\delta x_j}(x_j-a_j) + \frac{1}{2!}\sum_{j=1}^{d}\sum_{k=1}^{d}\frac{\delta^2 f(a_1,...,a_d)}{\delta x_j \delta x_k}(x_j-a_j)(x_k-a_k) + ... \tag{3.3.2}$$

Based on the definition of translog cost function, the generalised translog production function which takes into account of n inputs (Coelli & Rao, 1998) is given below;

$$ln(Y) = \beta_0 + \sum_{n=1}^{N}\beta_n ln(X_n) + \frac{1}{2}\sum_{n=1}^{N}\sum_{m=1}^{N}\beta_{nm} ln(X_n) ln(X_m) \tag{3.3.3}$$

Where Y is output, ln is the natural logarithm, X_n are the inputs, β_0,β_n, and β_{nm} are the model parameters. More precisely, β_n and β_{nm} are the first and the second partial derivatives.

Relying on the intermediation approach for measuring bank output (Ajisafe & Akinlo, 2013; Sealey & Lindley, 1977) the total cost of banks consists of one output, QTY, and three inputs, W_1, W_2,and W_3, representing price of labour (ratio of personnel expense to total assets), price of physical capital (non-interest expense to fixed assets) and price of fund (interest expense to total deposits) respectively. Hence, the total cost function of banks is given by;

$$C = F(QTY, W_1, W_2, W_3) \tag{3.3.4}$$

We substitute *equation (3.3.4)* in the generalised translog production function in *equation (3.3.3)*. This produced the translog cost function as shown in *equation (3.3.5)* which was obtained by approximating the logarithm of the total cost function by a function of the logarithm of the output and inputs. For the purpose of this work and for simplicity, we drop subscript *it* and denote W_1,W_2 and W_3 as *K,L,and M* respectively in subsequent equations unless otherwise stated.

$$ln(C) = \beta_0 + \beta_q ln(QTY) + \beta_K ln(K) + \beta_l ln(L) + \beta_m ln(M) + \frac{1}{2}[\beta_{qq} ln(QTY) ln(QTY)$$
$$+ \beta_{qk} ln(QTY) ln(K) + \beta_{kq} ln(K) ln(QTY) + \beta_{ql} ln(QTY) ln(L) + \beta_{lq} ln(L) ln(QTY)$$
$$+ \beta_{qm} ln(QTY) ln(M) + \beta_{mq} ln(M) ln(QTY) + \beta_{kk} ln(K) ln(K) + \beta_{kl} ln(K) ln(L)$$
$$+ \beta_{lk} ln(L) ln(K) + \beta_{km} ln(k) ln(n) + \beta_{mk} ln(M) ln(K) + \beta_{ll} in(L) ln(L) + \beta_{lm} ln(L) ln(M)$$
$$+ \beta_{ml} ln(M) ln(L) + \beta_{mm} lnM ln(M)] + \mu \tag{3.3.5}$$

Recall from basic partial derivatives that $f_x y = f_y x$ for any function with two variables. Hence, the second order cross derivatives of the form, $\beta_{nm} = \beta_{mn}$. Based on this, *equation (3.3.5)* is simplified thus:

$$ln(C) = \beta_0 + \beta_q ln(QTY) + \beta_K ln(K) + \beta_l ln(L) + \beta_m ln(M) + \frac{1}{2}\beta_{qq} ln(QTY)^2$$
$$+ \frac{1}{2}[2\beta_{qk} ln(QTY) ln(K) + 2\beta_{ql} ln(QTY) ln(L) + 2\beta_{qm} ln(QTY) ln(M)] + \frac{1}{2}[\beta_{kk} ln(K) ln(K)$$
$$+ \beta_{kl} ln(K) ln(L) + \beta_{lk} ln(L) ln(K) + \beta_{km} ln(k) ln(n) + \beta_{mk} ln(M) ln(K) + \beta_{ll} in(L) ln(L)$$
$$+ \beta_{lm} ln(L) ln(M) + \beta_{ml} ln(M) ln(L) + \beta_{mm} lnM ln(M)] + \mu \tag{3.3.6}$$

Rearranging *equation (3.3.6)* and simplifying it further by collecting like terms, it becomes,

$$ln(C) = \beta_0 + \beta_q ln(QTY) + \frac{1}{2}\beta_{qq} ln(QTY)^2 + \beta_K ln(K) + \beta_l ln(L) + \beta_m ln(M) + \beta_{qk} ln(QTY) ln(K)$$
$$+ \beta_{ql} ln(QTY) ln(L) + \beta_{qm} ln(QTY) ln(M) + \frac{1}{2}[\beta_{kk} ln(K) ln(K) + \beta_{kl} ln(K) ln(L) + \beta_{lk} ln(L) ln(K)$$
$$+ \beta_{km} ln(k) ln(n) + \beta_{mk} ln(M) ln(K) + \beta_{ll} in(L) ln(L) + \beta_{lm} ln(L) ln(M) + \beta_{ml} ln(M) ln(L)$$
$$+ \beta_{mm} lnM ln(M)] + \mu \tag{3.3.7}$$

We chose for simplicity to represent the parameters; $\beta_q = \beta_1$, $\beta_{qq} = \beta_2$, $\beta_{k,l,m} = \theta_{1,2,3}$, $\beta_{qk,ql,qm} = \oint_{1,2,3}$, $\beta_{kk,kl,km} = \varnothing_{11,12,13}$, $\beta_{lk,ll,lm} = \varnothing_{21,22,23}$, $\beta_{mk,ml,mm} = \varnothing_{31,32,33}$, and to transform the variables back to their original form such that *equation (3.3.7)* becomes

$$ln(C) = \beta_0 + \beta_1 ln(QTY) + \frac{1}{2}\beta_2 ln(QTY)^2 + \theta_1 ln(W_1) + \theta_2 ln(W_2) + \theta_3 ln(W_3) + \oint_1 ln(QTY) ln(W_1)$$
$$+ \oint_2 ln(QTY) ln(W_2) + \oint_3 ln(QTY) ln(W_3) + \frac{1}{2}[\varnothing_{11} ln(W_1) ln(W_1) + \varnothing_{12} ln(W_1) ln(W_2)$$
$$+ \varnothing_{13} ln(W_1) ln(W_3) + \varnothing_{21} ln(W_2) ln(W_1) + \varnothing_{22} ln(W_2) ln(W_2) + \varnothing_{23} in(W_2) ln(W_3)$$
$$+ \varnothing_{31} ln(W_3) ln(W_1) + \varnothing_{32} ln(W_3) ln(W_2) + \varnothing_{33} lnW_3 ln(W_3)] + \mu \tag{3.3.8}$$

The reduced translog cost function *(equation (3.3.9))* in panel form by bringing back the subscript i that we dropped for simplicity and in introducing time, t, to the model is shown below.

$$ln(C) = \beta_0 + \beta_1 ln(QTY_{it}) + \frac{1}{2}\beta_2 ln(QTY_{it}^2) + \sum_{k=1}^{3} \theta_k ln(W_{kit}) + \sum_{k=1}^{3} \oint_k ln(QTY_{it}) ln(W_{kit})$$
$$+ \frac{1}{2}\sum_{k=1}^{3}\sum_{j=1}^{3} \O_{kj} ln(W_{kit}) ln(W_{jit}) + \mu_{it} \tag{3.3.9}$$

Where QTY_{it} is bank output measured as the natural log of total assets of bank i in time t (Guevara & Maudos, 2011), W_{kit} is the vector of the three input prices and μ_{it} is the error term.

Taking the first derivative of the translog cost function with respect to output give the marginal cost as follows:

$$MC_{it} = \frac{\delta C_{it}}{\delta QTY_{it}} = \frac{1}{QTY_{it}} \left(\beta_1 + \beta_2 ln(QTY_{it}) + \sum_{k=1}^{3} \oint_k ln(W_{kit}) \right) \tag{3.3.10}$$

Substituting *equation (3.3.10)* for marginal cost in *equation (3.3.1)*, the degree of competition will be computed using;

$$LI_{it} = \frac{P_{it} - \frac{1}{QTY_{it}} \left(\beta_1 + \beta_2 ln(QTY_{it}) + \sum_{k=1}^{3} \oint_k ln(W_{kit}) \right)}{P_{it}} \tag{3.3.11}$$

According to Leon (2015a) the Lerner index for market j is obtained as follows;

$$L_j = \sum_{i \epsilon j} \phi_{ij} L_{ij} \tag{3.3.12}$$

Where L_{ij} is the Lerner index of bank i in market or country j and ϕ_{ij} the weighting of bank i (often the market share of bank i in market j). An unweighted Lerner index implies that $\phi_i = \frac{1}{N}$, where N is the number of banks in market j. Market share has been proxied in literature using the total assets of banks relative to industry, market or country's total asset (Ahokpossi, 2013).

The model for the estimation of the determinants of the competitive condition of the SSA commercial banks is based on Arellano and Bond (1991) and Arellano and Bover (1995) generalised method of moments modelled in Subsection 4.3.1 in Chapter 4. This permits the capturing of the commercial banks specific variables that drive competition while controlling for a range of macroeconomic variables. The estimable version of the model is expressed below;

$$li_{kit} = \delta_{kit} + \lambda li_{kit-1} + \psi_{kit}\Sigma\chi_{kit} + \varrho_{kit}\Sigma\aleph_{kit} + \upsilon_{kit} \tag{3.3.13}$$

Where the subscripts *kit* signify bank, country and year respectively. *Li* measures bank level competition with its one period lag value, δ is the intercept while λ, ψ, ϱ are coefficients. $\Sigma\chi$ represent the range of banks specific variables that drives competition, these are; equity capital ratio (ECR), liquidity ratio (LAR), assets quality (QLTY), return on assets (ROA), return on equity (ROE) and net interest margin (NIM). The macroeconomic variables considered are gross domestic product annual growth (GDPG) and annual inflation rate (INF) denoted by $\Sigma\aleph$ with υ as the error term.

3.3.2 Data

To compute the degree of competitiveness of SSA commercial banks, this study uses the individual bank level annual data sets of 440 banks financial profiles from 37 African countries for the periods 2006 - 2015. The choice of period is informed by data availability on BankScope database compiled by Fitch/IBCA Bureau Van Dijk. We excluded countries[5] with issues on data integrity and those we considered outliers.

Data on personnel expenses include wages and salaries, social security contributions, contributions to pension funds and other related labour expenses (Delis, Staikouras, & Varlagas, 2008). For interest expenses, data collected include interests on current accounts, savings accounts, time deposits, repurchase agreements and alternative funding sources such as retail bonds (Tan, 2013; Wang, Zeng, & Zhang, 2014). Non-interest expense comprise data on administration expenses which include rents, service charges, security, communication and information systems, other office and insurance expenses, professional charges, publicity and advertising, plus depreciation. Data on total revenue include both interest revenue, other operating income and non-interest income. The increase in non-interest income overtime in banking has prompted the use of total revenue in banking

[5]for instance, South Africa considered outlier because of the sophistication of the banking sector and countries like Congo, Sudan among others for paucity and integrity of data due their economies been ravaged by wars

research in the recent time (Ajisafe & Akinlo, 2013; Berger et al., 2009; Prasad & Ghosh, 2005).

Our main variable for the determinant of competition in the SSA region commercial banks is the size of the bank. This is proxied by the natural log of banks total assets. Nabieu (2013) argued that the total assets of a bank represent the bank's specific market share and is expected to be negatively related to competition based on SCP assumptions. Furthermore, we follow Hussain and Mustapha (2010) to select bank specific variables of capital, liquidity, quality of assets and profitability measures of banks as potential determinants of bank competition. They argued that changes in these variables have the effects of changing the overall banking conditions, thus hypothesise a logical link to competition. In addition, we included two macroeconomics variables of annual GDP growth and inflation due to the macroeconomic nature of the banking system.

3.4 Empirical Results

Tables 3.1 and 3.2 below present the results of the competition indices for SSA commercial banks for the period 2006-2015. We had in subsection 3.3.1 modelled the translog cost fuction for the variant of Lerner index used to capture the core activities of commercial banks in SSA region based on Sealey and Lindley (1977) as their activities to the present are still predominantly intermediation in nature. Hence, Table 3.1 contains the summary statistics of the bank level competition reflective of this model. This summary revealed some interesting features of the competitive nature of the banking environment in the SSA region. We found that competition index/degree of market power for individual banks range between 0.0000 in 2013 and 0.9978 in 2012 as depicted by the minimum and maximum values. The implication of this is that while some banks have absolutely very low market power others have very high degree of market power with the ability to control a sizeable proportion of the banking environment. However, we found that despite the degree of variation of market power, the means of the indices are close to the minimum value. We can deduce two possible implications from this. Firstly, the result implied that banks with a very high degree of market power are very few and in some cases, they are isolated cases. This is consistent with literature that used the concentration ratio as competition measure and found some degree of concentration in banking sectors. Secondly, the

Table 3.1: **Bank Level's Competition Index Summary Statistics**

Year	Mean	SD	Min	Max
2006	0.2557	0.1656	0.0006	0.8370
2007	0.2694	0.1557	0.0129	0.7842
2008	0.2884	0.1773	0.0109	0.9674
2009	0.2939	0.1884	0.0102	0.9213
2010	0.2959	0.1829	0.0004	0.9790
2011	0.2822	0.1728	0.0030	0.9767
2012	0.3237	0.1945	0.0050	0.9978
2013	0.3350	0.3143	0.0000	0.9881
2014	0.3318	0.1855	0.0003	0.9963
2015	0.3244	0.1964	0.0006	0.9957

Sources: Authors' Estimation, 2017, based on data collected.

means being close to the minimum suggests some form of competition within the banking sector as the minimum values are close to zero which meant a monopolistic competitive banking market. The standard deviation which measures the deviation from the mean affirms our suspicion providing credence to the conclusion of a monopolistic competitive banking system.

3.4.1 Competition analysis

Table 3.2 below shows the results of competition depicting a varying degree of market power in the commercial banking sectors during the periods considered. The total column shows the average index for the countries in the sample and the row total show the yearly distribution of the index of market power from 2006 to 2016 for the SSA region as a whole. Overall, SSA regions commercial banks competition index stood at 0.2460 approximately during the period of this study. While most countries have their indices below this mean, we found that only about six countries are above it. Furthermore, the results show that out of the six countries with index above the mean, Botswana, Malawi and Namibia belong to the Southern Africa region with 0.3454, 0.3804 and 0.3784 respectively. Ghana and Nigeria in West Africa also having 0.4352 and 0.3448 with Uganda in East Africa having 0.4221. This suggests that these regions may have the most concentration of market power compared to other regions of the SSA. Aligning with the summary statistics in

Table 3.2: **SSA Region Competition Index**

Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Angola	0.065421	0.097832	0.120411	0.124526	0.258332	0.207652	0.31061	0.230903	0.204018	0.213769	0.183347
Benin	0.18813	0.268522	0.074342	0.079369	0.109372	0.179535			0.191783	0.028362	0.139927
Botswana	0.41853	0.495537	0.415291	0.398058	0.352876	0.261277	0.290714	0.280079	0.279677	0.261429	0.345347
Burkina Faso	0.071393	0.135803	0.046363	0.068002	0.103534	0.154452	0.086129	0.095664	0.035652	0.018208	0.08152
Cameroon	0.226445	0.100812	0.12154	0.35474	0.38554	0.391537	0.495393	0.515827	0.372902	0.247272	0.321201
Cape Verde			0.080306	0.08957	0.166683	0.126485	0.097364	0.065904		0.016599	0.091845
CAR	0.466527	0.28377	0.567765	0.092447	0.127969	0.132734	0.077789	0.046362	0.122516		0.213098
Chad	0.837031	0.387705	0.275987	0.261423	0.207221	0.296301	0.092021	0.181206	0.147656	0.146466	0.283302
Djibouti	0.101319	0.092217	0.187151	0.074287		0.274413	0.518477	0.467877	0.380818	0.358804	0.272818
E. Guinea									0.274265	0.188215	0.23124
Ethiopia			0.036623				0.01417	0.021523	0.054223	0.061985	0.037705
Gabon	0.304602	0.339941	0.300123	0.257721	0.235867	0.167995	0.148784	0.282051	0.099412	0.119971	0.225647
Ghana	0.445172	0.351556	0.348728	0.462851	0.457683	0.4031	0.429117	0.455854	0.48128	0.516627	0.435197
Guinea	0.141299	0.312424	0.370526	0.074505	0.109427	0.071267		0.145692		0.175163	0.175038
Ivory Coast	0.134617	0.161376	0.143645	0.064083	0.102507	0.119813	0.097698	0.115092	0.11904	0.126009	0.118388
Kenya	0.245114	0.232857	0.277526	0.287116	0.291172	0.302607	0.409676	0.40179	0.385031	0.39278	0.322567
Lesotho		0.2254	0.358871	0.233187	0.171759	0.134115	0.215399	0.285591	0.213069	0.133109	0.218944
Liberia							0.023647		0.20779		0.115718
Malawi	0.456018	0.353385	0.270827	0.30436	0.311011	0.322545	0.390127	0.436769	0.503659	0.455597	0.38043
Mali	0.017308	0.053635	0.075161	0.110276	0.067184	0.092172	0.117589	0.116763	0.075745	0.018696	0.074453
Mauritania	0.236234	0.093693	0.392847	0.255537	0.117236	0.544336	0.109889		0.190124	0.275192	0.246121
Mauritius	0.222107	0.247908	0.292037	0.261771	0.313006	0.250943	0.235541	0.176467	0.059297	0.590743	0.264982
Mozambique	0.228342	0.351254	0.383867	0.308581	0.297472	0.381043	0.385831	0.285624	0.339606	0.306047	0.326767
Namibia	0.444722	0.428396	0.45753	0.460304	0.415033	0.343708	0.281095	0.304976	0.292295	0.355685	0.378374
Niger	0.053738		0.213415	0.186278	0.312917	0.080205	0.070264	0.119265	0.075966	0.105901	0.135328
Nigeria	0.224949	0.308661	0.336525	0.450728	0.336709	0.279205	0.379483	0.392744	0.376448	0.362907	0.344836
Rwanda			0.224498	0.264563	0.303845	0.361105	0.300362	0.269553	0.327953	0.297518	0.293675
Senegal	0.248176	0.282613	0.299681	0.292004	0.21978	0.275542	0.147133	0.251955	0.194679	0.123176	0.233474
Seychelles					0.021818			0.27152	0.166672	0.083041	0.135763
Sierra Leone	0.230387	0.238683	0.239474	0.278006	0.238491	0.270726	0.262031	0.275976	0.331167	0.290639	0.265558
Swaziland	0.187937	0.283316	0.398314	0.247199	0.151684	0.087821	0.083403	0.051569	0.11542	0.114098	0.172076
Tanzania	0.177395	0.25941	0.252369	0.281637	0.225099	0.19494	0.303348	0.288705	0.294501	0.289103	0.256651
The Gambia	0.276819	0.346128	0.418295	0.459172	0.348642	0.258864	0.301389	0.189866	0.199847	0.271667	0.307069
Togo	0.159375	0.170577	0.102373	0.059697	0.065713	0.018235	0.157644	0.188696	0.136832	0.09098	0.115012
Uganda	0.367278	0.359364	0.3989	0.404256	0.442976	0.395169	0.425404	0.48976	0.492994	0.445247	0.422135
Zambia	0.297172	0.188736	0.294294	0.292279	0.346161	0.320364	0.185807	0.534413	0.277874	0.337614	0.307471
Total	0.257709	0.256949	0.265927	0.244954	0.23796	0.240631	0.232604	0.257376	0.235889	0.229959	0.245996

Sources: Authors' Estimation, 2017; based on Leon (2015a)'s market Lerner index, $L_j = \sum_{i\epsilon j} \phi_{ij} L_{ij}$

Table 3.1 range of market power indices presented in the table suggests each of the countries commercial banking sectors considered have a condition of monopolistic competitive banking environment for the study period which in aggregate makes the banking sector of the subregion as a whole highly competitive and largely contestable.

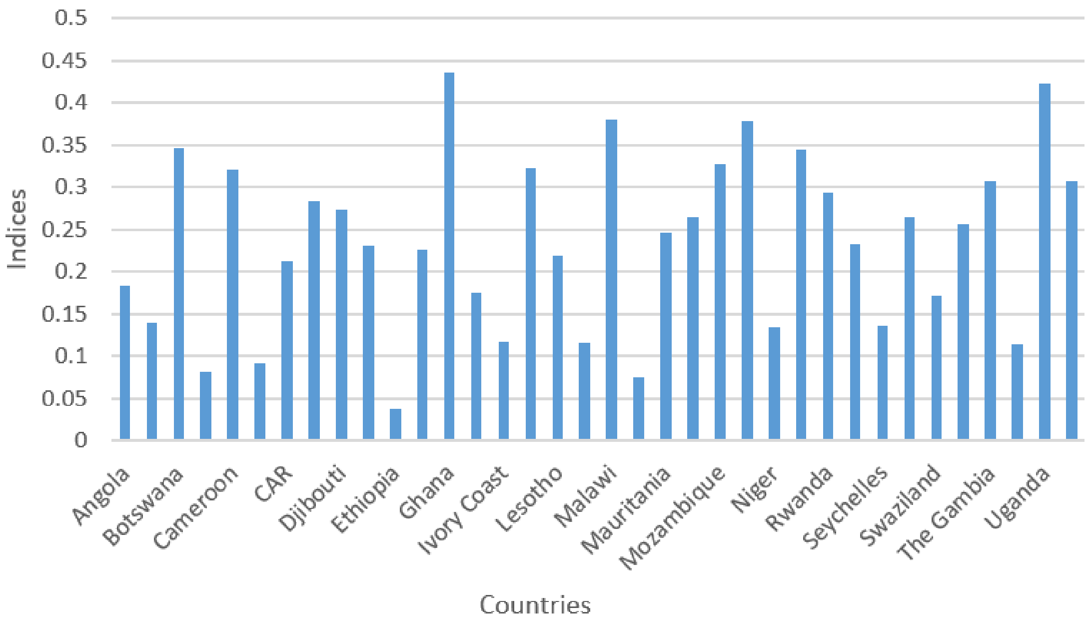


Figure 3.1: **SSA Competition Index by Country**

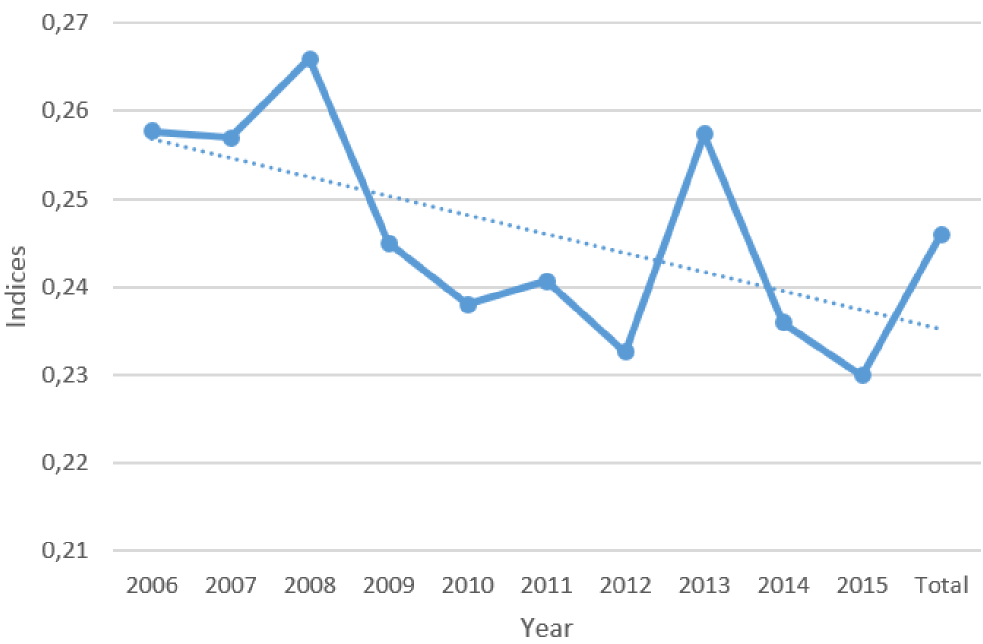


Figure 3.2: **SSA Competition Index by Year**

The graphs in Figure 3.1 and Figure 3.2 above provide a cursory look at the foregoing results, depicting the analysis of the trend of competition in the regions within the periods under review. Specifically the graph in Figure 3.1 represents the country analysis of competition providing a pictorial view of the descriptions attempted above. It suffices to say that the graph shows clearly the distinction of market power amidst the countries of the region. With Ethiopia having the least at 0.0377 and Ghana with the highest at 0.4352. Figure 3.2's graph depicts the evolution of commercial bank year-on-year competition/market power in the SSA region from 2006 to 2015. The indices peaked in 2008 at 0.2659 and least in 2015 at 0.2300. We noted from the graph that there is a downward trend in market power over the period as indicated by the trend line. This downward movement was maintained except in 2013 that it rose and dropped thereafter.

3.4.2 Determinants of Competition in SSA

The correlations between the endogenous and the exogenous variables are reported in Table 3.3 below. This is followed by the regression results of the determinant of competition in the commercial banking sectors of the SSA region in Table 3.4. We found a generally weak but significant correlation between competition and the determinant variables for most part of the study period. The size of banks for most periods of the study is negatively related to competition, though not significant except for 2014, which may have largely been due to the weakness in association. This association of size and competition is consistent with the expectation of the SCP framework, however, we will rely on the result of econometric analysis for a robust conclusion on this. CAP shows a negative correlation throughout the period while LAR exhibits the same association except in 2006 and 2007 that it is positive but rather too weak and insignificant. Although ALQTY shows a positive association, the results are not statistically significant. The measures of profitability, ROA, ROE and NIM show positive correlation in most cases but with mixed significance. This is the same for the macroeconomic variables, GDPG and INF. How much this influences competition will depend on whether the signs are consistent with the results of the econometric analysis in Table 3.4 below.

Our analysis followed the efficient estimation technique of Arellano and Bond (1991) to improve on Hussain and Mustapha (2010) and as well account for endogeneity. Hence, we employ the two-step system GMM approach to analyse the determinants of commercial banks competition in the SSA region. The regression result is presented in the second column of Table 3.4. We included the economic impact of the regression coefficients of the

Table 3.3: **Correlation Analysis**

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
li & size	-0.0981	0.0395	-0.0537	-0.0435	-0.0477	-0.0671	-0.0396	0.0781	0.0939	0.0615
p-value	0.1783	0.5649	0.3976	0.4726	0.4137	0.2312	0.4552	0.1227	0.0518	0.1977
li & cap	-0.1436	-0.2827	-0.0457	-0.1453	-0.3373	-0.3327	-0.3059	-0.0126	-0.0977	-0.0227
p-value	0.0481	0.0000	0.4716	0.0159	0.0000	0.0000	0.0000	0.8032	0.0428	0.6346
li & lar	0.0047	0.0352	-0.0197	-0.2795	-0.0902	-0.1441	-0.2842	-0.1451	-0.163	-0.1059
p-value	0.9492	0.6111	0.7599	0.0000	0.1269	0.0107	0.0000	0.0044	0.0008	0.0282
li & aqlty	0.0758	0.0349	0.0108	0.0482	0.0499	0.026	-0.0389	0.0432	0.0328	0.0402
p-value	0.335	0.6355	0.8726	0.4533	0.4252	0.662	0.4946	0.4294	0.5316	0.4409
li & nim	0.1885	0.1625	0.1994	0.184	0.266	0.1151	0.112	0.2204	0.0122	0.1136
p-value	0.0102	0.0184	0.0019	0.0025	0.0000	0.0416	0.0362	0.0000	0.8027	0.0186
li & roa	0.0338	0.2649	0.0771	0.3189	0.039	-0.0596	0.1213	0.0559	0.0715	0.0062
p-value	0.6433	0.0001	0.2244	0.0000	0.5041	0.288	0.0219	0.2699	0.1389	0.8966
li & roe	-0.0005	0.0496	0.0788	0.1581	0.0224	0.0099	0.0358	0.0302	0.0072	-0.0118
p-value	0.9943	0.4716	0.2184	0.0092	0.7027	0.8609	0.5002	0.5521	0.882	0.8057
li & GDPG	-0.0514	0.0093	0.0748	0.0724	0.0667	0.0464	0.0672	0.0416	0.1092	0.0335
p-value	0.4851	0.8921	0.2387	0.2314	0.2526	0.4085	0.2051	0.4119	0.0235	0.4937
li & inf	0.0609	-0.0169	0.0409	0.0925	0.0333	0.0342	0.0624	0.1036	0.0735	0.1339
p-value	0.404	0.8058	0.5195	0.1258	0.5687	0.5418	0.2399	0.0404	0.1287	0.0083

Sources: Author's Estimation, 2017, based on data collected.

explanatory variables on the dependent variable (competition). This indicates by what percentage competition will change as a result of one standard deviation change in the explanatory variable. The results at a glance show that previous year banking competition is a strong determinant of their current competition with competitive condition persistent overtime. This is evidenced by the positive and statistically significant coefficient of the lagged value of competition variable, LI. Size is strongly positive and statistically significant to explain competition in the SSA region's commercial banks.

Table 3.4: **GMM Regression Result**

	Model	
VARIABLES	lerneri	ecoimpact
L.lerneri	0.575***	
	(0.000703)	
size	0.0978***	0.8463
	(0.0186)	

Table 3.4: **(GMM Regression Result continued)**

	Model	
VARIABLES	lerneri	ecoimpact
ecr	4.439***	3.4818
	(0.245)	
lar	-0.647***	-1.7196
	(0.0429)	
aqlty	-0.980***	-0.2512
	(0.29)	
nim	1.157***	0.8063
	(0.195)	
roa	0.0279***	0.0076
	(0.00609)	
roe	-0.00324***	-0.0080
	(0.000817)	
gdpg	0.524***	0.1082
	(0.145)	
inf	0.00844***	0.2830
	(0.00126)	
Constant	-1.724***	
	(0.248)	
Observations	2,306	
Number of id	393	
Wald χ^2 (9)	1.31E+06	
$Prob > \chi^2$	0.000	
AR2	0.297	
Hansen J Stats	0.388	

Source: Author's Estimation, 2017

$ecoimpact = \frac{S.D\ of\ explanatory\ variable \times R.C\ of\ explanatory\ variable}{S.D\ of\ dependent\ variable}$

Where ecoimpact represents economic impact of regression, S.D is standard deviation and R.C is regression coefficient.

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The results show that the economic impact of the size of banks on the competitive condition is significant. Indicating that a one standard deviation increase in the size of a bank will increase its competitive potential by 84.6%. This is a direct relationship that is almost inconsistent with the result of the correlation found in Table 3.3. Theoretical expectation is that as size of banks increases the industry becomes more concentrated, hence reduces competition. This is the position of SCP for which this finding negates. This result aligns with the monopolistic competitive market reported earlier in subsection 3.4.1 above. One reason why size may not reduce competition despite the concentrated nature of the market as reported in literature can be explained by Perrakis et al. (1982)'s market contestability theory that argued that incumbent market participant get disciplined by potential new entrant and therefore becomes competitive irrespective of the level of concentration. Moreover, existing banks still have to fight for available market share thereby creating a quite competitive banking environment. Contrary to the signs of the correlation results, but in line with our expectations and consistent with the study of Hussain and Mustapha (2010), we found capital, CAP, to be positive and strongly significant to explain competition at 1% level of significance. The economic impact suggests that a one standard deviation increase in capital will induce about 348% direct influence on the competitive condition of the SSA banking system. Liquid assets, LAR, exhibit strong significance but negative relationship with competition. While this is consistent with the correlation results, we expect positive signs as banks are most likely going to find incentive to compete with more liquidity at their disposal, although issues of how much liquidity could be used up in the ordinary cause of their business is a subject of regulation. Similarly, asset quality, AQTLY was found to be negatively related to competition in line with the signs of their correlation association. The better the quality of assets of banks the more competitively dispose we expect the industry should be, however, the result might as well reflect the reality as the banking sectors in the region did not fair quite well in terms of asset quality over the study period as reviewed in literature and will be seen hereafter. All the performance measures employed, NIM, ROA and ROE, are significant and positively related to competition, with the exception of ROE that is negative. The results of ROA and NIM do not follow the study of Hussain and Mustapha (2010) who found them to be negatively related to competition in their studies, making ROE the only performance measure that align with their empirical findings. We indeed expect a profitable bank to find incentive to compete and this is the case with SSA commercial banking sector. In closing, GDPG and INF are found to be positive and strongly significant to determine competition in the banking sector of the SSA region. These are consistent with the correlation signs on the two macroeconomic variables and in fact in line with a priori, growth period encourages more economic activities while in periods of rising price level banks would strive to keep their firm's value by competing the more. Notably, the periods of inflation may also compel banks to be conservative in order to maintain their charter value.

3.4.3 Discussion and Inference

The variation in the bank level market power index as shown by the margin between the maximum and the minimum values in the competition summary statistics in Table 3.1 of this study is an indication of the pockets market concentration that is found to be prevalent in most Sub-Saharan African banking markets (Mlachila, Dykes, et al., 2013) and and also referred to in our reviews in Chapter 2. These call to mind whether or not the various regulations implemented to ensure a competitive banking system have fully actualised their aims. We have also found results that align with and in some cases consistent with studies in the extant literature as per the behaviour of bank level competition in a number of African countries in which similar studies have been carried out. A monopolistically competitive commercial banking sector in Tanzania for instance shows an improvement in the competitive condition of the banking sectors of the country. The two previous studies on competition in Tanzania by Abdelkader and Mansouri (2013) from 1993–2003 and Simpasa (2011) from 2004–2008 found monopoly condition and oligopolistic competition respectively in the banking sector. Our study, covering 2006-2015 is therefore a validation of the evolution of competitive behaviour of banking in the country. We found consistency of our result with the Ajisafe and Akinlo (2013)'s monopolistic competitive behaviour of Nigerian banking markets. Comparing the monopolistic competition we found in the SSA region with a more oligopolistic competitive condition found by Kouki and Al-Nasser (2014) in their study or 31 African countries is an indication that competition is evolving in the African region as whole. Kouki and Al-Nasser (2014) found an average market power index of within 58% and 74% within the period 2005-2010. Other studies that our findings are consistent with include, works in EU by Weill (2013) and Carbó et al. (2009), Spanish banking sector (De Guevara et al., 2007), and Mexican banking sector (Maudos & Solís, 2011) all concluded on monopolistic competitive banking conditions. Studies by Berger et al. (2009), Fu et al. (2014), Aboagye et al. (2008), Amidu (2013) and Ariss (2010) found a varying degree of market power in a number of countries that were studied.

In the case of market competition, it is not surprising, as already stated, to find a competitive market, which in this case is in the form of a monopolistic competitive market. This, no doubt, is informed by the contestable market theory of Perrakis et al. (1982) who argued that even in the face of market power and/or market concentration, a market could be contestable, as the threat of entry will impact on the behaviour of the incumbents in the market. How much this competition has impacted on the extent of financial intermediation as the core banking function in the region has left much to be desired. As shown in statistics by World Bank Development Indicators over our study period, interest rates spread is high, banks credit to the private sector is low, lending cost is high, while deposit rates could not be said to be moderate, and banking coverage is low on aggregate. These indices are not consistent with a competitive market environment, which should mean that they are good. Unfortunately, banks in the region are being accused of competing for government funds rather than mobilising surplus for deficit financing of the real sector of the economy, which could engender an overall growth in the long term. The policy implication will be to seek macroeconomic policies that gel with relevant statutory pronouncements and will complement the current level of market competition, while continually working to encourage the antitrust authorities to keep market power as low as practicable.

Ultimately, we found all the bank specific variables considered to be significant in determining the level of competition in the region. As against theory and a priori expectation, bank size has the ability to increase the level of competition. This we consider a plus but will need to be monitored closely to preclude its antitrust tendencies. In a similar way, capital especially increases the level of competition considerably as well as the level of performance including macroeconomics variable of annual GDP growth and inflation. Both the quality of assets and liquid assets were found to be indirectly related to the level of competition when in fact we expect a direct relationship. The fact that these variables can significantly influence competition in the region suggests that they can be tinkered with to moderate as well as increase the level of competition especially for a region that seeks to increase the competitive conditions of its banking sectors.

3.5 Summary

The Lerner index was used to analyse the bank level and market competitive condition of SSA commercial banks. GMM was also employed to determine the bank specific and macroeconomic factors that influence competition in the region. We took account of the various forms of criticism of the Lerner index notably that it ignores risk which is fundamental in bank cost and price measurement that has no single acceptable measure. As plausible as the arguments may be, empirical evidence has shown that studies that have adjusted for these issues have not achieved much remarkable difference from the results of the conventional Lerner index. Moreover, studies of Liu et al. (2013b) found the Lerner index to be one of the two most valid ways of measuring competition hence validating our methodology. We also modelled the translog cost function to reflect that the core activities of commercial banking sectors in SSA region still remain that of intermediation.

The study found a mixed market power at bank level across the 37 SSA countries that have been considered. Meanwhile, at market level lower market power is seen depicting a relatively competitive banking sector. Hence the study concludes that SSA banking sector is competitive notwistanding that it is laced with varying degrees of market power. This thus gives credence to the theory of contestable market that or though there may be high market power residing in the banks, the threat of potential entry will make the market contestable. Mlachila, Dykes, et al. (2013); Senbet and Otchere (2006) argued that banks in the region countries jostle for government funds rather than performing the main financial intermediation role of mobilising surplus unit saving to bridge the gap of deficit units. This study does recommend that while the antitrust agencies still need to concentrate more efforts at devolving the market powers that reside in the individual banks, it is vital to continuously maintain and improve on the current market competition. Fiscal and monetary policies must be harnessed to take advantage of the subsisting competitiveness of the region's banking sector so as to cash in on the much needed economic growth.

For determinants of banking competition, we found the size of banks, capital, and banks performance measures, among others, to influence competition in the SSA banking sector. As such, attention should be paid to capital and other bank specific variables that impact on bank competition in the region.

Chapter 4

Competition and Stability

4.1 Introduction

This chapter deals with the relationship between competition and stability in the SSA region's commercial banking sector. It draws on the previous chapter of the competitive condition of commercial banking sectors of the region. Various literature, theoretical and empirical on this relationship is reviewed with the empirical results analysed and conclusion drawn.

There are ongoing debates in literature on the relationship between competition and stability. Yet not much has been done on this in Africa let alone the Sub-Saharan African region whether on regional or individual country basis (Leon, 2015b). Theoretical propositions argue that competition affects the stability of banks both through the charter value and the franchise value, but are far from reaching concensus regarding the direction of relationship. However, the main arguements have been across two divides; that competition could be good or bad for the banking system. It is good where it enhances stability of the system, hence the competition-stability view argument. On the other hand, competition is bad if it leads to distress in the banking sector thereby causing the system to fail. This is in line with competition-fragility view which argues that banks margin effects are lost in competition that heightens banks incentives to take more risk which in turn threatens the stability of the system. Yet another view which is now gaining momentum in literature is the non-linear relationship between competition and stability that was theoretically modelled by Boyd and De Nicolo (2005) and found in empirical literature Berger et al. (2009); Tabak, Fazio, and Cajueiro (2012).

The SSA region is underdeveloped and confronted with abject poverty. The financial systems in the SSA region are dominated by the banking system that is also immature. Given that competition in the banking system has the potential to drive other sectors of the economy, increase access to finance that could spur economic growth in the region, there was the debate about increasing competition in this sector. While empirical work has chatted the course of dealing with the issue of competition and especially as it bothers on systemic stability in most regions of the world, no such work has focused on this region. This is the gap that this study wants to fill beside investigating what the implication of increasing competition is for stability in the region.

The study therefore contributes to extant literature in three ways. Firstly, we use large datasets of commercial banks in 37 SSA region countries to test competition and stability relationship. This is the first of its kind. Secondly, based on the agitation for increasing competition in SSA region, this study provides evidence to guide policy makers in dealing with issues of competition and stability relationship. And finally, we analysed whether risk appetite has effects on the stability of banks in a competitive banking environment and particularly identify a range and/or nature of risks to inform policy measures. Our results thus provide evidence that support the competition fragility view over the study period as we found negative and statistically significant relationship between competition, surrogate by Lerner index and stability proxied by Zscore, in the dynamic panel data model. In addition, we found that competition relates negatively with both surrogates of credit and overall banks' risks. This implies that risk-taking behaviour of banks, especially as it relates to their loans portfolio and charter value is significant in explaining the cause of failure in a competitive banking environment. These provide a bit of caution for policy makers in dealing with issues of competition and stability in SSA region while highlighting flashpoints for focus when crafting policies to stimulate competition. Fu et al. (2014) provided evidence to show that the recent financial crisis is a problem of excessive competition in the banking system.

Going forward, the chapter is structured to capture the review of related literature that includes both theoretical and empirical framework in Section 4.2. In Section 4.3 are described the various methods adopted to arrive at the results in Section 4.4 .Section 4.5

concludes this chapter.

4.2 Literature Review

There is a substantial amount of theoretical and empirical evidence on the relationship between competition and stability around the world. Yet specific literature telling the SSA region part of the story is lacking. The perception about the relationship between competition and stability in the banking system aligns with the industry disposition and dates back to the periods of the great depression (Vives, 2016b). These periods up until the 60's in the US and 80's in the EU (Carletti, 2008) were characterised by the feelings that competition was inimical to the stability of the banking system and the systemic well-being as whole and hence saw complacent regulators and practitioners preferring collusion and/or a concentrated banking system. The fact that competition might mean allocative efficiency that could help the stability of the system heralded the change in this trend that procreated the waves of liberalisation that took place in the industry to induce competition. This pattern continued until the recent financial crisis of 2007-2009 of which Africa was not spared as since in the 80s structural adjustment programs were implemented across SSA as a hallmark for liberalising the banking system and putting an end to indigenisation policies that characterised the nations after their independence. The financial crisis however brought mixed feelings as per the role of competition in bringing about the crisis and in some quarters the crisis was blamed on liberalisation and excessive competition in the sector (Fu et al., 2014).

4.2.1 Competition and Stability: Theoretical Perspectives

The foundation of theories on competition and stability is at the heart of the debates that competition accounts for the overweening risk taking in the loan market (in other words, the assets side of banks' financial position) culminating in probability of individual bank runs and eventual failure (Casu, Girardone, & Molyneux, 2012). The dominance of the assumption in conventional theories is that solving banks' portfolio problem determined by the allocation of banks' assets have in recent literature provided plausible evidences of the likelihood of competition being favourable to their risk portfolio. It follows that in competitive banking markets, banks face the temptation to offer higher rates in the deposit market while neglecting competition in the loan market thus causing earnings to decline.

And so banks more often than not have no further options than to take on more risky investments to compensate for the lost income. Conversely, when faced with competition restrictions, banks arrogate market power with the propensity to charge higher deposit rates with its attendant high profits. The tendency is that markets become uncompetitive with banks overly reluctant to invest in projects that will fetch them as much returns as in the deposit market, hence the probability of banks failure becomes low if not impossible.

Apparently, banks may fail in the absence of competition. Matutes and Vives (1996) modelled the combined Diamond's 1984 Banking Model, differentiated duopoly structure *à* la Hotelling and standard deposit contracts for investors show how banks could become fragile as a result of depositors' expectations rather than due to competition. The authors argued that the chances of failure are embedded in vertical differentiation among banks such that safer banks have larger margin cum higher market share that allows them to better diversify their risk because the probability of success depends on the quality of the bank. In their view, this likelihood of success is frail since it is based on depositors' expectation. Their model took into account multiple equilibria, with corner solution where just one bank is active or equilibrium where no bank is active. It explains that system-wide crisis of confidence occurs not due to market structure but happened due to coordination misalignments among investors/depositors.

Matutes and Vives (2000) did a theoretical review on the relationship between competition and risk taking incentives in banks on the assets-side of the statement of financial position, while focusing on competition for loans without taking cognisance of investment activities. They argue that at a higher level of competition with apparent portfolio risk on the asset side of the market, banks have no incentives to undertake risk if there are regulatory constraints on the maximum banks can charge on their deposits; given the close complementarity between the liability and the asset sides of their statement of financial position. They however posit that where moral hazards exist, banks take as much risk as they can as depositors are oblivious as to how deposit rates and asset allocation affect expected returns as well as the probability that a bank may fail. Moreover, deposit insurance with risk free premium based has the capacity to induce maximum asset risk taking incentives on the parts of the banks when competition is high in the deposit market because depositors pay less attention to banks' risk taking behaviour. On the other hand, a risk-based deposit insurance demands accountability from banks forcing them to minimise their assets risks. In another study, Allen and Gale (2004) considered banks competing *à* la Cournot on the liability side of the banks' balance sheet and chose a risk level in the loan market, they show with insured deposits that banks' have maximal incentives to undertake risk as the number of banks grow. Meanwhile, Niinimäki (2004) modelled the joint effects of competition and deposit insurance on banks' risk taking and concludes that the size of risk taking depends on the structure and the side of the market in which competition takes place. With deposit insurance, competition induces fragility as banks compete for deposits in the deposit markets, deposit rates becomes excessively high forcing banks to undertake high risk; while deposit insurance has no influence if its monopoly or banks competing in loan markets.

Theory modelling competition on both sides of the statement of financial position assumes the main preoccupation of banks is solving the optimal contraction problem. The argument is, with little or no competition in the deposit market, banks can take advantage of monopoly rents by offering a very low rate, while they are also able to exploit the loan market by charging very high interest rates. The bane of an uncompetitive market is that the less competitive the market, the more banks are able to charge higher rates and such rates make risk of default imminent as borrowers take on more risky investments. This situation is worsened with the presence of moral hazards on the borrowers' side. Thus, banks become even more risky in less competitive markets. Dam, Escrihuela-Villar, and Sánchez-Pagés (2015) also model the loan and deposit sides of banking sector balance sheet based on spatial competition and came to the conclusion of stability in deposit market - market power results in prudent investment and, fragility in loan market - as market power makes borrowers indulge in risky behaviour.

Assuming investment is financed by debt which generates strong limited liability effects, Koskela and Stenbacka (2000) examined the relationship between credit market and bank risk taking by modelling risk-shifting investment technologies in banks. They concluded that introducing competition lowers interest rates charged in credit market to borrowers. Hence, the result is higher investments without increasing the probability of borrowers' default. Limited liability effects get alleviated where investments are financed by debt and equity thereby resulting in further reduction in risk with competition.

In their work on theory of bank risk-taking and competition, Boyd and De Nicolo (2005) argue that portfolio problem is transformed to contraction problem in the face of moral hazards. The authors found theoretical analysis of competition stability relationship to be delicate as there are fundamental risk-incentive mechanisms operating in the opposite direction that make more concentrated bank market to become even riskier. They assumed project risk to be a function of the interest rates charged to borrowers while allowing their model to capture both the loan and deposits side of the bank balance sheet. Banks with market power are able to offer low deposit rates to depositors and charge higher interest rates to borrowers. In this scenario, portfolio theory suggests that banks lack incentives to take risk following the arguments that lower competition results in more stability. A new perspective to this is that contracting problem provides competition with another role as higher loan rates force borrowers to seek more risky investments creating risky portfolio for banks so that less competition increases risk. Whereas, competitive banks offer lower interest rates in loan markets reducing moral hazard problems, consequently, borrowers have less incentives to undertake risky projects implying lower risks for the banks.

Martinez-Miera and Repullo (2010) concluded that a non-linear relationship exists between competition and stability in banks. They argued that Boyd and De Nicolo (2005)'s competition-stability view may not hold when loan defaults and the banking market power are imperfectly correlated. They further state that intense competition may result in risk-shifting effects, reduce borrowers' default probability but result in margin effects, that is, reduce interest payment from performing loans that should serve as a buffer against loan losses. Measuring competition by the number of banks, they found competition to have a U-shaped relationship with bank stability. Their position was that, risk-shifting effects dominate more concentrated markets such that risk is reduced with competition; while margin effects are associated with highly competitive markets that erode banks' franchise values in an increased competitive environment hence increase risk. In a related study, Arping (2014) conducted a dynamic modelling of banks assets, deposits and capital and submitted that competition may be good or bad for the stability of the banking system. He argued that competition portends lower risk-taking to banks and at the same time makes banks riskier. Margins decline with rising competition driving reduced risk-taking to respond to it. However, direct destabilising effects of declining margin supersedes competition disciplinary effects, besides, banks' incentives to build precautionary capital buffer declines with increasing competition, thus making competition and risk-taking good or bad.

Thus, there is no consensus in theory on how best competition relates with stability and/or risk-taking behaviour in banks. Theorists have so far argued for both stability and fragility while in very rare cases, a non-linear relationship. According to Casu et al. (2012), it is not clear whether the opposing views of competition-fragility and competition-stability hold because inconsistencies in risk and competition measure, methodologies and samples chosen have made previous interpretations in empirical literature controversial. Post 2007-09 crisis evidence now points to less competition with a risk-averse banking system, suggesting the prevalence of competition-fragility views in developed banking system. Recent studies of Vives (2016a) argued that competition is not responsible for banking system fragility, but aligns with trade-off between the two along some dimensions such as information asymmetry, externalities. His reviews reveal average positive association of market power and bank-level stability but with country variation and some indications that an intermediate level of bank competition maximises bank stability. As well as positive association of some measures of bank competition (e.g. ease of entry) and systemic stability. We therefore go ahead to search into how consistent empirical evidences aligns with theoretical positions.

4.2.2 Competition and Stability: Empirical Evidence

Table 4.1 below summarises some of the notable works on the relationship between competition and stability on individual and panels of countries, including a number of developing African countries. We must note from the onset that empirical literature provides evidence that aligned with the above theoretical reviews that could be described as divisive, ambiguous and at best mixed. One of the earliest empirical works on competition and stability relation was by Rhoades and Rutz (1982) who in testing the 'quiet life' hypothesis investigated whether firms in monopolistic market will be more risk averse than firms in competitive markets. Using concentration ratios for competition measures and the coefficient of variation of profit rates for risk, they found results consistent with the competition-fragility view in a study of 6500 US banks between 1969-1978. The impact of concentration and foreign penetration on competition and risk in eight Latin American

Table 4.1: **Selected Literature on Bank competition and Stability Relationship**

Author(s)	Sample (African countries in parenthesis)	Period	Stability Measure	Competition Measure	Finding
Agoraki et al. (2011)	13 CEE countries	1998-2005	NPLs	Lerner	fragility
Amidu (2013)	55 Developing countries (22)	2000-2007	Z-score, NPLs and Cap. Ratio	Lerner and H-statistic	stability
Akins, Li, Ng, and Rusticus (2016)	US banks	2006-2010	bank failure	HHI and concentration ratio	stability
Demirgç-Kunt, Anginer, and Zhu (2013)	63 countries	1997-2009	distance-to-default	lerner index and H-statistics	stability
Beck et al. (2013)	79 countries (7)	1994-2009	Z-score	Lerner	fragility
Berger et al. (2009)	23 industrialized countries	1999-2005	Z-score and NPLs	Lerner	non-linear
Boyd, De Nicoló, and Jalal (2009)	134 countries	1993-2004	Z-score	HHI	stability
Fu et al. (2014)	14 Asian countries	2003-2010	Market distance to default	Lerner	fragility
Schaeck and Cihak (2012)	10 European countries	1995-2005	Cap. Ratio	H-statistic	stability
Schaeck and Cihák (2014)	10 European countries	1995-2005	Z-score	Boone indicator	stability
Tabak et al. (2012)	10 Latin American countries	2003-2008	Z-score (SFA)	Boone indicator	non-linear
Ariss (2010)	60 Developing countries (14)	1999-2005	Z-score	Lerner	fragility
Uhde and Heimeshoff (2009)	25 European countries	1997-2005	Z-score	CR3, CR5 and HHI	stability
Yeyati and Micco (2007)	8 Latin American countries	1993-2002	Z-score	H-statistic	fragility
Fernández, González, and Suárez (2013)	54 countries (23)	1980-2000	pre-/during crisis growth rate value added	HHI and concentration ratios	fragility
Fiordelisi and Mare (2014)	European cooperative banks	1998-2009	zscore	lerner index	stability
Hussain and Hassan (2012)	US banks	2003-2007	simultaneous equation model	lerner index	stability
Jeon and Lim (2013)	Korea commercial and mutual savings banks	1999-2011	zscore	Boone indicator	ambiguous
Jiménez, Lopez, and Saurina (2013)	Spanish commercial banks	1988-2003	NPLs	lerner index	ambiguous
Kouki and Al-Nasser (2014)	31 African countries	2005-2010	zscore	lerner index	fragility
Liu et al. (2013b)	10 European countries	2000-2008	zscore	lerner index	non-linear
Liu and Wilson (2013)	Japanese banking system	2000-2009	zscore	lerner index	mix
Maghyereh and Awartani (2016)	70 Gulf cooperation countries	2001-2011	zscore and NPLs	lerner index	fragility
Marques-Ibanez, Altunbas, and van Leuvensteijn (2014)	9 European countries and US banks	2007-2009	numbers of assisted banks	Boone indicator	fragility
Rhoades and Rutz (1982)	US banks	1969-1978	coefficient of variation of profit	concentration ratios	fragility
Schaeck, Cihak, and Wolfe (2009)	45 countries (4)	1980-2005	bank failure	H-statistics	stability
Soedarmono, Machrouh, and Tarazi (2013)	11 Asian countries	1994-2009	zscore	lerner index	stability

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countries' banks were investigated by Yeyati and Micco (2007) for the period of 1992-2002. Similar to Rhoades and Rutz (1982), they found a positive relationship between risk, proxy by Zscore and competition proxy by Panzar-Rosse H-statistics. Further, the test of both competition-fragility and competition-stability views was carried out by Berger et al. (2009) on 23 industrialised countries for the periods 1999-2005. They found a non-linear relationship between competition and stability using Zscore, non-performing loans and equity capital ratio as stability measure and Lerner index as competition measure. Their results show that banks with higher degree of market power have less overall risk exposure, while at the same time market power increases loan portfolio risk. This found consistency with the theoretical model of Boyd and De Nicolo (2005). Boyd et al. (2009) investigated models in which banks invest in less risky assets and compete in both loan and deposit markets for the periods 1993-2004 for 2600 banks in 134 non-industrialised countries and 2500 banks in the US (in 2003). Based on HHI and Zscore, competition and risk measures respectively, they concluded that the relationship between competition and stability is better described as ambiguous because different scenarios played out in their result. Firstly, they found that the probability of failure may increase or decrease with increase in competition and that loans and assets increase with increase in competition. They also found that the influence of competition on loan-assets-ratio is unclear pointing to evidence of a trade-off between bank competition and stability. Their results further revealed that competition favours the propensity to lend and that at higher competition levels there is low probability of failure with loan-to-asset ratio being positive and significantly related to measures of competition.

Schaeck et al. (2009) found competition-stability relationship in an investigation of the relationship between competition and systemic stability in 45 countries that include four African countries for the periods 1980-20005. Their evidence show that competitive banking systems are less susceptible to systemic crises with longer lead time to crisis. In other words, competition reduces the probability of a crisis and increases the time it takes for a banking system to get into crisis. The result holds even when concentration is controlled, revealing that concentration is associated with higher probability of crisis with shorter time to crisis. They argued that concentration measures are not good proxies for competition as their result shows that both competition and concentration measures captured different banking features. This result suggests that if policies promoting competition are well-crafted they will improve systemic stability. On their part, Uhde and Heimeshoff (2009) examined the impact of bank consolidation on banks soundness in 25 European markets for the periods 1997-2005. As consolidation is meant to increase capital that should provide incentives for competition, hence they measure competition using concentration ratios like HHI, CR_3 and CR_5[1] and stability with Zscore. They show that competition is good for stability as their result found Eastern European banking markets more prone to financial fragility because the banks exhibit lower level of competitive pressure and as such held down by fewer diversification opportunities. Meanwhile Ariss (2010) carried out the investigation on the relationship among market power, efficiency and stability in 60 developing countries in Eastern Europe, Central Asia, Middle East, East and South Asia, the Pacific and including 14 African countries between 1999 and 2005, and found that increase in market power increases stability with Zscore and Lerner Index as stability and competition measures, respectively. In considering whether regulation effects are transmitted through market power to bank risk-behaviour, Agoraki et al. (2011) use Zscore, NPLs and Lerner Index to study competition and risk taking behaviour in Central and Eastern Europe banking sector for the periods 1998-2005. They found that banks with market power take on lower credit risk, hence low probability of default.

In another US banks study, Hussain and Hassan (2012) investigated how the degree of competition, risk-taking and efficiency relate among small, medium and big banks in the US between 2003-2007 with simultaneous equation modelling of stability and Lerner Index for Zscore. Unlike Rhoades and Rutz (1982) who found fragility in competition stability relationship, Hussain and Hassan (2012) found that collusive behaviour among US banks causes the rise in their risk taking behaviour. Tabak et al. (2012) modelled stability-inefficiency using stochastic frontier analysis in a regression on competition using Boone indicator surrogate and found a non-linear relationship between competition and risk-taking behaviour. Their work bordered on 376 banks in 10 Latin American countries from 2003 to 2008. They revealed that both high and low degree of competition levels enhance financial stability with average competition showing opposite effects, implying that competition could be both good or bad for the banking system under review. Furthermore, trying to know why banks maintain capital above the regulatory requirements

[1] These are various proxies for industry concentration. HHI represents Herfindel-Herschman Index, while CR_3 and CR_5 are concentration ratios of 3 and 5 and firms.

level, Schaeck and Cihak (2012) studied 2600 banks in 10 European countries for the periods 1999-2005. They measured competition by H-statistics and capital and/risk with equity capital ratio. They found that competition encourages high capital ratio, implying positive relationship between competition and stability. Similarly, Amidu (2013) found competition-stability relationship in a study of 55 emerging and developing countries that included 22 African countries. His study covered periods of 2000-2007 with Zcsore, NPLs and equity capital ratio as stability measures and Lerner index cum H-statistics as competition measure. The study showed that as competition reduces internal capital, market power increases, and banks utilise internal funds to invest in non-interest income generating ventures. He further stated that market power explained the low insolvency risk experienced by the banks during the financial crisis.

Demirgç-Kunt et al. (2013) studied the relationship between bank competition and systemic risk by examining the correlation in risk taking behaviour of banks to measure systemic risk. Samples of 1872 listed banks were obtained from 63 countries for the periods of 1997-2009. They adopted market measure, distance-to-default as a measure for stability with Lerner Index, H-statistics and HHI as measures of competition. Their results provide evidence which support competition stability views. They also found that greater competition encourages more diversified risk with the banking system responding more robustly to shocks and that increases in competition show a reduction in systemic risk. Large samples of 17055 banks across 79 developing and developed countries that included seven African countries were investigated for periods between 1994 and 2009. Beck et al. (2013) analysed how the relationship between competition and stability varies according to geographical location and found that competition has great influence on stability. However, they argued that such influence depends on the market, regulation as well as the institution in which the banks operate. They reiterated that studies on banks in individual countries have reached mixed conclusions on the relationship between competition and risk while cross-country studies tend to indicate a positive relationship between the duo. Korean mutual savings and commercial banks constituted the study area for Jeon and Lim (2013) when they attempted to examine the influence between competition and concentration on Korean financial industry stability. The study was implemented for the periods 1999-2011 using Boone indicator and Zscore for competition and stability measures respectively. They found that the nature of the financial institution determines the kind of relationship that subsist between competition and stability. This is because, their results provided evidence that supports different conclusions for the two types of banks considered. The Korean commercial banks were less stable with competition and non-linear relationship over the period considered. For the mutual savings banks, competition shows positive impact on stability even with greater business risk and weak corporate governance.

In a related study of commercial banks in the Spanish banking system, Jiménez et al. (2013) investigated the franchise value assumption role in limiting banks risk-taking. The focus was over the periods spanning 1988-2003 on 107 banks with non-performing loans and Lerner Index, CR_n, HHI as surrogates for both stability and competition. In the case of concentration ratios, they found non-linear relationship between competition and bank risk taking in both deposits and loan markets while the outcome of the Lerner index supports fragility. This obviously is in tandem with the argument of Schaeck et al. (2009) that discourages the use of concentration ratios as competition measures. Ten European countries banking system were the studies of Liu et al. (2013b) on a regional measure of competition and stability. Their evidence was built on an unbalanced panel analysis of 2322 banks over the periods 2000-2008. Surrogate Zscore for stability and Lerner Index for competition and found an inverted U-shaped relationship between competition and stability in the 10 European countries banking sectors over the study period. Like the studies of Beck et al. (2013) their studies also found that regional economic condition to play a role in competition-stability relationship in the region. For Liu and Wilson (2013), competition and stability relationship exhibit a mixed result. While they found competition to increase the risk of regional banks, it reduces the risk of national banks. This is based on their investigation of the relationship between competition and risk in Japanese banking sector for the periods 2000-2009 with Lerner index and Zscore as competition and stability surrogates.

Soedarmono et al. (2013) in a study of 11 Asian emerging countries, 636 commercial banks over the period of 1994-2009, found result consistent with competition-stability view. They probed the impact on financial stability of bank competition in emerging markets of Asian with Lerner Index as competition measure and Zscore. The authors show that higher degree of market power is associated with higher capital ratio, higher income volatility and higher risk of bank insolvency. Although banks in less competitive markets hold more capital, their results revealed that the extent of capitalisation was inadequate to offset the impact on default risk of higher risk taking. They however admitted that banks market power provided the necessary cushion for stabilising the system during Asian financial crisis in 1997. Overall, with closer investigation they however showed that such findings only hold for countries with a smaller proportion of the largest banks, suggesting that the impact of bank competition is conditional on the extent to which the banking industry may benefit from too-big-to-fail subsidies. Fernández et al. (2013) included a sample of 23 African countries in their study of the effects of market concentration, regulation and institution on 68 systemic crisis in 54 countries. Using HHI plus other concentration ratios to account for competition and pre-/during crisis growth rate value added, they found that between 1980 and 2000 concentration of banks helped to reduce systemic failure. Marques-Ibanez et al. (2014) also found fragility in competition and stability relationship in their study of US and nine European countries for the periods 2007-2009. Their study analysed the role played by securitisation and capital in competition risk relationship during 2007-2009 crisis. A total of 495 largest listed banks parent companies were studied with a number of banks that received assistance during the crisis as risk measure and boone indicator for competition. They show that more intense competition is correlated with higher levels of realised risk and that as competition increases, banks that relied more heavily on securitisation had more incentives to undertake more risk. Fiordelisi and Mare (2014) found a result consistent with the models of Boyd and De Nicolo (2005)'s competition stability view, arguing that banks' market power negatively Granger cause the soundness of banks. They found this result in their assessment of both the short and the long run dynamic relationship between competition and stability with focus on European countries cooperative banks for the period 1998-2004. The study used both Zscore and Lerner Index as stability and competition measures respectively. In a related study Schaeck and Cihák (2014) found competition to be positively related to stability using Boone indicator and Lerner Index to empirically assess this relationship in 10 European banking sectors over the periods 1995-2005. This suggests that competition may generally be good in relation to stability in Europe as evidence has shown the consistency of direct relationship between the two phenomenon in literature.

Theories have alluded to a potential trade-off between competition and stability in competition-stability relationship. To test these theories in 14 Asian countries for the periods 2003-

2010, Fu et al. (2014) surrogates distant-to-default for stability and Lerner Index for competition and came to a rather ambiguous conclusion. Their results show that greater concentration fosters fragility and at the same time lower pricing power increases bank risk exposure. This suggests that a middle way must be sought. Kouki and Al-Nasser (2014) studied the implication of market power on stability of 127 banks in 31 African countries for the period 2005-2010 and argue against competition-stability views. They found consistency with the 'quite life' hypothesis with evidence showing that market power has benefits for risk and stability. Included in their stability and competition measures are Zscore and Lerner index. Recently, Maghyereh and Awartani (2016) uses Zscore and NPLs for stability as well as Lerner Index for competition to test for the average relationship between competition and stability. This study covered the period 2001-2011 and for 70 Gulf Cooperation countries. The authors' result aligns with the competition-fragility view as they found that as competition increases so does instability abounds. Akins et al. (2016) also recently used large samples of US banking sector and concluded based on evidence in favour of competition-stability views. Specifically, they considered 7351 US banks between 2006-2010 with a number of bank failures as surrogate for stability and concentration measures to represent competition in studying how competition and stability relationship faired in the course of the 2007-09 financial crisis. They found that more competitive banks charged lower interest margin and held less risky portfolio, among others, before the crisis. They also found that during the crisis, the probability of enforcement actions and bank closure reduced with competition.

In summary, there is no straight answer for competition and stability relationship as shown by the evidence around the world. Apart from pockets of empirical works that incorporated a number of African countries which peradventure will include some SSA region we have found no studies dedicated to study this case in SSA region and on commercial banks in particular as they account for the largest shares of market and assets of the SSA financial sectors that are burdened with underdeveloped capital market. It is this gap that this study is out to fill especially at a point when policy makers are out to stimulate competition in the region's banking sectors as a catalyst to drive economic growth.

4.3 Methodology

Extant literature has employed various methods to investigate the relationship between competition and stability in the banking system. Notable among these methods are OLS (Akins et al., 2016; Beck et al., 2013; Fernández et al., 2013; Jeon & Lim, 2013, among others); fixed and random effects regression (Demirgç-Kunt et al., 2013; Hussain & Hassan, 2012; Kouki & Al-Nasser, 2014; Schaeck & Cihak, 2012, among others) and Tobit model (Ariss, 2010). Others include logit model and duration analysis (Schaeck et al., 2009), probit regression (Marques-Ibanez et al., 2014), 2SLS (Soedarmono et al., 2013), Granger causality (Fiordelisi & Mare, 2014) and GMM (Agoraki et al., 2011; Amidu, 2013; Berger et al., 2009; Boyd et al., 2009, among). Each of these methods has its merits and demerits. In this study, we employ the system GMM because of its ability to deal with endogeneity issues that are inherent in the regression of stability on competition. Fiordelisi, Mare, and Molyneux (2015) argue for the need to account for endogeneity problem in competition and stability regression because of issues of reverse causality, simultaneity and variables omission notwithstanding the inclusion of a number of control variable. This ensures the robustness and validity of our regression results. Besides focusing on commercial banks and particularly a SSA region study, this is another area that our study is different from Kouki and Al-Nasser (2014) who studied the implication of market power on stability in Africa with fixed effects regression that does not account for endogeneity. Based on the literature reviewed and for want of data in the study area, we surrogate the Lerner Index for competition and Zscore for stability. Moreover, the Lerner index is best at measuring bank level competition which makes it a better choice for the study and the fact that it has strong theoretical basis. Zscore has wide application in literature and it measures the overall stability of the banking sector incorporating most risks that banks may face.

This study pooled together cross-sectional time series data of the sampled banks in the SSA countries under consideration using GMM. The choice of panel data analysis is informed by the benefits that the technique offers to the study. According to Baltagi (2008), panel data analysis accommodates the creation and analysis of more difficult behavioral models. Moreover, the technique provides for additional degree of freedom, efficient when compared to time series and cross-sectional data and offers more explanatory analysis. Panel analysis generally meant more variability, fewer collinearity and controlled heterogeneity within individual data (Baltagi, 2008).

4.3.1 Model Specification

The implementation of the regression of the relationship between competition and stability in the SSA region commercial banks is done using the Generalised Method of Moments (GMM) regression. Quite a number of approaches have been employed in extant literature and none seems to have adequately resolved the ongoing debate in this area. The commonly used model in the study of competition and stability in the banking system has been probit/logit framework (Beck, Demirgüç-Kunt, & Levine, 2006; Demirgç-Kunt, Detragiache, & and, 1997). The only known study to the best of our knowledge that has been done in Africa on competition and stability (Moyo, Nandwa, Council, Oduor, & Simpasa, 2014) employed survival analysis (duration model with time varying covariates). Besides being a static model, they are also limited in accounting for endogeneity issues between competition and stability. The prevalence of individual cross-sectional data over–time has resulted in the development and the increase in the popularity and/or acceptability of panel data techniques. This no doubt has ignited the application of dynamic panel data (DPD) that allows finance and economics experts alike to accommodate individual dynamics in their studies. At the same time, the inclusion of lagged endogenous variables in a model where individual effects may be present poses a problem of dynamic panel bias (DPB). Meanwhile, the conventional DPD estimators like; first difference, pooled ols, GLS, among others are inefficient in handling DPB, hence the use of instrumental variables was proposed to alleviate the issue of endogeneity in the lagged endogenous variables. In addition, it is a normality free regression technique, having great adaptability and data generating process assumptions with dependent variables being instrumented by their lagged variables.

Here we assume the relationship between competition and stability of the commercial banks in SSA region to take following general form of linear dynamic panel model;

$$\Gamma_{it} = \rho_1 \Gamma_{it-1} + \chi_{it}^{'} \rho + \epsilon_{it} \tag{4.3.1}$$

Where $i = 1, 2, \cdots, N$, $t = 1, 2, \cdots, T$, $\chi^{'}$ is a $(1 \times \kappa)$ vector of explanatory variables, ρ is a $(\kappa \times 1)$ vector of coefficients to be estimated and $\epsilon it = \gamma_{it} + \psi_{it}$; where, γ_{it} denotes the individual fixed effects capturing individual differences of the cross–sections (banks in the sample), and ψ_{it} is the idiosyncratic term such that $\gamma \sim iidN(0, \delta^2_\gamma)$, $\psi \sim iidN(0, \delta^2_\psi)$, assuming that;

$$E\left[\gamma_{it}\right] = \left[\gamma_{it}\psi_{it}\right] = 0 \tag{4.3.2}$$

Since Γ_{it} brings up *DPB* given that γ_{it} is correlated with Γ_{it}, it therefore follows that, if Γ_{it} is a function of γ_{it}, then Γ_{it-1} will also be a function of γ_{it} making one of the explanatory variables to correlate with one of the composed error terms thus given rise to endogeneity problem.

OLS could not be used to estimate *equation (4.3.1)* because the correlation between Γ_{it-1} and ϵ_{it}, in other words, $E\left[\Gamma_{it-1}, \epsilon_{it}\right] > 0$, leading to overestimation of ρ_1 and so the result will be bias upward as well as inconsistent. One way to fix this endogenity bias is to remove the individual fixed effects through data transformation. Another way is to look for a valid instrument of the lagged endogenous variable. For the purpose of simplicity, lets assume a model competition and stability relationship with just one regressor;

$$\Gamma_{it} = \rho_1\Gamma_{it-1} + \epsilon_{it} \tag{4.3.3}$$

Taking one more lag from *equation (4.3.3)* will remove individual fixed effects;

$$\Gamma_{it-1} = \rho_1\Gamma_{it-2} + \epsilon_{it-1} \tag{4.3.4}$$

This gives;

$$(\Gamma_{it} - \Gamma_{it-1}) = \rho_1(\Gamma_{it-1} - \Gamma_{it-2}) + (\gamma_i - \gamma_i) + (\psi_{it} - \psi_{it-1}) \tag{4.3.5}$$

Therefore;

$$\Delta\Gamma_{it} = \rho_1\Delta\Gamma_{it-1} + \Delta\psi_{it} \tag{4.3.6}$$

Where $\Delta = (1 - L)$ represents the first difference operator. The problem with the transformation is the loss of degree of freedom as T first–period observations is dropped which could pose a serious challenge for unbalanced panel data. In the views of Griliches and Mairesse (1995) the first differencing transformation is able to get rid of the individual effects. The transformation prompts Moving Average (MA(1)) for $\Delta\psi_{it}$ given the assumption of $\psi \sim iidN(0, \delta^2_\psi)$. This requires the application of *GLS* that is able to transform data by means of subtracting the time averaged model from *equation (4.3.3)*;

$$\overline{\Gamma}_i = \rho_1\overline{\Gamma}_{t-1} + \overline{\gamma}_i + \overline{\psi}_i \tag{4.3.7}$$

so that the transformed model becomes;

$$(\Gamma_{it} - \overline{\Gamma}_i) = \rho_1(\Gamma_{it-1} - \overline{\Gamma}_{i,-1}) + (\gamma_i - \gamma_i) + (\psi_{it} - \overline{\psi}_i) \tag{4.3.8}$$

In *equation (4.3.8)*, $(\Gamma_{it} - \overline{\Gamma}_i)$ is regressed on $(\Gamma_{it-1} - \overline{\Gamma}_{i,-1})$ using *OLS* within group estimator. Although within group estimator manages to eliminate individual effects, according to Nickell (1981), it is inconsistent due to its inability to deal with dynamic panel bias. Thus makes first difference conversion a better approach than the within group conversion in resolving endogeneity issues. For instance, in the first difference transformation, only previous error term realised is included in the model, meanwhile, in within group conversion, all preceding realisations are incorporated into the model. For this reason, all *OLS* estimators are unable to resolve dynamic panel bias and therefore require an alternative approach.

The work of Anderson and Hsiao (1982) among others, argued that the failure of the *OLS* estimator in dealing with the issues arising from the dynamic panel bias orchestrated the popularity that instrumental variable estimator gained in literature. *Equation (4.3.6)* requires instrumental variable estimator for implementation since the first difference conversion is unable to recover consistency with the application of *OLS* estimator. To deal with this, Anderson and Hsiao (1982) proposed a two stage least square *(2SLS)* approach that is able to utilise the first difference transformation to eliminate the fixed effects, as well as employ the lags of the explained variable to instrument the transformed lag endogenous variable. The essence is that, since Γ_{it}, a component of $\Delta\Gamma_{it-1}$ is correlated with ϵ_{it-1} which is also contained in $\Delta\epsilon_{it}$, then the deeper lags of the explanatory variables are not correlated with the error term, as such could be used as instrument. Anderson and Hsiao (1981) proposed Γ_{it-2} to be used as instrument for $\Delta\Gamma_{it-1}$ because it is correlated with $\Gamma_{it-1} - \Gamma it - 2$ but orthogonal to $\Delta\epsilon_{it}$ if error terms are assumed not to be serially correlated. Be that as it may, *2SLS* does not utilise all the valid instruments available, thus suffers similar setback as the *OLS* - not efficient.

Consequently, the generalised method of moments (*GMM*) proposed by Arellano and Bond (1991) is applied to efficiently and consistently estimate the relationship between competition and stability of SSA region commercial banks in *equation (4.3.1)*. *GMM* is able to take equations both in first difference and in levels with its specific sets of instrumental variables. To deal with banks specific effects, first difference is taken as in *equation (4.3.5)* and the utilisation of the appropriate lag instruments needed resolves the issues of the correlation between $\Gamma_{it} - \Gamma_{it-1}$ and $\psi_{it} - \psi_{it-1}$. The same approach is deployed to generate instruments for other regressors that are permitted to be dependent on the past and the current realisation of the explained variable. Given the assumptions that regressors are weakly exogenous and that the error term is devoid of serial correlation, dynamic *GMM* employs the following moments conditions;

$$E\left[\Gamma_{i,jt-s^{\cdot}}\left(\epsilon_{i,jt} - \epsilon_{i,jt-1}\right)\right] = 0 \quad for\ s \geq 2, \quad t = 2, \cdots T \tag{4.3.9}$$

$$E\left[\chi_{i,jt-s^{\cdot}}\left(\epsilon_{i,jt} - \epsilon_{i,jt-1}\right)\right] = 0 \quad for\ s \geq 2, \quad t = 2, \cdots T \tag{4.3.10}$$

The outcomes of the above moments of condition produces the first difference *GMM*. One major drawback associated with this is that, where the lagged endogenous variables and the regressors are persistent overtime, there is every likelihood that the lagged levels may be weak instrument for the first differenced variables. Hence, amount to finite bias with reduced accuracy culminating in the need to regress at levels as well as to complement the regression at the first differences. The lagged first differences instrument the regression in levels of the same variables. Additional moments of condition for the regression in levels are as stated below.

$$E\left[\left(\Gamma_{i,jt-s} - \Gamma_{i,jt-s-1}\right) \cdot \left(\gamma_i + \epsilon_{i,jt-1}\right)\right] = 0 \quad for\ s = 1 \tag{4.3.11}$$

$$E\left[\left(\chi_{i,jt-s} - \chi_{i,jt-s-1}\right) \cdot \left(\gamma_i + \epsilon_{i,jt-1}\right)\right] = 0 \quad for\ s = 1 \tag{4.3.12}$$

We however applied the orthogonal deviation of Arellano and Bover (1995) which Roodman (2006) argues to be more applicable in the case of an unbalanced panels with pockets of missing data. To be consistent, the instrument of the *GMM* regressors must be valid. This is verified through the Hansen J statistics in a robust estimation Mileva (2007). Also, test of serial correlation among the error terms is required for valid *GMM* results.

Arellano-Bond test for serial correlation assumes no serial correlation and its applied to the differenced residuals. Once the null hypothesis is acceptable order two, inferring the absence of serial correlation, the study will then employ corresponding moment of conditions.

To estimate the relationship between competition and stability of SSA region commercial banks therefore we employ the following estimation equation;

$$æ_{kit} = \beta_{kit} + æ_{kit-1} + \pi_{kit} LI_{kit} + \zeta_{kit} \Sigma X_{kit} + \xi_{kit} \quad (4.3.13)$$

Where ae_{kit} measures the stability and other risk proxies for bank i in country k at year t. The risk measures include, loan loss provision to gross loan ratio (LLPRATIO), loan loss provision to equity ratio (LLPERATIO), off-balance sheet obligations to assets ratio (OBSARATIO), off-balance sheet obligations to equity ratio (OBSERATIO) and capital to asset ratio (EQCAPRATIO). β_{kit} is a constant; π_{kit} is the coefficient of competition measure, LI, for k's regression in year t; ζ_{kit} is the coefficient of the vector of bank specific variables and other macroeconomics/non-financial variables; ξ_{kit} is the error term. The banks' specific variables employed include, log of total assets (LNABV) to control for size, liquid assets to total assets (LAR), performance measures (ROA and ROE). While the macroeconomic variables are annual GDP growth (GDPG) and inflation (INF) measured by consumer price index.

4.3.2 Data and Variables Description

Data for this study were mainly sourced from BankScope that is considered to house the most comprehensive database on banks. We employed an unbalanced panel of 440 commercial banks from 2006 to 2015 to account for entry and exit and also cater for periods of data unavailability. The focus on commercial banks ensured uniformity in our choice of banks as quite a good number of other deposit money banks still enjoy government support at one time or the other, besides accounting for more than 70% of the total assets and market share of the region's financial system. Data required for the estimation of Lerner Index, competition variable that were collected include personnel expenses, total assets, total revenue, interest and non-interest expense, fixed assets and total deposits. For the stability measure, the Zscore, we collected equity capital ratio (ECR) and return of assets (ROA). A range of risk measures data included loan loss provision (LLP) and off-balance-sheet activity. Other data collected include Return on equity (ROE), GDP annual growth rate and corruption perception. The GDP annual growth rate and inflation are available from WDI of World Bank while corruption perception is from Transparency International.

We adopt the Zscore of Roy (1952) as the measure of stability of the SSA region commercial banks. The Zscore measures the probability of insolvency of a bank as follows;

$$Z = \frac{\overline{ROA}_{ikt} - \overline{ECR}_{ikt}}{\sigma ROA_{ikt}} \tag{4.3.14}$$

where $\overline{ROA}_{ikt}$ is average return on asset, $\overline{ECR}_{ikt}$ is the average equity capital ratio and σROA_{ikt} denotes the standard deviation ofROA, and ikt is bank i in country k at time t. It measures banks overall stability by combining their individual profits, capital and return volatility. The estimates predict the number of standard deviation that bank profit must fall below before its equity becomes negative. Higher scores indicate a more stable bank and/or less risky bank with less likelihood of becoming bankrupt (Berger et al., 2009; Laeven & Levine, 2009; Lepetit & Strobel, 2013, among others). Specifically, the Zscore presents the advantage of serving as a health check for banks and can reflect the various forms of risk that a bank may face.

For robustness, we consider a range of risks faced by banks as far as data is available. Measures of risks used in this study are majorly credit risks and off-balance-sheet risks. The main concern of credit risk is the quality of banks' assets which has traditionally focused on banks' loan portfolio. Chiou and Porter (2015) argue that attention of banks' risk measure have extended to considering all banks' assets due to the possibilities of potential default risk. Hence we collected data on off-balance-sheet activities to gauge the sensitivity to competitive banking environment because in highly competitive banking markets, banks employs creative accounting measures to conceal their toxic assets off-balance-sheet, thus distorting their outlook thereby exacerbating risk of default.

The variable of competition, Lerner Index (estimated in Chapter 3 Subsection 3.3.1) is a measure of market power, gauging the ability of a bank to charge a price above its marginal cost. Increase in market power represents concentration of the banking sector which implies absence or low degree of competition. When market power is low, competition is high within the banking sector. This measure of competition is largely used in literature and has been adjudged as one of the two best measures of competition (Liu et al., 2013b).

The ECR wears two caps in this study; firstly, as a measure of capital and secondly as a measurement of risk. Bank capital defines the amount of capital a bank must hold in order to carry out banking business. This is highly a subject of regulation and according to the Basel Accord, it currently stands at 10% minimum capital adequacy. Capital requirements have constituted a major variable in competition stability studies Agoraki et al. (2011) and we expect it to be positively related to bank stability. As a risk measure, ECR is a measure of bank overall risk (Chiou & Porter, 2015) and a control for differences in the risk propensities that banks faces. Coccorese (2013) and Bikker, Groeneveld, et al. (1998) argue that high ECR may suggest high risky loan portfolio. We proxy performance with ROA and ROE. While ROE relates to equity shareholders, ROA measures the overall outlook of banks performance in relation to assets employed. They have been employed in this study to serve their different purposes in relation to bank stability and have been used in a number of studies, (Chiou & Porter, 2015; Naceur & Omran, 2011, among others).

Based on existing theories, we expect competition to be positively related to stability as much as we anticipate better performance to mean a more stable banking system. We also expect liquidity to be negatively related to bank risk because low level of liquidity implies higher loan exposure which increases default risk and reduces stability. Furthermore, we expect bank size to be negatively related to risk, in line with Berger (1995) who argues that economies of scale and market power meant that larger banks are synonymous with higher stability or lower risk. On the contrtary, Demirgüç-Kunt and Huizinga (2010); Herring and Carmassi (2012); Stern and Feldman (2004) provide evidence which shows that higher returns induced by risky projects entice larger banks' managers to take on more risks, confident that governments will not let them fail, 'too big to fail' (TBTF). This makes risk and size relationship unclear in literature.

Regarding the effects of macroeconomics variables on the stability of SSA commercial banks; GDPG and INF are used. We expect GDPG to be negatively related to bank stability. Banks tend to lend excessively in times of boom and are much more cautious during recessions, (Agoraki et al., 2011; Berger & Udell, 2004; Dell'Ariccia & Marquez, 2006). Similarly, a negative relationship is expected between inflation and stability. This is consistent with the arguments of Lown and Morgan (2006) and BUCH, EICKMEIER, and PRIETO (2014) that economy and financial systems suffer more adversely during inflation. Moreover, the period is usually associated with distorted decisions, aggravated information asymmetry and high price volatility.

Given the SSA region profile, we control for the impact of corruption. We used corruption perception index of the Transparency International that indicates the perception of both the administrative and political environment to corrupt practices. The index ranges from 0 to 1 and the closer to 1 the better for an economy. An economy with very low corruption perception index may face some kind of instability in their banking system.

4.4 Empirical Results

We present the results of the relationship between competition and stability of SSA countries commercial banks in this section. Competition is measured using Lerner index that has the ability to capture bank level market power. We surrogate stability with Zscore. Zscore has been used in literature as a stability test for banks and banking sectors' stability. The measurement is based on banks' performance in terms of assets employed in relation to their capital. We also considered a range of bank risk measures, specifically credit and off-balance-sheet risks for robustness. Ongoing results in literature provide evidence that competition may be good or bad for the banking sectors. Specifically, empirical works have supported both stability and fragility of the banking sector due to competition. Most of these debates have largely been domiciled in the advanced world, especially in US and Europe, with few of the literature in emerging markets like China. We do not expect the SSA commercial banking markets to behave differently like most of these economies, SSA banking market is monopolistically competitive in nature (as found in Chapter 3). Moreso, most of the banking systems in the region were applauded for their resilience during the 2007-2009 financial crisis that was partly blamed on excessive competition. To this end, we hypothesise that competition may have contributed significantly to such stability in this part of the world[2]. In the next three subsections are the summary statistics providing insight to the data used in this study, the correlation results which though not

[2]Following the evidence of Moyo et al. (2014) that found competition to be good for the region's banking sector. We do differ in scope, extent and method of study.

an econometrics analysis, gives a precursor to what the econometrics analysis might be, and finally the regression analysis results.

4.4.1 Summary Statistics

Table 4.2 below presents the summary statistics which provides insight into the nature of data used in the study. Columns 3 - 6 in Table 4.2 relate exclusively to the competition measure. For the purpose of hindsight, Lerner index is a measure of market power that ranges from 0 to 1, with indices close to 1 signifying high market power and/or low degree of competition/concentration in the banking sector. Banks at this end of the markets are said to be oligopolistic or at the extreme, monopolistic. Whereas, indices close to zero denote low market power and/or high competition, with banks either competing in monopolistically competitive banking market or faced with perfect competition[3]. We found market power to range almost between 0.0000 in 2013 and 0.9980 in 2012 giving the minimum and the maximum indices across the 440 banks considered over the study period of 2006 - 2015. This momentarily suggests a mixture of high and low market power. However, further analysis by the mean and the standard deviation suggests a highly competitive commercial banking sector having mean of market power that are below 0.50 with a total bank level competition average of about 0.30 over the study period. Thus implies that the means are closer to the minimum than the maximum in all the years considered and the standard deviation substantiated our claim by not being fundamentally far from the mean.

The other parts of Table 4.2 are the mean of Zscore, stability measure; size, representing the log of total assets used as a control variable; equity capital ratio, which is the ratio of capital to total assets and most times used to denote regulatory capital; ROA and ROE, as performance measures. Others include the means of of the various risk measures, ratio of liquid assets to total assets (LAR), GDP annual growth and corruption perception. Taking a staggering insight at the mean of these listed variables, the Zscore is minimum at 2.9889 and having a total mean of 3.3433 depicting a relatively stable banking sector. The mean of the risks measures are also presented. The eqcapratio tends to support this assertion as its mean over the period suggest that most banks have capital above the Basel regulatory benchmark of 10%. The banks however performed poorly in terms of

[3]The two extremes of monopoly and perfect market Moltiklein theory argued as unattainable in the banking industry.

Table 4.2: **Summary Statistics**

		Lerner Index															
year	N	mean	SD	min	max	zscore	size	eqcapratio	roa	roe	llpratio	llperatio	obsaratio	obseratio	lar	GDPG	cop
2006	190	0.2557	0.1656	0.0006	0.8370	3.5434	11.9643	0.1612	0.0205	0.1913	0.0117	0.0837	0.1880	1.8962	0.3670	0.0694	28.7816
2007	215	0.2694	0.1557	0.0129	0.7842	3.2046	12.1933	0.1441	0.0182	0.1963	0.0135	0.0756	0.2174	2.2071	0.4245	0.0704	29.4434
2008	250	0.2884	0.1773	0.0109	0.9670	3.3802	12.2133	0.1569	0.0204	0.1796	0.0146	-0.0080	0.1584	1.5051	0.2922	0.0547	30.7553
2009	275	0.2939	0.1884	0.0102	0.9210	3.2950	12.3373	0.1503	0.0140	0.1481	0.0197	0.0957	1.4459	17.1647	0.3126	0.0389	30.3731
2010	296	0.2959	0.1829	0.0004	0.9790	3.2740	12.3817	0.1564	0.0099	0.1317	0.0215	0.0976	0.1652	1.5486	0.3119	0.0631	29.6118
2011	320	0.2822	0.1728	0.0030	0.9770	2.9889	12.5777	0.1397	0.0116	0.1232	0.0201	0.1096	0.1748	1.6728	0.2985	0.0586	30.8179
2012	357	0.3237	0.1945	0.0050	0.9980	3.2351	12.5994	0.1542	0.0134	0.1158	0.0187	0.0837	0.2653	1.7612	0.2921	0.0584	34.5457
2013	392	0.3521	0.3143	0.0000	0.9978	3.4038	12.6364	0.1701	0.0117	0.0870	0.0227	0.0910	0.1949	1.6888	0.2768	0.0581	34.6199
2014	430	0.3318	0.1855	0.0003	0.9960	3.6243	12.5857	0.1810	0.0106	0.0761	0.0233	0.0571	0.1802	1.4728	0.2699	0.0522	34.9233
2015	440	0.3244	0.1964	0.0006	0.9960	3.4840	12.6107	0.1704	0.0110	0.0692	0.0267	0.1230	0.1886	1.5120	0.2718	0.0400	34.4226
Total		0.30175	0.19334	0.00439	0.9453	3.34333	12.40998	0.15843	0.01413	0.13183	0.01925	0.0809	0.31787	3.24293	0.31173	0.05638	31.82946

Author's computation, 2017, based on data collected.

ROA over the period ranging from 0.01 to 0.02 with a total average over the study period approximating 0.014. Even though ROE provides a better outlook with minimum average at 6.9% in 2015. Overall, the SSA commercial banking system could be adjudged to have faired quite well over the period and we expect this to also have some implication on the stability of the banking sector apart from competition; this will be confirmed in the econometrics analysis. The COP, corruption perception seems to be commendable on the average though with much improvement desired. The index of COP increases as the perception about corruption of the economic environment in which the banks operate improves which should mean a better avenue for banking business and investment. We expect this to impact positively on the banking sectors' stability. Consistent with our review in Chapter 2, we found the overall mean of annual GDP growth approximating 5% over the study period, indicating a fair economic performance compared to the global average. Next is the correlation analysis of how each of these variables relates to competition.

4.4.2 Correlation Analysis

Correlation describes the degree of association between variables. The coefficients range from -1 to 1 and both the sign and size of the coefficient are vital in explaining the relationship between the variables and the implication it might have for our econometrics analysis. We provide a robust correlation analysis over the study period among stability, the dependent variable of interest and the regressors in Table 4.3. Zscore shows a quite weak but significant inverse association with Lerner Index, the variable of interest. This relationship is negative over the study periods except in 2013 when there is a positive association. This is contrary to our expectation and a pointer to the fact that competition may be detrimental to stability in the study area. If that is the case, it will align towards the competition-fragility view. As we have expressed, we do not expect competition to be negatively related to stability, however, the level of banking development in the region impacting its competition management may have accounted for this. Further econometric analysis will validate this view. Surprisingly, bank size also showed a significant and inverse relationship with Zscore over the study periods. Our expectation is positive relationship given that larger banks have advantages of economies of scale. However, large banks have been said to provide impetus for increased risk taking which in essence will lower stability. The question also arise as to how large a bank may be to benefit from this advantage. Depending on the results of the econometrics analysis, policies may need to be crafted to

Table 4.3: **Correlation Results**

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
zscore & lerner index	-0.1346	-0.2072	-0.0259	-0.0098	-0.3066	-0.3131	-0.2533	0.0038	-0.0681	-0.0174
p-value	0.0640	0.0023	0.6834	0.8715	0.0000	0.0000	0.0000	0.9409	0.1586	0.7166
zscore & size	-0.4253	-0.2936	-0.3279	-0.2966	-0.1474	-0.0913	-0.1588	-0.2291	-0.3007	-0.2238
p-value	0.0000	0.0000	0.0000	0.0000	0.0111	0.1031	0.0026	0.0000	0.0000	0.0000
zscore & eqcapratio	0.9478	0.9480	0.7938	0.8324	0.8105	0.8167	0.6661	0.5692	0.6157	0.6990
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
zscore &lar	0.0521	-0.0384	0.124	0.0569	0.0105	0.0033	0.1415	0.0329	0.0926	0.1552
p-value	0.4788	0.5781	0.071	0.3505	0.8575	0.9528	0.0076	0.5172	0.0552	0.0011
zscore & roa	0.1778	0.2587	0.3241	0.1765	0.3096	0.5014	0.3173	0.2496	0.3083	0.5687
p-value	0.0141	0.0001	0.0000	0.0033	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
zscore & roe	0.0650	-0.0466	0.0490	0.0224	0.1126	0.0175	0.0990	0.0958	0.0883	0.0895
p-value	0.3751	0.4991	0.4443	0.7131	0.0546	0.7564	0.0621	0.0585	0.0683	0.0608
zscore & cop	0.1158	-0.0587	0.0541	-0.0115	0.0865	0.0918	0.0448	0.0889	0.1023	0.1291
p-value	0.128	0.4057	0.4073	0.8541	0.1685	0.1183	0.4186	0.0789	0.0339	0.0071
zscore & GDPG	-0.0215	-0.0165	-0.0713	0.0853	0.0069	0.0532	-0.0787	-0.0177	-0.1646	-0.0532
p-value	0.7701	0.8102	0.2613	0.1582	0.9065	0.3427	0.1379	0.7262	0.0006	0.2772
zscore &inf	0.127	0.1497	-0.0179	0.2154	0.0693	0.0864	0.1227	0.088	0.1095	0.0555
p-vlaue	0.0808	0.0282	0.7785	0.0003	0.2348	0.123	0.0204	0.0819	0.0234	0.276

Authors' estimation, 2017, based on data collected

optimally utilise banking assets for the improvement of banks in this region. But in the case of the association between competition and equity capital ratio, the relationships over the study periods are strong, positive and significant showing that a very sound capital base is consistent with the stability of the banking system. This is in line with a priori expectation as well as literature. This is a plus to the commercial banking sector in this region with its attendant policy implications. Liquidity, LAR, is over the study period positive associated with stability except in 2007. This again negates our expectation of negative relationship as lower liquid assets implies high default rate of loan portfolio. It important to note that the banking sectors of SSA region are relatively liquid which may have explained the positive relationship. We expect more insight from the econometric analysis on which the study inference will be predicated.

The two performance measures show weak but positive and significant overtime association with stability. For want of generalisation, ROE is most weak with a maximum of 11.3% in 2010 with an inverse association in 2007. But ROA seems a bit of an average overtime ranging between 17.8% in 2006 and 56.9% in 2015. While we expect performance to boost stability, this weak relation provides us a bit of some concerns and although we do not pre-empt the outcome of econometrics analysis, this should also constitute a flash point for policy issues. Corruption perception should bear direct relationship with stability. Because, when a banking environment is less corrupt, bank loans are likely to be less defaulted. Over the study period, we found COP though positive in 8 out of 10 years our study but very weakly related to stability and mostly insignificant as well. The negative coefficient signs of GDPG association with stability align with literature and our expectation. On the contrary, inflation appeared positively related to stability against literature evidence. These are subjects of further analysis in the next section of econometric analysis as only EQCAPRATIO has given a particularly good result from the stand point of correlation analysis.

4.4.3 Econometrics Analysis

We regressed stability on competition and some measures of bank risks including some banks specific variables as contained in literature to explain the stability of the commercial banking sector in the SSA region. We have analysed the summary statistics as well as the correlation results previously in Subsections 4.4.1 and 4.4.2. Our main objective is to measure the impact of competition on stability in SSA commercial banks. The essence of the other variables is to also look at other factors that may also impact on stability and so the emphasis will be on competition and stability relationship. Our dynamic panel data analysis model employs the two-step system GMM with orthogonal deviation as contained in subsection 4.3.1. This has been proven to resolve panel data bias with the ability to handle unbalanced panel data analysis. The regression results are presented in Table 4.4.

Table 4.4: **Regression Results**

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
VARIABLES	zscore	llpratio	llperatio	obsaratio	obseratio	eqcapratio
L.zscore	0.361***					
	(0.00203)					
li	-0.0244***	6.22e-05***	0.00179***	-0.00210***	-0.0218***	0.00122***
	(0.000232)	(7.22E-06)	(9.92E-05)	(5.11E-05)	(0.00334)	(0.000165)
size	-0.0529***	0.00484***	0.0252***	0.0697***	0.0949**	0.0152***
	(0.0076)	(0.00016)	(0.000991)	(0.00111)	(0.0469)	(0.00343)

Table 4.4: **(continued)**

VARIABLES	Model 1 zscore	Model 2 llpratio	Model 3 llperatio	Model 4 obsaratio	Model 5 obseratio	Model 6 eqcapratio
eqcapratio	8.603***	0.0228***	-0.0597***	1.183***	-3.507***	
	(0.0708)	(0.00145)	(0.005)	(0.0103)	(0.465)	
lar	-0.802***	0.0152***	0.00672***	0.312***	2.274***	0.114***
	(0.0357)	(0.000582)	(0.00251)	(0.00456)	(0.27)	(0.0138)
roa	11.16***	-0.488***	-1.999***	0.259***	10.92***	0.758***
	(0.138)	(0.00544)	(0.0255)	(0.0156)	(2.452)	(0.0966)
roe	-0.00261***	3.36e-05***	-0.000216***	0.000130***	0.00161	-0.000201*
	(0.000184)	(4.94E-06)	(3.05E-05)	(7.15E-06)	(0.00273)	(0.000113)
cop	0.00699***	-0.000157***	-0.000464***	-0.00168***	-0.00806**	0.000208
	(0.000771)	(1.51E-05)	(7.48E-05)	(0.000146)	(0.00344)	(0.000188)
gdpg	0.378**	-0.0319***	-0.288***	0.0781***	-1.684**	-0.0805**
	(0.154)	(0.0027)	(0.0168)	(0.0149)	(0.764)	(0.0342)
inf	0.00648***	0.000434***	0.000510***	-0.00289***	-0.0320***	-0.000309**
	(0.000763)	(2.10E-05)	(7.44E-05)	(6.63E-05)	(0.00513)	(0.00015)
L.llpratio		0.449***				
		(0.00272)				
L.llperatio			0.0200***			
			(0.000819)			
L.obsaratio				0.000701***		
				(3.94E-05)		
L.obseratio					0.000901***	
					(7.36E-05)	
L.eqcapratio						0.770***
						(0.0167)
Constant	1.160***	-0.0471***	-0.165***	-0.891***	0.601	-0.206***
	(0.0866)	(0.00195)	(0.0117)	(0.013)	(0.607)	(0.0427)
Observations	2,513	2,169	2,174	2,024	2,024	2,510
Number of id	420	385	387	368	368	420
Wald χ^2 (10)	381655.81	102465.91	16909.67	50990.1	635.3	4520.78

Table 4.4: **(continued)**

VARIABLES	Model 1 zscore	Model 2 llpratio	Model 3 llperatio	Model 4 obsaratio	Model 5 obseratio	Model 6 eqcapratio
$Prob > \chi^2$	0.000	0.000	0.000	0.000	0.000	0.000
AR2	0.150	0.336	0.642	0.178	0.592	0.242
Hansen J Stats	0.287	0.311	0.158	0.192	0.738	0.470

Sources: Author's Estimation, 2017, based on data collected; Note: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Model 1 represents the results of competition and stability regression while models 2 to 6 are results of competition and bank risks regressions. Table 4.5 below shows the economic impacts of the variables on which we regressed stability and risk measures, that are significant in explaining stability and risks in the banking system. Depending on the signs of the regression coefficients, the values in Table 4.5 indicates how in percentage one standard deviation increase in the explanatory variables economically impacts on stability and the risks measures respectively.

A quick look at the model 1 result shows that the lagged value of stability (L.Zscore) is positive and strongly significant signifying that stability in the past periods has a considerable effects in ensuring current period stability and is persistent overtime. In fact, it has an impact of up to 0.36% on the current banking system stability. We found competition, measured by Lerner Index, to be negative and strongly significantly related to stability. In other words, if competition increases, stability goes down. This is consistent with the correlation coefficient obtained earlier. Although it is against our expectation, it is however consistent with the competition-fragility views that argues potential risk associated with competition results in banks' instability. We therefore posit that competition-fragility view may well be the relationship that exists between competition and stability in the commercial banking sectors of the SSA region. This aligns with the studies of Maghyereh and Awartani (2016), Kouki and Al-Nasser (2014), Beck et al. (2013), Ariss (2010), Martinez-Miera and Repullo (2010) and Allen and Gale (2004) among others, most of whom employed the Lerner index and Zscore to study the relationship between competition and stability in different regions of the world and found competition to be inversely

Table 4.5: **Economic Impacts of Regression Results**

variables	model 1	model 2	model 3	model 4	model 5	model 6
lerneri	-0.0015	0.0002	0.0007	-0.0006	-0.0007	0.0016
size	-0.0274	0.1427	0.0807	0.1587	0.0262	0.1677
ecr	0.4044	0.0609	-0.0173	0.2441	-0.0878	
lar	-0.1277	0.1377	0.0066	0.2182	0.1929	0.3863
roa	0.1821	-0.4528	-0.2015	0.0186	0.0949	0.2632
roe	-0.0004	0.0003	-0.0002	0.0001		-0.0006
cop	0.0232	-0.0296	-0.0095	-0.0244	-0.0142	
gdpg	0.0047	-0.0225	-0.0220	0.0042	-0.0111	-0.0212
inf	0.0130	0.0496	0.0063	-0.0255	-0.0343	-0.0132

Source: Author's Estimation, 2017, from Table 4.4 with

$$Economic\ Impact = \frac{S.D\ of\ explanatory\ variable \times R.C\ of\ explanatory\ variable}{S.D\ of\ dependent\ variable}$$

Where S.D is standard deviation and R.C is regression coefficient.

related to stability. These authors also included a number of African banking sectors in their studies. Competition-fragility views argued that competition encourages banks to take further risks as their franchise values get eroded which consequently results in fragility. Given this evidence, we negate the arguments of Schaeck and Cihák (2014), Amidu (2013), Soedarmono et al. (2013), Schaeck et al. (2009), Demirgç-Kunt et al. (2013), and Boyd and De Nicolo (2005) among others, who provided evidence to a support positive relationship between competition and stability.

The economic implication of the result of the regression of competition on stability shown in Table 4.5 indicates that a one standard deviation increase in competition will result in 0.2% fall in the banking system stability. In other words, the more competitive the banking system the worse off the stability of the banking system. A decrease in the values of Lerner index means more competition, hence less stability. It logically follows that the model supports market power and stability hypothesis that argues more market power more stability. Thus a further substantiation of the competition-fragility debate that arguably implies more market power, better stability as found in Kouki and Al-Nasser (2014) in their study of 31 African countries.

Similarly, we found evidence to show that the size of banks is negatively and significantly related to stability at 1% level of significance. Signifying a confirmation of the studies of Demirgüç-Kunt and Huizinga (2010), Herring and Carmassi (2012) and Stern and Feldman (2004) who argued that managers of larger banks have more incentives to undertake more risk which induce instability, while the result proved otherwise for Berger (1995). The economic impact of the result shows that a one standard deviation increase in the size of banks brings about an approximate 3% decline in the stability of banks. This may well provide further explanation for the result of competition and stability relationship discussed above. Size causes banks to be more competitive, as suggested by our estimation of determinants of competition in Chapter 3 subsection 3.4.2, which then provides more incentive for banks to undertake increased risk that lowers the stability of the system. This is another salient potential contribution of this study as these connections suggests linkages among bank size, competition and stability hence a potential transmission from size to competition to fragility is apparent.

In the other results, we found capital to be positively and significantly related to stability and consistent with the correlation results. This again reiterates the literature rooting for stability as the cardinal reasons for capital regulation in the banking sector (Casu et al., 2015; Llewellyn, 1999, among others). The result however, does not support Kouki and Al-Nasser (2014) who found capitalisation as not only insignificant with Zscore but also negative. Table 4.5 above shows that capital has a considerable impact on the stability of the banking sector as one standard deviation increase in capital increases stability of the banking system by 40%. Giving result consistent with Bolt and Tieman (2004) who found that capital increases stability, thus advocated increased capital stringency, Maghyereh and Awartani (2016) that level of soundness depends on size of capital, among other studies. In line with our expectation, liquidity is negatively related and statistically significant with stability. Although inconsistent with correlation results, the argument is that low ratio signifies rising risk of default while otherwise high ratio may as well mean lack of profitable investment which in either way will be detrimental to stability. While ROA shows positive and significant relationship with stability, ROE is negatively related. Both are performance measures that we expect positive relationship. We noted that while the ROE is very weakly correlated with stability, ROA showed a noticeably fairly strong correlation. This may have been partly the reason for the negative relationship between ROE and stability over the study period. The result of COP in the regression model is consistent with the correlation result as the coefficient is significant and positive to explain stability in SSA commercial banks. This substantiates the fact that corruption perception has signalling effect on the stability of the banking system in the region as data suggest a more improved perception over the periods under review. Both annual GDP growth and inflation show significant and positive relationship with stability. The results negate our expectations and suggest that economic boom favours banking stability as well as inflation in the region. While it may be plausible to argue the case for economic growth, it seems more of an aberration in the case of inflation and needs a further investigation.

Results in Models 2 to 6 show the regression results of competition on risk. All the lags of the risk proxies considered show positive and strongly significant relationship with the present. This mplies that a volatile prior period has the potential to increase the risk of the present period. Competition showed positive relationship with three among the five risk measures considered. This provides an indication that increase in competition increase credit risk specifically as well as capital risk (overall risk measure). These align with literature and substantiate the foregoing results of competition fragility as increase in risk results in decline in stability. Again we found evidence to support literature that argues for increased risk with large banks as size becomes uniformly significant and positively related to all the risk measures employed. This further substantiates our initial proposition of possible transmission from size to competition to fragility in the banking system, as size increases competition and then risk. We found a 50 percent chance based on our result of increased capital increasing risks of banks. In other words, out of the four measures of risks capital is regressed on, two show increased risk with increased capital and the other two show reduction in risk. Thus partly supporting Chiou and Porter (2015) studies on bank capital and risk-taking behaviour. Liquidity is positive and significantly related to all the risk measures indicating that the more liquid the banks are the the more the chances of risk, in terms credit, off-balance-sheet engagement and capital risk. The two performance measures showed mixed results with the risk measures. While ROA is positive and significantly related to capital and off-balance-sheet risk measures but negatively related with the credit risk measures, ROE shows weak and negative significance to capital and insignificant to explain the equity related off-balance sheet risk. As expected, corruption perception reduces risks of credit and off-balance-sheet engagement and confirms its positive relationship with stability. As against literature, the macroeconomics variables largely show a negative relationship with the risk measures. As previously expressed, one may find reasons to argue for the results in GDPG but those of inflation would call for further work.

The regression results presented above warrant a deeper discussion and have several policy implications. Careful attention will be paid to the variables of interest, that is, competition and stability relationship. To begin with, the persistent, positive and significant relationship of stability in the immediate past period with the present reflects the fact that stability in the past is fundamental for the current and future periods' stability. This is a wakeup call for unrelenting efforts in ensuring a stable banking environment at all time for the smooth running of the monetary economic system as in the words of Vives (2016a), the banking system is so pivotal to an economy to the extent that the modern monetary economy stops functioning with bank failure. This study found a negative and significant relationship between Zscore and Lerner index. In other words, stability is negatively related to competition as measured by the Lerner index in the SSA region commercial banks. We had reported a monopolistic competitive banking market given the outcome of the commercial banks' market power computation in the SSA region in Chapter 3. This result suggests that competition is associated with instability and consistent with the competition fragility view of Yeyati and Micco (2007) in a study of eight Latin American countries between 1993–2002; Beck et al. (2013) in 79 countries between 1994–2009; Fu et al. (2014) in a study of 14 Asian countries from 2003–2010; Agoraki et al. (2011) who studied 13 Central and Eastern European countries between 1998–2005 and Ariss (2010) who studied 60 developing countries that included 14 African countries. Most of these studies had employed both Lerner Index and Zscore to measure competition and stability respectively making our study directly comparable with them. Although, the summary statistics about bank capital base, bank performance and the stability measures estimated, do not suggest any form of instability in the SSA commercial banking sectors, banks in this region continue to face the risk of high non-performing loans *NPLs* among others in their asset portfolios. These are likely to arise from undue competition that makes banks to either wave or not to pay proper attention to credit due diligence and loan appraisal processes including other corporate governance issues that arise during selection of loan assets portfolio. Knowing that potential instability is associated with competition in this region is a call for caution among players, regulators and practitioners alike, such that their priorities should be aligned to avoid any eventualities. A point to note is that the proponents of competition-stability view emphasise the role of efficiency in the relationship between competition and stability. This we have not taken account of in this chapter but later in Chapter 5 to further investigate the role of efficiency in mediating this relationship in the commercial banking sector of the SSA region.

The emphasis on banks' capital base and why it is made as the cardinal point of regulation is justified by the direct influence it has on the stability of the banking system as found in this study. This again underscores the relationship between bank capital and competition in Chapter 3. As such, banks must at all times maintain adequate and sound capital bases to withstand stress and provide cushion for their survival. Liquidity is found to pose a great danger for the stability of the banking sector in the region. This is explained by its negative and positive relationship with stability and the risk measures respectively. As explained previously, both high and low liquidity are likely to pose great danger to the health of the banking system. Shortage of liquid assets is an immediate risk of inability to meet up with ongoing obligations while excess liquidity reduces quality of earning assets. The implication is determining an acceptable balance for the workability of the system as each case has stability consequences either in the immediate or in the long-term. Therefore banks must on the basis of these findings model the level of liquid assets that is considered adequate for normal course of business to reduce the stability challenges it portends. Both measures of performance employed were found to be significant in explaining the stability of the region's banking sector. However, ROE showed an inverse relationship. Perhaps this might be as result of accounting measurements as it is not clear why this is the case, hence, we briefly like to draw the attention of stakeholders in this region to it and the need for further studies as well. The revelations on the impact of competition on risk-taking behaviour of banks in this region is cardinal to policy making. Both credit and banks overall risks are seen to increase with competition indicating that risk-taking behaviour of banks especially as it related to their loans portfolio and charter value is significant to explain the cause of fragility in a competitive banking environment. This substantiates the negative relationship between competition and stability and thus, highlight the flashpoints for focus when crafting policies to stimulate competition.

The macroeconomic variables, annual GDP growth and inflation, also proved to be important determinants of stability. It makes economic sense to think that banks may become more stable during economic boom as the risk of defaults is likely to reduce, even though some literature argue otherwise. We noticed that during the periods under review most of the economies improved in spite of the global economic crisis. This again may have helped the stability experienced in the banking sectors in the region. A possible explanation to banking system being more stable during inflation may well be that banks become more sceptical and meticulous in granting loans in order to protect its charter value. However, this probably warrants further investigation. On corruption perception, it will make sense to increase anti-corruption crusades in the region given that our result suggests that corruption perception plays a significant role in the stability of banks. Overall, the results show that risk and stability work in opposite directions as most factors that increase risk reduce stability and vice versa suggesting that measures to reduce risk will have considerable impact in enhancing stability.

In terms of validity, our result meet the various requirements of the regression models as shown in Table 4.4. In particular, for the GMM, the overall fitness of the result is good as indicated by the Wald test probability, *AR2* confirms the absence of serial correlation and the result of the Hansen J statistics gives us the confidence that the instruments are not over identified.

4.5 Summary

This chapter looked at competition and stability relationship in the SSA region's commercial banks in the light of the call to increase competition of the banking system in the region to fight poverty through stimulating economic growth. Models that we reviewed argue for and against competition and stability, expressing that competition may be good and bad for the banking system. The study employed the robust orthogonalised version of the Generalised method of Moments to analyse this relationship. The choice of methods is to avoid the shortfalls of OLS while accounting for possible endogeneity issues between competition and stability. We proxy competition with the Lerner index and stability with the Zscore. Both measures have been used prominently in this kind of literature and have continued to gain relevance. The study concludes based on the findings that competition is detrimental to the commercial banking sector of the SSA region. This is a departure from the results of Moyo et al. (2014) that found otherwise in the SSA region and other studies done elsewhere around the world. However, their studies differ from ours in size and coverage. Based on these findings, we recommend policy makers exercise caution in crafting policies directed towards increasing competition in the region. Meanwhile we investigate this relationship further in Chapter 5 by factoring efficiency into competition stability relationship in the region. The outcome will go a long way in informing further policy recommendations. This study contributes to the literature on competition and stability in Africa. As far as we know, this study is the first empirical works focusing on the SSA region employing such large dynamic panel dataset analysis.

Chapter 5

Competition, Efficiency and Stability

5.1 Introduction

This chapter takes the relationship between competition and stability considered in Chapter 4 further and investigates the place of efficiency in the competition and stability relationship. Specific literature relating market structure to efficiency and possible transmission between competition and stability through efficiency are reviewed. Evidence from Chapter 4 supports competition-fragility view which purports that competition brings about instability in the SSA banking sector. For a robust conclusion for policy consideration, this chapter includes empirical analysis on whether competition leads to efficiency and the implication that has for banks stability in the region. The outcome will proffer whether or not there is the need to invest resources in trying to stimulate competition in the region and perhaps the role regulation could play in the later chapters.

Competition and stability in banks are important issues to bankers and regulators alike especially in the wake of the 2007/2009 financial crisis. Bank competition has become even more a burning issue as policy makers in the SSA region rethink strategies to break the yoke of poverty and grow their economies. The theoretical expectation is that; a competitive banking environment will promote efficiency, which in turn should increase overall competitiveness in other sectors of an economy and thus promote economic growth (Casu et al., 2015). However, the competition stability trade-off means that caution must be applied in order not to sacrifice financial system stability in the bid to engender competition to stimulate economic growth. In this study, the role of competition in the financial stability of the SSA region is examined by evaluating a panel analysis of 37 SSA countries' commercial banks data. Over the years, the findings of both theoretical and empirical papers on the relationship between competition and stability have been mixed, indefinite and inconclusive. Yet, a new look at the role of bank competition in bringing about the dynamic efficiency of the banking system and other sectors without compromising financial stability is now essential if the SSA region is to harness the gains of competition without compromising financial system stability.

There is a subsisting debate on the effect of competition on stability. Two strands of literature exist which are for and against competition stability view (Agoraki et al., 2011; Schaeck & Cihák, 2014). We found evidence that is consistent with the competition-fragility views in Chapter 4 which differs from the competition-stability conclusion of Moyo et al. (2014) who studied 16 SSA countries banking sectors. Although our foci differs, these inconsistencies have been found to be the case in most studies around the world (Liu, Molyneux, & Wilson, 2013a; Marques-Ibanez et al., 2014; Schaeck & Cihák, 2014). Casu et al. (2012) argued that such inconsistent results of the relationship between competition and stability make interpretation and policy measure very difficult. Hence, there is the need for further investigation in this chapter to affirm or otherwise, these views, including possible transmission channels of competition to stability (Leon, 2015b). Therefore, the compelling question is, does efficiency play any significant role in the relationship between competition and stability? This question becomes germane because the SSA region seeks a competitive banking sector in order to stimulate economic growth of the region (Watkins, 2014).

This study aligns with a long history of literature dealing with banking competition and specifically the concerns as to through what channel of transmission does competition impact on the stability of the system. Our contributions involve the use of a unique method, stochastic frontier analysis (SFA), to exogenously model an instrumental variable for competition in a regression with stability. Thus modelled how much efficiency is associated with a competitive SSA commercial banking system, and therefore able to assess the role of eficiency in competition and stability relationship. In addition, we extended the study of Moyo et al. (2014)[1] to include quite a sizeable number of SSA countries for possible generalisation. Our results indicate that the Lerner index is negatively related to stability. However, our instrument of competition provides evidence to support the competition-stability view as found by Moyo et al. (2014) given that the result of the SFA reveals a marginal efficiency in competition efficiency relationship. Therefore, it reaffirms the possible transmission from competition to stability through efficiency.

The rest of the chapter is organised as follows. Section 5.2 reviews the literature that deals with competition, efficiency and stability relationship. Section 5.3 presents our methodology, and in Section 5.4 we present the empirical results. Section 5.5 concludes.

5.2 Literature Review

The place of competition in banking has been a subject of intense debates among practitioners and the academics alike. According to Casu et al. (2015), a healthy degree of rivalry is considered necessary for the efficiency of the banking industry and for the stability of the system as a whole. Based on theories, works that have investigated the nexus between competition and stability have alluded to the presence of efficiency as imperative in the study of the relationship between competition and stability (Bolt & Humphrey, 2010; Hussain & Hassan, 2012; Schaeck & Cihák, 2014). This section explores various theories that underline this thought including the empirical literature that has been compiled on this topic.

5.2.1 Theoretical Literature Review

As reviewed in Chapters 3 and 4, there are quite a number of underpinning theories of banking competition as well as competition and stability relationship that is predominantly rooted in the industrial organisation theory. Their major preoccupation is whether market power can earn monopoly rent for banks, in other words, the relationship between the structure of a bank and its performance, in charging beyond equilibrium price in terms of lower deposit rates and higher lending rates. Dansby and Willig (1979) believe that the analysis of bank performance has important social and economic impacts as welfare is optimised from an efficient and optimal allocation of resources through intermediation.

[1]They considered 16 SSA countries

At the centre of this theory lies the welfare theorem associated with competition.

The market structure theory argues that firms' conducts are influenced by the feature of the industry in which they operate in (Nyong, 1999). Rios, McConnell, and Brue (2013) admit that economic industries fall into four main categories; perfect competition, monopolistic competition, oligopoly and monopoly. Within these structures, firms exhibit different traits. According to Sloman and Garratt (2010), the conduct of firms under perfectly competitive environment differs from that of those under monopoly firms, likewise from that of those under monopolistic competition or oligopoly. Accordingly, structure-conduct-performance (SCP) hypothesis argued that firms' conducts affect their performance, in terms of prices, profit, efficiency, among others (Nabieu, 2013), which in turn affects the performance of other firms in the industry. These chain reactions triggers collective firms' behaviour to affect the entire industry's performance.

In the long run, pure competition forces firms to produce at the minimum average total cost (ATC) of production and then charge the minimum price (P) that is consistent with the cost ($P = ATC$). Firms' survival is thus hinged on their ability to utilise least cost (best available) production approaches and inputs combinations. In other words, a particular output has to be produced from a minimum amount of resources. From the consumers' perspective, this is a highly favourable situation. The production methods provide the society with the "right goods" that customers want the most. Rios et al. (2013) referred to this as allocative efficiency (AE) in which the price charged in perfect competitive market equals the marginal cost (MC). Hence, in the long run under perfect competition, productive or technical efficiency (TE) and AE take place.

Since monopolist's output is less than the output required to achieve average total cost and its price always above marginal cost, the monopoly firm is inefficient. Hence, Harberger (1995) argued that monopoly is allocativelly inefficient, often referred to as dead-weight loss of non-competition. A number of explanations were offered to explain why the spontaneous estimation of dead-weight loss was practically not feasible in the early 1950s giving way for the estimation of the cost of non-competitive markets. One explanation was that monopoly waste resources or increase costs by rent seeking. A further explanation relates to X-inefficiency where a firm's actual costs of producing any output is greater than its average total cost. X-inefficiency also known as technical inefficiency is a reflection of bad management which according to Rao (2002) is the reasons for rising firm's costs and thus regarded as cost inefficiency. The absence of competitive pressure on profit margin could mean lax cost control culminating in wastages and misuse of resources. There exists an inverse relationship between X-inefficiency and competition, explaining why it is more observable in monopoly, followed by oligopoly, monopolistic competition and least in pure competition. It makes average costs and marginal costs higher than expected minimum.

Leibenstein (1966) argued that with light competitive pressure, dissatisfaction of greater efforts is traded to satisfaction of little efforts or search for the satisfaction of feeling less pressured or of better interpersonal relations. He examined the molecular make-up of a firm and concluded that firms' internal agents are non-maximisers. Thus, aligned with the Yerkes-Dodson law that individuals put less efforts to carefully calculating decisions at low pressure levels but move towards more maximising conduct with increasing pressure. Meanwhile, Stigler (1957) opined that increased output due to increased efforts, for instance, does not amount to change in efficiency but a mere change in output.

The welfare theorem became the rational for the link between market structure and the efficiency debate was triggered by Hicks (1935)'s quiet life hypothesis (QLH) who argued that a monopoly market is less efficient as producer becomes passive about optimising production since it is relieved of competitive pressure. In other words, monopoly affords managers a quiet life devoid of competition, which permits them to either reduce their efforts or to appropriate their share of monopoly rent through discretionary expenses. The author hence concluded that concentration reduces efficiency thus became the first work to link the structure of market to efficiency, a theory in 1966 identified as X-efficiency by Leibenstein. Hence the birth of the structure-conduct-performance hypothesis (Bain, 1956) which states that collusion is anti-competition and is the cause of abnormal profit. Bain (1956) established a direct relationship between competition and profitability and emphasised the fact that the feature of market structure explains its conduct. Leibenstein (1966) admits that increased competitive pressure improves efficiency as managers react to the challenges.

The offshoot of strucuture-conduct-performance hypothesis is efficiency structure hypothesis (ESH) theory which argued that efficiency may as well be the reason for market power (Demsetz, 1973). This assumption predicts an inverse relationship between competition and efficiency. The argument borders on the fact that competition makes more efficient firms operate at lower costs which directly increases their profits. Hence, the ability of the firms to acquire larger market shares that may cause higher level of concentration, a phenomenon referred to as relative market power (RMP) theory of the efficiency structure hypothesis. Therefore, competition and efficiency are negatively related since market concentration implies reduced competition. This theory further argued that large banks can exploit their market power to charge uncompetitive high prices. Shepherd (1982, 1986) and Berger (1995) further substantiated this with the arguments that superior efficiency and/or market power related factors or influences explain the differences in bank performance. Another arm of efficiency structure hypothesis, called X-efficiency structure hypothesis believes that technical efficiency may be realised through greater efficiency attributable to superior management and/or production processes with direct effects of lowering costs thus being able to earn higher profits. In the case of scale efficiency hypothesis of the efficiency structure hypothesis, some firms of equally good management/ production process may acquire greater efficiency arising from economies of scale and be able to produce at output levels closer to average total cost (Sloman & Garratt, 2010). The three contrasting theories of efficiency structure hypothesis hence conclude a negative relationship between competition and efficiency. This is a negation of the structure conduct performance hypothesis that argued a positive relation between the duo.

Neither technical efficiency nor allocative efficiency is feasible in monopolistic competition or oligopoly in the long run because firms here do not produce goods and services and offer them to the market at average total cost, and price does not equate marginal cost. The welfare theorem is undoubtedly consistent with pure competition with its peculiar features; free entry and exit, perfect market information, among others. Banking industry realities preclude pure competition, thus impede optimal utilisation of resources in the industry, giving ways for varying levels of inefficiency to occur. Prices do not equate marginal costs in most lines of banking, likewise, products are differentiated, with absence of free entry and exit. In the presence of notable binding constraints of regulatory policies and procedures, the reality of banking is either monopolistic competition or oligopoly.

The later theory of market contestability posits that with free entry and costless exit, market structure will not matter as potential competition guarantees efficient production and pricing regardless of existing players in the market. This, according to Dietsch (1993), brings the market to stability and equilibrium irrespective of the existing market structure. Existing literature on this model in Africa tends to find consistency with it, (Chirwa, 2003; Mugume, 2008) but suffers the setback of using concentration as a measure of competition. Attempts to overcome the setback of the structural model gave rise to the Lerner index and the Panzar-Rosse H-statistics, among other non-structural models of measuring competition. In spite of their own various shortcomings, they offer better competition measures (Liu et al., 2013b)

Recapping subsection 1.9.8, a simple measure of a firms efficiency is defined by Farrell (1957) who argues that the technical efficiency reflects the firm's ability to obtain maximal output from a given set of inputs. Farrell explains his idea by assuming that firms use two inputs (X_1 and X_2) to produce one output (y), and the production is under the assumption of constant return to scale (CRS). In other words, an increase (decrease) in the inputs, leads to the same proportional increase (decrease) of the output. Overtime, the parametric stochastic frontier analysis (SFA) introduced by Farrell (1957) has been used to empirically test this theory. It is important to note that most studies that have considered output related technical efficiency measures have mainly used pretax income, return on assets, and return on equity, and have concluded that a statistically significant positive relationship exists between competition and efficiency.

5.2.2 Empirical Literature Review

Subsisting empirical models in banking literature, specifically competition-stability and competition-fragility views, canvassed that competition could be good and bad for the banking industry as it may result in either stability or fragility. The fragility view says that competition is associated with moral hazards, adverse selection and agency problems as managers strive to cope with competitive environment, resulting in instability (Agoraki et al., 2011; Ariss, 2010; Beck et al., 2013; Fu et al., 2014; Yeyati & Micco, 2007). They explained that banks under high competitive pressure take more excessive risk, thus, increasing fragility which may result in individual bank failure. This means that moral hazards and adverse selection problems are associated with excessive competition in banks where the wrong client is attracted which in turn pushes up loan rate to the detriment of low risk customers. On the other hand, The stability view believes that efficiency comes with competition which results in systemic stability (Boyd et al., 2009; Schaeck & Cihák, 2014; Uhde & Heimeshoff, 2009). Their arguments have been that competition can have a stabilising effect on the banking system as efficiency is improved and loan interest rates lowered, thereby reducing the likelihood of borrowers defaulting. Notably, efficiency and stability literature suggests that efficiency enhances loan administrations reducing the probability of loan defaults hence stability of the system (Berger & Mester, 1997; Petersen & Rajan, 1995; Williams, 2004) . It is imperative that further research is done to revalidate this result and perhaps explore the channels through which competition affects stability in the SSA region. These are among the foci of this study.

Earlier application of the theories linking competition and efficiency in banking contended with the competing interpretation of concentration-profitability relationship. While Smirlock (1985) became the pioneer application of the efficiency theory to banking, it was Berger (1995) who first comprehensively tested the hypothesis using specific measures of bank efficiency. Thereafter, more extended works have empirically tested these assertions. Casu and Girardone (2006) analysed the relationship between competition and efficiency in the European banking market for the periods 1997-2003 and concluded in favour of the quiet life hypothesis. They applied the fixed effects panel analysis on Panzar-Rosse H-statistics and efficiency score generated by DEA and found that increasing competition enhances efficiency. Their results also show that increasing efficiency does not foster competition in the EU banking market as there was little evidence that more efficient banking systems are more competitive. In a related study, Casu and Girardone (2009) revisited the same objective in the European Union commercial banking market, this time with Lerner index as a competition measure and efficiency scores generated by SFA and data envelopment analysis (DEA). The study covered a period of 2000-2005 and using generalised method of moments (GMM) and Granger causality test, their results negate the quiet life hypothesis as collusion does not reduce cost. They argued in favour of the efficiency structure hypothesis as their results show that efficiency precedes market power. They found that as European banking markets become increasingly concentrated and cost efficiency decreases, their marginal costs fall faster than their prices thus increase in market power.

In their study of technical efficiency of large and small city banks pre– and post–WTO in Chinese banking system, Lin, Tsao, and Yang (2009) used and unbalanced panel analysis of 63 banks for the periods 1997-2006 and with efficiency scores generated by SFA rooted for quiet life hypothesis as they found that efficiency scores improved post-WTO with increased competition. Bolt and Humphrey (2010) developed a new way to measure competition using efficiency in a study of 11 European countries banking market for the period 199-2008 and found little evidence to support relationship between competition and efficiency. Their result shows that differences in banks competition play less role in accounting for the differences in bank efficiencies across the countries considered. In rather mixed results, Ariss (2010) in a Tobit model of 60 developing countries in Eastern Europe, Central Asia, Middle East, South Asia and the Pacific for the periods 1999-2005 investigated the effects of different degrees of market power on efficiency. Using the Lerner index as a measure of market power, they provide evidence to show that market power increases profit efficiency but decreases cost efficiency. For Mlambo and Ncube (2011), competition and efficiency relationship in South Africa is consistent with the Hick's quiet life hypothesis but with a number of efficient banks decreasing with competition. They analysed the evolution of competition and efficiency using the Panzar-Rosse H-statistics as a competition measure and DEA for efficiency score for the periods 1999-2008 in the South African Banking sector.

Previous literature on the various measures of competition and stability were reviewed by OECD (2011) in exploring the complex interrelationship between competition and stability in retail banking. They concluded that, competition helps to make the financial sector more efficient, ensuring that rescue and stimulus packages benefit final consumers. On the contrary, Hussain and Hassan (2012), used the fixed effects model and Granger causality and arrived at an inverse relationship between competition and efficiency in the US commercial banking market. Their study specifically captured pre-financial crisis era of 2003–2007 with the use of the Lerner index and SFA for competition measure and efficiency scores respectively. Agreeing with this study, Fungáčová, Pessarossi, and Weill (2013) found competition to negatively Granger cause efficiency in the western Chinese banking market. They used the Lerner index and cost efficiency to study the direction of causality between competition and efficiency and with analysis done with GMM over the periods 2002-2011 in Chinese banks. They further found that, cost efficiency improved in the period without increase in competition and with no significant relationship between competition and efficiency in their banking system. Meanwhile Duygun, Sena, and Shaban (2013) measured competition based on new registered product trademarks in the UK banking sector to investigate the effects of Schumpeterian competition on efficiency of commercial banks. Using maximum likelihood estimates a number of trademarks registered and efficiency scores measured by DEA for the periods 2001–2012, they found competition to increase both profit and cost efficiency.

In another Granger causality test, Thota (2013) investigated the relationship among competition, concentration and efficiency in the Indian banking market using Panzar-Rosse H-statistics and DEA efficiency measure. They found decline in efficiency with competition and whether competition Granger causes efficiency depends on the competition measure used. Schaeck and Cihák (2014) in a further study of competition, efficiency and stability in the European banking markets with nearly 17000 bank year observations found evidence to show that efficiency is the conduit through which competition contribute to stability of the banking system, hence support the quite life hypothesis. Recent studies of Çelik, Kaplan, Şahin, et al. (2015) and Castellanos, Ángel, and Garza-García (2016) are consistent with this study as they found that efficiency increases with increase in competition. The former was based on the Turkish banking market for the periods 1990–2011 using PR H statistics and DEA for efficiency, while the latter is a study of the Mexican banking sector for the periods 2002-2012 using the Boone indicator, DEA and multivariate Tobit panel regression.

Historically, theories and empirical literature on competition and efficiency align along two opposing views; competition enhances efficiency (quiet life hypothesis) and efficiency precedes market power (efficiency structure hypothesis). To the former, banking competition should result in efficiency, hence, the stability of the banking system. However, empirical models and evidence reveal that competition results in both stability and instability. But these models and evidences fail to consider the mediating role of efficiency in the study of the relationship between competition and stability which probably is the flash point of the endogeneity between them. This study, therefore, fills the gap in the literature on this subject matter by applying stochastic frontier analysis (SFA) to investigate the role of efficiency in the competition-stability relationship. The study also sheds light on how much efficiency is orchestrated that warrants the need for competition which the competition fragility view argues increases the risk appetite of banks. Hence, the endogeneity issues between competition and stability can also be addressed with the exogenous instrument of competition which is created to be used in the regression of competition on stability.

5.3 Methodology

The main objective of this chapter is to investigate the effects of competition on stability taking into account the role of efficiency among SSA commercial banks. In other words, we explore a possible transmission from competition to stability via efficiency. The stochastic frontier analysis (SFA) approach is employed to generate an instrumental variable of competition to be regressed on bank stability for the period 2006 to 2015. Previous studies on competition and stability view found competition-stability, competition-fragility and U-shaped relationship (Fu et al., 2014; Schaeck & Cihák, 2014; Tabak et al., 2012). It has also been established that efficiency is pivotal in competition and stability relationship (Ariss, 2010; Chirwa, 2003; Mugume, 2008), However, to the best of our knowledge, no existing studies have explicitly attempted to explore factoring in efficiency in studying the relationship between competition and stability. How is competition related to banks overall stability? Does competition help to improve or lower banks efficiency? Answers to these questions will help to establish the role of competition in stability management in banks. Extant literature, however, confronts an inherent problem in regressing competition against stability in order to measure the effects of competition on stability because of the obvious endogeneity problem. Hence, this study follows Chiou and Porter (2015) to develop an exogenous instrument of competition in a regression with stability using the unique SFA.

Concerning the techniques, Debreu (1951); Farrell (1957); Koopmans (1951); William (1970) describe and measure firm's efficiency in terms of divergence from the frontier of its actual performance. In the context of production function, the frontier is the maximum feasible level of outputs given the level of inputs, in other words, it is the minimum feasible level of inputs given the level of outputs. A firm's inefficiency is therefore measured as the divergent inputs shortfalls or divergent outputs expansion from the frontier. A substantial amount of works exist in literature on the measurement of efficiency of which two methods are used, namely; the parametric like SFA (Hughes, Lang, Mester, Moon, & Pagano, 2003; Hughes & Mester, 2013; Hughes, Mester, & Moon, 2001; Nguyen, 2010) and non-parametric methods such as the Data Envelopment Analysis (DEA) (Bauer, Berger, Ferrier, & Humphrey, 1998; Berger & Hannan, 1998; Kouki & Al-Nasser, 2014), among others. SFA is an economic modelling method that was introduced by Jondrow, Lovell, Materov, and Schmidt (1982) following the stochastic production frontier previously introduced by Aigner, Lovell, and Schmidt (1977); Meeusen and Van den Broeck (1977) and Farrell (1957). This study adopts the SFA approach because among the modern and most popular frontier analysis techniques, the SFA allows the construction of a unique instrumental variable of competition that is exogenous to banks' stability. This helps to create the transmission channel and as well deal with the endogeneity between competition and stability by using SFA to estimate the inefficiency in our sample of SSA banking sectors. Furthermore, the SFA fits best in analysing firm's efficiency as it accounts for statistical noise (Coelli et al., 2005; Kao & Liu, 2009). They argue that empirical efficiencies calculated from a non-parametric technique such as DEA provide low consistent estimators of the true inefficiencies.

5.3.1 Model Specification

To construct the instrumental variable of competition, this study follows Chiou and Porter (2015). The efficiency of the banks is measured by the distance between the frontier and the specific bank's profit before tax.

The production frontier model without random component can be written in the following form:

$$PBT_i = TE_i.f(X_i : b), \tag{5.3.1}$$

Where PBT_i is the profit before tax of bank i,$i = 1,.,N$. TE_i is the technical efficiency defined as the ratio of observed output to maximum visible output, X_i is a vector of J input used by bank i,$f(X_i, b)$ is the frontier and b is a vector of technology parameter to be estimated. Given that the frontier enable us to estimate the maximum visible output, it is then possible to measure the shortfall of the observed output from the maximum feasible output.

Equation (5.3.1) is deterministic, thus ignores that output can be affected by random shocks that are not under the control of banks. Considering a stochastic component that describes random shocks affecting the production process in this model, the stochastic frontier becomes:

$$PBT_i = e^{v_i}.TE_i.f(X_i : b) \tag{5.3.2}$$

Where e^{vi} is the shock which is neither directly attributable to the bank nor the technology but may emanate from random white noise in the economy; each bank faces different shocks that are assumed to be random and are expressed by a common distribution. TE_i is further described as a stochastic variable with a specific distribution function;

$$TE_i = e^{-u_i}, \tag{5.3.3}$$

Where $u_i \geq 0$, since it is required that $TE_i \leq 1$, hence the following equation is obtained

$$PBT_i = e^{v_i - u_i}.f(X_i : b). \tag{5.3.4}$$

From this, the frontier is expressed according to a specific production model; in this case it is assumed that banks profitability can be specified as the Cobb Douglas production function;

$$In(PBT_{it}) = \alpha + \sum_{h=1}^{H} b_h ln(X_{it,h}) + v_{it} - u_{it} \tag{5.3.5}$$

Where v_{it} is the noise component, considered as two-sided normally distributed variable and u_i is the non-negative technical inefficiency component. Because v_i and u_i constitute a compound error term with a specific distribution to be determined, SFA is therefore often referred to as composed error model.

The above stochastic frontier will therefore be used to create a unique instrumental variable of bank competition to be used in the regression of competition and financial stability in SSA region commercial banks. This is expected to answer the question of how efficient is a bank in converting the resources with which it has to work into profit in the face of competition. From this, we can measure the inefficiency of the banks as the distance between the frontier and the specific bank pre-tax income.

An unrestricted frontier model is then developed which will determine the highest possible profitability based solely on the book value of assets employed. This is specified as;

$$PBT_{it}(ABV) = \alpha + b_1 ABV_{it} + b_2(ABV_{it})^2 + e_{it} \tag{5.3.6}$$

Where PBT_{it} equals pre-tax income, ABV_{it} is assets book value, $e_{it} = \oint_{it} - \lambda_{it}$, the composite error, $\oint \sim iidN(0, \delta^2_{\oint})$, is the stochastic noise which is a two-sided error term, $\lambda \sim iidN(\mu, \delta^2_{\lambda})$, the systematic fall (technical inefficiency) a one-sided error and $\lambda \geqslant 0$. A quadratic equation is used to allow for a nonlinear relation between the pre-tax income and the book value of asset. The specification is imperative to allow technical efficiency to vary through time, and in a different manner for each bank (Kumbhakar & Lovell, 2003).

The efficiency scores are estimated using frontier version 4.1 (Coelli, 1996), a computer program based on stochastic production functions of Battese and Coelli (1992, 1995) written to provide maximum likelihood estimates of different types of stochastic frontier production as independently introduced by Aigner et al. (1977) and Meeusen and van Den Broeck (1977). It accounts for truncated normal assumption including panel data with time varying efficiencies. Hence applicable to our unbalanced panel model with firm effects having truncated normal random variables distribution assumption that are allowed to vary systematically with time (Battese & Coelli, 1992).

Hence, the parameter λ, the systematic fall, in *5.3.6*, is estimated as the conditional expectation of λ_{it} given e as follows;

$$E\left(\lambda_i | e_i\right) = \left\{ \frac{1 - \Phi\left[\eta_{it}\sigma_i^* - (\frac{\mu_i*}{\sigma_i^*})\right]}{1 - \Phi(\frac{-\mu_i^*}{\sigma_i^*})} \right\} e^{\left[-\eta_{it}\mu_i^* + \frac{1}{2}\eta_{it}^2\sigma_i^{*2}\right]} \tag{5.3.7}$$

Where $\mu_i^* = \frac{\mu\sigma^2_{\oint} - \eta_i^{'} e_i \sigma^2}{\sigma^2_{\oint} + \eta_i^{'}\eta_i\sigma^2}$, $\sigma_i^{*2} = \frac{\sigma^2_{\oint}\sigma^2}{\sigma^2_{\oint} + \eta_i^{'}\eta_i\sigma^2}$, η is an unknown scalar parameter to be estimated[2] and $\Phi(\cdot)$ is the standard normal random variable of the distribution function. The mean technical efficiency of the banks at time t is then obtained by integration with u_i density function as;

$$\lambda_t = \left\{ \frac{1 - \Phi\left[\eta_t\sigma - (\frac{\mu}{\sigma})\right]}{1 - \Phi(\frac{-\mu}{\sigma})} \right\} e^{\left[-\eta_t\mu + \frac{1}{2}\eta_t^2\sigma^2\right]} \tag{5.3.8}$$

providing the efficiency scores results in Frontier version 4.1 (Coelli, 1996) used in the regression estimations.

[2]In maximum likelihood output

Next, we develop the second frontier based on the level of banking sector competition. The essence of the unrestricted model is to measure the unconditional inefficiencies of the banks. Restricting the model will enable us to develop a measure of incremental efficiency or inefficiency of the banking organisation due to the level of competition within the banking industry. It is this incremental efficiency/inefficiency due to bank level of competition that the study proposes to use as instrument for competition in the regression of bank stability on competition.

The restricted model again, in a quadratic form, is as follows;

$$PBT_{it}(ABV, BCL) = \alpha + b_1 ABV_{it} + b_2 (ABV)^2_{it} + b_3 BCL_{it} + \epsilon_{it} \tag{5.3.9}$$

Where BLC is bank level competition, estimated using the Lerner index in Chapter 3 Subsection 3.3.1, $\epsilon_{it} = v_{it} - u_{it}$ is the composite error, such that, $v \sim iidN(0, \delta_v^2)$, is stochastic noise and $u(\geqslant 0) \sim iidN(\mu, \delta_u^2)$ is the inefficiency orchestrated by the level of competition that the banking sector has to cope with. The estimation of u is the same as in *equation (3.7)* above. Based on the two inefficiencies assessments, the profitability due to the influence of competition can then be measured by subtracting the inefficiency of the unrestricted model from the restricted model, thus;

$$\vartheta_{it} = u_{it} - \lambda_{it} \tag{5.3.10}$$

This therefore constitutes the instrumental variable for competition.

From the foregoing, the relationship between the variable specifying banks stability and competition is analysed by the regression equation specified as follows;

$$Y_{kit} = C_{kit} + b_{kit}\vartheta_{kit} + \phi_{kit} In(ABV_{kit}) + \eta_{kit} \tag{5.3.11}$$

Where Y_{kit} measures the stability for bank i in country k at year t. C_{kit} is a constant; b_{kit} is the coefficient of instrumental variable of competition, ϑ_{kit}, for k's regression in year *t;* ϕ_{kit} is the coefficient of the natural logarithm of bank asset book value; η_{kit} is the error term. The book value of asset helps to control for the impact of size on banks risk taking behaviour (Gatev, Schuermann, & Strahan, 2009).

The SSA banking sector's stability will for the purpose of this study be defined as the Z-score[3]. Z-score, according to Roy (1952) is used to measure the overall stability of a bank and has been used in bank literature, (Cihak, Demirgüç-Kunt, Martínez Pería, & Mohseni-Cheraghlou, 2012; Kouki & Al-Nasser, 2014; Laeven & Levine, 2009; Lepetit & Strobel, 2013). A Z-score is an indicator of a bank's probability of insolvency by combining banks' profitability, capitalization and volatility of returns. It estimates the number of standard deviations that a bank's profit has to fall below its expected value before its equity becomes negative. Higher scores correspond to a more stable bank.

We implement the regression using the Generalized Method of Moments (GMM) regression modelled in Chapter 4. The Ordinary Least Square (OLS) method could not be used because of the departure from normality of the variable ϑ due to the combined error terms. Unlike other estimators, the GMM is robust and does not require information on the exact distribution of the disturbances. The GMM estimator is known to be consistent, asymptotically normal and efficient in the class of all estimators that do not use any extra information apart from that contained in the moment conditions (Arellano & Bond, 1991; Athanasoglou, Brissimis, & Delis, 2008; Campbell, Lo, MacKinlay, et al., 1997; Gatev et al., 2009; Hamilton, 1994; Roodman, 2006). It is also efficient for a large number of observations over a relatively small time period. In addition, GMM deals with endogeneity in a better way than other methods.

5.3.2 Data

We obtained our data on banks for this study from the Bankscope database by Fitch/IBCA Bureau van Dijk on 37 SSA countries commercial banks' financial profiles for the years 2006 to 2015. A total of 440 banks data ranging from 190 banks in 2006 to 440 banks in 2015 were sampled. The selection is based on the availability of data from the database. SSA countries selections exclude those we considered as outliers[4]. Bankscope is considered as the most comprehensive data base for banking research. Specific data collected relate to total revenue, total assets, interest and non- interest expense, personnel expense, total asset, and total deposits required for the estimation of bank level competition as contained

[3] Estimating formula stated in Chapter 4 Subsection 4.3.2

[4] South Africa, having highly developed and sophisticated banking system, while others like Sudan ravaged by wars, were excluded for data availability and consistency.

in literature (Berger et al., 2009; Kouki & Al-Nasser, 2014, among others). Data collected for the estimation of Z-score include return on assets and equity capital ratio as part of the annualized data obtained from Bankscope.

Other specific data collected include annual data on pre-tax income (Chiou & Porter, 2015) and asset book value (Barro & Barro, 1990) employed for the input and output variables for the output-oriented stochastic frontier analysis. Based on competition-stability views, we expect a positive relationship between the instrument of competition and stability. Our argument is that an efficiency-flexed competition should enhance the stability of the banking system.

5.4 Empirical Results

This section presents the results of our estimations. Based on the questions we posed to actualise the objective of this study, we test for these two hypotheses about our expectation of the relationship among competition, efficiency and stability in SSA region. $H_0 1$: There is no significant relationship between competition and efficiency. $H_0 2$: There is no link between competition and stability that results from efficiency. Our assertions are borne out of the level of development of the commercial banks in the SSA region.

5.4.1 Summary Statistics

The numbers of banks and statistics of the competition measure, the Lerner index, presented in Table 3.2 of Chapter 3, over the sample years are reported in Table 5.1 below. The means of other descriptive statistics are listed: Z-score, the stability measure; ABV, asset book value; ROA, return on asset; ROE, return on equity and PBT, profit before tax. As explained in previous chapters, the Lerner index produced a range of competition measures with varying degrees of market power with the overall mean suggesting a monopolistic competition market. The mean of the Z-score shows indices that are greater than 1. The higher the Z-score, the better, as higher a Z-score depicts a stable banking system. While the return on assets seems to be quite low in contrast to those of the return on equity, overall, the mean values provide evidence of a banking system that is performing over the periods under investigation which corroborates the stability reflected by the Z-score. This sketchy behaviour shown by the summary statistics tends to point

Table 5.1: **Summary Statistics**

		Lerner Index								
year	N	mean	SD	min	max	zscore	abv	roa	roe	pbt
2006	190	0.2556606	0.165618	0.0006262	0.8370308	3.54343	371504.8	0.0204855	0.1913219	10401.98
2007	215	0.2693673	0.155672	0.0128989	0.7842373	3.204579	529336	0.0181973	0.1962862	12804.17
2008	250	0.2884124	0.1773142	0.0109381	9.67E-01	3.380152	582587.9	0.0203531	0.1795552	18338.83
2009	275	0.293903	0.1883627	0.010171	9.21E-01	3.29502	691492	0.0140424	0.1480773	14048.96
2010	296	0.2959335	0.182933	0.0003647	9.79E-01	3.273991	695666.8	0.009863	0.1317374	18974.79
2011	320	0.2821636	0.1727603	0.0029686	9.77E-01	2.988873	970764	0.0116465	0.1232481	20293.32
2012	357	0.3237032	0.1944634	0.00499	9.98E-01	3.235099	1060910	0.0133897	0.1158373	26529.1
2013	392	0.3520863	0.314314	0.0000355	4.26E+00	3.403835	1153087	0.0116615	0.08695642	27427.43
2014	430	0.3318136	0.1854892	0.0003017	9.96E-01	3.624344	1159650	0.0106149	0.07606974	27434.95
2015	440	0.3243521	0.1964074	0.0005727	9.96E-01	3.484	1111977	0.0110423	0.06922351	23320.27

Source: Author's computation, 2017, based on data collected

to the model of competition, efficiency and stability which this study hopes to reveal in subsequent sections.

5.4.2 Instrumental Variable

The instrumental variable for competition' descriptive statistics over the years sampled is displayed in Table 5.2. The instrumental variable $\vartheta_{it} = u_{it} - \lambda_{it}$ is a measure of incremental bank inefficiency due to bank level competition and/or market power, where the stochastic frontiers are $PBT_{it} = \alpha + b_1 ABV_{it} + b_2(ABV_{it})^2 + e_{it}$, $e_{it} = \oint_{it} - \lambda_{it}$, and $PBT_{it} = \alpha + b_1 ABV_{it} + b_2(ABV)^2_{it} + b_3 BCL_{it} + \epsilon_{it}$, $\epsilon_{it} = v_{it} - u_{it}$. The first frontier measured the level of banks inefficiencies in converting their resources to output (profit). This determines the maximum possible income achievable from a given level of asset which is exogeneous to a specific bank because it is determined from the data of all banks in the sample. The distance from this frontier to any specific bank's actual income is a measure of the bank's inefficiency. With the second frontier, the instrument of competition is created conditioned to bank level competition given its production capacity. The incremental inefficiency/efficiency from the second frontier is a function of bank competition; in other words, the difference between the second and the first frontier's efficiency scores is used as the instrument for competition (as in Table 5.2 for the description of our instrumental variable). Based on pairwise correlation, the instrument is strongly negatively correlated with Lerner index, the variable it replaces at 0.7732 with 0.0000 p-value, and uncorrelated with the residual at -0.0000 with 1.0000 p-value, affirming that it is a good instrument. We

Table 5.2: **Instrumental Variable Distribution**

year	mean	SD	kurtosis	skewness	min	max
2006	-4.08368E-06	7.04307E-05	66.46838888	7.558965536	-6.73E-05	0.00067622
2007	5.52651E-07	0.000163903	167.7121601	12.41309188	-0.00015733	0.00224774
2008	-1.35568E-05	4.3518E-05	31.93930828	4.276213275	-0.00011717	0.00036802
2009	-4.68567E-06	0.000117389	127.1648157	10.31878458	-0.0001322	0.00157034
2010	2.18235E-05	0.000305294	119.5363149	10.46394279	-0.00013972	0.00395189
2011	-1.00525E-06	0.000216933	272.8637947	15.94867855	-0.00015109	0.0037175
2012	2.69355E-05	0.000644388	343.9703535	18.38833656	-0.00014222	0.01205672
2013	-9.40666E-06	9.1474E-05	56.41178163	5.86973908	-0.00035134	0.0010471
2014	-3.38535E-06	0.000123564	62.19802236	7.017162991	-0.00015697	0.00133269
2015	-1.14878E-05	8.35993E-05	46.01088163	5.639606657	-0.0001813	0.0008062

Source: Author's estimation, 2017, based on data collected.

found marginal efficiency from the results of the SFA, that is, the efficiency scores are closer to the frontier with bank level competition as against the absence of competition. This provides evidence to support a positive relationship between competition and efficiency, which is consistent with literature (Castellanos et al., 2016; Casu & Girardone, 2009; Çelik et al., 2015, among others). On the contrary, Apriadi, Sembel, Santosa, and Firdaus (2016) found evidence in Indonesia that competition reduces the efficiency of bank; however, our result negates this in the case of the SSA region. For our sample, the distribution of ϑ in the same year tends to be skewed to the right-hand side and has positive excess kurtosis. On this note, we consider a non-parametric and use a normality-free regression model for our analysis to avoid the possible errors of estimation.

5.4.3 GMM Results

The results of our generalised method of moments (GMM) estimations are as shown in Models 1 - 5 in Table 5.4 below. To enhance robustness, we present both Pairwise correlation coefficient between the tested variables, the instrumental variable for competition, ϑ, and the Lerner index in Table 4.3. Table 5.5 shows the estimate of the economic impacts of the regression coefficients of the explanatory variables on the explained variables. We relaxed the assumption of cross-sectional dependence in our panel estimation, because as explianed in Chapter 4 subsection 4.3.1, the GMM model is based on *iid* assumption, that is, the data is assumed to be identically and independently distributed, hence largely account for issues of cross-sectional dependence. Besides, according to Chudik and Pesaran (2013) and Chudik, Pesaran, and Tosetti (2011), it is ideal to relax the cross-sectional dependence assumption in large cross-sections like ours. They argue that even where it exists, controlling for it is difficult and the result would not necessarily be biased. For efficient and robust estimates, this study uses the dynamic panel data estimation technique, and the two-step system GMM with robust and orthogonal deviation to account for the unbalanced nature of the panel. To control for the size of the banks, the coefficient of ϑ and those of Lerner index are generated by GMM regression with a constant and the natural logarithm of the book value of assets. The coefficients of the control variable and the constant term are reported in Table 5.4.

Table 5.3: **Correlation Results**

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ϑ & zscore	0.1644	0.2468	-0.027	0.0341	0.2341	0.2791	0.2583	-0.0572	0.1089	0.0296
p-value	0.0234	0.0003	0.6712	0.5737	0.0000	0.0000	0.0000	0.2584	0.0239	0.5363
lerner index & zscore	-0.1346	-0.2072	-0.0259	-0.0098	-0.3066	-0.3131	-0.2533	0.0038	-0.0681	-0.0174
p-value	0.064	0.0023	0.6834	0.8715	0.0000	0.0000	0.0000	0.9409	0.1586	0.7166
lerner index & pbtaratio	0.0198	0.2863	0.0183	0.2339	0.0131	-0.0737	0.1276	-0.0045	-0.0204	-0.0387
p-value	0.7859	0.0000	0.7737	0.0001	0.8225	0.1886	0.0159	0.9297	0.6735	0.4184
lerner index & roa	0.0338	0.2649	0.0771	0.3189	0.039	-0.0596	0.1213	0.0559	0.0715	0.0062
p-value	0.6433	0.0001	0.2244	0.0000	0.5041	0.288	0.0219	0.2699	0.1389	0.8966
lerner index & roe	-0.0005	0.0496	0.0788	0.1581	0.0224	0.0099	0.0358	0.0302	0.0072	-0.0118
p-value	0.9943	0.4716	0.2184	0.0092	0.7027	0.8609	0.5002	0.5521	0.882	0.8057

Author's estimation, 2017, based on data collected.

The results in Table 5.4, particularly the stability measure in the Models 1 & 2 exhibit a statistically significant and positive relationship with their lagged values which implies that previous financial systems stability in the banking sector largely determines the current stability of the system as well as persistence in relationship. This relates to the disaster myopia theory noted in Chapter 1 subsection 1.9.9 which often makes bank managers complacent and most times fail to forecast future instability in the system. Our variable of interest, ϑ, the instrument of competition is shown in Model 1. ϑ is the instrument of competition[5], derived from the relationship between competition and efficiency

[5] A proxy for competition.

using SFA. The essence of this is firstly, to create a variable that is exogenously related to stability in the regression of stability on competition and secondly, a variable that can capture efficiency in competition, henece measure the transmission from competition to stability through efficiency. This way we found a new way to capture competition and stability relationship whose results have been inconsistent in literature largely due to the endogeneity between the duo. We found the instrument to be statistically significant and positively related to the Z-score, the stability measure. This implies that competition brings about stability in the SSA region's commercial banks. Hence, we found consistency with Schaeck and Cihák (2014) of a possible transmission from competition to efficiency and then stability in the banking system of the SSA region. The positions of Petersen and Rajan (1995), Berger and Mester (1997) and Williams (2004) suggest that this result may be plausible as they argued that an efficient banking system enhances the quality of assets of banks resulting from better management and administration of loans. It logically follows that if competition causes efficiency as in our result above, efficiency enhanced competitive banking system should bring about stability. On the basis of this and the economic implication of the coefficient of the instrument on stability that reveals that a standard deviation increase in efficiency enhanced competition variable will increase stability by 2.4% (Table 5.5), we argue for competition-stability view in the SSA region. This is against the backdrop of a weak negative economic contribution of 0.2% respectively as shown in Tables 5.5 in this chapter and 4.5 in Chapter 4, of the original competition variable, Lerner index, to stability. However, this is predicated on a healthy competition that can engender efficiency of the system. Furthermore, the results invalidate our hypotheses of no significant relationship between competition and stability in SSA region commercial banks and more specifically that there is no link to efficiency. Our results predict that the more competitive, the better the efficiency and the more stable the banking sectors will be.

For robustness, the original variable, the Lerner index, that is, the competition measure is also found to be statistically significant but negatively related to the stability measure. It suggests an inverse relation between competition and stability without efficiency, substantiating our findings in Chapter 4. This may be the reason why models have found competition to be fragile for banking sectors in literature in some parts of the world, suggesting that competition, if not well-managed to bring about efficiency may the detrimental to the system, as competition fragility views argued.

Table 5.4: **GMM Regression**

VARIABLES	Model (1) zscore	Model (2) zscore	Model (3) pbtaratio	Model (4) roa	Model (5) roe
L.zscore	0.785***	0.580***			
	(0.0582)	(0.0875)			
ϑ	287.4***				
	(-108.5)				
Lnabv	0.322*	0.195**	0.00168**	-0.00316**	3.052***
	(0.187)	(0.0803)	(0.000751)	(0.00139)	(0.497)
Lerner index		-0.0345***	0.000221***	-5.85e-05**	0.0806**
		(0.0084)	(0.0000647)	(0.0000254)	(0.0386)
L.pbtaratio			0.432***		
			(0.0337)		
L.roa				0.562***	
				(0.132)	
L.roe					0.146**
					(0.0596)
Constant	-3.399	-1.326	-0.00838	0.0478***	-25.98***
	(2.455)	(1.044)	(0.01)	(0.017)	(6.331)
AR(2)	0.080	0.100	0.771	0.685	0.295
Hansen J Stats	0.451	0.176	0.496	0.655	0.732
Wald (Chi2)	942.24	87.72	185.35	32.36	61.06
$Prob > Chi2$	0.000	0.000	0.000	0.000	0.000
Observations	2,725	2,725	2,725	2,725	2,696
Number of id	430	430	430	430	429

Author's estimation, 2017, based on data collected.

Standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Where ϑ represents the instrument, Lerner index in the competition measure, pbtaratio, roa and roe depict profit before tax to asset book value ratio, return on assets and return on equity respectively surrogate efficiency measures.

We further tested the results of the SFA by using a range of efficiency measures as contained in Models 3, 4 and 5 for consistencies and comparison. Model 3 measures the relationship between Lerner index and pretax income to assets ratio (pbtaratio). Pretax income measures the intrinsic profitability of the sampled banks to enable for comparability across borders because of differences in corporate taxes. Hence, pbtaratio is an indicator of how profitable a bank is relative to its total assets. It gives an idea as to how efficient management is at using its assets to generate earnings. The study found that Lerner index is statistically significant and positively related with pbtaratio. In fact, the economic implication shows that one standard deviation increase in competition will cause 0.1% increase in profitability. This confirms the SFA results and existing theories that posit a positive relationship between competition and efficiency. One would ordinarily assume a negative relationship between competition and efficiency and/or the performance measures owing to the level of development of the SSA region as known existing models and results relate largely to developed countries.

The results of Lerner index and ROA however give a statistically significant but inverse relationship. While ROA and Pbtaratio measure the same thing, we assume that the difference in the results of ROA from those of Pbtaratio, is largely due to the impact of tax that banks face which differs across countries. The SSA region might have to consider tax harmonisation as every sacrifice to achieve sustainable economic growth will be worth the while. Finally, Model 5 results shows a statistically significant and positive relationship between Lerner index and ROE. ROE measures a corporation's profitability by revealing how much profit a company generates with the money shareholders have invested. This is again an affirmation of a positive relationship between competition and efficiency in the SSA region's commercial banks.

In general, this study found the result of Model 1 to be consistent with the competition stability views model in literature (Schaeck & Cihák, 2014) which argues that competition brings about efficiency which then leads to stability of the banking sector. This provides evidence that despite the level of development, the behaviour of banks in the SSA region does not differ remarkably from that of their European counterparts. Having brought in the element of efficiency into competition and stability relationship, the result validates the study by Moyo et al. (2014) of 16 SSA region banking sectors that supported more stable banks in systems that are more competitive. This becomes more interesting as our

Table 5.5: **Economic Impact of Regression**

variables	model 1	model 2	model 3	model 4	model 5
ϑ	0.024427078				
Lnabv	0.166976014	0.1011	0.053829119	-0.1004	10.64698336
Lerner index		-0.0021	0.00081826	-0.0002	0.032491377

Source: Author's Estimation, 2017, from Table 5.4 with

$Economic\ Impact = \frac{S.D\ of\ explanatory\ variable \times R.C\ of\ explanatory\ variable}{S.D\ of\ dependent\ variable}$

Where S.D is standard deviation and R.C is regression coefficient.

study differs largely in scope, methods and bounds from theirs. Our result confirms this relationship through the role of efficiency as shown from the result of SFA that reported that efficiency is associated with competition in the SSA region. The implication will be that provided competition could be managed to such a level that it produces efficiency, it will continue to enhance stability. It is not surprising, however, that competition on its own is inversely related to the stability measure which substantiates the fact that competition on its own will more likely to be inimical to the banking system unless it improves efficiency without which it adds no value to the system, but rather causes instability. Juxtaposing the competition-fragility result in Chapter 4 and competition-stability result in this chapter provide a further insight to support the growing consensus of a trade-off between competition and stability in literature. This suggests that there is an optimal level of competition that is beneficial to the banking system and policy direction to modelling this will assist regulators to monitor and regulate competition activities, if the banking sector is to benefit from the good while avoiding the bad side. The competition and efficiency results found in the SFA result is also confirmed in the results of Models 3 and 5 which are seen to be consistent with literature on competition and efficiency (Chirwa, 2003; Kouki & Al-Nasser, 2014; Mugume, 2008). Notwithstanding that Model 4 suggests an inverse relationship between competition and ROA, on the average, we tend to find evidence to support the aforementioned assertion that competition causes efficiency.

The result of these models is further supported by the tests of overall significance through the Wald test as shown in Table 5.4. This shows that the estimated results for the five models are statistically significant. Therefore, all the variables used as determinants are all desirable and would influence both stability and efficiencies of the banking sectors significantly. This study also did not find any violation of serial correlation and over-identification of instruments as the results of the test show the respective thresholds were satisfied (Mileva, 2007; Roodman, 2006).

The results of the over-identification test and serial correlation tests are presented as appendages to the GMM results in Table 5.4. It has been observed that over-identification is a common problem with dynamic panel data analysis in GMM estimates. This problem is associated with the finite sample behaviour of the GMM estimator and there are two major factors that affects this finite behaviour of samples. These are strength of identification and numbers of moment conditions, (Hayakawa, 2012) . The latest test for the validity of the identification problem is the Sargan/Hassen test which is also referred to as the J test, which in a robust estimation as ours, the Hansen J statistics is reported. This test has been proven to be valid even when the number of instruments is large in the cross sectional regression and under weak moments asymptotic, (Bijwaard, Ridder, & Woutersen, 2013; Newey & Windmeijer, 2009). Furthermore, the presence of serial correlation or autocorrelation in the estimates of dynamic panel data has also been pointed out as one of the problems of dynamic panel data estimators. The implication is that it limits the efficiency of GMM estimators (Hayakawa, 2012).

For legitimate instruments, the Hansen J null hypothesis must be accepted (Arellano & Bond, 1991; Hausman, 1978) and the higher the p-value the better. We have no evidence to doubt the validity of our instruments as the J statistics are in favour of the null hypothesis as shown in Table 5.4. The implication is that the number of instruments used in the GMM estimation does not have any negative effect on the estimators of the GMM. Likewise, Table 5.4 shows the acceptance of the null hypothesis at order two which is the system estimator step used for the GMM estimation. The implication is that, based on the null hypothesis, no autocorrelation is accepted since the tests are computed for the two-step system estimator with GMM. Therefore, the GMM estimates are not affected by the problem of serial correlation hence the estimates remain consistent and efficient.

5.5 Summary

This chapter set out to investigate the relationship between competition and stability especially as it relates to the SSA banking sector. To achieve this, we leveraged on the relationship between competition and efficiency as contained in the literature to craft a new way of rethinking this relationship by developing an instrument for competition using SFA. We then used this instrument in a regression of competition against stability. We used the Z-score to surrogate stability. Z-score measures the overall stability of the banking system. Our competition measure is the Lerner index which enables us to estimate the market power of the 440 banks in our sample over the study period. The efficiency scores generated from the SFA reveal in actual sense a marginal efficiency between banking sectors without competition and banking sector with competition. The SFA model ensures that technical efficiency is allowed to vary through time and in different manner for each bank. This result is not surprising since it is consistent with literature that argues that efficiency is inherent in competition. Furthermore, the index of competition we computed shows a banking system with varying degrees of market power but overall having the mean that is close to the minimum values which are close to zero which implies a monopolistic competitive banking system over the study period. This gives us the confidence to forge ahead with our regression.

Using GMM, we found the coefficient of our instrument to be strictly positive and statistically significant with our stability measure. This affirms a possible transmission from competition to efficiency and then to stability. Hence, this is consistent with competition stability view which argues that competition brings about efficiency which then causes stability. We, therefore, conclude that competition causes stability in the SSA region's banking sector. However, as a rider, efforts must be made to manage competition such that efficiency is ensured, because regressing Lerner index against stability shows a negative and statistically significant relationship. Again, this is not surprising in that competition fragility has already been reported in the literature, thus, the key phrase is managing competition for efficiency.

This result presupposes that driving and maintaining a sustainable banking competition in SSA region is most fundamental and a welcome development. The challenge, however, lies in optimising competition to achieve the desirable goal of ensuring the dynamic efficiency of the banking sector that would engender stability, and consequently, economic growth. Of utmost importance, will be the need to strengthen the various antitrust agencies and, ensuring strict adherence to various banking regulations that address issues of competition including monitoring and developing new ones where necessary. Efforts must also be made to come up with complementary monetary and fiscal policies to sustain and improve on current gains. Regulators and watchdogs must also be alive to their responsibilities.

Chapter 6

Competition, Regulation and Stability

6.1 Introduction

In the last two chapters of this study, we have considered the competition and stability relationship and accounted for the role of efficiency. More importantly, we found efficiency to be the conduit through which competition benefits the banking system in terms of stability. This chapter explores the relationship among competition, regulation and stability issues. In particular, a short-term approach is taken to investigate the role of regulation in ensuring an acceptable balance of competition such that stability is not compromised. This provides a forward-looking approach to managing the relationship among these phenomena.

Regulation has been long debated in the banking industry and the events leading to the 2007 - 2009 financial crises have increased attention to bank regulation across the globe (Allen & Carletti, 2013). Amidst the reasons for regulations in banking is engendering competition and also to foster stability of the system (Casu et al., 2015; Llewellyn, 1999). Most regulations in banks are tied to capital requirements (Agoraki et al., 2011). The contestable market theory posits that competition will result in stability. Meanwhile, empirical work by Northcott et al. (2004) considers regulation as fundamental to the effective working of the contestability theory. Regulation does not only stimulate competition, but also helps in moderating the excessiveness of competitive activities as the potential instability that could result with excessive competition often constitutes part of the agitations for banking regulation (Agoraki et al., 2011; Angkinand, 2009; Barth, Caprio, & Levine, 2004; Carletti, 2008; Cihak et al., 2012; De Serres, Sløk, Kobayakawa, & Vartia, 2006). In spite of the reforms implemented by SSA countries, their banking sectors are highly concentrated (Mlachila, Dykes, et al., 2013) and potentially unstable due to high incidences of NPLs which are on the increase. Meanwhile in an earlier study of some banking sectors in SSA region, Mlachila, Dykes, et al. (2013) provide evidence to show that reforms in the SSA region have reduced the number of systemic crisis witnessed in the region from 1980 to 2010. This was substantiated by Moyo et al. (2014) who found that financial liberalisation in the areas impacted positively on the stability of the system.

As seen in the previous chapters of this study, quite a substantial amount of work has been done on the competition and stability relationship including the possible trade-off between them yet the dilemma still subsist as to how to deal with this all important aspect of the financial system. According to Vives (2016b), regulation in terms of conduct and structure has the capacity to alleviate the competition-stability trade-off but not eliminate it. Matutes and Vives (2000), Vives (2014) among others, agree that capital requirements need to be tougher with more intense competition. But how well to do this has remained unresolved. This study therefore contributes to literature in this area by employing P-SVAR to investigate how best to regulate the banking system in order to strike an acceptable balance between competition and stability using data on SSA commercial banks.

We found evidence to support the relationships among these three phenomena in the commercial banks of the SSA region. Our results reveal capital regulation as most important in dealing with issues of stability and competition in banks and stated how best to respond to this in the next 24 quarters in the region. To the best of our knowledge, this is the first study of this nature.

The rest of the chapter is organised as follows. The literature review; theoretical and empirical, is presented in Section 6.2. We specifically looked at SSA commercial banks regulatory experience in Subsection 6.2.3. Section 6.3 explains the method adopted including data source and description of variables employed. Section 6.4 presents the results and the summary and conclusion are presented in Section 6.5

6.2 Literature Review

The Banking sector is highly regulated to prevent systemic instability, avoid monopoly exploitation and to protect small retail clients (Casu et al., 2015; Llewellyn, 1999). Regulations have largely taken the form of capital base (Basel Accord)[1] and have been problematic for lack of theoretical underpinning (Allen & Carletti, 2013; Bhattacharya, Boot, & Thakor, 1998). Historically, regulation in banking has been measured in terms of the safety and soundness of the system, capital adequacy and asset quality (known as prudential regulation) as well as corporate governance (conduct of business regulation), all of which have received even more attention in the wake of the 2007-2009 financial crisis. There have been linkages in extant literature on the relationship between regulation and competition. Delis (2012) found that reforms affect competition, with their results supporting the fact that reforms reduce market power of banks. He however argued that the strength of the relationship diminishes in countries with weak institutions and low economic development. Considering the impact of bank regulation on stability, the position of Agoraki et al. (2011) is that capital regulation may not be efficient when banks have sufficient market power. The next section inquires further into prior theoretical and empirical literature on what is known on competition and stability relationship and the place of regulation.

6.2.1 Theoretical Literature Review

In a review of theoretical and empirical literature, Vives (2016b) concluded that competition is not in any way the reason for fragility in the banking system. While he admits that the existence of heightened competitive banking environment could only aggravate the situation, instability in banks and systemic failure in general is a subject of certain bank fundamentals. In other words, banks may fail without necessarily being caused by competition. Vives (2016b) posits that there are two ways competition may induce instability in the banking system and cause systemic run. One way is where depositors' coordination problem is worsened on the liability side of the bank's statement of finan-

[1] Basel I and II dwell more on capital, while Basel III in addition to capital, introduces aspects of liquidity and asset quality.

cial position. The other way is where there is an incentive to undertake increased risky projects on either side of the balance sheet with the attendant likelihood of failure. The global game theory consolidates the self-fulfilling theory of crisis with fundamentals driven views to provide insight into the competition and stability views. Based on this theory, runs can happen independent of competition levels but rising competitive funding pressure worsens depositors' coordination problems by increasing the strategic complementarity of the actions of the investors. The reason is that the increasing cost of funds constitutes the resistant levels that most investors must overcome that makes runs takes place even without sensitivity to the fundamentals. The diminished sensitivity of the resistant threshold to fundamentals makes a depositor to react more strongly to changes in the strategies of other investors. In the work of Vives (2014), increased strategic complementarity in the actions of investors results in increased fragility and thus potential instability because the impact of bad news on fundamentals and the range for which a bank is solvent but illiquid raises the probability of a crisis.

Hakenes and Schnabel (2011) conducted a theoretical review of capital regulation, competition and stability in banks to analyse capital requirements in situations where banks compete on both the assets and liabilities sides of their balance sheets. They concluded that the ambiguous effects of competition on bank risk taking translates to ambiguous effects of capital requirements on financial stability as banks chose the correlation of their loans portfolio. The authors further argued that capital can hurt stability because of its influence on competition. In other words, the stabilising effect of capital regulation tends to obtain in those situations where the charter value effect dominates, and vice versa. Their model suggests that capital regulation may not be suited in all circumstances to prevent excessive risk-taking in banking. On the other hand, Daesik and Santomero (1988) in a single-period mean-variance model of the role of capital in risk control, argue that simple capital ratio regulation is ineffective in ameliorating banks' likelihood of insolvency risk, because it ignores the individual banks' different preference structures and allows risky banks to circumvent the restriction via financial leverage and/or business risk. Bolt and Tieman (2004) did a theoretical dynamic modelling of demand for loan to examine the interaction of competition, bank risk taking and regulation and came to the conclusion that increased competition in the banking industry leads to riskier banking behaviour. They argue that it is more beneficial for banks to hold more equity than prescribed by regulators, as the more intense the competition, the greater the risk taking by commercial banks, the higher the failure rates hence the charter value falls. For Freixas and Ma (2014), competition's impact on insolvency, systemic and liquidity risk is a function of bank's liability structure for which risk-shifting or the charter-value may predominate.

A number of theories have associated bank run with the presence and nature of deposit insurance in a banking system. From their models, Allen and Gale (2004) showed that as the number of banks grow with insured depositors, banks have the highest incentives to take on risk on the asset side of the market. Likewise, according to Matutes and Vives (2000) deposit insurance that is not risk dependent motivates banks' maximal asset risk taking with high competition in the deposit market because depositors are carefree about banks' risk taking attitudes. This is not the case with a risk-based deposit insurance that demands that banks are accountable, compelling them to minimise their asset risks. In an earlier work, Matutes and Vives (1996) developed a framework that links incentive and competition theories to study rivalry among financial intermediaries in an imperfect competition context as well as the policy implications of deposit insurance. They concluded that deposit insurance has the impact of improving welfare by preventing collapse, extending the market, and minimising frictions. They however argue that deposit insurance may induce deep competition for deposits and increase the dead-weight losses associated with failing institutions. The welfare impact of deposit insurance depends on market structure, and is thus ambiguous even in a world of full liability and no moral hazard in bank investments.

Furthermore, Niinimäki (2004) modelled the joint effects of competition and deposit insurance on banks' risk taking and concluded that the size of risk that a bank takes depends on the structure and the side of the market competition is taking place. He argued that with deposit insurance, competition induces fragility as banks compete for deposits in the deposit market, deposit rates becomes excessively high forcing banks to take high risk. He added that deposit insurance has no influence on monopoly or banks competing in the loan market. The theories focusing on bank competition for deposit and systemic risk argue that banks in distress have more incentives to aggressively compete for deposits in the absence of deposit insurance because they have lower market share. However, their distressed predicaments make them face harder times attracting deposits, hence the aggression is short-lived. Meanwhile, deposit insurance helps to relieve this hurdle but increased deposit rates by distressed banks will be matched by corresponding higher rates by safer competitors resulting in higher systemic risk.

Financial liberalisation has the positive effects of increasing depositors' welfare but has the potential to increase fragility. Chang and Velasco (2001) modelled liberalisation as a departure from monopoly banking to highly competitive banks in modelling financial crises in emerging markets. They argued that monopolies hold depositors to their reserve by remaining insensitive to a self-sufficient system with no financial intermediation. This is done by the monopolist bank by reducing payments to depositors and therefore its short run liabilities. Since profits act as buffers against unexpected withdrawals, the consequence is less likelihood of bank crisis than it would in a competitive banking environment. Hellmann, Murdock, and Stiglitz (2000) concluded that if the liability side of bank balance sheets are competitive enough, banks will invest in risky assets because, as banks compete for insured deposits, they are able to invest in conservative or in volatile assets while raising outside capital. However, banks are closed if capital becomes negative. Though not an efficient means, as capital decreases banks' franchise value, but they argued that it helps to restore incentives to invest in prudent assets by imposing high capital requirements. According to these authors, this explains the superiority of deposit regulation in contrast to capital regulation in excessive competition control. Modelling competition for deposits with banks utilising internal capital, Repullo (2004) insists that deposit regulation does not outperform capital regulation. Advocating minimum capital regulation, Allen and Gale (2004) in a general equation model of financial intermediaries and markets with spatial competition and Schumpeterian competition including contagion, concluded that perceived trade-off between competition and stability arising from the allocative efficiency that is associated with competition increased the calls for regulation to ensure the coexistence of competition and stability. The authors argue that the most important means to strike the necessary balance is to impose minimum capital regulation on banks, as this will reduce the capital available to them thus curtail their risk appetite and compete fairly.

Competition at the interbank market affects stability through its impacts on liquidity. In most cases, distressed banks may not find support in a competitive interbank market as single bank has no impact on the market. However, big banks may be able to offer help to another troubled bank in an interbank market where competition is imperfect, even though coordination problems may arise in liquidity provision especially with a large number of banks. Market power in interbank markets could impede liquidity provision since banks with surplus funds could strategically under provide lending in order to induce fire sales of the bank specific assets of the bank that is in need of liquid funds. Allen and Gale (2004) and Carletti, Hartmann, and Spagnolo (2007), among others, posit that there will be a high volatility of aggregate demand for liquidity in the interbank market where imperfect competition in loan market with banks of different sizes, in a context where banks need access to the interbank market to deal with liquidity shocks.

The theories dealing with excessive risk-taking and competition explains that the incentive for risk-taking is driven by moral hazard and limited liability with the problem aggravated with banks on the verge of insolvency. Limited liability banks take excessive risks on the asset side but it is difficult for banks with observable risk position to do so. This deprives banks the ability to enjoy both market share and profit by taking on more risk because investors will discount them and ask to be compensated for increased risk. Flannery (1998) provides evidence to show that bank risk taking is consistent with high cost of funding because of the demands of the holders of uninsured liabilities. Matutes and Vives (2000) argue that flat-deposit insurance and bailout erode market discipline effects with investors/depositors' incentives to monitor banks' extinction. But Kim, Kristiansen, and Vale (2005) opine that borrower discipline effect may still subsist to avoid losses since banks serves as their certifier.

Caminal and Matutes (2002) model whether higher probability of banking failures is necessarily a result of intense competition in the banking sector and came to the conclusion that the relationship between market power and banks' probability of failure is ambiguous. Their model show that banks have to choose between costly monitoring and capital rationing as borrowers face the problem of moral hazard. Monopoly power provides incentives for monitoring rather than capital rationing because investment declines with lending rate and increases with monitoring efforts; the relationship between market structure and investment is ambiguous. Notably, more market power also induces lending rate and depresses investment with the consequent multiplicative shocks on the overall portfolio risk of banks. Furthermore, increased competition can increase the probability of bank failure as intense rivalry has the effects of stifling monitoring incentives with the attendant effects of reducing lending rates. Depending on which is strong enough, monopoly banks may be more exposed to aggregate uncertainty and more likely to fail, as they argue that the more the presence of non-diversifiable risk and decreasing return to scale, the more investment creates the danger of a higher failure rate.

Diamond and Rajan (2012) link excess risk taking arising from moral hazard to monetary policy. The moral hazard problem is rooted majorly in the unobservable efforts of banks in monitoring which may be worsened with highly liquid banks. It is the norm that the usual banks' optimal monetary policy is to conduct audit when there is liquidity shock without which there is the tendency for loan officers to over extend credit. Thus the presence of loose monetary policy often translates to bogus balance sheet with excessive risk taking, the authors argued. Providing a theoretical foundation on the claims that lax monetary policy conditions increase bank risk taking, Dell'Ariccia, Marquez, and Laeven (2010) posit that the effects of monetary policy on risk taking by banks is a function of the sensitivity of leverage to interest rate. In a model of leveraged financial intermediaries that endogenously choose the riskiness of their portfolios, the authors argue that lax monetary policy inevitably results in greater leverage and higher risk where a bank can adjust its capital structure. But in a situation where a bank's capital structure is fixed, the effects of monetary easing depends on the degree of leverage.

A reduction in interest rates provides incentives for highly capitalised banks to increase risk-taking attitude, but depending on the degree of competition; while banks with high leverage decrease their risk. Boot and Ratnovski (2016) modelled the interactions of relationship banking and banks' trading. They showed how a bank can use the franchise value of its relationships to expand the scale of trading. They argued that the moral hazard occur when bank bets retail franchise value with scalable short-term arm's length activities of banks. Banks thus get exposed to trading activities as against what is optimal for their principal due to time-inconsistency problem. They face the temptation to allocate too much capital to trading activities at the expense of honouring their commitments to their customers. The impact becomes even more reinforced when trading is used as a means of shifting risk. This process heightens the banks' risk-taking problems that may even be severe with a more robust financial market.

The problem of selection in the credit market has also been traced to impact on systemic stability. Adverse selection problem could result from information asymmetry among banks and among banks' borrowers alike. Adverse selection refers to the unsavouring consequences of stakeholders in the banking system having access to different and/or imperfect information. Dell'Ariccia and Marquez (2006) examine the interaction between banks' strategic behaviour in determining lending standards, lending volume, and the aggregate allocation of credit and the informational structure of loan markets. They show that banks tend to reduce their lending standards as they get to have more private information about borrowers and information asymmetries across banks decrease; causing increase in portfolio risk, lower profits and expanded aggregate credit. The lower the ratio of unknown borrowers, the higher the required collateral banks expect in screening borrowers. In contrast, banks require no collateral with increase in the ratio of unknown borrowers which indicates the presence of more new projects requiring financing in the market. Because as the rate of new projects increases, adverse selection decreases as less borrowers get turned down by other banks, making banks to lower collateral to attract more customers and increase their market share. These practices, De Meza and Webb (1987) argue, pose the danger of good borrowers drawing in bad ones. In other words, a higher proportion of borrowers with unknown characteristics in the market results in credit expansion as it prompt banks to loosen up credit requirements, lower screening, with zero collateral. This increases the likelihood of systemic failure because the reduction in loan portfolio quality reduces banks profitability. This provides a plausible explanation as to why expansionary economic policies end up breeding crises and instability in the banking system.

Competition produces similar scenario when there are new inflows of borrowers that cause existing monopolistic banks to abandon screening in favour of pooling loan applicants in order to sustain its market share and take advantage of the information at its disposal. According to Mahoney and Weyl (2014), customers that pose more risk to the banks are often the least likely to approach the bank for loan and only get attracted by generous banks' offers. Increased competition thus becomes bad to welfare where marginal increase of borrowers worsen credit risk than average borrowers. Hence competitive market over supply credit because lenders are unable to differentiate between good and bad credit risk when they compete and attract both types with generous offers. The externalities associated with this are that a lender whose good customer is attracted away by another gets hurt. Therefore, monopoly lender provides too little credit as it has the market power to restrict quantity and competitive market offers too much credit to the point that it equates price to the average cost of serving the customers. This shows that there is an intermediate degree of market power that yields the social optimum.

At the root of risk taking problems of banks is the debate of agency conflicts between managers and owners. Often times owners attempt to resolve this with compensation schemes that target the reduction in managers' risk appetite and failure. Most of these schemes however provides incentives for risk taking behaviour in banks. For instance, Fahlenbrach and Stulz (2011) provide evidence to show that banks with a higher level of Chief Executive Officers (CEOs) compensation linked to share price were worse hit in the 2007-09 financial crisis. The coincidence of limited liability and high leverage that persuades the propensity to undertake risks at the expense of stakeholders other than shareholders differentiates corporate governance in banks from conventional industries. Issues arise where banks have powerful diversified owners that are risk lovers who are prepared to increase risk taking to compensate for capital requirements and activity restrictions. Laeven and Levine (2009) found widely owned banks less riskier than banks with powerful diversified holders.

In the next subsection are highlights of some of the empirical evidence on the role of regulation and how some other factors other than competition impact on the stability of the banking system.

6.2.2 Empirical Literature Review

It is important to note from the outset that the empirical literature reviewed in Chapters 3, 4 and 5 provide an enabling background for this review as the focus in this chapter is on evidence on how regulation and other influences have helped to shape the relationship between competition and stability. For the purpose of hindsight, empirical studies provide evidences to argue mixed conclusions on the competition-stability relationship. It has been argued in theory that regulation, especially capital regulation plays a pivotal role in determining the relationship between competition and stability. Other studies concluded that competition is not in itself the cause of instability in the banking sector, but rather the peculiarity of the system itself. Though not much work has been done empirically in this regard, nevertheless, there seems to be some consensus on the effects of regulation but the direction thereof is far from being agreed on.

A number of empirical studies exist on the effects of regulation as well as other factors' impact on stability with and without banking competition. Capital regulation influences competition and stability in various ways. Stringent capital requirements can constitute a barrier to new comers thus restrict competition and increase stability. Agoraki et al. (2011) argued that high fixed costs of running banks are associated with high overall banking capital requirements which will only be affordable to fewer banks. According to Bolt and Tieman (2004), more stringent capital adequacy requirements raise the bar of new loans acceptance criteria; this has the potential to reduce incidence of non-performing loans hence increase bank stability. Agoraki et al. (2011) used GMM to analyse regulation, competition and bank risk-taking in some sets of Central and Eastern European (CEE) banking sectors for the period 1998-2005 to examine whether bank regulation affects stability directly and if not, is it transmitted via banks' market power. They found that capital requirements generally reduce risks in banks in the CEE countries. However, the effect is less effective with market power and perhaps eroded at very high levels of market power. In other words, they provide evidence in a long term analysis of the role of capital in determining the stability of banks. In addition, they found evidence to support the role of activity restriction and supervision as their results reveal that a combination of high activity restriction and market power reduces credit risk and the likelihood of default with supervisory power having direct impact on bank risk.

This substantiates the study of Uhde and Heimeshoff (2009) carried out on European banking studies that found that financial regulation is supported by capital regulation across the entire European Union. Though they agree with the findings of Agoraki et al. (2011) on capital having impact on competition and stability relationship, Berger et al. (2009) differ on market power eroding and/or reversing the impact of capital. In a GMM analysis of Zscore, NPLs, equity capital ratio and Lerner index of 8235 banks in 23 countries over seven years from 1999 to 2005, Berger et al. (2009) found that market power increases loan portfolio risk. Their results provide evidence to show that such risk may be offset in part by higher equity capital ratio and these findings favour increased equity capital ratio as a cushion to the risk that market power may pose for banks' loan portfolios. According to Tabak et al. (2012), bank capitalisation is an essential force in explaining the non-linear relationship they found between competition and the risk-taking behaviour of banks. In a GMM regression of stability on competition to investigate the role of capital and size on risk competition relationship in 10 Latin America's 376 banks between 2003 and 2008, they emphasised that higher capital ratio has merits for banks that operate in collusive markets but argue the capitalisation only enhances the stability of larger banks under high and average competition. The recent work of Maghyereh and Awartani (2016) affirms the importance of the role of regulation on competition stability relationship. Applying a dynamic panel data analysis using GMM on the influence on financial stability of 70 banks in the Gulf cooperation countries between 2001 and 2011, they found that increased competition results in rising fragility with the influence determined by the strength of regulation across the council. They state in particular that the impact on bank soundness will strongly depend on the size of capital, the strength of supervisory power, the strictness of the regulations imposed on bank activities, and the level of transparency and market discipline.

In related studies, Beck et al. (2013) who in a simple multiple regression of stability (Zscore) on competition (Lerner index) for over 17000 banks in 79 countries from 1994 to 2009 advocated for the understanding of a banking system regulatory environment in explaining their competition and stability relationship. The impact of increase in competition will be much felt on banks' risk-taking behaviour in banking markets with stricter activities restriction. They listed other factors such as the level of development of capital market, the nature of deposit insurance held and the effectiveness of the systems of sharing credit information as having roles to play. Fernández et al. (2013) did not agree any less as their study of the effects of market concentration, regulation and institution in shaping the real effects of banking crisis in 68 systemic banking crisis in 54 countries over 1980-2000 show a negative impact of lax restriction on non-traditional banking activities. With an instrumental variable and OLS estimations of activity restriction, HHI and concentration ratios they found evidence to show that combining traditional and non-traditional banking activities has a negative effect on economic growth during normal periods but mitigates the negative effects of banking crises on economic growth. This changing influence between crisis and non-crisis periods is reinforced by market concentration; explicit deposit insurance and better accounting standard mitigate the negative real effects of systemic banking crises and interact positively with bank concentration to minimise the reduction of economic growth during the periods of crisis. Investigating the impact of regulation and supervision on banks risk taking, Bouheni (2014) also employed dynamic panel data analysis base on GMM on European banking sectors for the periods 2005-2011 and found that stability reacts differently depending on the extent of regulation in a particular location. Specifically, the study found evidence to show that stability improves in France, Germany and the United Kingdom banking systems due to restrictions on banking activities during the study period but also found that supervisor's power and capital adequacy encouraged risk-taking. Similarly, the study found risk incentives encouraged by more supervisors' power only in largest banks in Italy, Greece and Spain, while regulation and supervision strengthening weaken bank stability with risk-taking reduced by capital requirements in these countries. Overall, the study concluded that tightening regulatory and supervisory framework, and compliance with Basel principles enhance financial stability in Europe explaining that the different results are a reflection of the level of monitoring of regulation and supervision.

Furthermore, in a fixed effects regression of 1872 listed banks data for the periods 1997-2009, Demirgç-Kunt et al. (2013) examined the impact of regulatory and institutional environment on systemic risk in 63 countries. They found that frail banking systems are associated with weak supervision, private monitoring, more government ownership and public policies restricting competition. The authors however added that strong institutional environment that enhances efficient public and private monitoring of financial institutions is able to mitigate the negative effects of lack of and/or weak banking supervision. Beck et al. (2006) examined the impact of national bank concentration, bank regulations, and national institutions on the likelihood of a country suffering a systemic banking crisis using logit probability model that is robust to heteroskedasticity in 69 countries for the periods 1980-1997. Their analysis provides evidence to show that stability and/or less crisis thrive better with a concentrated banking system. However, their data reveal that greater banking fragility is associated with regulatory policies and institutions that distort competition. In the second part of the foregoing study, Beck (2007) repeating the same approach probed the reasons for the conflict in theories and empirical studies on these relationships and found that while their result on concentration and fragility subsist, there is no reverse causality between concentration and stability and that concentrated banking systems are well diversified. Nonetheless he found evidence to prove that the presence of concentration in the banking system does not translate to the absence of competition in the system as they found less crisis in competitive regulatory and institutional environments. Also, Beck (2008) reviewed literature on the position of theories and empirical studies on competition and stability relation, and concluded that the failures of bank regulation and bank supervision are often times the reasons why liberalisation and uncontrolled competition result in instability in the banking system. He recommends that the strong advantage that competition has for efficiency and inclusive financial system could only be harnessed if policies on regulation and supervision dwell on engendering the right banking environment instead of dissipating efforts at fine tuning market structure and/or the degree of competition.

Few studies have also considered these issues in Asian countries. Fu et al. (2014) employed the instrumental variable technique with GMM estimator to investigate the influence of bank competition, concentration, regulation and national institutions on individual bank fragility in 14 Asian Pacific economies for the periods 2003 to 2010 and found that tougher restriction may benefit bank stability while stronger deposit insurance schemes are associated with greater banks instability. Jeon and Lim (2013) examined the influence of competition and concentration on Korean financial industry stability during 1999-2011 using OLS and found that competition and stability relation depends on financial institution features while emphasising the role of corporate governance.

An individual country study of the Norwegian banks for periods between 1993 and 1998 by Kim et al. (2005) examined banks strategies for service differentiation from those of their rivals using two stage-least-square. They investigated if the size of bank, its ability to avoid losses, and its capital ratio can be used as strategic variables to make banks different and increase the interest rates it can charge its borrowers. They found no evidence to support that the use of high capital ratio is a strategic variable that borrowers are willing to pay for and that borrowers in the markets for credit line loans can discipline banks to avoid failure. OECD (2011) reviewed competition in retail banking and financial stability and concluded that the design of financial regulations is equally important as market structure for the stability of the banking sector. Marques-Ibanez et al. (2014) in a probit regression of roles played by securitisation and capital in competition and risk relationship during 2007-2009 crisis found that higher level of capital did not mediate impact of competition on realised risk; as competition increases banks resorting more heavily to securitisation find incentives to take more risk. Exploring whether increased banking sector competition via financial liberalisation enhances bank stability, Moyo et al. (2014) used duration bank stress prediction model on 16 SSA countries banking sectors from 1995 to 2010. They found evidence to submit that CAMEL-type bank specific factors are good predictors of which banks are more likely to experience banking distress. They also found that increased competition via liberalisation increases the lead time to distress post-reforms periods and that banking system stability in a liberalised and competitive system is contingent on pursuing sound macroeconomic policies and enhanced institution effectiveness. Going forward, we briefly highlight regulatory experience of the SSA banking systems to gauge the level of regulatory reforms on the banking system.

6.2.3 Regulatory Experience in SSA Banking Sectors

Modern banking began in most SSA region economies in the late 50s and early 60s. Given the peculiarity of banks, regulation of the sector becomes part of the process and can be said to be as old as the banking sectors themselves. However, at commencement, banks were mere appendages/branches of the colonial masters' banking systems. When at independence the banking sectors became nationalised, they were indigenised making the banking sectors of most of the region predominantly centralised and public owned. From the 80s, African governments began to unbundle their commitments to these sectors paving way for private participation and ownership. This development saw the wave of reforms leading to liberalisation, restructuring, privatisation and recapitalisation of the banking sectors across the region. The situation became even more pronounced with the structural adjustment programs (SAPs) of the International Monetary Fund (IMF) that were largely adopted in the region which encouraged deregulation. As shown in Chapter 1 Table 1.2, notable major reforms of the banking sectors of SSA regions banking sectors were in Ghana in 1983 followed by liberalisation in 1988 and further restructuring in 1989 with unprecedented privatisation in 1997. Ghananian banking sectors have also recapitalised lately commencing from 2009 in the wake of the 2007-09 financial crises.

Nigeria has been hit with two major financial crises in its banking sector, one in the early 90s when banks were going under and later in the late 2000 despite the major reforms that have characterised the banking sector. The first major reform in the Nigerian banking sectors was the indigenisation policy in the mid 70s that saw the influx of many

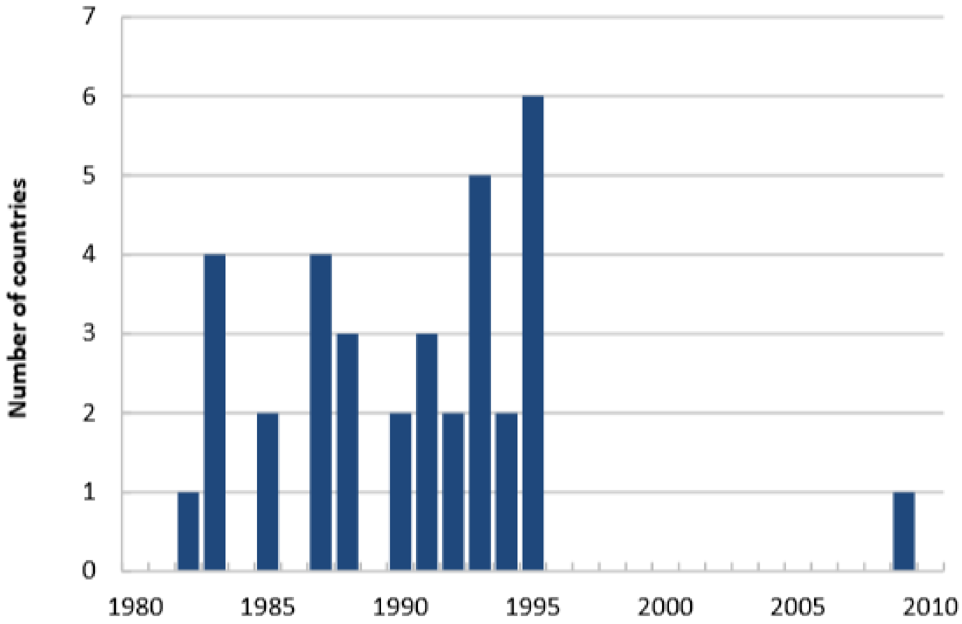


Figure 6.1: **SSA Systemic Banking Crisis, 1980-2010**

Source: Mlachila, Dykes, et al. (2013), Pg.19

banks in the economy as well as the SAPs of 1986 leading to liberalisation of the sectors in 1987. Further restructuring in the 90s and specifically 1992 witnessed privatisation of the sector. Nigerian banks have also been recapitalised twice from 2000 to date with the major one in 2004 completed in 2006 and another post 2007-2009 financial crisis that saw some banks nationalised, others bailed out due to what was called poor corporate governance practices within the sector that led to near failure of the banking sectors in Nigeria. Other notable reforms in banking sectors in the region were those in Tanzania in 1985 with liberalisation and restructuring in 1991 as well as privatisation in 1994. Kenya also witnessed reforms commencing from 1989 with privatisation in the same 1989 and further liberalisation in 1991. In the same vein, Malawi reformed its banking system in 1987, liberalised in 1988 and further restructured in 1990. There was also a similar development in Uganda in 1987 when the banking sector had a major reform followed by liberalisation in 1988. Banking sectors of Cote d'Ivoire, Benin, Gambia and Mauritius also begun major reforms in the mid/late 80s while Botswana, Cameroon, Mauritania and Namibia started in the early 90s. It is noteworthy that reforms in the banking sectors are an ongoing phenomenon and only a few were enlisted to highlight some of the efforts made in this regards.

The thrusts of these reforms were interest rate liberalisation, removal of credit controls, establishment of new refinancing policies, consolidation, writing off of NPLs, deregulation and prudential management. They are meant to reposition the banks so that they are well capitalised with management taking off the shackles of government inefficiencies in order to stem the tides of runs and/or failure/instabilities in the system. There is no doubt that these developments have far-reaching effects on financial deepening in most of the sectors overtime, not minding that their financial systems are still poorly developed relative to their counterparts in the developed countries. Moreover, since the mid-90s, incidence of systemic banking crises has reduced to the lowest ebb among the banking systems of the region, as shown in Figure 6.1 above. This is a fallout of strengthened capital base, reduced involvement of states in banks ownership, brought about by the various reforms that also increased the pace of commercialisation.

From the foregoing, it is clear that issues of regulation in banking have been subject of debates both in theory and empirical works notwithstanding that the sector still remains perhaps the most regulated industry in any economy. The strategic nature of commercial banks, as the heart of a nation's financial system make them a flashpoint for intense and ongoing regulation. In spite of the fact that the major financial crisis have increased attention to the regulation of banks across the globe, Allen and Carletti (2013) affirm that banking regulation is quite problematic for lack of widely agreed underlying theoretical framework. Regulation which has mainly been capital base and lately liquidity and the quality of assets (Basel Accords I -III), have been set without specific theoretical basis and with no consensus on the nature of the problem and how it is to be solved. Yet if well-crafted, it has the potential to prevent damaging financial crises and at the same time if otherwise managed could result in dysfunctional allocation on the part of the bank, attendant slow growth and ultimately inefficiency. While it is in contention that regulation has direct effects on competition as well as the stability of banks, Agoraki et al. (2011) found that the stabilising effects of capital regulation on bank risk varies with bank market power and therefore the need for the investigation of bank market structure. Given this background, this study differs from extant literature as it applies P-SVAR that requires no special theories to prospectively model the short term relationship between competition,

Table 6.1: **Research hypothesis for analysis**

Objectives to be analysed	Variables	H_0	Selected References
Regulation on competition	capital on Lerner Index	$H_0 = 0$	Gap
	Capital on interest rate spread	$H_0 = 0$	Hussain and Mustapha (2010)
	Liquidity of Lerner index	$H_0 = 0$	Gap
	Liquidity on interest rate spread	$H_0 = 0$	Hussain and Mustapha (2010)
	Asset quality on Lerner index	$H_0 = 0$	Gap
	Asset quality on interest rate spread	$H_0 = 0$	Gap
Regulation on efficiency	Capital on efficiency	$H_0 = 0$	Gap
	Liquidity on efficiency	$H_0 = 0$	Gap
	Asset quality on efficieincy	$H_0 = 0$	Gap
Regulation on stability	Capital on Zscore	$H_0 = 0$	Fu et al. (2014), Moyo et al. (2014), Agoraki et al. (2011)
	Liquidty on Zscore	$H_0 = 0$	Moyo et al. (2014)
	Asset quality on Zscore	$H_0 = 0$	Moyo et al. (2014)
competition on regulation	Lerner index on capital	$H_0 = 0$	Gap
	Interest rate spread on capital	$H_0 = 0$	Gap
	Lerner index on liquidity	$H_0 = 0$	Gap
	Interest rate spread on liquidity	$H_0 = 0$	Gap
	Lerner index on asset quality	$H_0 = 0$	Gap
	Interest rate spread on asset quality	$H_0 = 0$	Gap
Competition on efficiency	Lerner index on efficiency	$H_0 = 0$	Fungáčová et al. (2013), Hussain and Hassan (2012)
	interest rate spread on efficiency	$H_0 = 0$	Gap
Competition on stability	Lerner index on Zscore	$H_0 = 0$	Maghyereh and Awartani (2016), Beck et al. (2013), Amidu (2013)
	Interest rate spread on Zscore	$H_0 = 0$	Fu et al. (2014)
Efficiency on regulation	Efficiency on capital	$H_0 = 0$	Gap
	Efficiency on liquidity	$H_0 = 0$	Gap
	Efficiency on asset quality	$H_0 = 0$	Berger and Mester (1997)
Efficiency on competition	Effciency on Lerner index	$H_0 = 0$	Fungáčová et al. (2013)
	Efficiency on interest rate spread	$H_0 = 0$	Apriadi et al. (2016)
Efficiency on stability	efficiency on Zscore	$H_0 = 0$	Apriadi et al. (2016), Petersen and Rajan (1995)
Stability on regulation	Zscore on capital	$H_0 = 0$	Gap
	Zscore on liquidity	$H_0 = 0$	Gap
	Zscore on Asset quality	$H_0 = 0$	Gap
Stability on competition	Zscore on Lerner index	$H_0 = 0$	Gap
	Zscore on interest rate spread	$H_0 = 0$	Apriadi et al. (2016)
Stability on efficiency	Zscore of efficiency	$H_0 = 0$	Apriadi et al. (2016)

Source: Author's Review[a], 2017

[a]Identified number of gaps is to the best of our knowledge based on reviewed literature.

regulation and stability of SSA region commercial banks. This methodology contribution is in addition to filling the gaps in literature that are summarised in Table 6.1 above. This will provide insight to policy makers and practitioners in this region as to how to optimise these phenomena to achieve the best possible outcome.

6.3 Methodology

The objective of this chapter is to analyse the relationship between competition, regulation and stability among SSA commercial banks using a Panel Structural Vector Autoregressive (P-SVAR) model approach. The identical yet distinctive features of the economies in the SSA region provides an incentive for this study to pool cross-sectional data together and deploy a panel data estimation. In particular, countries of the SSA region adopted similar banking regulation to liberalise their various banking sectors to make them more competitive. In addition, countries of this region are faced with the common enemy, poverty, that has the degrading effect of under developing their systems and economies.

Previous studies have attributed part of the reasons for regulations in banking to competition stimulation and stability. Such studies found that regulation could have some influence on competition (Allen, Carletti, & Marquez, 2011; Demirguc-Kunt, Laeven, & Levine, 2003). However, there are conflicting views in theories and empirical evidence among the few studies that have considered the effects of regulation on competition in banking. Delis (2012) found that regulation enhances competition because it helps to curtail market power. Based on this view, it may be justified to support SSA policy makers calling for regulation that will ensure the right competition to unlock its potential for savings mobilisation. But the efficiency structure hypothesis theorists argue that efficiency causes market power and discouraged checking the later through regulation. This study thus attempts to analyse their relationships.

Although the Vector Autoregressive (VAR) model, pioneered by Sims (1980) is most popular among monetary economists in studying short run impulse response functional relationship among variables, (Beetsma & Giuliodori, 2011; Boubtane, Coulibaly, & Rault, 2013; Canova & Ciccarelli, 2004, 2009, 2014; Canova & Pérez Forero, 2015; Davoodi, Dixit, & Pinter, 2013; Dungey & Fry, 2009; Dungey & Pagan, 2000, 2009; Rebucci, 2010, among others), it has been criticised for not catering for the needs of researchers that are interested in shocks other than monetary policy shocks (Bernanke, 1986; Elbourne, 2008).

Hence the birth of Structural Vector Autoregressive (SVAR) model which does not only cater for this deficiency but as well accounts for economic information that lay bare the rationale for the restrictions that help in identifying even other non-monetary policy shocks. For instance, Omolade (2014) employed this to measure oil resources and oil price shocks in the individual economies of five net oil producing nations in Africa. It has been applied in banking and finance related studies, for instance, Graeve and Karas (2010) have applied VAR to the study of bank run, and likewise Love and Zicchino (2006). However, both VAR and SVAR handle only time series data which limit their application to one economy and precludes the gains of panel data analysis in carrying out such investigation. Further efforts to capture effects of transmissions and interdependences across countries and economic units created the Panel VAR (PVAR) (Canova & Ciccarelli, 2014). However, PVAR is faced with the problem of dimensionality. Hence the P-SVAR applied in this study was then introduced by Kutu and Ngalawa (2016). It was built on the same principles of PVAR but overcomes its plagues through the imposition of structural restrictions, rendering it much more efficient and powerful to deal with finance and economic policy issues. This study therefore benefits from the gains of SVAR, of being able to accommodate studies that are interested in shocks outside monetary policies and still be able to pool panel data of 37 SSA commercial banks together given the P-SVAR.

As already highlighted, previous literature has considered the relationship between competition and regulation as well as the relationship between competition and stability but has not looked at how this relationship subsists. This approach is therefore considered for this study. Moreover, it ensures that the dynamic behaviour of the variables in the model is captured as well as obtain more efficient estimation of the parameters which are congruent with this study. In addition, the power of structural VARs lies in the fact that they allow the recovery of interesting patterns in the VAR using a minimum amount of theory which is particularly useful in fields with little or no theoretical consensus (Graeve & Karas, 2010) as in the case of this study. Furthermore, with VAR, this study does not lose focus of the differences in the countries under review as it affords the flexibility of dynamic cross-section and slope heterogeneity (Canova & Ciccarelli, 2014). The P-SVAR permits us to use past tendencies to explain the current situations and forecast what the future holds (Canova & Ciccarelli, 2014).

6.3.1 Model Specification

This study follows the SVAR and the PVAR models of Graeve and Karas (2010) and Canova and Ciccarelli (2014) respectively, to analyse the relationship between competition and regulation among SSA commercial banks using a P-SVAR approach of Kutu and Ngalawa (2016).

Assuming that the SSA commercial banking sector can be represented in the following structural model:

$$QY_{it} = \beta_{io} + \omega_1 Y_{it-1} + \omega_2 Y_{it-2} + \cdots + \omega_\rho Y_{it-\rho} + K\epsilon_{it} \tag{6.3.1}$$

Where Q is an invertible (kxk) explaining the simultaneous relationship among the bank variables; Y_{it} is a $(kx1)$ vector of SSA region commercial banks endogenous variables such that $Y_t = Y_{1t},\ Y_{2t} \cdots Y_{nt}$; β_{io} is a vector of constant denoting banking sector specific intercept terms; $\omega_1,\ \omega_2,\ \cdots \omega_\rho$ are (kxk) matrix of lagged banks endogenous variables respectively; K represents a (kxK) matrix having a zero diagonal element that allows for direct effects of some shocks on more than one endogenous variable in the system; and ϵ_{it} is a vector of uncorrelated error terms (structural shocks or white noise innovation).

Since the P-SVAR *equation (6.3.1)* above could not be estimated directly because of the feedback that is innate to the VAR process (Enders, 2008), the reduced form representing Y as the lagged form of Y is estimated by multiplying through by the inverse of Q to produce;

$$Y_{it} = Q^{-1}\beta_{io} + Q^{-1}\omega_1 Y_{it-1} + Q^{-1}\omega_2 Y_{it-2} + \cdots + Q^{-1}\omega_\rho Y_{it-\rho} + Q^{-1}K\epsilon_{it} \tag{6.3.2}$$

Further simplifying the forgoing equation we represent; $Q^{-1}\beta_{io} = J_i,\ Q^{-1}\omega_1 = L_i$ for $i = 1 \cdots \rho,\ Q^{-1}K\epsilon_{it} = \mu_{it}$. Therefore, *equation (6.3.3)* becomes

$$Y_{it} = J_i + L_i Y_{it-1} + L_2 Y_{it-2} + \cdots + L_\rho Y_{it-\rho} + \mu_{it} \tag{6.3.3}$$

Equation (6.3.3) differs from *equation (6.3.1)* in that the later is a primitive system that allows all variables to have contemporaneous impact on one another. The former is the standard/reduced form of P–SVAR where all the right-hand side variables are predetermined at time t with no variable having an immediate impact on another in the system. Furthermore, according to (Enders, 2008), the error term (μ_{it}) is composite shocks in Y_{it}.

Hence, the reduced form of the P–SVAR from *equation (6.3.3)* above can be rewritten as

$$Y_{it} = J_i + L(B)Y_{it} + _{it} \tag{6.3.4}$$

Where Y_{it} is (nxk) vector variable given as

$$Y_{it} = (ECR, LQTY, AQLTY, LI, IRS, EFF, Zscore) \tag{6.3.5}$$

Equation (6.3.5) is the vector of SSA region Commercial banks endogenous variables used in the study. Where Zscore is stability measure, IRS, interest rate spread and LI is competition index. Others are ECR, represents regulatory capital; LQTY, liquidity reserve; AQLTY, asset quality and EFF is efficiency score estimated with SFA as efficiency measure. From *equation (6.3.4)*, J_i is the vector of constants denoting country intercept terms, $L(B)$ is the matrix of polynomial in the lag operator that captures the relationship between the banks endogenous variables and their lags, $\mu_{it} = Q^{-1}K\epsilon it$ and/or $Q_{it} = K\epsilon it$, is a vector of random disturbance. This will be employed in order to estimate the interaction among regulation, competition and stability of SSA region commercial banks.

To recover the information in the structural model, we impose a restriction in the matrix Q and K in the system as contained in *equation (6.3.6)* below. The identification scheme follows Davoodi et al. (2013), whereby structural restrictions are applied to the contemporaneous parameter matrix.

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ \omega_{21} & 1 & 0 & \omega_{24} & 0 & 0 & 0 \\ 0 & \omega_{32} & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & \omega_{52} & \omega_{53} & \omega_{54} & 1 & \omega_{56} & 0 \\ \omega_{61} & 0 & 0 & 0 & 0 & 1 & 0 \\ \omega_{71} & \omega_{72} & \omega_{73} & \omega_{74} & \omega_{75} & \omega_{76} & 1 \end{pmatrix} \begin{pmatrix} \epsilon_{it}^a \\ \epsilon_{it}^b \\ \epsilon_{it}^c \\ \epsilon_{it}^d \\ \epsilon_{it}^e \\ \epsilon_{it}^f \\ \epsilon_{it}^g \end{pmatrix} = \begin{pmatrix} \eta_1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \eta_2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \eta_3 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \eta_4 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \eta_5 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \eta_6 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \eta_7 \end{pmatrix} \begin{pmatrix} \mu_{it}^a \\ \mu_{it}^b \\ \mu_{it}^c \\ \mu_{it}^d \\ \mu_{it}^e \\ \mu_{it}^f \\ \mu_{it}^g \end{pmatrix} \tag{6.3.6}$$

The notations *a,b,c,d,e,f and g* in the matrix above are used to represent each variable *ECR, LQTY, AQLTY, LI,IRS, EFF and Zscore* respectively. Variables ordering meant that bank features react to simultaneous innovations in regulations. The first matrix in *equation (6.3.6)* is the Q matrix, relating to the non-recursive restrictions in the system.

The diagonal matrix, also known as the K matrix describes the first matrix on the left-hand side of the same system. ϵ^a_{it}, ϵ^b_{it}, ϵ^c_{it}, ϵ^d_{it}, ϵ^e_{it}, ϵ^f_{it} and ϵ^g_{it} are terms denoting the residuals in the standard form disturbances to the variables and further explain unexpected movements of each variable, based on the information in the system. While μ^a_{it}, μ^b_{it}, μ^c_{it}, μ^d_{it}, μ^e_{it}, μ^f_{it}, and μ^g_{it} are the structural shocks associated with the respective equations.

We relied on Amisiano and Giannini (1997) for the identification of the scheme, whereby the $P\text{–}SVAR$ requires $2n^2 - n(n+1)/2$ or 70 restrictions on the Q and K matrices combined (where n is the number of variables). We imposed 48 maximum restrictions on the diagonal matrix K so that the Q matrix absorbed the remaining 28 restrictions for the system to be exactly identified. Given that our non-recursive $P\text{–}SVAR$ imposes 28 zero restrictions on Q, the system is over-identified and 21 free parameters in the Q matrix with the 7 in the K matrix were estimated, as in *equation (6.3.6).*

The $P\text{–}SVAR$ used in this study contains seven variables. ECR, LQTY and AQLTY are regulation surrogates, LI measures competition, IRS measures banks pricing of their core intermediation activities that are influenced by competition and regulation, while Zscore is a stability measure. The ordering of the variables and their position in the identification scheme is informed by the way the variables influence one another which is largely informed by theories and empirical models. One unique strength of $SVAR$ is that it also provides flexibility in cases without underlying theories Davoodi et al. (2013)[2]. The regulation surrogates are deemed to determine the level of competition and stability of the banking system. We also expect some sort of transmission from competition to stability via efficiency given the competition stability view. The non-zero coefficients in the matrices, ω_{mn} indicate that variable m affects variable n immediately. In other words, row 1, for instance, measures the effects of capital regulation on the system captured by equity capital ratio. The second and third rows represent liquid assets ratio and asset quality. Based on the Basel accords, these, besides capital regulations are the most important targets of regulations in banking. While the main transmissions are expected from these three variables as the main targets are competition and stability variables, ω_{21}, ω_{24} and ω_{32} indicates that the regulation variables respond to shocks within themselves and the system as well. Liquidity responds instantaneously to capital and to competition

[2]Part of the justification for its application in this study

measured by the Lerner index, while asset quality responds to liquid assets.

In the fourth and fifth equations are competition variable; Lerner index and IRS, we included an efficiency measure variable, efficiency score, in *equation 6* based on possible transmission in models from competition to efficiency then to stability. ω_{52}, ω_{53}, ω_{54}, ω_{56} and ω_{61} signify that IRS does respond to liquidity, asset quality, Lerner index and efficiency with efficiency responding instantaneously to capital. Finally, is stability measure, Zscore, sitting at equation 7 responding immediately to all the variables in the system, capital, liquidity, asset quality, competition and/or market power and efficiency measure, given ω_{71}, ω_{72}, ω_{73}, ω_{74}, ω_{75} and ω_{76} allowing simultaneous relations between stability, competition and regulations.

6.3.2 Variables Description and Data Source

Given the nature of the study area in terms of availability of data for banking study, our choice of bank regulatory parameter was instructed by some of the components of *CAMEL*[3] for which data are readily accessible. Regulatory capital (ECR), measured by the ratio of equity capital constitutes the main capital measurement used in banking regulation researches (Agoraki et al., 2011; Casu et al., 2015). The higher the capital adequacy ratio a bank has, the more its ability to compete favourably and the more the cushion it has for stability. As argued by Matutes and Vives (2000); Repullo (2004), capital requirements may prove inadequate as regulation for the banking sector, hence they advocated, among others, for the inclusion of deposit rates control. This conforms with the industrial organisation theory of banking that emphasised the equilibrium mechanism of the banking sectors market structure based on the deposits rates, loan rates and the liquidity reserves a bank is allowed to maintained. Liquidity ratio thus forms a formidable regulatory instruments used to curtail the activities of banks. This study uses the ratio of banks liquid assets to depreciation and short term funds to measure liquidity reserve. This provides an insight into the level of liquid assets a bank has at its disposal to discharge its routine obligations including funding loan assets (Moyo et al., 2014). Interest rate spread, used interchangeably as net interest margin is the difference between interests paid on bank assets such as loans and those paid on its liabilities such as deposits. It is often used in

[3] Capital adequacy, Asset quality, Management capability, Earnings, Liquidity, and Sensitivity to market risk (Akins et al., 2016)

banking literature as an indication of competitiveness of the sector as high interest rate spread denotes a highly concentrated banking sector (Demirguc-Kunt et al., 2003; Laeven & Majnoni, 2005).

Asset quality (AQLTY), measured as loan loss reserves to net loan assets is one of the targets of capital requirements (Moyo et al., 2014). The quality of the assets a bank possesses determines it stability as well as also impact on its competitive abilities. Bank asset quality is also a major determinant of the performance of its loan portfolio in terms of whether they are performing or non-performing. High incidence of non-performing loans (NPL) in turn impacts on stability. These ratios are expected to be positively related to the likelihood of a bank's survival.

The main competition measure used in this study is the Lerner index. While data for IRS were sourced directly from Bankscope, Lerner index is as estimated in Chapter 3 Subsection 3.3.1 following Kouki and Al-Nasser (2014). The Lerner index measures the market power of banks and it is an expression of the degree to which a bank is able to charge prices above its marginal cost. It ranges between $0 \leq li \leq 1$ with extreme indices at 0 and 1 signifying perfect competition and monopoly respectively while indices close to 0 represents monopolistic competition and those close to 1 denote oligopolistic competitive market. Given the indices estimated, the study expects the Lerner index to respond to regulation variables while it is also expected to reasonably cause efficiency and stability as well, based on empirical results of this study and theory.

Stability measure is estimated in Chapter 4 Subsection 4.3.2 based on Roy (1952)'s Zscore. It is a measurement of banks resilience to volatility or the distance to bankruptcy of a bank. High scores is an indication of a more stable bank with less likelihood of failure. Based on theory, the study expects stability to react to both competition and regulation. Specifically, a negative direct response is expected from competition while a positive reaction is expected from the regulatory variables. Furthermore, we generated the banking sectors efficiency scores using Stochastic frontier analysis by Coelli and Rao (1998); Coelli et al. (2005) as contained in Chapter 5 Subsection 5.3.1. Asset quality (AQLTY) and liquidity ratio (LQTY) were obtained from the BankScope database. Asset quality in this case is the ratio of loan loss provision to net loan while liquidity ratio is the ratio of liquid assets to short term liabilities. All data were collected over the period of 2006 to 2015. Each of the variables series is originally in ratio besides lerner index and Zscore that are computed and thus does not require logging.

Given the short-term period coverage of the data that is available for this study and for the purpose of the time series component of the P-SAVR analysis, we carried out frequencies conversion by converting the data for each variable per country on a quarterly basis using the quadratic moving average method tool available in Eviews and as used in the works of (Borys, Horváth, & Franta, 2009; Cheng, 2006; Kutu & Ngalawa, 2016; Ngalawa & Viegi, 2011). The choices of conversion method as argued is to achieve high frequency data while maintaining the original relational features of data.

Data Summary

We present the mean of the data for this study in Table 6.2 below for the periods under consideration. The table shows that commercial banks in the SSA region are well capitalised above the 8% minimum total capital ratio required by most financial regulations and the Basel Accord. On the average, the capital base was up to 18.10% in 2014 and a minimum average of 13.97% in 2011. Overall, the banking system in terms of the capital base can be adjudged to be robust. Closely tied to capital is the stability measure. We estimated the stability of the SSA commercial banks using the Zscore. The higher the level of score the better for a banking system in terms of stability. The average stability measure over the period hovers around 3% which by every standard signifies stable banking systems reflecting the level of capitalisation. The banking system is also faced with a monopolistic competitive market based on the Lerner index[4]. Another variable that has been used overtime to measure concentration/market power in banking study is interest rate spread. It is also a variable that reflects the potency to deposits and interest rate regimes in a banking system. The mechanism is that a monopoly bank is able to charge high lending rate while offering lower rates to their depositors. The case is different with a competitive market where pooling effects may make a bank to offer competitive rates for

[4]Having maximum average index in 2013 of 0.3521 and minimum in 2006 with 0.2557. A Lerner index is a measure of market power and the lower the index the more competitive the banking sectors will be. The reverse is the case where the index is high denoting high market power. Within the periods covered by this study the SSA commercial banking system can thus be concluded as competitive.

Table 6.2: **Summary Statistics**

				Mean				
year	N	Capital	Liquidity	Asset Quality	Lerner Index	IRS	Efficiency Score	Zscore
2006	190	0.1611557	0.470746	0.0139041	0.2556606	0.0701743	0.9632438	3.54343
2007	215	0.1441192	0.4439588	0.0153758	0.2693673	0.0702588	0.9611767	3.204579
2008	250	0.1568832	0.3978305	0.0160256	0.2884124	0.0752672	0.962111	3.380152
2009	275	0.150284	0.4420819	0.021476	0.293903	0.0758463	0.958097	3.29502
2010	296	0.1563837	0.4201964	0.0241048	0.2959335	0.0743105	0.9552949	3.273991
2011	320	0.139725	0.3727514	0.0221538	0.2821636	0.0725276	0.9558327	2.988873
2012	357	0.1542496	0.3743644	0.0210687	0.3237032	0.0736195	0.9566049	3.235099
2013	392	0.170136	0.4193003	0.0221185	0.3520863	0.0722735	0.9559925	3.403835
2014	430	0.1810446	0.3973395	0.0226412	0.3318136	0.0916671	0.9549598	3.624344
2015	440	0.1704147	0.3809	0.0260906	0.3243521	0.0804629	0.954971	3.484

Author's estimation, 2017, based on data collected.

deposits and lower lending rates in order to attract customers. Apparently, the interest rate spread as reported in the table above is relatively high overtime compared to other regions of the world and does not reflect the competitive nature of the banking system as reported by the Lerner index. Efficiency generated with SFA looks quite high and close to 1 (the frontier). SFA allows the efficiency to be exogenously modelled to generate the frontier from which efficiency of each bank in the system is compared to produce efficiency score. The distance between the frontier and the individual bank score reflects the level of inefficiency. Liquidity assures depositors of banks' ability to honour their contracts. It is often one of the elements of the assets side of bank balance sheet that can trigger runs, no wonder it is now part of the cardinal points in pillar I of the new Basel Accord (Basel III). Banks that are able to manage their liquid assets to strike balance between profiting and honouring the short term obligations as they fall due are able to avoid insolvency problems. Table 6.2 shows the liquid assets of SSA commercial banks to range between 37% in 2011 and 47% in 2006. The level of liquidity a bank must hold will generally depends on the volume of obligation, but according to Basel III, a bank must have sufficient liquid assets available for one-month survival in a stress scenario case. Asset quality overtime ranges from 1.4% in 2006 to 2.6% in 2015. Banks' asset quality ratio is at the heart of the stability of the system since it measures the loan loss rate in the banking system. Higher ratio of loan loss portends danger to the stability of the banks and the system as a whole.

6.3.3 Panel Unit Root

Unit root deals with the stationarity of the data series used in the analysis, presented in Appendix B.1. According to Dendramis, Spungin, and Tzavalis (2014), one necessary precondition to implementing any VAR estimation is, all data series must be integrated of the same order but not cointegrated. Hence, this study follows Vonnák (2005), Ibrahim and Amin (2005), Uhlig (2005), Peersman and Smets (2005), Fève and Guay (2010), Elbourne (2008), Kutu and Ngalawa (2016) among others that used levels VAR. They argued that the estimation of VAR or SVAR when all series are at levels will prevent efficiency loss or loss of vital information about the data sets that are usually associated with a differenced SVARs and VARs. A further justification in Afandi (2005) who argued that this procedure also has an advantage of producing consistent parameter estimates irrespective of whether the time series are integrated or not, making it produce a more robust result than a cointegrated SVAR or VAR model. Moreover, Berkelmans (2005) is of the view that the inclusion of lagged lengths in the SVARs or VARs variables enables the residual to be stationary even with I(1).

6.4 Empirical Results

For the purpose of hindsight, we expect a causal relationship among competition, regulation and stability. Specifically, we expect an individual transmission from regulation to competition and regulation to stability. Since models have established the relationship between competition and stability, we assume this should result in a tripartite causality/relationship running from regulation to competition to stability. According to Casu et al. (2015) and Llewellyn (1999) the main reason for bank regulation is to foster competition and stability of the banking system. Competition, on the one hand, is to engender efficiency of the system which in turn also leads to stability; on the other hand, stability is needed to sustain confidence and reduce bank runs. For this pioneering study we have adopted a number of measures to proxy regulation, competition and stability. Furthermore, we fill the gaps identified in literature presented in Section 6.2 Table 6.1, given the various hypothesis stated and to be analysed going forward in this study.

6.4.1 Lag Selection

Lag selection is an important component of VAR estimation (Canova, 2007) because too many lags increase the error in the forecasts and as well waste degrees of freedom, while too few lags could leave out relevant information leaving the equations potentially misspecified with the likelihood to cause autocorrelation in the residuals (Stock & Watson, 2007). Besides experience, knowledge and theory that underscore the determination of the number of lags required, there are information criterion procedures that help to come up with the optimal number of lags to allow for adjustments in the model and the attainment of well-behaved residuals. Five commonly used information criterion are: Sequential Modified LR test, Final Prediction Error (FPE), Schwarz's Bayesian Information Criterion (SBIC), the Akaike's Information Criterion (AIC), and the Hannan and Quinn Information Criterion (HQIC). Given a transformed quarterly data series, we test for the optimal lag lengths using these different lag selection criteria. The results as shown in Appendix B.2 show that the standard FPE, AIC, SBIC and HQIC suggest an optimal 5-lag lengths while Sequential Modified LR test suggest an optimal 8-lag length for the P-SVAR. Since majority of the criteria opt for 5 maximum lag length, with the fact that all the criteria is efficient, and out of five criteria, four suggest 5-lag length as against one that suggests 8 maximum lag length. Therefore, we follow the majority to choose the more general model suggested by the FPE, AIC, SBIC and HQIC. The choice of the 5 lags by this study offers accurate and more robust dynamics without necessarily shortening the estimation sample too much, which would compromise the degrees of confidence. This lag length also allows for no serial correlation in the residuals (Kutu & Ngalawa, 2016).

6.4.2 Diagnostic Tests and other Econometric Issues

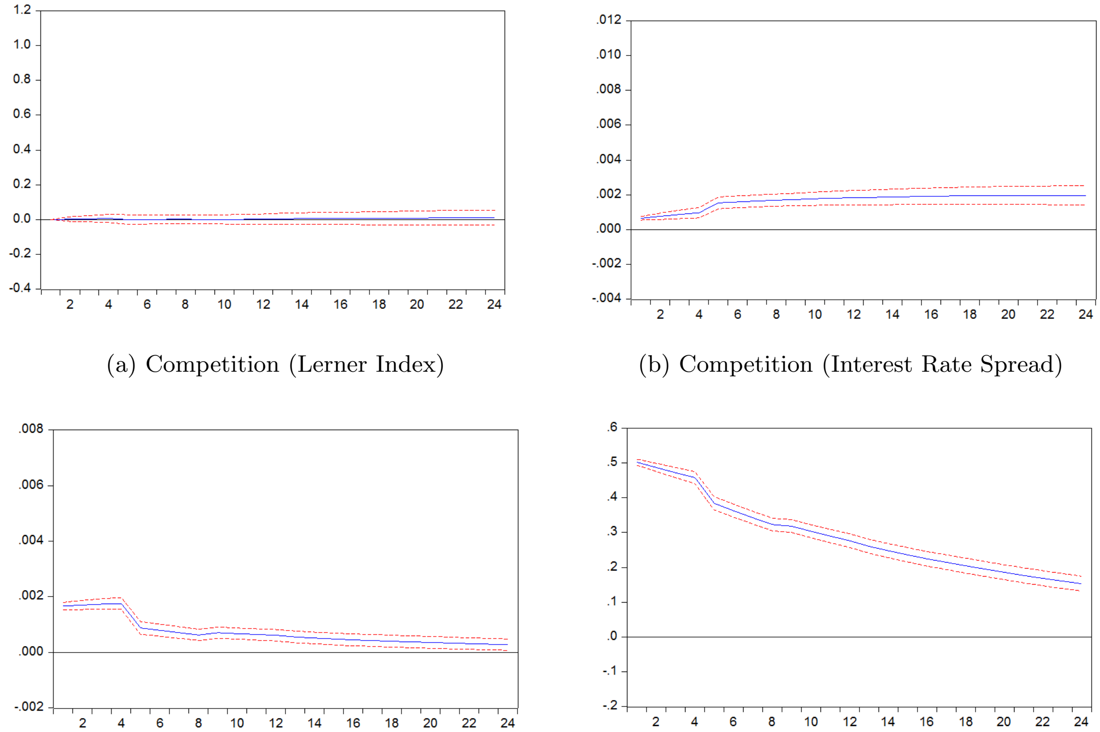
For robustness, we present various diagnostics test relevant for this study viz; serial correlation test in Appendix B.3, normality tests in Appendix B.4 and tests of heteroskedasticity in Appendix B.5 and B.6. As indicated in Appendix B.3, there is absence of serial correlation at lag 5 (Appendix B.2). This serves to also validate the optimal lag selection procedure carried out as a misspecified model on that basis would result in the problem of serial correlation. In addition, it is an indication of the absence of cross-sectional dependences across time. Even though P-SVAR largly accounts for cross-sectional interdependence across panels/economics units as it was built originally to recognise and account for transmissions and effects of one unit on another as global interdependence became apparent with globalisation (Canova & Ciccarelli, 2014). We do not envisage any break in the model series because although banking policies are homogeneous almost across region, they are undertaking at different points in time. Besides, the period considered for this study is not seriously affected, as only 2006 data came before the only known global financial crisis that could have impacted on the data. Moreover, the IPS unit root test carried out, shown Appendix B.1, is argued to account for issues of structural breaks (Glynn, Perera, & Verma, 2007).

6.4.3 Impulse Response Analysis

The impulse response function analysis was first introduced in VAR modelling by Sims (1980). It helps to highlight the state of an economic system in the future if there is a change in any of the components. Put differently, the impulse response provides an answer to the question of how the future of a system is affected with a change in one of its variables. It thus shows how much time to the future the variables react to each other. Given the assumption that innovation returns to zero in subsequent periods and that all other innovations are equal to zero, (Amisano & Giannini, 1997; Stock & Watson, 2001; Ziegel & Enders, 1995), it permits the tracing out of the time path response of current and future values of each variable to a one unit increase in the current value of one of the VAR innovations. It provides a quantitative measure of the reaction of each variable to shocks in the different equations of the system (Bernanke & Mihov, 1997). In this study, having achieved the stability of the VAR system as shown in Appendix B.7, we therefore examined the SSA banking system impulse response in phase based on responses to innovations in regulations, viz; capital, liquidity and asset quality, competition; looking at lerner index measure of competition and interest rate spread, efficiency and finally stability. The X-axis of the impulse response graphs denotes the periods covered in the analysis which are a quarterly basis.

6.4.4 Response to Capital Regulation Innovation

Figure 6.2 shows the impulse responses of competition, efficiency and stability to one standard deviation capital regulation innovation over the next twenty four quarters. As shown in Figure 6.2*(a)*, capital regulation is positive but insignificant to explain competition in the banking sector of the SSA region. One standard deviation shock in capital causes a flattened competition, as measured by the Lerner index, with competition rising slightly above zero in periods between period two and period four and from period twelve to the end. This insignificant short run relationship, notwithstanding, the behaviour demonstrates the ability of capital regulation to cumulatively increase the banking system's competition on a long term basis. The impact of capital regulation on competition becomes even more glaring in Figure 6.2*(b)*. A large interest rate spread (lending rates - minus deposit rates) signifies the presence of market power and/or concentration, while the reverse holds for a competitive banking system. This also gauges the efficacy of deposits and lending regulations. Capital regulation is significant and positively related to interest rate spread,



(a) Competition (Lerner Index)

(b) Competition (Interest Rate Spread)

(c) Efficiency

(d) Stability

Figure 6.2: **Impulse Responses to Capital Regulation**

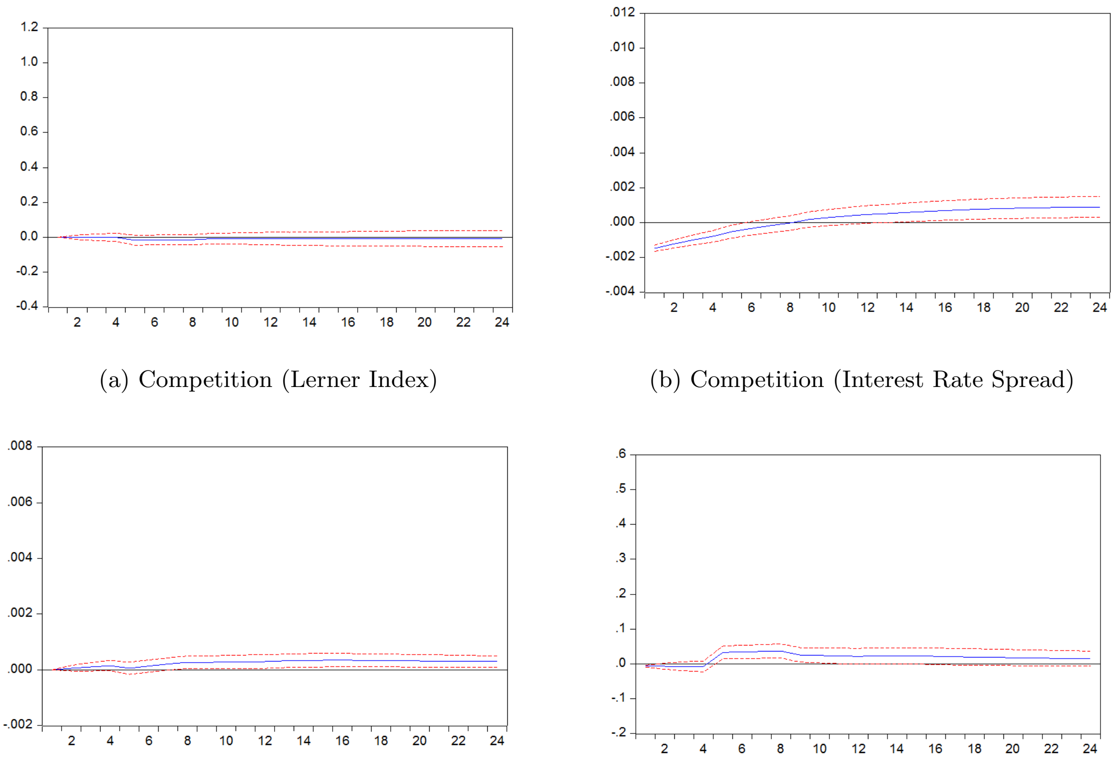
Author's Estimation, 2017

showing that interest rate spread rises with a shock in capital regulation. This is consistent with the study of Hussain and Hassan (2012) who found a positive and significant relation between capital and concentration measures. A standard deviation shock in capital regulation shows a steep rise from period three to period five and continued steady up until period eighteen and flattened thereafter. This suggests that market power increases in response to capital regulation. Likewise, bank efficiency response to capital shock is significant and positive but with a declining trend over the periods. In Figure 6.2*(c)*, efficiency increases steady from period one to period four and declines suddenly with a steep slope up to period eight and then steady decline in the rest of the periods. The implication of this is that the level of capital of a bank determines the relative efficiency that the bank can attain and that bank capital have a direct and short term positive relationship with commercial banks efficiency in the SSA region. As indicated in Figure 6.2*(d)*, in line with a priori, capital regulation has direct bearing on the stability of banks. Capital is positive and strongly significant to explain its relationship with bank stability in the SSA banking sector. This is consistent with the results of Moyo et al. (2014) and Agoraki et al. (2011). Moyo et al. (2014) found positive and strong relationship between capital and stability pre and post reforms in SSA countries. This result does not fully support the findings of Fu et al. (2014) who found positive but insignificant relationship between the two phenomena. In terms of transmission mechanism, we found a rather declining response of stability to an innovation in capital regulation.

The capital and stability relationship confirms our expectation of an alternative hypothesis that capital regulation is able to have direct impact on stability and is consistent with literature on stability which posits that the very essence of regulation in banks is engendering the stability of the sector (Llewellyn, 1999, among others). This also affirms our result of the impact of capital on stability in Chapter 4 subsection 4.4.3 where capital is positively significant to explain stability with economic impact of potential 40% increase in stability with one standard deviation increase in capital. From the result in Figure 6.2*(d)*, stability will decline over the period with any decrease in the subsisting capital base of the commercial banks in the SSA region. Every time capital decreases, it has consequences on the stability of the banking system. There is a sharp decrease in stability if capital falls from the first period to the ninth and continues to fall steadily over the periods to the next twenty fourth period. The more reason why Bolt and Tieman (2004) may have advocated for more stringent minimum capital requirements. This again reiterates the importance of capital regulation in ensuring the stability of the banking sector.

6.4.5 Response to Liquidity Regulation Innovation

This section considers the responses of competition, efficiency and stability to a standard deviation liquidity regulation shock. Figure 6.3*(a)* shows similar response of competition as measured by the Lerner index to capital regulatory shock in Figure 6.2*(a)*, but this time a negative relationship. Against expectation, we again found that competition does not significantly respond to shock in bank liquidity. From the fourth quarter, competition falls below zero and remains flattened and negative thereafter. A standard deviation shock to



(a) Competition (Lerner Index) (b) Competition (Interest Rate Spread)

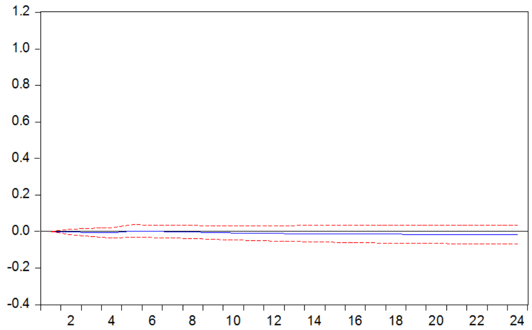
(c) Efficiency (d) Stability

Figure 6.3: **Impulse Responses to Liquidity Regulation**
Author's Estimation, 2017

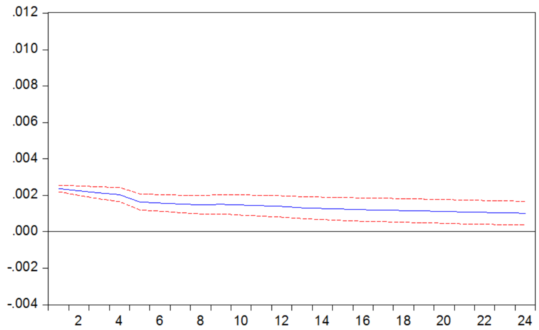
liquidity causes a steady increase response of interest rate which was initially negative up to period eight and become positive from then to the end of the periods, in Figure 6.3*(b)*. We found liquidity to be both negative and positively significant to explain competition in the banking sector of the SSA region banking sector bringing to bear the dynamism of the P-SVAR methodology. Hussain and Hassan (2012) had found a positive and significant relationship between liquidity of banks and concentration measure but with an economic impact that is not fundamentally different from zero. The implication of our result is that competition reduces with widening interest rate spread as the ability to charge higher lending rates and low deposit rate is synonymous with monopoly banks or banks with high market power. They are able to place restrictions on lending irrespective of the size of liquidity at their disposal in order to achieve monopoly rent. Figure 6.3*(c)* depicts the impulse response graph for liquidity and efficiency. Again, liquidity is positive and significant to explain the efficiency in the banking system of SSA. A standard deviation shock in liquidity causes a positive rise in efficiency with a steady decline between period four and period six. From period six, efficiency rises, flattened over the periods but declines steady towards the twenty fourth period. This negates the subsisting hypothesis being tested as result affirms a positive effects of liquidity on bank efficiency. Although issues of liquidity are quite tricky in the banking system, it however follows that adequate liquid assets will both support lending and profitable investments without compromising short term obligations, thus having far-reaching effects on profitability. In Figure 6.3*(d)*, we test the reaction of commercial banks' stability to bank liquidity regulation. Liquidity is significant and positively related to bank stability, affirming the results of Moyo et al. (2014). Stability does rise in response to a standard deviation shock in liquidity from the fourth quarter but flatly fluctuating over the rest of the period. This suggests that a decrease in banks' liquid assets may not significantly reduces bank stability for the next twenty four quarters. This may be plausible because our review in Chapter 2 revealed that most of the banking sectors in the SSA region are highly liquid. However, this must be approached with a great deal of caution given the implications of illiquidity to bank runs.

6.4.6 Response to Asset Quality Regulation Innovation

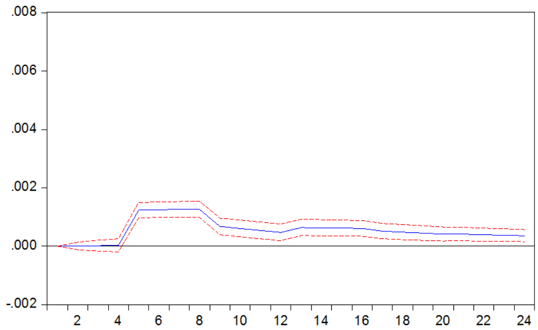
Figure 6.4 shows the response of competition, efficiency and stability to a standard deviation asset quality regulation shock. Specifically, Figure 6.4*(a)* denotes the reaction of competition based on the Lerner index to a shock in the quality of assets of banks. The response is insignificant with competition falling below zero from period eight and declining further henceforth. This signifies that competition is continually shrinking with a standard deviation asset quality shock. Unlike the response of interest rate spread to capital regulation and liquidity shocks, Figure 6.4*(b)* shows interest rate spread decreasing in response to one shock in the asset quality standard deviation. The fall in interest rate spread fluctuates over the periods with visible steps downwards in virtually each of the periods except within period two and period four with a longer steady decline. We further note a positive and significant relationship between interest rate spread and asset quality suggesting that a shock in the quality of asset of banks favours a more competitive bank-



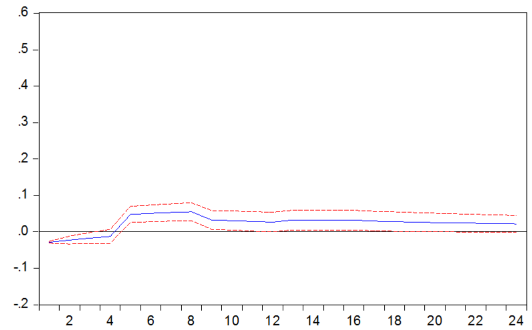
(a) Competition (Lerner Index)



(b) Competition (Interest Rate Spread)



(c) Efficiency



(d) Stability

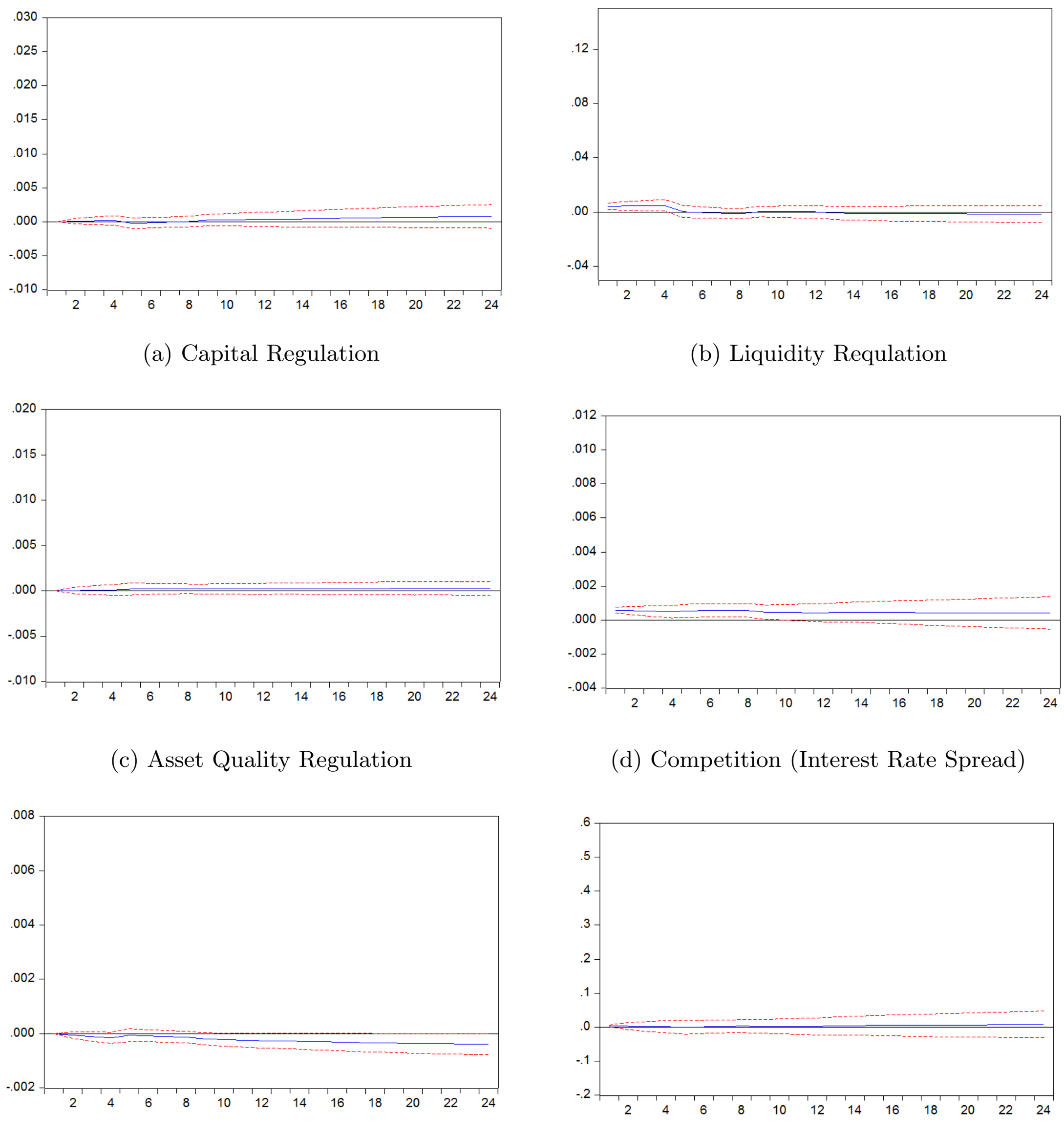
Figure 6.4: **Impulse Responses to Asset Quality Regulation**

Source: Author's Estimation, 2017

ing environment. The relationship between banks asset quality and competition and/or market power as explained by interest rate spread has received less attention in literature. This to the best of our knowledge explains why there is little or no theoretical or empirical literature in this area. Banks asset quality has however been included in the three cardinal targets of the Basel Accord post 2007/09 financial crisis given the perceived role it played in the events leading to the crisis. As for efficiency, Figure 6.4*(c)* shows a positive and significant relationship between banks asset quality and efficiency. As indicated in the graph, a standard deviation asset quality shock triggers quite an interesting pattern of reactions over the next twenty four periods. It begins with an insignificant response until the fourth period where it becomes significant and positive with a very sharp increase to become flat and steady between period five and period eight. By the ninth period, it declines steadily and rises again with twelfth and fourteenth quarters respectively only to decline from there but shows positive responses throughout the periods. This reiterates the fact that efficiency in banks is also directly impacted upon by asset quality regulation and with short term significant influence. We also found a similar response with respect to stability where a shock in asset quality standard deviation is at first insignificant, becomes significant and positive at some point in period four, then flattens over three to four quarters and with steep slop decline in the ninth period; it evens out from period sixteen and slowly falls till the end of the period in Figure 6.4. Our result negates the positive but insignificant relationship found by Moyo et al. (2014) between asset quality and the stability of banks. Asset quality is directly linked to banks' loan portfolio and this has implications for liquidity and the profitability of the banking system and constitute one of the biggest problematic components of banking with great implications for stability. This further clearly shows that the stability of the banking system can directly be influenced by the nature, extent and manner in which the regulation is made and managed.

6.4.7 Response to Competition (Lerner index) Innovation

Figures 6.5*(a)* - 6.5*(f)* presents the responses of capital, liquidity, asset quality, interest rate spread, efficiency and stability of banks to a standard deviation competition shock. Apparently, the results show that there appear to be no significant short term responses to innovations in competition for most of these variables. Capital in Figure 6.5*(a)* indicates that competition as measured by the Lerner index is positive but insignificant to explain capital regulation in the banking sector of the SSA. The graph shows capital regulation's response to a standard deviation shock in competition, rising above zero in period nine and gradually increasing thereon. The main emphasis in literature has been looking at the effects of bank capital in shaping the competitiveness of the banking system and not much if any has been said as to whether competition could impact on the level of capital. This result points to the likelihood of a long term impact in this direction. Figure 6.5*b* depicts the response of liquidity regulation to a standard deviation shock in competition. We found the response of liquidity to competition to be almost opposite of that of capital as it is both positive and negative but insignificant. Liquidity responds positively initially up to the fourth period and later falls gradually and flattens around zero till the thirteenth quarter and thereafter becomes negative. Freixas and Ma (2014) argued an inverse relationship between competition and liquidity. Boot and Ratnovski (2016) agreed with this in a general literature on moral hazard in a competitive banking environment. The authors admit that banks have incentives to divert liquidity for more profitable trading



(a) Capital Regulation

(b) Liquidity Requlation

(c) Asset Quality Regulation

(d) Competition (Interest Rate Spread)

(e) Efficiency

(f) Stability

Figure 6.5: **Impulse Responses to Competition Measured by Lerner Index**

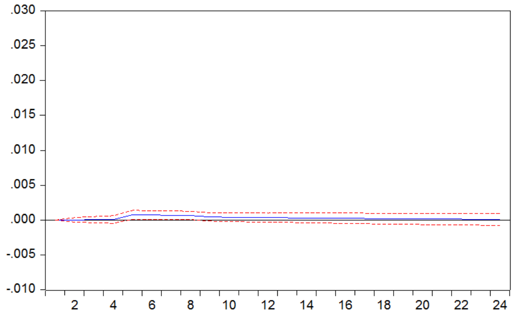
Source: Author's Estimation, 2017

ventures at the expense of meeting their obligations to their customers suggesting that competition should reduce liquidity. Asset quality in Figure 6.5*(c)* shows a positive but insignificant relationship with competition. In other words, asset quality is insignificant to explain competition in the short-term in the SSA banking system. The positive sign suggests a departure from general literature that has arugued in favour of adverse selection during competitive banking environment that would mean a negative relationship between competition and asset quality. Asset quality's response over most parts of the period is positive as it begins to rise slightly above zero from period three and remains flat at a steady state from period five to the end of the periods. Perhaps in the long run, there may be some significant evidence to consumate this positive relationship and that should be a plus to the banking system (Mahoney & Weyl, 2014). Looking at the response of interest rate spread to a standard deviation competition shock, Figure 6.5*(d)* shows a positive and significant response from the first up to the tenth period. Even though the response becomes insignificant from thereon it remains positive and with steady decline over the period.

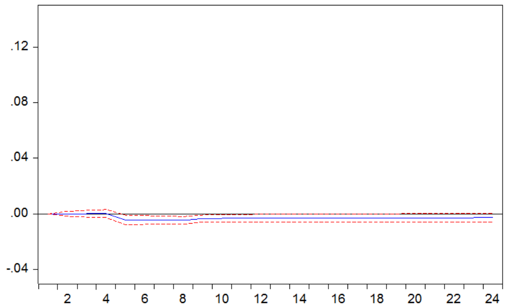
While the aim is not to consider intra competition measures response, interest rate spread also in this case showcase the impact of both lending and deposit rates regulation and thus show that competition in the short term has a considerable influence reducing the spread. This is consistent with the welfare theorem of banking competition. Competition in Figure 6.5*(e)* shows a negative but insignificant relationship with efficiency. This is partly consistent with the study of Fungáčová et al. (2013) who found competition to negatively Granger cause efficiency and Hussain and Hassan (2012) that found a significant negative relationship between competition and efficiency. In our results, efficiency reacts negatively in the short term against expectations to a standard deviation competition innovation. Although the response is not significant over the study period, based on our results in Chapter 5 we expect a positive relationship. Therefore, the need for cumulative long term effects of theis relationship becomes desirable to ascertain this result vis-a-vis our previous result. The reaction of stability to competition is shown in Figure 6.5*(f)*. Competition is posititive but insignificant to explain stability in the short term. In other words, stability does not react significantly even though positive over the periods and at some points not seemingly different from zero over the study period. Although our study had in the previous two chapters argued against and for competition and stability relationship as did other studies like (Amidu, 2013; Beck et al., 2013; Fu et al., 2014; Maghyereh & Awartani, 2016, among others) , we may be able to understand why this relationship is not significant in the short term. Given the economic impact of their long run relationship to be within -0.02% and 2.4% as reported in the previous chapter, an immediate response may well be insignificant. This might be a confirmation of some studies that have argued that competition does not on its own adversely impact the stability of the banking system (Vives, 2016a).

6.4.8 Response to Interest Rate Spread Innovation

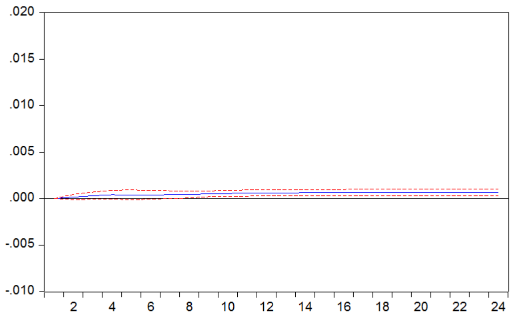
The response to one standard deviation interest rate spread shock by capital, liquidity, asset quality, competition (Lerner index), efficiency and stability is presented in Figure 6.6. Similar to the responses to shocks in competition as measured by the Lerner index above, a cursory look at the figures shows that these variables do not largely react significantly to



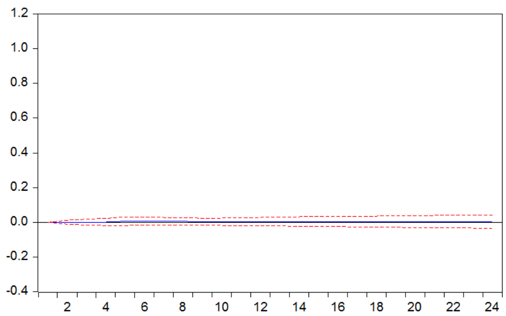
(a) Capital Regulation



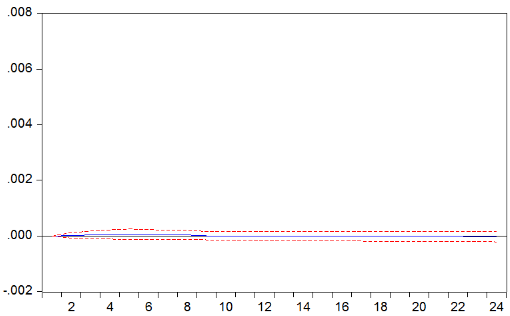
(b) Liquidity Requlation



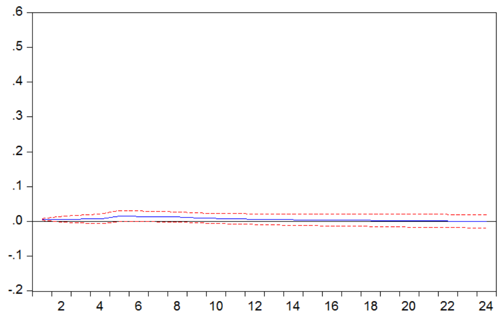
(c) Asset Quality Regulation



(d) Competition (Lerner index)



(e) Efficiency



(f) Stability

Figure 6.6: **Impulse Responses to Interest Rate Spread**

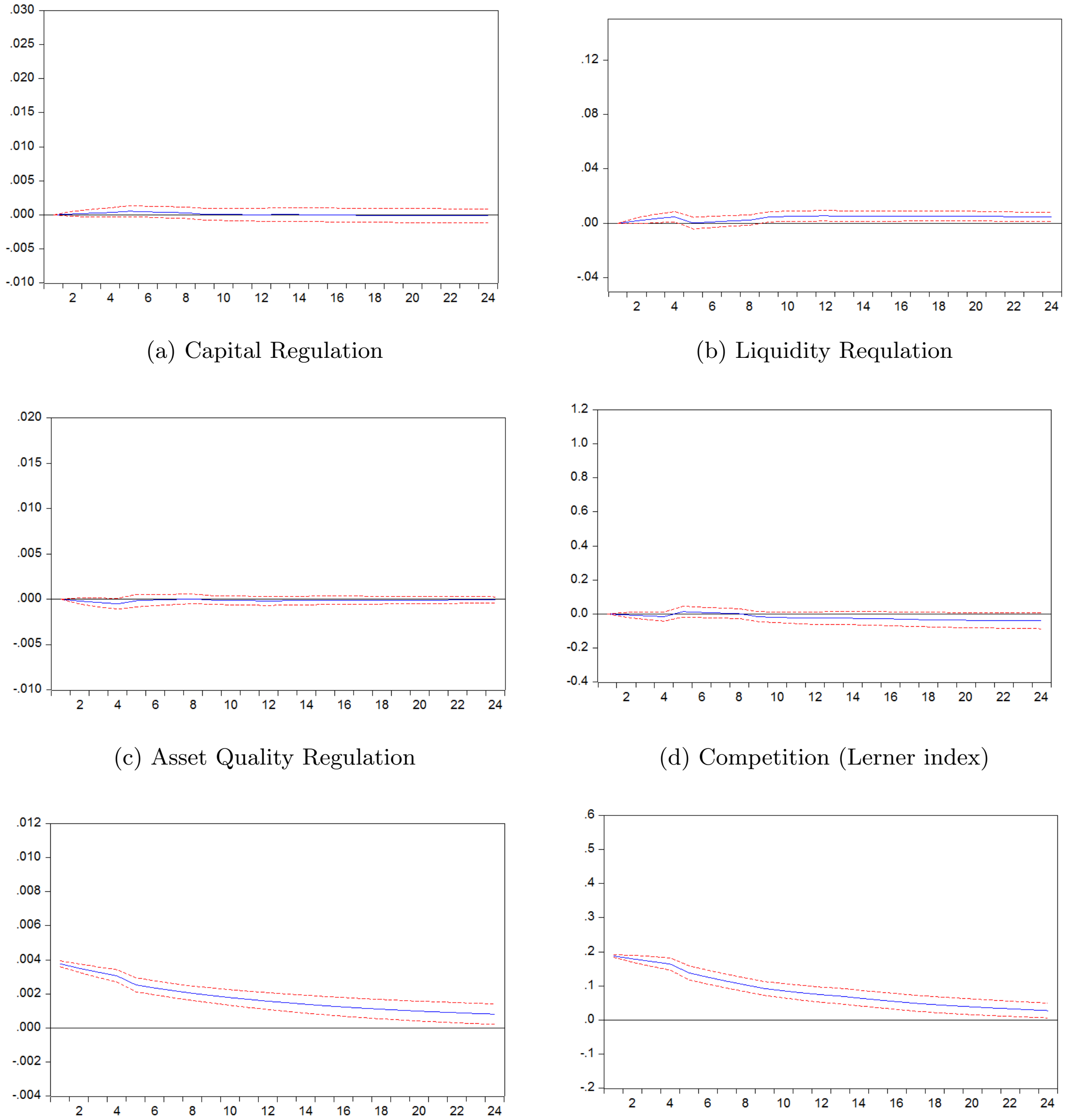
Source: Author's Estimation, 2017

competition as measured by interest rate spread in the short term except for asset quality in Figure 6.6*(c)*. Capital responds positive from period four but with a declining trend till the twenty second period when it becomes significantly not different from zero, as shown in Figure 6.6*(a)*. In Figure 6.6*(b)* liquidity exhibits a similar but opposite behaviour to that of capital, falling below zero from the third period. The negative response subsists but with a bit of fluctuations having recover from the decline in period eight and become flat until the twenty third period where it rise and tending towards zero. Asset quality in Figure 6.6*(c)* responds significantly with positive movement from seventh period to the end of the periods. Though the earlier periods are insignificant, the response is still positive. Implying that one standard deviation interest rate spread has a considerable impact on the nature of assets maintained by banks even in the short term. In the case of Lerner index in Figure 6.6*(d)*, an innovation in interest rate spread does not elicit any significant reaction from competition in the short term. Only between period four and period eight that its positively rises slightly above zero otherwise it response is not fundamentally different from zero over the periods. A similar scenario plays out for efficiency while stability in Figure 6.6*f* is slightly different in that its positive but insignificant and rises above zero for most part of the periods from the start to the eighteenth quarter. This is partly consistent with the result of Fu et al. (2014) who found positive significance relationship between the variables at 10%. A cumulative long run relationship may well be consistent with concentration and/or market power and stability.

6.4.9 Response to Efficiency Innovation

Figure 6.7 shows the various responses of the variables being considered to a standard deviation efficiency shock. Figure 6.7*(a)* represents the response of capital regulation to efficiency in the banking system. Efficiency is insignificantly related to capital as capital regulation does not significantly respond to a standard deviation shock in efficiency. Between the first and tenth periods, capital response is barely positive and above zero and thereafter declines and tends to fall below zero. In contrast, liquidity responds (Figure 6.7*(b)*) significantly and positively over substantial periods of the study. This implies that efficiency is positive and significant in explaining liquidity regulation in the banking system. Liquidity rises and falls to zero in period five and while the response is not significant in the fourth to the eighth periods, it reacts with a steady surge with significant positive rise towards the end of the twenty fourth period. This indicates that changes in efficiency have considerable short term effects on the liquidity of banks. It is logical that an efficient bank may be able to properly manage its liquid asset in the face of competition. In the case of asset quality, we found in Figure 6.7*(c)* that efficiency is not significantly related to the quality of assets of banks. It shows that asset quality regulation responds not significantly different from zero to a standard deviation efficiency shock for most parts of the periods. Notably, the response is negative up to the fifth period. This is inconsistent with Williams (2004) and Berger and Mester (1997) that argued a better asset management with a more efficient bank. Efficiency as shown in Figure 6.7*(d)* is negative but insignificantly related to competition as measured by the Lerner index. We found the response of competition to a standard deviation shock in efficiency to be initially negative up to period five but rises above zero to be positive between period five and period eight from where it gradually falls back to negative to the end of the period. This result aligns with Fungáčová et al. (2013) who found evidence to show that competition does not increase overtime with improvement in banks' cost efficiency.

The case is however different with competition measured by interest rate spread. Figure 6.7*(e)* shows that efficiency is positive and strongly significant to explain interest rate spread as a measure of competition in the banking sector. We found a downward and gradual decline of interest rate spread in response to a standard deviation efficiency shock. This significant and positive relation means that competition increases with efficiency since reduction in net interest margin and/or interest rate spread denotes reduction in market power and increase in competition. This may also speak about changes in lending and deposit rates regulations reacting as efficiency of banks changes. The response steadily declines till period four where it experiences a sudden surge that results in a steep slope that becomes normal in period five and then the gradual decline continues. We found this result to be consistent with the recent findings of Apriadi et al. (2016) who showed evidence that efficiency negatively Granger cause banking concentration. This indicates a positive response of competition to an efficient banking system since reduction in concentration is competition. Figure 6.7*(f)* again establishes the existence of short term relationship between bank efficiency and bank stability. Stability responds positively and significantly to a standard deviation efficiency innovation. This is consistent with Apriadi et al. (2016) who found a positive relationship between efficiency and stability. The response as shown in the graph declines steadily overtime but positive and significant over the periods. Efficiency has been argued to influence the stability of banks in competition in efficiency and



(a) Capital Regulation

(b) Liquidity Requlation

(c) Asset Quality Regulation

(d) Competition (Lerner index)

(e) Competition (Interest Rate Spread)

(f) Stability

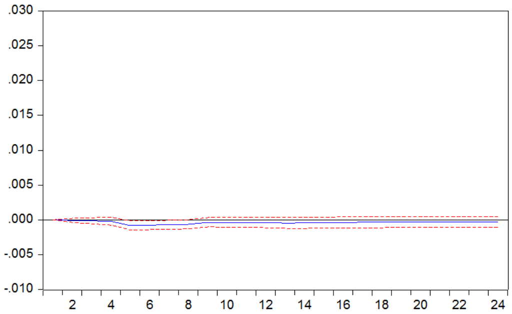
Figure 6.7: **Impulse Responses to Efficiency**

Source: Author's Estimation, 2017

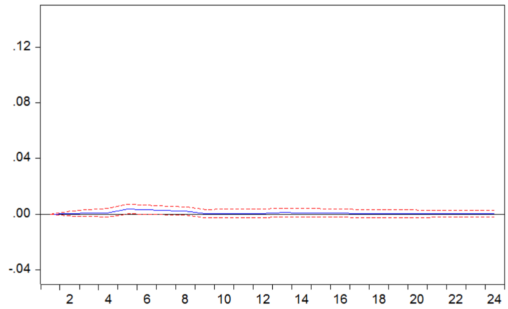
stability literature (Petersen & Rajan, 1995; Williams, 2004). This therefore provides evidence to underscore the importance of efficiency in banks in relation to stability especially in the short term which will be of tremendous implication for policy development in this area.

6.4.10 Response to Stability Innovation

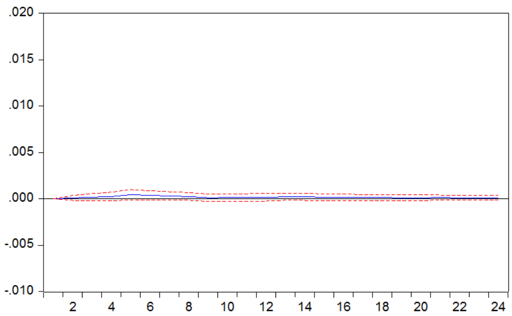
Figure 6.8*(a)* - Figure 6.8*(f)* display the reaction of capital, liquidity, asset quality, Lerner index, interest rate spread, and efficiency to a standard deviation stability shock. While capital respond negatively, liquidity and asset quality are not fundamentally different from



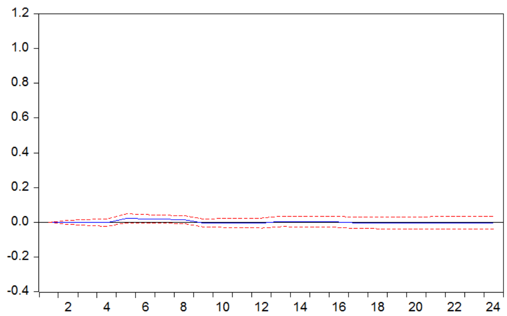
(a) Capital Regulation



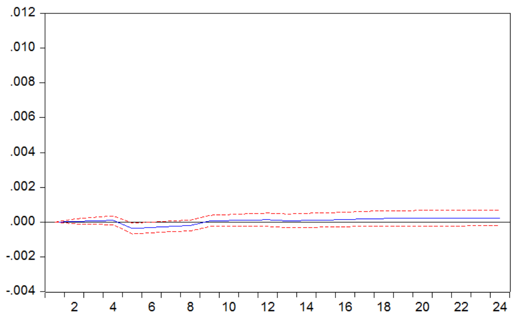
(b) Liquidity Requlation



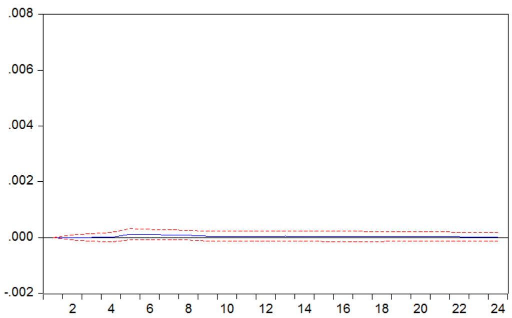
(c) Asset Quality Regulation



(d) Competition (Lerner index)



(e) Competition (Interest Rate Spread)



(f) Efficiency

Figure 6.8: **Impulse Responses to Stability**

Source: Author's Estimation, 2017

zero in their short term reaction to shock in stability over the periods. A similar scenario plays out for Lerner index and efficiency while interest rate spread was positive initially up to the third period and becomes negative and significant from then until the eighth period only to become positive again but insignificant thereafter. This behaviour implies that while stability reacts to most other variables in the system, non of the variables significantly react to stability in the short term. Meanwhile, Apriadi et al. (2016) found stability to positively Granger cause both efficiency and stability. We did not find consistency with their study.

Going forward, we analyse the decomposition of variances to gain a better insight on which of the variables impact more on each other in the system.

6.4.11 Variance Decomposition

Variance decomposition is an indication of the extent to which the forecast error variance of each variable can be explained by shocks that are exogenous to the remaining variables. According to Ziegel and Enders (1995), variance decomposition accounts for the information about the proportion of the movements in a sequence that is due to the shock in the variable itself and other shocks identified. This splits the variation in endogenous variable into the component shocks of the VAR. Table 6.3 below presents the variance decomposition for capital regulation as measured by equity capital ratio as an extraction from Appendix E.1. The table shows a marginal contribution of shocks from the other

Table 6.3: **Variance Decomposition of Capital Regulation**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest RS	Efficiency	Stability
4	0.041273	99.95617	0.011035	0.013340	0.003925	0.000668	0.011578	0.003279
8	0.053275	99.16903	0.430126	0.216725	0.004594	0.070758	0.032001	0.076763
12	0.060292	99.10694	0.426108	0.281371	0.014323	0.072222	0.025226	0.073811
16	0.064742	99.03454	0.424141	0.335604	0.031883	0.071085	0.021982	0.080766
20	0.067689	98.97586	0.414251	0.373998	0.063872	0.068627	0.020752	0.082637
24	0.069682	98.91596	0.404575	0.399443	0.107962	0.066131	0.020972	0.084960

Author's Estimation, 2017, based on data collected

variables in the system to variations in bank capital. Specifically, none of the variables confer significantly to shocks in capital as they each do not contribute up to 1% of the variations. The contribution of bank stability to capital by the fourth period is very small at about 0.0032% though increasing, such that by the eight period it becomes 0.077%, dropping in the twelfth period to 0.074%, picking up in the sixteenth period to 0.081%, twentieth period, 0.083% and finally in the twenty fourth period, 0.085%. This situation is not fundamentally different from efficiency contributing only about 0.012%, 0.032%, 0.025%, 0.022%, 0.021% and 0.021% at the end of the fourth, eighth, twelfth, sixteenth, twentieth and twenty fourth periods respectively to variations in the capital of the banks. Competition based on Lerner index shows that it does not contribute meaningfully to variation in capital. Between the end of the fourth and the sixteenth period, competition does not cumulatively confer up to 0.06% on the variation in capital. The contribution however improves from the end of the twentieth and twenty fourth period to 0.064% and 0.10% but still very marginal. It is then not surprising why the contribution of interest rate spread is not remarkably different from the aforementioned variables. It contributes near 0% at the end of the fourth period then jump to 0.071%, 0.072% and 0.071% in the eight, twelfth and sixteenth period respectively and declines thereafter to 0.069% and 0.066 in the twentieth and twenty fourth period. While we do not emphasise the behaviour of the intra-regulatory variables, we noted however that most of the impacts on the variation in capital over the periods emanate from both liquidity and asset quality especially from the end of the eighth period. The bar chart in Figure 6.9 provides a clearer view of the results

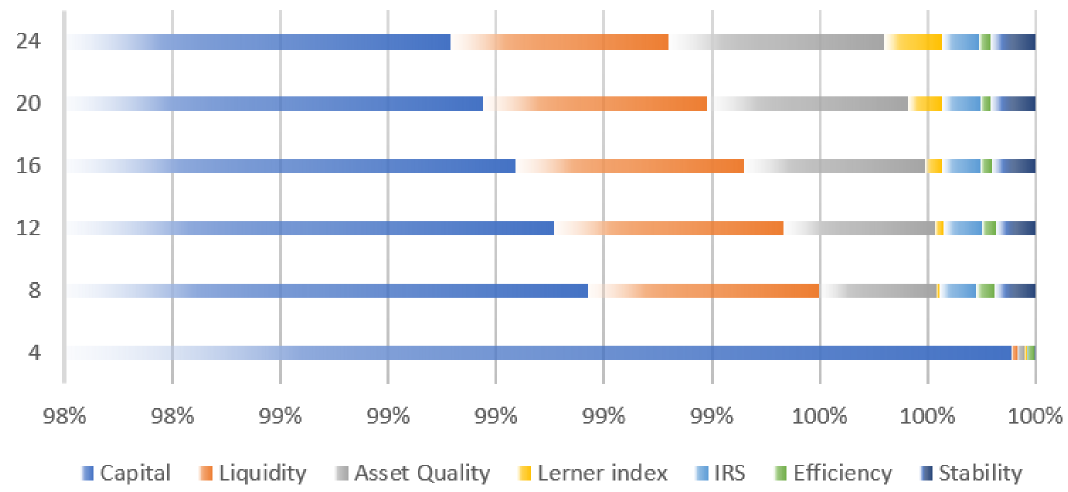


Figure 6.9: **Capital Variance Decomposition Bar Chart**

Source: Author's Estimation, 2017

in Table 6.3. On the aggregate, the variation in capital in period four as seen in the figure is based on factors peculiar to capital itself and exogenous to the activity within the system. Again we found that this trend changes drastically by the end of period eight where the systems contribution increases but in bulk by factors within the regulatory variables; liquidity and asset quality and not due to either competition or stability. This explains why capital hardly responds significantly to any of those in the impulse response function.

In Table 6.4 below we present the various contributions of each innovations to bank liquidity changes. Besides capital which is also a regulatory variable that contributes about 6.724% as at period twenty, efficiency, interest rate spread and Lerner index in that order

Table 6.4: **Variance Decomposition of Liquidity Regulation**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest RS	Efficiency	Stability
4	0.220739	4.298169	95.40601	0.034615	0.177139	0.000169	0.079264	0.004635
8	0.252493	5.416644	94.06321	0.118169	0.139250	0.124635	0.076347	0.061743
12	0.269753	5.982561	93.27819	0.184600	0.122418	0.162385	0.213931	0.055914
16	0.278231	6.419105	92.58710	0.267817	0.119660	0.202303	0.345773	0.058245
20	0.282796	6.724136	92.05322	0.328430	0.122149	0.237874	0.477049	0.057138
24	0.285319	6.939906	91.64249	0.375952	0.131664	0.269872	0.583368	0.056744

Author's Estimation, 2017, based on data collected.

contributes 0.583%, 0.270% and 0.132% to changes in the level of bank liquidity. Interest rate spread contributes least at the end of the fourth period near 0%, followed by stability at 0.005%, efficiency at 0.07% and then Lerner index at 0.177% apart from asset quality

Figure 6.10: **Liquidity Variance Decomposition Bar Chart**

Source: Author's Estimation, 2017

that is a regulatory variable at 0.035%. There is thus an indication that capital has direct effects on liquidity as well as competition, efficiency and stability without necessarily passing through each other. It is plausible to conclude that liquidity is responsive to every other variable in the system especially from the end of the fourth period for competition, efficiency and stability. As has been noted, the response of liquidity to interest rate spread meant response regulations to changes in both deposits and lending rates reflecting here in terms of their differences. Figure 6.10 above clearly displays the impact of the shocks that the variables in the system have on the changes in liquidity. Given liquidity as the reference point, the figure shows quite clearly that the bulk of the impact comes from capital changes. Beside capital, every other variables put together does not seem to make any meaningful impact on the variation in liquidity in the quarters considered as extracted from Appendix E.2.

Further on regulatory variables, the variations in asset quality as explained by the impact of shocks in other variables in the system is represented in Table 6.5 (Appendix E.3 for the comprehensive result). As stated earlier, our focus is not particularly on the impacts amidst regulatory variables, nevertheless, the previous two results have shown that the major changes in regulatory variables are as a result of shocks within them rather than due to those of competition, efficiency and stability. The case with asset quality is however different as both capital and liquidity contribute quite marginally to the its variation as does other variable in the system suggesting that factors that cause fluctuations/changes in asset quality are exogenously determined and not due to any of those in the system. To be specific, Table 6.5 shows the contribution of stability to variation in banks asset

Table 6.5: **Variance Decomposition of Asset Quality Regulation**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest RS	Efficiency	Stability
4	0.034598	0.001160	0.092124	99.83690	0.001413	0.024046	0.036280	0.008078
8	0.036607	0.038673	0.093061	99.70494	0.015407	0.069718	0.035079	0.043121
12	0.037967	0.066535	0.116171	99.55242	0.026638	0.154244	0.038967	0.045025
16	0.038403	0.108517	0.132513	99.36311	0.043157	0.255958	0.042996	0.053751
20	0.038611	0.150214	0.147101	99.17530	0.061239	0.363616	0.045544	0.056987
24	0.038713	0.191046	0.158369	98.99229	0.080954	0.469848	0.047326	0.060162

Source: Author's Estimation, 2017, based on data collected.

quality to be 0.008%, 0.043%, 0.045%, 0.054%, 0.057% and 0.060% at the end of periods four, eight, twelve, sixteen, twenty and twenty four respectively. Even though the impact increases overtime across the periods, the increase shows an insignificant influence. The impact is even less prior to the end of twentieth period with the Lerner index having 0.001%, 0.015%, 0.027%, 0.043%, 0.061% and 0.081% for the end of period four through to period twenty four in that order respectively. This is also the same with interest rate spread and efficiency whose impact ranges from 0.024% to 0.047% over the periods. These various impacts are depicted in the component bar chart in Figure 6.11 below. It is obvious from this figure that none of the variables have any significant contribution to the changes in the banks' asset quality.

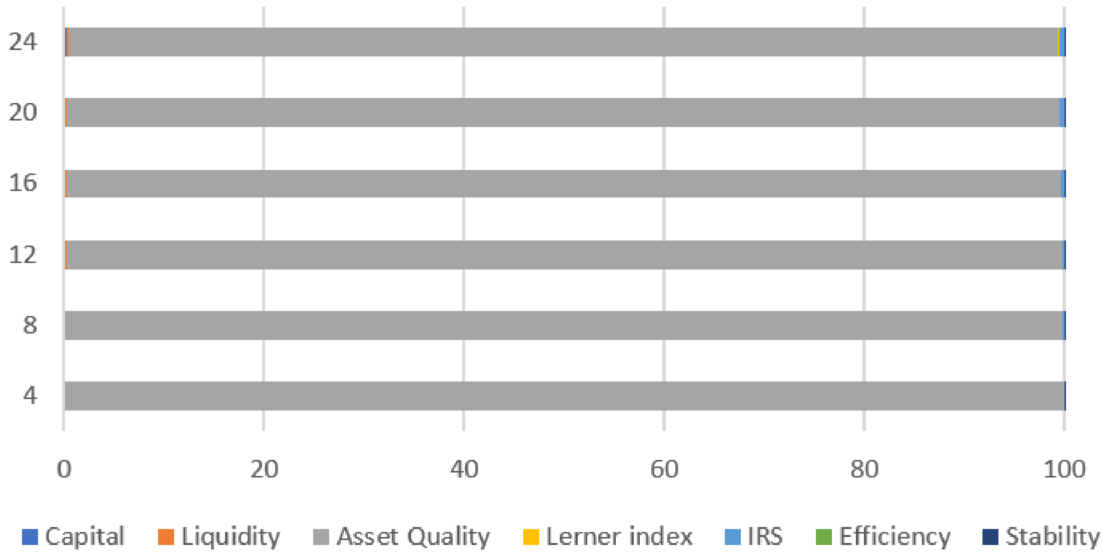


Figure 6.11: **Asset Quality Variance Decomposition Bar Chart**

Source: Author's Estimation, 2017

The dominance of asset quality component of the bar charts supports our conclusion that variations in asset quality in the banks is predominantly due to exogenous factors and not by variables in the VAR system.

Looking at the variance decomposition of Lerner index in Table 6.6 (details in Appendix E.4 we found that the changes in bank competition as measured by Lerner index are not significantly explained in the short term by shocks in either capital, liquidity, assets quality, interest rate spread, efficiency or stability. Interest rate spread least impact on changes in Lerner index with 0.000%, 0.005%, 0.004%, 0.005%, 0.005% and 0.005% at the

Table 6.6: **Variance Decomposition of Lerner Index (Competition)**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest RS	Efficiency	Stability
4	1.610183	0.002707	$2.65E-05$	0.003217	99.97894	0.000116	0.014659	0.000332
8	1.899298	0.002223	0.027932	0.002666	99.90336	0.004749	0.018944	0.040122
12	2.245922	0.001708	0.024281	0.007683	99.88202	0.004216	0.049645	0.030450
16	2.501632	0.003952	0.024813	0.016500	99.84187	0.004863	0.082653	0.025348
20	2.738224	0.006630	0.024326	0.025898	99.78446	0.004915	0.131535	0.022237
24	2.945663	0.011149	0.024592	0.035679	99.72121	0.005103	0.182505	0.019759

Author's Estimation, 2017, based on data collected.

end of the fourth to the end of the twenty fourth period. It is important to state that both interest rate spread and Lerner index are for the purpose of this study measuring competition, except that interest rate spread also reflects the effectiveness of deposits and lending rates regulations. This is followed by capital with the impact of 0.003%, 0.002%, 0.002%, 0.004%, 0.007% and 0.011%; asset quality with 0.003%, 0.003%, 0.007%, 0.017%, 0.026% and 0.036%. Then next to this in impact is stability having 0.000%, 0.040%, 0.030%, 0.025%, 0.022% and 0.020%; then 0.000%, 0.028%, 0.024%, 0.025%, 0.024% and 0.025%. Efficiency seems to contribute the most among the variables' shocks especially from the end of period twelve with 0.015%, 0.019%, 0.050, 0.083%, 0.13% and 0.183%.

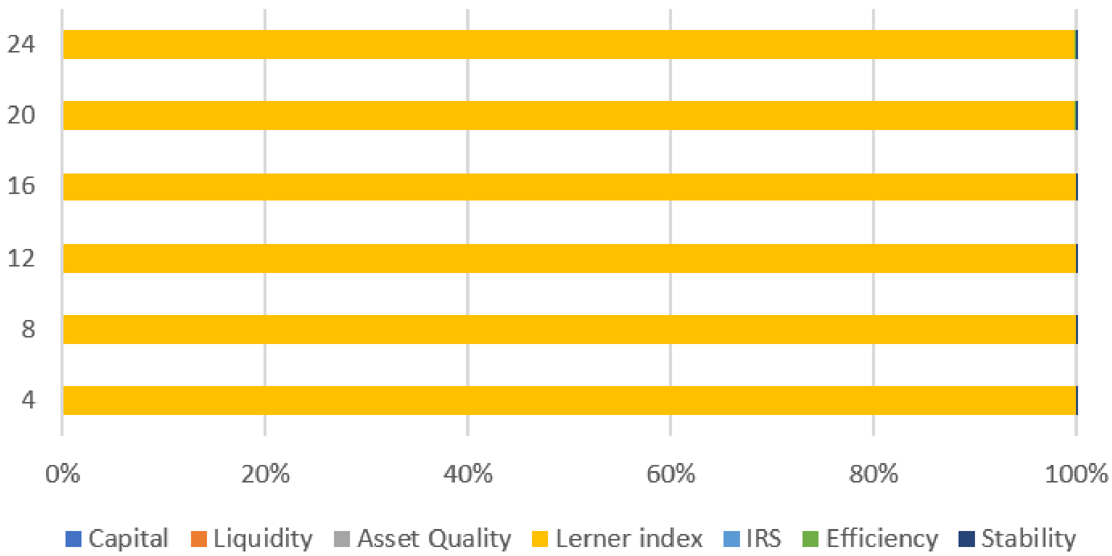


Figure 6.12: **Lerner Index Variance Decomposition Bar Chart**

Source: Author's Estimation, 2017

In the component bar chart in Figure 6.12, it is apparent that these impacts are marginal and almost non-existent till the end of the sixteenth period. Only at the end of the twentieth and twenty fourth period that the impacts become visible but relatively small and insignificant. Therefore, variations in bank competition in the short term are due to competition itself and factors outside the system.

Still on variables that measure competition, the extraction of the variance decomposition of interest rate spread from Appendix E.5 is shown in Table 6.7 below. The results show that besides stability, shocks in every other variables in the system directly impact on variations in interest rate spread. The highest impact is contributed by efficiency having about 12.5% at the end of the fourth period but with impact declining thereafter to 10.6%

Table 6.7: **Variance Decomposition of Interest Rate Spread (Competition)**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest RS	Efficiency	Stability
4	0.019283	0.729236	1.425739	5.219649	0.310952	79.77632	12.53340	0.004705
8	0.025240	2.072900	0.896505	4.567905	0.375509	81.44026	10.59258	0.054340
12	0.029496	2.987995	0.711543	4.311312	0.366129	82.42924	9.148664	0.045114
16	0.032738	3.752955	0.715328	4.097874	0.375979	82.90277	8.113680	0.041415
20	0.035351	4.436092	0.812107	3.941449	0.380660	83.05167	7.328149	0.049869
24	0.037503	5.044259	0.940284	3.816619	0.389164	83.02032	6.729362	0.059990

Author's Estimation, 2017, based on data collected.

at the end of period eight, 9.15% at the end of period twelve, 8.11% at the end of period sixteen, 7.33% at the end of period twenty and 6.73% at the end of period twenty four. Following efficiency in impact of shocks on changes in interest rate spread is asset quality. It contributes in the region of 5.22%, 4.57%, 4.31%, 4.10%, 3.94% and 3.82% at the end of periods four, eight, twelve, sixteen, twenty, and twenty four respectively. We found that the nature of contribution is similar to that of efficiency as the impacts decline overtime during the periods. Shocks in capital also contribute significantly to changes in interest rate spread. Unlike efficiency and asset quality, the impact of capital increases overtime with 0.729%, 2.073%, 2.988%, 3.753%, 4.436% and 5.044% by the end of the fourth, eighth, twelfth, sixteenth, twentieth and twenty fourth periods. Liquidity contributes 1.426% in period four, 0.897% in period eight, 0.712% in period twelve, 0.715% in period sixteen, 0.812% in period twenty and 0.940% in period twenty four. Stability contributes the least with 0.005%, 0.054%, 0.045%, 0.041%, 0.050% and 0.060% by the end of periods four, eight, twelve, sixteen, twenty, and twenty four respectively.

Figure 6.13 graphically depicts this influence and unequivocally shows that efficiency has the highest impact followed by asset quality and then capital. In essence, shocks in each of the variables in the system apart from stability affect variations interest rate spread directly in the short term.

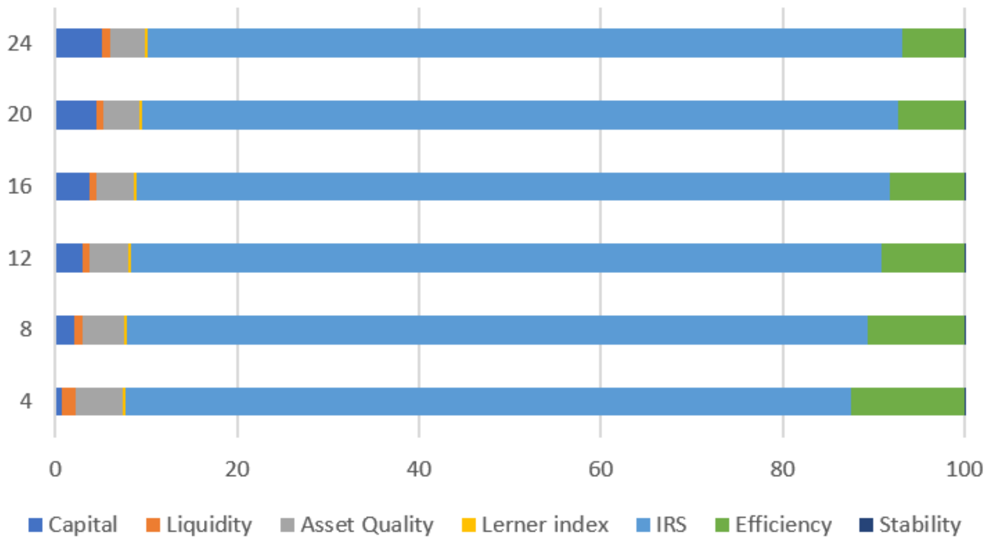


Figure 6.13: **Interest Rate Spread Variance Decomposition Bar Chart**

Source: Author's Estimation, 2017

The extent to which shocks in capital, liquidity, asset quality, Lerner index, interest rate spread and stability impact on changes in bank efficiency in the short term is presented in Table 6.8 (Rest of the table in Appendix E.6). The table reveals the shocks in capital, asset quality, Lerner index and liquidity to have the most direct impacts on the changes in the efficiency of banks. Notably, interest rate spread and stability least affect it and with their effect transmitted through the other variables. Innovation in capital has an average of 6.5% impact on the changes in efficiency over the periods. Specifically 7.69%, 6.55%, 6.33%, 6.24%, 6.19% and 6.17% by the end of periods four, eight, twelve, sixteen, twenty, and twenty four. The impact of shocks in asset quality is significant after the fourth period when it is near zero to 2.917%, 3.048%, 3.400%, 3.566% and 3.683% thereafter to the end of twenty fourth period. Again the impact of shocks in the Lerner index become obvious from the twelfth period with 0.116%,

Table 6.8: **Variance Decomposition of Efficiency**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest RS	Efficiency	Stability
4	0.012370	7.685921	0.022868	0.000645	0.026200	0.002886	92.26139	$9.14E-05$
8	0.014644	6.549961	0.079695	2.917262	0.036139	0.006040	90.39019	0.020715
12	0.015784	6.337248	0.196785	3.048439	0.116330	0.005291	90.27414	0.021762
16	0.016407	6.236244	0.349491	3.399150	0.232502	0.004959	89.75433	0.023326
20	0.016761	6.193195	0.488903	3.566373	0.391819	0.005096	89.33045	0.024169
24	0.016972	6.167736	0.605381	3.683419	0.583340	0.005464	88.92998	0.024684

Author's Estimation, 2017, based on data collected.

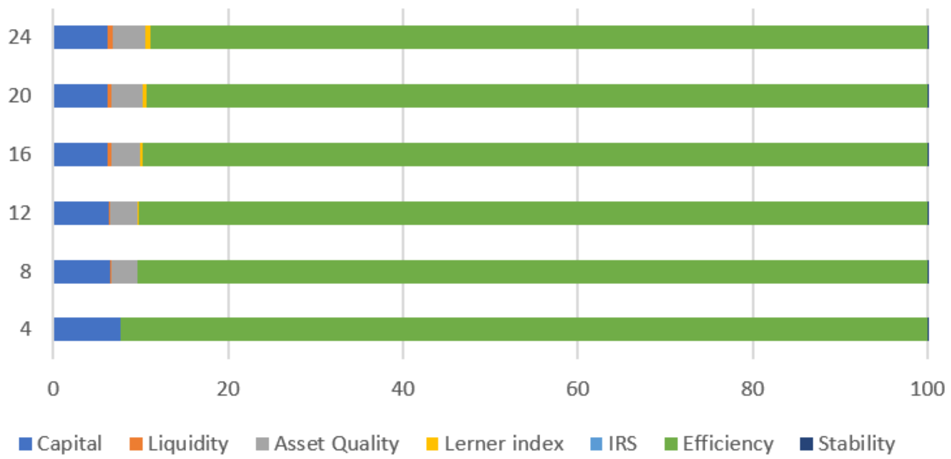


Figure 6.14: **Efficiency Variance Decomposition Bar Chart**

Source: Author's Estimation, 2017

0.233%, 0.392% and 0.583% by the end of period twenty four in that order. In like manner, shocks of liquidity to changes in efficiency become pronounced from the end of period twelve at 0.197%, 0.349%, 0.489% and 0.605% by the end of the sixteenth, twentieth and twenty fourth period respectively. The impact of interest rate spread is almost negligible with an average of 0.005% while stability average about 0.02% beyond the end of period four. The variations in bank efficiency are therefore explained mainly by the shocks in the VAR system rather than variables that are exogenous to it.

Finally, Table 6.9 below shows the variance decomposition of stability as extracted from Appendix E.7 explaining whether or not innovations in the variable in the system are the reasons for the variations in stability. We found from the table that shocks in capital substantially account for the variation in the stability of banks, followed by efficiency, asset

Table 6.9: **Variance Decomposition of Stability**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest RS	Efficiency	Stability
4	1.046061	84.34058	0.018223	0.163104	0.002261	0.014259	11.32617	4.135404
8	1.293435	85.14309	0.303692	0.746914	0.002325	0.055910	10.89870	2.849366
12	1.437686	86.06973	0.352647	0.775919	0.002776	0.057704	10.16140	2.579824
16	1.525033	86.62596	0.401873	0.868822	0.006062	0.054816	9.696503	2.345965
20	1.581024	87.02667	0.432162	0.928954	0.010347	0.052107	9.329244	2.220520
24	1.617507	87.31053	0.451480	0.970396	0.017677	0.049881	9.066356	2.133677

Author's Estimation, 2017, based on data collected.

quality and liquidity. It also becomes apparent that even though shocks in competition have some influence on stability, the impact seems indirect and transmitted through other variables such as efficiency. Capital accounts for an average of over 80% of the variation in stability over the periods, with 84.34%, 85.14%, 86.07%, 86.63%, 87.03% and 87.31% from the end of the fourth to the twenty fourth period in that order. Interestingly, the influence is progressive throughout the periods. The impact of shocks in efficiency on the changes in stability though tangible, declines across time with 11.33%, 10.90%, 10.16%, 9.70%, 9.33% and 9.07% respectively at the ends of the periods.

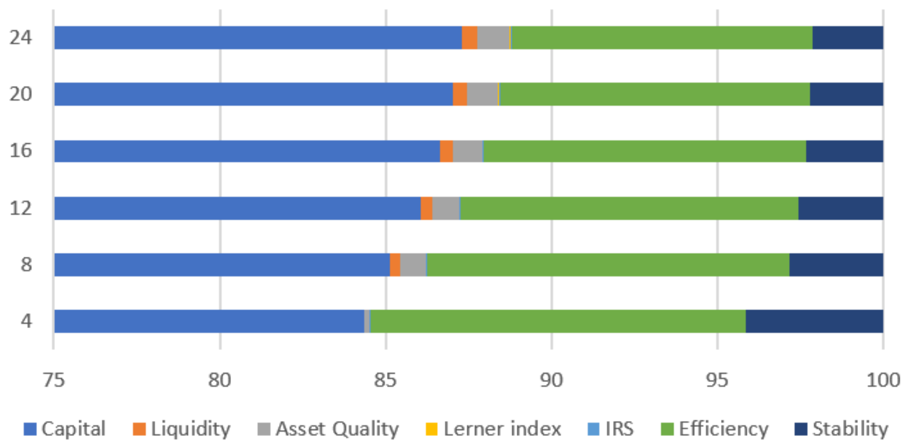


Figure 6.15: **Stability Variance Decomposition Bar Chart**

Source: Author's Estimation

Next in influence are shocks in asset quality accounting for 0.163%, 0.750%, 0.776%, 0.869%, 0.929% and 0.970% from the end of periods four, eight, twelve, sixteen, twenty, and twenty four respectively. These are followed by liquidity shocks that contribute about an average of 0.40% to changes in stability. Both competition measures contribute most insignificantly to changes in stability with Lerner index contributing the least at 0.002%, 0.002%, 0.003%, 0.0060%, 0.010% and 0.018% at the end of the fourth period to period twenty four; further details are contained in Appendix E.7. Figure 6.15 also provides a clearer picture of the results, showing vividly the impact of capital graduating per period followed by efficiency which even though declines along the progress remains a significant force in explaining the variations in stability. We find from the figure the exact influence of asset quality which becomes visible after the end of quarter and going forward with liquidity while the presence of Lerner index is noticeable faintly in the twentieth period and beyond. Hence, competition thus indirectly affects stability, the effects which may be transmitted through other variables in the system especially through efficiency.

6.4.12 Inference and Discussion of Findings

The cardinal objective of this study is to establish the possible transmission channels amongst competition, regulation and stability. Studies have attributed the essence of regulation in banking as primarily to stabilise the system and also to engender a competitive banking environment. Based on our results in section 5.4 and some empirical work in this area, we include bank efficiency as we found that competition has implications for the efficiency that transmitted to the stability of SSA commercial banking sector. Overall, we sought to establish the transmission channels among these variables for possible policy implication for a region that sought a policy to stimulate competition in its banking sectors. To do this, the study employed a P-SVAR model approach that is strong and best in analysing short run relationships among variables. Our results are set out in subsections 6.4.3 and 6.4.11 above providing far-reaching revelations.

Firstly, we found evidence to support the conclusion of Vives (2016b) that competition only provides an enabling environment to stability or otherwise in banks and is not the major cause of instability. Our results show that capital regulation among other regulatory variables is the singular shock that can influence the variation in the stability of banks. We found that over 80% of these changes are attributable to changes in capital regulation. In other words, capital can directly influence and in the short term whether or not the banking system will be stable. It suffices to say that capital regulation is the most important individual regulatory instrument for regulating the activities of the banking system and has constituted a major flashpoint for policy makers, regulators and practitioners alike. One reason is that a bank capital base provides the necessary cushion against eventualities and possible runs. Accordingly, this must be safeguarded at every point in time. The impulse response analysis results showed a declining response of stability to capital regulation shock in the SSA region's commercial banks over the near term. This suggests that reduction in the capital base of the banks will negatively impact on the stability of the banking sector of the region. This should be taken seriously by regulators to guard against eventualities that could jeopardise the current perceived stability in the system. The summary statistics in subsection 6.3.2 suggests the commercial banks in this region have been well-capitalised overtime; as such, efforts must be made to maintain the status quo.

Other regulatory variables considered that play a vital role in determining the stability of the commercial banks in the SSA region are liquidity and asset quality. Liquid assets determine how well banks are able to execute their day-to-day activities and also been able to finance their commitments to the customers as they fall due, which must also be balanced with the quest by the banks to make profit as theory suggests that banks face the moral hazard to over allocate their liquid asset to trading at the expense of honouring their obligation to their customers which in turn could result in instability Boot and Ratnovski (2016). There is thus no doubt as to why stability responds significantly to shocks in liquidity in Figure 6.3 and accounts for about an average of 1% changes in stability as suggested by the variance decomposition in stability in Table 6.9. This empirical evidence provides support for the impact of liquidity on the stability of banks, especially on the short term direct influence, which constitutes one of the contributions of this study. The positive response of stability to a standard deviation liquidity shock over the period of the study justifies the renewed regulatory efforts at optimising the liquid in order to safeguard the stability of the system. Although the response appeared to be flat for most of the periods, the negative response in the immediate requires urgent policy reactions. Still on regulatory variables, it has been noted that asset quality determines the quality of earning assets that a bank has including the collateral available against the asset side of the bank balance sheet. This will in most cases affect stability where the quality is poor and rightly so, we found evidence to support this. In Figure 6.4 stability responds significantly and positively to innovations in asset quality and this is substantiated in Table 6.9 with asset quality accounting for an average of about 1% in changes in stability. This implies that changes in asset quality in the next 24 quarters will have considerable impact on the stability of commercial banks in the SSA region. Hence, policies relating to this must be enhanced to take advantage and improve on this relationship.

Next is bank competition. Evidence from our results in 6.4.3 and 6.4.11 shows that competition, especially as measured by the Lerner index does not have significant short term influence on either capital, efficiency or stability. Thus, reinforced empirical findings that competition may just be a transmission channel through which these variables impact on each other. In particular, the results of the impulse response function in Figures 6.2*(a)*, 6.3*(a)*, 6.4*(a)* and 6.8*(d)* show that competition does not respond significantly to capital regulation, neither does it respond to stability in the short term as well. This is substantiated by the outcomes of the variance decomposition in Table 6.6 that shows that none of the aforementioned variables contributes up to 1% to changes in the Lerner index over the study period. Therefore, we conclude that there is no immediate or direct impact on bank competition from changes in any of the regulatory variables considered as well as stability, neither does competition contribute significantly to changes in those variables in the immediate as revealed by Figure 6.5 and Tables 6.3, 6.4, 6.5 and 6.9. While this does not void the impact of these variables on competition and otherwise, as found in our study in Chapter 4 on competition and stability and in Chapter 5 on competition, efficiency and stability and other previous studies, evidence suggests that competition effects on the system are not in the immediate and may take a longer periods to manifest, hence serving as just a conduit pipe.

Expectedly, efficiency in Figure 6.5*(e)* responds significantly negatively to competition by the Lerner index sometimes in the future, as supported by Table 6.8 on variance decomposition. This provides an affirmation of our findings in Chapter 5 as to the impact of competition on efficiency. The result suggests declining efficiency in the future with a standard deviation Lerner index innovation. As the Lerner index suggests, the banking system is competitive with monopolistic competition in as shown in Table 6.2; caution must be applied to avoid overcompetitive banking system that could erode the efficiency currently gained as excessive competition was blamed for the recent financial crisis (Fu et al., 2014). The Lerner index however does not respond significantly to shocks in efficiency as shown in Figure 6.7 ruling out the possibility of a reverse causality in the short term. The result however differs significantly when we consider competition measured by interest rate spread that reflects the presence of relative market power as shown in Table 6.2.

Results show that interest rate spread responds significantly positively to all the regulatory variables. This implies that capital, liquidity and asset quality have significant influence over competition, measured by interest rate spread. A shock in capital increases interest rate spread inferring less competitive banking environment. It is logical to think that banks faced with declining capital may hold back lending at smaller margin hence with consequent effects of larger banks dominating the assets side of the banks' balance sheet hence reducing competition and increasing market power in the banking markets. Similar conclusions apply to the other regulatory variables. We found marginal evidence to show that stability responds significantly positively at some points to interest rate spread. This seems to suggest stability at higher interest rate which is consistent with market power. This is consistent with literature that argued that a moderate market power is considered necessary for the stability of the banking system (Casu et al., 2015). However, what constitutes a moderate market has to be determined by the antitrust agencies and monitored to avoid deliberate exploitation of the banking public.

We found consistency with the efficiency structure hypothesis in the short as results show evidence of reverse causality between efficiency and interest rate spread. Efficiency significantly and positively influence interest rate spread and vice versa. This hypothesis argued that as competitive banks become more efficient, they gain market power which may eventually result in monopoly rent, giving banks the ability to charge high uncompetitive market prices. According to the Austrian school, the monopoly rent is only temporary as new bank entrants that are rent seeking will erode the abnormal profit and or market power such that the banking system becomes competitive again. The danger is that the presence of entry and exit cost in the banking system may invalidate the Austrian school arguments and unless policy makers and regulators alike monitor and moderate the market process, the monopoly rents may continue unabated. The evidence of reverse causality between efficiency and market power are affirmed by the variance decomposition of interest rate spread which suggests that the main variations in interest rate spread is directly caused by efficiency, asset quality, capital and liquidity as well as variations in stability and efficiency indirectly caused by interest rate spread. These scenarios confirm the apparent workings of the banking system and the fact that competition does not apply to the system as it does in other conventional industries because of certain fundamentals like information asymmetry, moral hazard and adverse selection that meant that a certain level of market power is desirable within the banking system. The evidence therefore should guide regulators in determining the balance between what is competitive banking and the level of market power desired at least over the next twenty four periods in the banking sectors of the SSA region.

Furthermore, bank efficiency seems central to the effectiveness of regulation, competition and stability in the banking system. Figure 6.7*(b)* reflect the influence of efficiency for bank liquidity. Likewise, Figures 6.6*(d)*, *(e)* and *(f)* for competition and stability respectively as buttressed by their variance decompositions in Tables 6.4, 6.6, 6.7, 6.8 and 6.9. Hence one can conclude that efficiency is the blood of the banking system that aids the proper workings of every other features of the banking business. The results therefore establish the impact of efficiency on stability and efficiency on market power; as to our knowledge, no short run analysis has been done in this respect. We also establish the short run influence of efficiency on competition, juxtaposing this result to existing long run analysis in literature and in Chapter 5 of this study, we can conclude that there is evidence to support a reverse causality between competition and efficiency of banks. This is plausible as a bank becomes more efficient, it has better capacity to compete and on the other hand, competitive banks increase efficiency in terms of turn around which will eventually accentuate to bank wellness and returns. Banking practitioners and policy makers must therefore take this aspect of banking seriously.

Last but one in this series, we discuss the result of stability and its implications. Firstly, the results provide evidence that stability is directly impacted by regulatory capital. In fact, the influence is strongly positive and significant and by the variance decomposition in Table 6.9, capital determines over 80% of changes in the stability of banks in the short term. This suggests that stability must be borne in mind each time issues bordering on regulation are considered. This is particularly important as the impulse response analysis in Figure 6.2*(d)* suggests a decline in the stability of commercial banks in the SSA region over the next 24 quarters with a standard deviation capital shock. Notwithstanding that the decline is still positive and far above zero point, it is a point for concern. Apart from capital, both liquidity and asset quality play significant roles in determining the stability of the banking system in the short term as shown in Figures 6.3*(d)* and 6.4*(d)*. This confirms what happens in practice where banks mostly fail for lack of liquidity and high NPLs. Although the results suggest this relationship may be positive and good for the banking sector over the next 24 quarters, efforts must made to tend the tides and ensure a more stable banking system. As has been discussed above, stability is impacted on indirectly in the short run by competition and /or market power, while directly influenced by efficiency. The results synced with our Chapter 5 that suggest that the impact of competition pass through efficiency to stability. Bank stability is as important to an economy as a heart to the body, as in the words of Vives (2016b), modern banking ceases to operate with a dead bank. This underscores the importance of stability in the banking system and the need to continually uphold the tenets of a sound banking through the policies.

Recapping our findings above, regulation, especially, capital regulation have direct effects on stability and a transmitting effect to stability via efficiency. Efficiency also has direct effects on stability. Competition has direct effects on efficiency suggesting its indirect influence stability through efficiency; however, it has no direct significant influence on stability in the short-term. Neither regulation, stability nor efficiency has short term effects on competition. There could be competition and presence of market power at the same time as suggested by a relatively high interest rates spread, that has reverse causality in the short-term with efficiency reaffirming the efficiency structure hypothesis. Interest rate spread also wields some direct influence on stability and this supports literature that advocates for market power for a stable banking system and of course the likelihood of trade-off between competition and stability. The implications of these; capital regulations must continue to be jealously guided as has been the case, focus on both liquidity and asset quality must be enhanced as results provided evidence to support their influence on competition, efficiency and stability. The mixture of competition and moderate market power must be ensured for an overall stability of the system. This mixture will avoid excessive competition and excessive usage of market power and so a perfect option will be to moderate the current monopolistic competitive banking system where the market power of each bank lies in their product differentials. In all ramification, beside the method used and the transmission mechanisms analysed, this study made specific significant contributions to literature by the hypotheses explored that were identified as gaps in literature as shown in Table 6.1.

6.5 Summary and Conclusion

We investigated the short term relationship among competition, regulation and stability of commercial banks in the SSA region using P-SVAR. The essence was to establish the possible transmission channels and/or mechanisms among the variables. We introduced efficiency as measured by SFA into the system to capture its role between competition and stability, while competition is estimated based on the Lerner index with Zscore for stability. Although theories and empirical literatures have been conflicting in conclusions on the relationship between competition and stability, there is a growing acceptance of the possibility of trade-off in competition stability relationship. There is also evidence that competition does not necessarily result in fragility in the banking system as some fundamental features of banks play an important role and competition may only aggravate the process. Yet there seems to be no headway as to how the interplays of these outcomes could be managed and/or moderated to get the best out of the relationship for the economic growth of the host economies.

In this study, we however carried out for the first a holistic transmission analysis among regulation, competition, efficiency and stability in the SSA commercial banking sectors. We found direct effects of regulation, viz; capital, liquidity and asset quality of bank efficiency and bank stability respectively in the short term. There is also evidence of short run direct effects of competition and/or market power on efficiency as well as reverse causality between market power and efficiency of banks. Our results do not suggest any short term relationship between the competition measure and any of the regulatory measures adopted in this study and stability as well since none of these respond significantly in the short run to shocks in their residuals. We therefore conclude that there are direct effects of regulation on stability as well as transmission from regulation through efficiency to stability. The results also suggest a transmission from competition through efficiency to stability, since efficiency impacts directly on stability and competition impacts directly on efficiency. The impulse response function and the variance decomposition results also provide insights into how these phenomenon could be managed over the next 24 quarters in order to optimise the outcome of their interactions. For instance, response of stability to capital regulation suggests that stability will decline overtime with one standard deviation capital innovation. This must be taken seriously.

As regulation, especially capital and efficiency have become the cardinal variables for short term moderation for bank stability in the banking system and especially in the SSA region's commercial banking system as revealed by this study results, practitioners and regulators alike must ensure regulatory capital is sustained at all times. Rather than fine tuning competition as the supposed cause of instability in the banking sectors, attention should be directed to managing other fundamentals like moral hazard, information asymmetry and adverse selection, among others, in order to complement the impact of regulation and competition in engendering efficiency and therefore stability.

Chapter 7

The Interplay of Competition Regulation and Stability

7.1 Introduction

Previous chapters have shown that competition in banking is complex. Taking into account its relationship with stability and regulation poses an even more greater challenge. In this section, the study explores the interplay among regulation, competition and stability in the SSA commercial banks. It is not clear in literature how competition, regulation and stability interrelate. Agoraki et al. (2011) found that the stabilising power of capital regulation diminishes when banks have sufficient market power to increase credit risk and are reversed for banks that possess moderate market power. This suggests that regulation alone may not be adequate to ensure bank stability, hence, a thorough investigation of the market power of banks is desirable. Structural Equation Modelling (SEM) provides an avenue to model the causality that exists among these variables.

The literature for this chapter is predicated on the previous reviews in chapters 3, 4, 5 and 6 of this study. However, a recap is attempted for the purpose of emphasis. Competition and stability have been argued to be the essence of regulations in the banking sector (Casu et al., 2015, among others). In other words, regulation causes competition and stability individually, hence suggestive of regulation and competition as well as regulation and stability relationship. Models on the relationship between competition and stability are inconclusive and present conflicting views that suggest that competition could be both good and bad for the banking system (Vives, 2016a). Put more succinctly, competition causes stability because of efficiency that is inherent in competition as argued by the microeconomics market structure theories (Boyd et al., 2009; Schaeck & Cihák, 2014, among others). On the other hand, competition has the ability to orchestrate a volatile banking environment that is able to trigger instability in the banking sector (Beck et al., 2013; Fu et al., 2014, among others). While these arguments still subsist, others have argued in favour of trade-off between competition and stability (Vives, 2016a, among others), hence the need for a balancing act in order to benefit from the good of competition while avoiding the down side.

More recent literature is now converging on the views that competition is rather not the cause of fragility in the banking system but that its presence especially when in excess aggravates the risk of instability (Vives, 2016a). This line of thought put forward the fundamentals such as moral hazard, adverse selection, information asymmetry, and switching costs, among others, as the reasons for risks in the banking sector which at the same time impede the workings of competition in the banking system as opposed to the conventional industrial organisation. Empirical literature as reviewed previously has used a number of methods to test this relationship but none have achieved a structural analysis where competition, regulation, and stability are investigated simultaneously, by not only answering the question why but also how the relationship exists.

Therefore, in addition to the P-SVAR transmission mechanism employed in Chapter 6 that investigated the contemporaneous relationships and/or responses of banking system variables considered, this study further contributes to literature by investigating a path and mediating model analysis of the structure of the banking system. Hence, the ability to capture the variables simultaneously to analyse both the direction of causality and the direct and the indirect relationship using SEM, thus filling the methodology gap in literature. This way the trio of competition, regulation and stability could be better managed in the banking system for optimal performance as proposed in the model in Subsection 7.3 given the methodology that follows.

7.2 Methodology

Following the outcome of short run estimation analysis in Chapter 6 that explains the bidirectional relationship between the variables considered in the system, the objective is to further investigate the relationship among competition, regulation and stability as well as consider the mediation roles of competition and efficiency in the structure using the SEM. SEM which dates back to the early 19th century and credited to Spearman (1904) who developed the common factor model for correlating between tests of mental ability. By 1930, a psychometric, Thurtson Louis, faulted the use of one common factor for the test of intelligence score and thus came up with a multiple common factor model. Then Jreskog (1969a, 1969b) extended the technique with the addition of confirmatory factor analysis including its estimation using maximum likelihood estimates (MLE). This development allows for hypothesis testing of the number of factors and their relationship with observed variables. The concurrent development of path analysis and systems of simultaneous equations in econometrics saw economists (Haavelmo, 1943; Koopmans, 1945, among others) work with the system including introducing a range of other estimation methods. The early 70s marked the merging of the two methods with unobserved variables included in the path models (Hauser & Goldberger, 1971) and the general model for including latent variables and for fitting systems of linear equations including fitting the models using MLE (Werts, Joreskog, & Linn, 1973) as well as works on the frameworks that generally combined the two methods (Keesling, 1973; Wiley, 1973). So much more has been done thereafter to advance the frontier of the method that includes identification evaluation and model fit test (Hu & Bentler, 1999; Marsh, Balla, & Hau, 1996, among others).

SEM therefore consists of a vast litany of models from the linear regression model to measurement models to simultaneous equations. It is thus a way of thinking, writing and estimation that is not constrained by a particular kind of model; a multivariate method that permits the system of equation estimation. In other words, it allows hypotheses testing about relationships among variables. Furthermore, SEM is also referred to as analysis of covariance structures that is able to fit models utilising the observed covariance and/or the mean. The power also lies in the ability to measure both direct and indirect causal effects among structure variables hence the mediation analysis. Moreover, it allows one to fit chains of conditional relationships via the path analysis.

Testing mediating effects according to Li (2011) has in literature been analysed using step-wise regression or SEM. A significant attenuation of independent-dependent relationship, following adjustment for the potential mediator, is the necessary condition for mediation. Although stepwise regression is easier to conduct than SEM analysis, it lacks the capability to control for measurement error and accordingly unable to take on the effects of multiple mediators that is applicable in this study. Thus, SEM is a utility model most effective in testing mediating effects once data requirements are met as it is able to simultaneously test all the relationship specified in this study model.

7.2.1 Model Specification

Based on underlying theories, this study follows Chingfu, Lee, and Lee (2009) and Ralph (1999) to fix a structural model of competition-efficiency, regulation and stability for commercial banks in the SSA region given the general recursive path diagram for observed variables as in Figure 7.1 below. The hypothesised a-priori expectation, as indicated in the structure is that, 1. Regulation is expected to directly cause competition, efficiency and stability and indirectly cause stability through competition and efficiency;

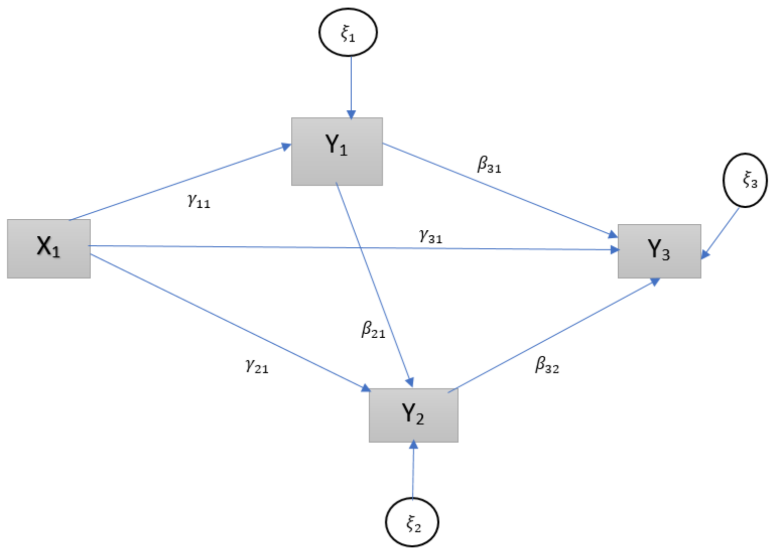


Figure 7.1: **Possible Recursive Path Model For CRS**
Author's Views Based on Theories

2. We also expect competition to have direct causal effects on stability and an indirect

effect through efficiency. For the purpose of this study, the observed regulatory variables considered are, capital, liquidity and asset quality. Based on theories, the unidirectional arrows in the path diagram above indicate structural influence from one variable to another and the arrows pointing to the variables from outside of the structure denote the disturbances which aggregate all unmeasured influences. Independent variables are influenced exclusively by factors outside of the model and are said to be exogenous, denoted as X_j, $j = 1, \cdots, NX$, and variables assumed to be influenced from inside of the model are known as endogenous, denoted as Y_j, $j = 1, \cdots, NY$. Hence, regulatory variable (ecr, lqty & aqlty) is the exogenous variable X_1 while competition (lerneri), Y_1, efficiency score (eff), Y_2, and stability in index (zscore), Y_3 are the endogenous variables.

Given that the path diagram represents a set of univariate regression equations, having specified the structural model variables, the structural coefficient equals the regression coefficient with β representing the structural effects of endogenous variables on other endogenous variables and γ the structural effects of exogenous variables on endogenous variables. Then the recursive model in Figure 7.1 can be expressed in the following three structural equations.

$$Y_1 = \alpha_1 + \gamma_{11} X_1 + \xi_1, \tag{7.2.1}$$

$$Y_2 = \alpha_2 + \beta_{21} Y_1 + \gamma_{21} X_1 + \xi_2, \tag{7.2.2}$$

$$Y_3 = \alpha_3 + \beta_{31} Y_1 + \beta_{32} Y_2 + \gamma_{31} X_1 + \xi_3, \tag{7.2.3}$$

Where α_i is the intercept associated with endogenous variables Y_i, β_i is the structural coefficient in the endogenous, Y_i regression on other endogenous, $Y_{i'}$, variables, γ_{ij} is the structural coefficient in endogenous Y_i regression on X_j exogenous variables, ξ_i is the error term , and i & j are endogenous and exogenous variables subscripts respectively.

Equations *7.2.1 - 7.2.3* are represented in the matrix equation below;

$$\begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 \\ \beta_{21} & 0 & 0 \\ \beta_{31} & \beta_{32} & 0 \end{bmatrix} \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \end{bmatrix} + \begin{bmatrix} \gamma_{11} \\ \gamma_{21} \\ \gamma_{31} \end{bmatrix} \begin{bmatrix} X_1 \end{bmatrix} + \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \end{bmatrix} \tag{7.2.4}$$

This produces the reduced general form of the SEM path analytical model in equation *2.5*.

$$Y = BY + \Gamma X + \alpha + \xi \tag{7.2.5}$$

Where Y represents $(NY \times 1)$ column vector of endogenous variables, lerneri, eff & zscore, X is a $(NX \times 1)$ column vector of exogenous variables, ecr, lqty & aqlty, $B = [\beta_{ij}]$ representing the matrix of coefficients of endogenous predicting other endogenous variables, $\Gamma = [\gamma_{ij}]$ is the coefficients of exogenous matrix to endogenous variable, $\alpha = [\alpha_i]$ is column vector of intercept of endogenous variables, ξ represents $(NY \times 1)$ column vector of error terms of endogenous variables, NY is the number of endogenous variable, Y, while NX is the number of exogenous variables.

The structure of this path analysis model is determined by the nonzero elements in the B & Γ coefficients matrices. Furthermore, let $\Phi = [\phi_{ij}] = Var(X)$ and $\Psi = [\psi_{ij}] = Var(\xi)$; all this determine the model in Figure 7.1, giving four matrices as;

$$B = \begin{bmatrix} 0 & 0 & 0 \\ \beta_{21} & 0 & 0 \\ \beta_{31} & \beta_{32} & 0 \end{bmatrix}, \quad \Gamma = \begin{bmatrix} \gamma_{11} \\ \gamma_{21} \\ \gamma_{31} \end{bmatrix}, \quad \Phi = \begin{bmatrix} \sigma^2_{X_1} \end{bmatrix}, \; and \;\; \Psi = \begin{bmatrix} \sigma^2_{\xi_1} & 0 & 0 \\ 0 & \sigma^2_{\xi_2} & 0 \\ 0 & 0 & \sigma^2_{\xi_3} \end{bmatrix}$$

Notably, one of the merits of path analysis over multiple regression analysis is the potential to estimate the mediating effects among any two variables. Therefore, the direct and indirect effects in the path diagram of competition, regulation and stability can be estimated. Recall from the foregoing that the coefficient of B matrix was employed to explain the direct effects (DE) of an endogenous on another endogenous observed variables that are associated with the two variables. Again, Γ matrix associated with the two variables defines the structural coefficient of DE of exogenous on endogenous observed variables. The indirect effect (IE) between two observed variables through particular mediating variables is then the product of the structural coefficients in the B and/or Γ matrices along the particular path from the exogenous to the endogenous variables. Therefore, the total *IE* between two observed variables is the sum of all particular *IE* through all possible mediating variables. The sum of the direct and total indirect effect components between two observed variables is defined as the total effect (TE). To illustrate from Figure 7.1, let

TE between $X_1 \rightarrow Y_3$ be c[1], *IE* from $X_1 \rightarrow Y_1$ and $Y_1 \rightarrow Y_3$ be a & b respectively, and *DE* from $X_1 \rightarrow Y_3$[2] be c'. then the TE is

$$c = c' + ab$$

Hence, the *DE*, *IE* and *TE* components of general structural equation model for observed variables are given as;
The direct effects are

$$E_d = \begin{bmatrix} B & \Gamma \end{bmatrix}, \tag{7.2.6}$$

the total effects are

$$E_t = \begin{bmatrix} (I - B)^{-1} - I, & (I - B)^{-1}\Gamma \end{bmatrix}, \tag{7.2.7}$$

and the indirect effects are

$$E_i = E_t - E_d \tag{7.2.8}$$

The SEM model largely uses the maximum likelihood method for its estimation and relies on a set of assumptions for implementation. It assumed a large sample size as maximum likelihood method depends on asymptot, that requires large sample size to obtain reliable parameter estimates. What constitutes a large sample size has become relative based on different suggestions by different authors but a general rule of thumb is to have a sample size of above 200. Although often relaxed, particularly for exogenous variables, the likelihood that is maximised when fitting SEM using the maximum likelihood method is based on the assumption that the observed variables follow a multivariate normal distribution. Moreover, a more important assumption is that the model is correctly fitted in that no relevant variable is omitted from the model equations to stem the risk of bias outcome. Quite a number of approaches have been put forward for assessing model goodness of fit which adjudge overall whether the model is acceptable. Available indices are classified as discrepancy functions - chi square test, relative chi square, and RMSEA; comparative baseline model - such as the CFI, NFI, TFI, and IFI; information theory measure of goodness of fit - such as the AIC, BCC, BIC, and CAIC; and non-centrality fit measures, such as the NCP. Marsh et al. (1996) suggest the use of a range of fit indices, while Jaccard

[1]Without mediating effects

[2]With mediating variables

and Wan (1996) further recommend the range that is able to consider different classes of indices especially that some indices are sensitive to sample size. However, indices like RMSEA, PCLOSE, TFI, among others, are considered critical information indices in SEM and are often used.

Once found to be fit and stable, the strength of SEM lies in determining the path of causality in a structure with the ability to simultaneously deal with multiple endogenous and exogenous variables in addition to the mediating analysis described above.

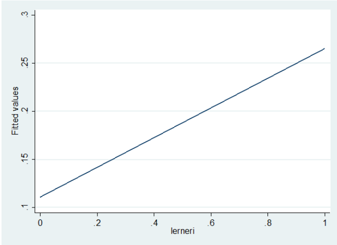
7.2.2 Data Source and Variable Description

In this study, 440 banks with 3165 observations for the periods 2006 to 2015 from 37 SSA countries are considered. The nature of data used is consistent with that described in the previous chapters of this thesis, from the BankScope database compiled Fitch/IBCA Bureau Van Dijk. The main variables of interest for our proposed model, competition, regulation and stability nexus in the SSA commercial banks include capital regulation, liquidity regulation, asset quality regulation, bank level competition, efficiency and stability.

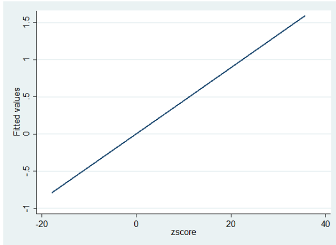
Theoretically we expect a direct relationship between regulation and competition, and competition and stability. Based on competition stability views, we expect an indirect relationship from competition through efficiency to stability. It then suffices to say that there is also an expectation of an indirect relationship from regulation to stability via competition-efficiency relationship. We also hypothesised that a well regulated banking system with relatively adequate liquid assets, capital and improved asset quality should result in efficient banks. These underline the direction of our proposed model. The choice of variables follows previous studies as previously described and in particular the restriction of regulatory variables to capital, liquidity and asset quality is based on data coverage in the study of SSA countries, besides they also constitute the major pillars of the Basel Accords.

7.2.3 Summary Statistics and Data Exploratory Analysis

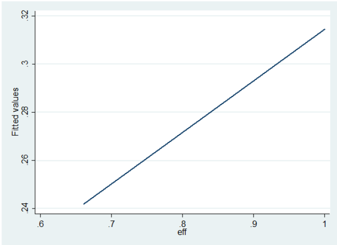
The summary statistics of the data employed in the model is the same as for the competition, regulation and stability relationship presented in Chapter 6 Table 6.2 providing a



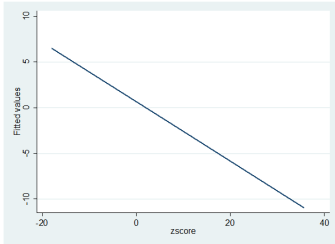
(a) ecr on lerneri



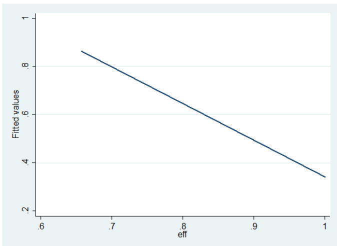
(b) ecr on zscore



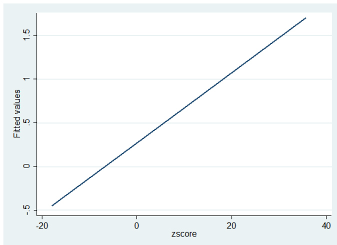
(c) lerneri on eff



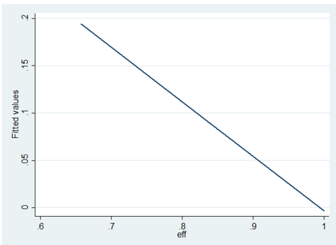
(d) lerneri on zscore



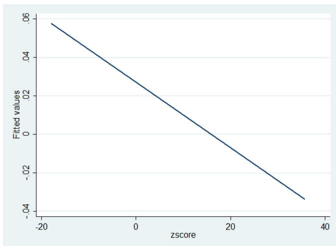
(e) lqty on eff



(f) lqty on zscore



(g) aqlty on eff



(h) aqlty on zscore

Figure 7.2: **Data Two-way Graphs**

Author's Estimation, 2017

brief insight to the nature of the data. The main essence is for data distribution to satisfy the thresholds for implementing the SEM model. The distribution of the individual data is also present in the normality test in Appendix B.4 and the histograms in Appendix

F.1. Overall, the data is normally distributed as confirmed by the Jarque-Bera statistics in Appendix B.4 validating the use of SEM.

Exploring the theoretical relationship among data hypothesised in Subsection 7.2.2, the reality observed in Figure 7.2 and Appendix F.2 is quite revealing. While some of the relationships aligned with a-priori expectations, quite a number are in the apposition. The graph in Figure 7.2*(a)* shows that the relationship between capital and competition follows theoretical expectation with competition increasing with capital. Likewise, for capital and stability, and competition and efficiency in Figure 7.2*(b)* and *(c)* respectively. The case is different with competition and stability in Figure 7.2*(d)*, while theory expects a direct relationship the reality of data suggests a kind of trade-off relationship. This has been a subject of debate lately among academics in this field. How this eventually plays out will largely depend on the outcome of the statistical modelling.

7.3 Estimation Results

Once the model is found to be fit, the expectation is a structural bank model where regulation, competition, efficiency and stability simultaneously interplay to determine the well-being of the banking system. This suggests that none of the variables can be treated in isolation as decision made on one will have ripple effects on all the other variables in the system. We presented a proposed recursive CRS model in Figure 7.1 in Subsection 7.2.1 for the commercial banking system of the SSA region. The estimated version of this model as shown in Figure 7.3 below, for the purpose of SEM contains six observed variables consisting three observed exogenous variables, ECR, LQTY and AQLTY, as well as three observed endogenous variables, LERNERI, EFF and ZSCORE. Observed exogenous variables are variables with datasets that are determined outside of the model and for the sake of the banking system, issues of regulations are largely exogenously handled. These variables have no arrows pointing at them in the model and they are otherwise known as independent variables. Observed endogenous variables also known as dependent variables represent variables with datasets that are determined within the system. The pointed arrows show the directions of causality and the estimates on the path represent the standard coefficients estimates generated using STATA 13. While we do not interpret the coefficient in isolation from the results in the previous chapters, as in the case of sign inconsistencies, the most powerful method[3] prevails, SEM provides an opportunity to model the banking system as a unit. This is the first application in a study of this nature to the best of our knowledge and a major contribution to literature.

Table 7.1: **Correlation Results**

	ECR	LQTY	AQLTY	LERNERI	EFF	ZSCORE
ECR	1.000000	0.312420	−0.021381	−0.176526	−0.065236	0.945292
LQTY	0.312420	1.000000	0.038314	−0.045985	−0.076470	0.255193
AQLTY	−0.021381	0.038314	1.000000	0.009755	−0.317865	−0.119063
LERNERI	−0.176526	−0.045985	0.009755	1.000000	0.045299	−0.150826
EFF	−0.065236	−0.076470	−0.317865	0.045299	1.000000	0.190637
ZSCORE	0.945292	0.255193	−0.119063	−0.150826	0.190637	1.000000

Author's Computation, 2017, Based on Data Collected from BankScope

Table 7.1 is the correlation matrix showing the degree of association among variables. A cursory look at the table indicates that the sign of association coefficient is consistent with the two-way graph explained in Subsection 7.2.3 above. Only capital and stability show a very strong positive association while others exhibit some varying degree of weak association. The validity of the model results depend on the fitness of the model. A

Table 7.2: **Data Measurement Model Fit**

Model fit indicators	LR Prob > chi2	RMSEA	PCLOSE	SRMR	CFI	TLI
Model measurement	0.817	0.000	1.000	0.002	1.000	1.001

Source: Author's Estimation, 2017, Based on SEM Global Fitness Criteria

number of model goodness of fit have been proposed in literature for gauging model fitness as mentioned in Subsection 7.2.1. However, a couple of the indicators as presented in Table 7.2 are considered fundamental for any SEM fitness because they are adjudged to be the most informative (Barbara, 2001; Fan, Thompson, & Wang, 1999). In terms of the psychometric properties, all the data measurement model fit showed acceptable results for the observed variables examined. The overall model fitness explained by LR chi2 prob of 0.817 indicating that the model if very fit as null hypothesis requires the prob to be > 0.05. Moreover, the Root Mean Square Error of Approximation (RMSEA) often used as

[3]SEM uses method of maximum likelihood for its estimation.

a better approach for testing the fitness of large datasets SEM model is found to be 0.000 indicating exact fit or absence of misfit. The rule of thumb is for RMSEA to be < 0.05 for a model to be considered good fit (Brown & Cudeck, 1993; Marais & Andrich, 2007, among others). PCLOSE is the p-value for testing the null hypothesis that the population RMSEA is not > 0.05 which is expected to be > 0.50 substantiate the exact fit of our model as it is 1.000 in our study, a further confirmation of model fitness.

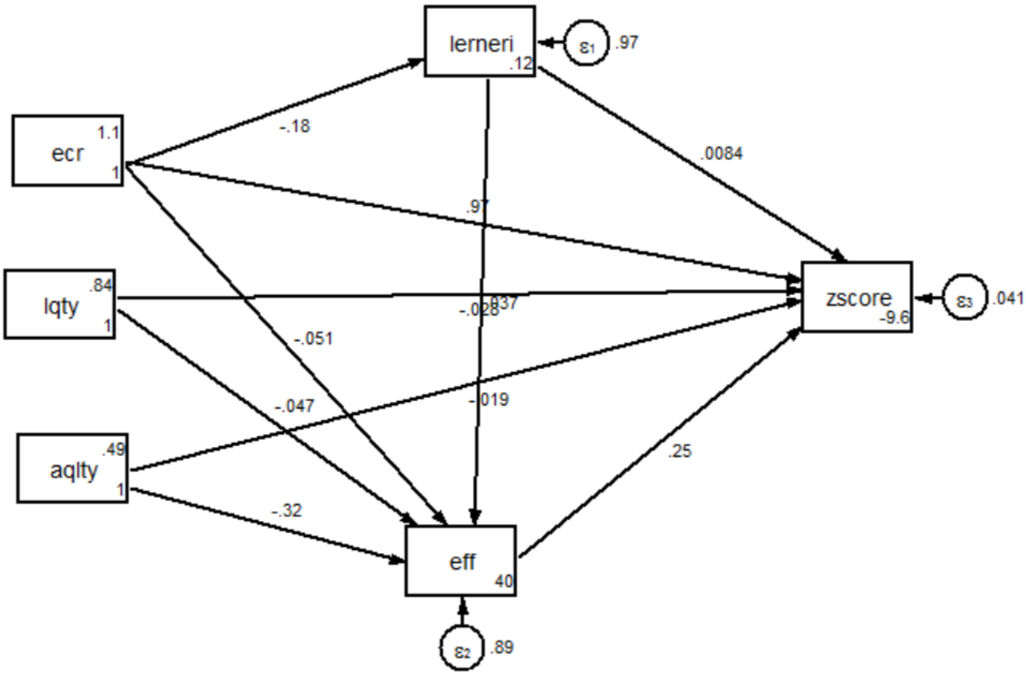


Figure 7.3: CSRE Model

Source: Author's SEM Estimation Output, 2017

The Standardised Root Mean Square Residual (SRMR) provides absolute measure of fit, it is the standardised difference between the predicted correlation and the observed correlation. Because it is an absolute measure, a value of 0 equals perfect fit but (Hu & Bentler, 1999) suggest a value < 0.08 as generally considered a good fit. Our results show SRMR not to be different from 0. Other tests of fitness used are Comparative Fit Index (CFI) and Tucker Lewis Index (TLI); they are both incremental measures of fits that examine the discrepancy between the data and the model hypothesised. They range from 0 to 1, and specifically values > 0.95 are considered very good fit and where greater they are restricted to 1.

7.3.1 Interpretation and Discussion of SEM Results

Having been satisfied with model fitness, the proposed CERS model estimates are presented in Table 7.3 below. The boxes in Figure 7.3 represent either exogenous or endogenous and/or mediating variables. The arrows linking variables in the structural model depict the direction of causality between variables in the system displaying the standardised coefficients or the standardised regression weights that are also stated in Table 7.3. The underlying goodness of fit indices confirm a good fit of the structural model to the data employed. All the variables are observed, in other words, they are variables with datasets. ECR, LQTY and AQLTY are exogenous regulatory variables while LERNERI and EFF are endogenous variables that also predict other endogenous variables, ZSCORE.

All the paths allowed to be fitted by the model fit criteria are found to be statistically significant with signs and magnitude shown in Table 7.3. Specifically, regulatory variables are shown to have strong and direct influence on competition, efficiency and stability variables. The path of the direct influence are; $ECR \rightarrow LERNERI$, EFF & $ZSCORE$; $LQTY \rightarrow EFF$ & $ZSCORE$ and $AQLTY \rightarrow EFF$ & $ZSCORE$. Likewise, both competition and efficiency variable have strong and direct influence on stability with LERNERI directly causing ZSCORE, $LERNERI \rightarrow ZSCORE$ and EFF causing ZSCORE, $EFF \rightarrow ZSCORE$. Figure 7.3 contains seven mediating paths; $ECR \rightarrow LERNERI \rightarrow ZSCORE$, having LERNERI mediating the effects of ECR on ZSCORE; $LERNERI \rightarrow EFF \rightarrow ZSCORE$, with EFF mediating; and $ECR \rightarrow LERNERI \rightarrow EFF \rightarrow ZSCORE$, having LERNERI and EFF mediating the effects. Others are; $ECR \rightarrow LERNERI \rightarrow EFF$, with LERNERI mediating; $ECR \rightarrow EFF \rightarrow ZSCORE$, with EFF mediating; $LQTY \rightarrow EFF \rightarrow ZSCORE$, having EFF mediating; and $AQLTY \rightarrow EFF \rightarrow ZSCORE$, also with the mediation of EFF. Overall, all effects (total, direct and indirect effects) on the links among the variables in the CERS model are found to be significant. It therefore suggests the presence of partial mediation in the structural model. In essence, competition partially mediates the influence of capital on stability, efficiency partially mediates the effects of competition on stability with competition-efficiency partially mediating the effects of capital on stability. This striking result of the SEM model confirms the results of our models in Chapter 5 and Chapter 6 of competition-stability view hypothesis in the commercial banks of SSA region and hence substantiating the reference to competition and stability as the reasons for capital regulation. This study has also extended extant

Table 7.3: **Recursive Model Estimates**

	Coefficient Estimates			Direct Effects			Indirect Effects			Total Effects		
VARIABLES	lerneri	eff	zscore	lerneri	eff	zscore	lerneri	eff	zscore	lerneri	eff	zscore
Lerneri		0.0373**	0.00839**		0.0373**	0.00839**			0.00914**		0.0373**	0.0175***
		(0.170)	(0.00368)		(0.0000622)	(0.0017)			(0.00193)		(0.0000622)	(0.00257)
eff			0.245***			0.245***						0.245***
			(0.00485)			(0.485)						(0.485)
ecr	-0.177***	-0.0509***	0.971***	-0.177***	-0.0508***	0.971***		-0.00657**	-0.0156***	-0.177***	-0.0574***	0.956***
	(0.017)	(0.0179)	(0.00416)	(0.803)	(0.003)	(0.0823)		(0.000516)	(0.0935)	(0.803)	(0.00296)	(0.122)
lqty		-0.0467***	-0.0284***		-0.0467***	-0.0284***			-0.0115***		-0.0467***	-0.0398***
		(0.0176)	(0.00381)		(0.000886)	(0.0242)			(0.0276)		(0.000886)	(0.0367)
aqty		-0.317***	-0.0193***		-0.317***	-0.0193***			-0.0779***		-0.317***	-0.0972***
		(0.0155)	(0.00382)		(0.00926)	(0.267)			(0.3004)		(0.00926)	(0.383)
constant	0.123***	39.867***	-9.63***									
	(0.025)	(0.493)	(0.153)									
observation	3,165	3,165	3,165	3,165	3,165	3,165	3,165	3,165	3,165	3,165	3,165	3,165

Source: Author's Estimation, 2017, Based on data collected from BankScope; Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

literature by establishing direct and mediating effects among other regulatory variables, efficiency and stability supporting one of our hypotheses in Subsection 7.2.1. Statistically, the indirect paths from regulation to stability better explains the fluctuations in the workings of the banking system internal mechanisms utilising competition and efficiency as mediating variables.

The major conclusion of this study for policy implication is that the mechanism of regulation, competition and stability in the banking systems operates simultaneously substantiating the short-term contemporaneous responses among the variables obtained in Chapter 6. The implication is that change in policies targeted on any of the components affects the others either instantly or remotely. A further conclusion from the above findings is on the role of competition-efficiency relationship in mediating the effects of regulation and stability. As much as regulation directly impacts on stability, the influence becomes mediated by competition and efficiency, this again point to the stance in literature that competition may not be the major cause of instability but that its presence may aggravate it. Moreover, the mediating role of efficiency and stability relationship found in Chapter 5 of this thesis has again been reaffirmed suggesting that competition may not on itself cause stability unless efficiency is engendered. The policy implications are enormous for practitioners and regulators alike with further research needed to unbundle how policies should be crafted to address these issues.

7.4 Summary

The overall essence of this chapter and by extension the study is to propose a model that will enable policy makers to deal with the issues of competition, regulation and stability in the banking sector. Based on theories, models and extant empirical literature within and without this thesis, we fitted a structural equation model to examine the interplay among competition, efficiency, regulation and stability for the commercial banking sectors of the SSA region. Having established fitness in the model, the results show all variables in the structure to be statistically significant. In other words, decisions that affect the exogenous variables (regulation, competition and efficiency) will have simultaneous corresponding effects on the endogenous variables (competition, efficiency and stability) within the banking system. Furthermore, mediating effects became apparent in the results hence we conclude a strong interrelationship among competition, regulation and stability in the banking system.

Even though the degree of influence among variables differs, especially for capital regulation as alluded to in previous chapters of this thesis, we recommend policies should not consider these issues in isolation but address them holistically, if the banking system is to function at the optimal capacity that could engender the much anticipated growth and development in the region. Given the enormous challenge in dealing with the balancing act expected to optimise the working of these relationships, we recommend a further research work as an offshoot of Chapter 6 to unbundle the management and implementation process.

Chapter 8

Summary, Conclusion and Recommendations

8.1 Summary

This study explored the relationships among competition, regulation and stability in the commercial banks of the SSA region. The study covered eight chapters divided into three sections. The first section deals majorly with background to the study; namely, Chapter 1, introduction, and Chapter 2 which is a review of the banking sectors of the study areas. Next is the second part that contains the body of the thesis where the objectives of the study were considered. This has five chapters that includes; Chapter 3 – competitive condition, Chapter 4 – competion and stability, Chapter 5 – competition, efficiency and stability, and Chapters 6 and 7 – competition, regulation and stability. This chapter constitutes the final section where the entire study is summarised and concluded with key findings highlighted for policy recommendations.

We motivated for this study in Chapter 1 giving the call to increase the competitive condition of the banking sector in the region as a means to stem the tides of poverty and underdevelopment. It became imperative to understand the context of banking competition and the implications for the stability of the sector and the role that regulation could play to strike an acceptable balance. We also highlighted some of the contributions of the study and the significance to academics, regulators, policy makers and practitioners alike. Chapter 2 generally captures the macroeconomic and financial environments of the

SSA region. The review reiterated the level of financial development vis-a-vis the major exposures that banks are faced with in the region.

In Chapter 3 we used the Lerner index to analyse the bank level and market competitive condition of the SSA commercial banks. We took account of the various criticisms of Lerner index notably that it ignores risk which is fundamental in bank cost and price measurement that has no single acceptable measure. We noted that even though the arguments may be germane, there have been no acceptable measures to account for the risks, besides empirical evidences has shown that studies that have adjusted for these issues have not achieved much remarkable difference from the results of the conventional Lerner index, thus accounting for its popular use in literature. It may be rather cumbersome attempting to control for risk in a study like ours with heterogenous panel of countries without homogenous risk. Moreover, studies of Liu et al. (2013b) found the Lerner to be one of the two most valid ways of measuring competition hence validating our methodology. We also modelled the translog cost function to reflect that the core activities of commercial banking sectors in the SSA region still remain that of intermediation. We further analysed the drivers of competition in the region.

Chapter 4 explored the competition and stability relationship in the SSA region commercial banks. We reviewed models that argue for and against competition and stability, expressing that competition may be good and bad for the banking system. We employed the robust orthogonalised version of the GMM to analyse this relationship. The choice of methods was motivated by the need to avoid the shortfalls of OLS while accounting for possible endogeneity issues between competition and stability. We proxy competition with the Lerner index and stability with the Zscore. Both measures have been used prominently in this kind of literature and have continued to gain relevance.

In Chapter 5 we factored in efficiency in competition and stability relationship in the SSA banking sector in line with the arguments of the competition-stability views. This is hoped to help in crafting a new way of rethinking this relationship by developing an instrument for competition using SFA. We used the instrument in a regression of competition against stability. Stability was proxied by the Z-score. Z-score measures the overall stability of the banking system. Our competition measure is the Lerner index which enables us to estimate the market power of the 440 banks in our sample over the study period. The efficiency scores generated from the SFA reveal in actual sense an increase efficiency in the banking sectors with competition over the periods under review. The SFA model ensures that technical efficiency is allowed to vary through time and in a different manner for each bank. Hence we provide evidence consistent with literature that argues that efficiency is inherent in competition. We found that the instrument of competition is strictly positive and strongly significant to explain stability of commercial banks in the SSA region. Therefore we were able to find evidence of transmission from competition through efficiency to stability.

Chapter 6 investigated the short run relationship among competition, regulation and stability of commercial banks in the SSA region using P-SVAR. The essence was to establish the possible transmission channels/mechanism among the variables. Seven bank variables were considered to capture competition, efficiency, regulation and stability. The same measures of competition and stability subsist as in the previous chapters. Although theories and empirical literature have provided conflicting evidence on the relationship between competition and stability, there is a growing acceptance of the possibility of trade-off in competition stability relationship. There is also evidence that competition does not necessarily result in fragility in the banking system as some fundamental features of banks play an important role, and competition may only aggravate the process. Yet there seems to be no headway as to how the interplays of these outcomes could be managed and/or moderated to get the best out of the relationship for the economic growth of the host economies. Our result thus provided insights on how variables interplay in the short-term with far-reaching policy implications.

Finally, Chapter 7 wrapped up the studies with SEM that captures our core variables in a system. The overall essence is to propose a model that will enable policy makers to deal with the issues of competition, regulation and stability in the banking sector. Based on theories, models and extant empirical literature within and without this thesis, we fitted a structural equation model to examine the interplay among competition, efficiency, regulation and stability for the commercial banking sectors of the SSA region. Having established fitness in the model, the results show all variables in the structure to be statistically significant. In other words, decisions that affect the exogenous variables (regulation, competition and efficiency) will have simultaneous corresponding effects on the endogenous variables (competition, efficiency and stability) within the banking system. Furthermore, we found competition and efficiency partially mediating the relationship between regulation and stability.

8.2 Key Findings and Conclusion

Given the above summary, a number of key findings become apparent. To begin with, the review of the banking sectors of SSA countries' commercial banks indicated that there is no immediate threat to bank stability in the region. Most of the banking sectors are well capitalised, sound, profitable and liquid. In spite of this, various exposures and ongoing vulnerabilities exist in the banking sectors of the region that if unattended to have the capabilities to result in banking systemic failure. Notable among them is poor assets portfolio arising from high incidence of NPLs. Closely linked to that is the issue of non-diversification of loan assets with banks loans concentrated in the governments and their agencies including large individual customers such as oil and gas firms/industry. Most obligations are denominated in foreign currencies; this could spell disaster with any sudden surge in exchange rates. The review also spotted poor and/or weak institutions especially legal and judicial systems that are incapable of protecting customers' rights including enforcement of loan recovery. Besides, weak contracts enforcements make banks risk averse limiting business opportunities. Prudential and ways of doing business regulations unable to limit banks' exposure to net-foreign exchange and rising NPLs. A good credit assessments framework is also lacking which in a competitive banking environment meant poor loan appraisal processes with attendant poor asset portfolio. These and many more were found to remain forces to contend with in most of the various banking sectors.

Objective one tested the competitive condition of the SSA region's commercial banking sector and explored some of the factors influencing competition in the region. We found monopolistic competitive condition in the banking sectors of the region. All the countries considered have the trait of this form of competition. We further found bank size, capital and performance as constituting the major factors that are driving competition in the banking sectors of the region. A monopolistic competitive banking market presumes some level of welfare and/or efficiency in terms of operational costs, bank charges, lending rates, among others. The present realities proved otherwise. Perhaps this might be due to the nature of the banking sectors that compete for few large company's deposits and government funds with the bulk of the real sector lacking access to finance. This competitive environment has to be harnessed by government and regulators alike to make banks services better inclusive for economic growth by considering a number of policies. Government should ensure that their central/reserve banks serve their traditional role of being their bankers. This will compel banks to rethink their strategies and better focus on competing for the real's sector financial intermediation services. Such competition will effectively drive down costs and rates as managers are forced out of their shelves to innovate products at lesser cost to gain competitive advantage. A further policy issue may be to provide incentives to banks, such as reduction in corporate income tax and some related moratorium, provide financial and social infrastructure that will break the barriers of access making banks to reach areas that may be considered originally unprofitable. While competition in its current state should be encouraged and improved upon, this study highlighted some banks' specific factors that drives competition which could be tinkered with.

Objective two investigated the relationship between competition and stability. The study found competition to engender stability in the banking sector of the SSA region provided it is efficient without which fragility occurs. This established a transmission mechanism from competition to stability via efficiency. Hence, we found that competition brings about efficiency and thus stability of the banking system. This is after the study had found competition-fragility view relationship between competition and stability in the banking sector of the region, and outlined the credit and overall risks measures that account for some of the fragilities. The culmination of these results clearly reiterates the suggested trade-off relationship between competition and stability and this is a point that policy makers must take very seriously. In other words, while competition is desired, there has to be a cut-off point without which the gains turn to be a curse for the sector and systemic stability as a whole. A framework must be developed similar to the credit score models in the banking system that is able to gauge the level of banking competition that is considered to be healthy for the continuing efficiency of the bank and the overall system as a whole. That way the gains of competition can be sustained without necessarily invoking the demerits.

Objective 3 dealt with the interplay among competition, regulation and stability in the banking system of the SSA region with particular interest on how regulation shapes competition, stability and their relationship. Hence assessed the role of regulation in ensuring competition and stability at the same time. This was implemented using near- and long-time analysis. For the near-term analysis, we found that regulation variables employed (capital, liquidity and asset quality) to influence the stability of banks in the near term with no significant impact on competition. Specifically, variation in capital regulation is found to have the largest impact on the stability of the banking sector of the region. Within the next twenty-four quarters, stability will continually decline with any infraction in capital of the banking sector of the region. In addition, we found these regulation variables impacting on efficiency in the near-term as well. Modelling these relationships in the long run, the study found regulation to have direct effects both on competition and stability and an indirect effect between regulation and stability with competition being the mediating variable. Again, this established a transmitting effect from regulation to stability with competition partially mediating the relationship. This informed the study's proposed competition-regulation-stability (CRS) model.

The implications of the foregoing results are that regulators do not have to worry about competition in the short-term but concentrate on maintaining stability in the system as the impact of regulatory policies will only become much more visible in the long-term. Notably, the impulse-response function provided insight on the management of stability in this regard. However, much could be done to ensure ongoing sustainable regulations in terms of capital, liquidity and asset quality in this banking sector. One major solution to ensuring a resilient banking sector with all time adequate capital is to strengthen both the prudential and ways of doing business guidelines. Regulators must intensify efforts at subscribing to the Basel Accord which encapsulates strategies on how to better enhance the three regulatory variables employed and with one of the major pillars dwelling of capital adequacy. This study noted that about 70% of the banking sectors of the region are yet to implement Basel II let alone Basel III that have come to effects since 2010. This way capital can be maintained and issues of stability largely solved. Liquidity and asset quality are closely tied as poor quality of loan portfolio will reduce the liquid assets of banks with attendant impacts on capital hence stability issues may arise. Again, the Basel

Accord could offer most of the solutions required if the provisions are religiously implemented. Concentration of assets in large individual borrowers and exposure to foreign exchange must be addressed. Asset portfolios must be diversified and perhaps regulations to restrict the percentage of total deposits that can be given as loan to an individual bank customer must be enacted and where in place strengthened. This will reduce the ongoing vulnerability faced by the system. Supervisory and corporate governance aspect of regulation must be strengthened and/or put in place where nonexistent. A risk-based deposit insurance that compel banks to be more proactive is encouraged as most of the sectors also do not have deposit insurance in place.

Methodologically, we employed three unique methods, SFA, P-SVAR and SEM that are major contributions to literature. Although, SFA may have been used in literature in this area, we have for the first time employed it in a new way to measure the amount of efficiency that is associated with competition. To the best of our knowledge, this is the first study that has done this. P-SVAR that accounts for the curse of dimensionality in PVAR arising from the imposition of Cholseki decomposition by using structural restriction in panel VAR in cases like ours was employed for the first time in this field. Pooling together the strengths of both PVAR and SVAR while avoiding their shortcomings, the imposed structure decomposition was strong enough to handle econometric issues like cross-sectional dependence, etc., that may arise. Moreover, the P-SVAR which was built on the same principles of PVAR enabled us to analyse how past banking tendencies in the region have created what the sector now faces and how the sector should expect the status quo to evolve in the future of banking in the region in the area of competition, regulation and stability. This provides facts over which regulators and policy makers alike could ruminate on to create alternative scenarios and formulate policy decisions. The method proved valuable in measuring the contemporaneous relationship among variables thereby recovering interesting pattern of the behaviour of the variables in the structural model. We also employed SEM for the first time in this study area that simultaneously captured model variables in a structure. This made it possible to measure both direct, indirect and total effects of relationships with the direction of causality clearly indicated.

From the results of our analysis of the various objectives considered in this study we arrive at some far-reaching conclusions. The banking market of the SSA region's commercial banks was found to be competitive given that the index of market power indicates a monopolistic competition. We found competition to be significantly related to stability in the banking sector of the region. Specifically, our result is consistent with the competition-fragility view, implying that competition breeds instability. However, considering the effects of efficiency that is associated with competition in competition-stability relation, we found competition to positively influence efficiency in the region hence leading to the stability of the banking system, hence competition-stability view, upholding the assertion that competition may be good or bad for the banking system. Furthermore, we found direct effects of bank regulations (capital, liquidity and asset quality) on bank efficiency and bank stability respectively in the short term. There is also evidence of short run direct effects of competition and/or market power on efficiency as well as reverse causality between market power and efficiency of banks. Our results do not suggest any short term relationship between the competition measure and any of the regulatory measures adopted in this study and stability as well since non of these respond significantly in the short run to shocks in their residuals. Finally, the result of the structural equation modelling provides evidence of a simultaneous reaction of competition, regulation and stability variables in the banking system with competition and stability partially mediating the influence of regulation on stability. Based on these findings, we found evidence to conclude that, the commercial banking system of SSA region is competitive. However, competition is detrimental to stability unless it is able to engender efficiency. We also conclude that competition, regulation and stability within the banking system respond contemporaneously in the short run to one another and simultaneously in the long run.

8.3 Recommendations

In addition to the foregoing, some other recommendations based on the findings this study are made as follows.

This study recommends that while the antitrust agency still needs to concentrate more efforts at devolving the market powers that reside in the individual banks, it must continuously maintain and improve on the current market competition, fiscal and monetary policies must be harnessed to take advantage of the subsisting competitiveness of the region banking sector to cash in on the much needed economic growth.

Based on the conclusion, we recommend caution in the way policies are directed towards increasing competition further in the region. The preoccupation of competition policies in the region should be to maximise competition. Competition policy and bank regulation should not be crafted in isolation, since there is no perfect regulation, it must be complemented by competition policy. Regulation must take consideration of the force of competition and the level of market power and/or concentration to be allowed, which should be made temporary and reviewed from time to time.

Tied to the foregoing, this study's results presuppose that driving and maintaining a sustainable banking competition in SSA region is most fundamental and a welcome development. The challenge, however, lies in optimising competition to achieve the desirable goal of ensuring the dynamic efficiency of the banking sector that would engender stability, and consequently, economic growth. Of utmost importance, will be the need to strengthen the various antitrust agencies and, ensuring strict adherence to various banking regulations that address issues of competition including monitoring and developing new ones where necessary. Efforts must also be made to come up with complementary monetary and fiscal policies to sustain and improve on current gains. Regulators and watchdogs must also be alive to their responsibilities.

As regulation, especially capital and efficiency have become the cardinal variables for short term moderation for bank stability in the banking system and especially in the SSA region's commercial banking system as revealed by this study results, practitioners and regulators alike must ensure regulatory capital are sustained at all time. Rather than fine tuning competition as the supposed cause of instability in the banking sectors, attention should be directed to managing other fundamentals like moral hazards, information asymmetry and adverse selection among others, in order to complement the impact of regulation and competition in engendering efficiency and therefore stability. Furthermore, regulation on the level of capital base should be tied to the intensity of competition just as the formulation of optimal regulation must take into account the degree of competition.

Banking reviews in Chapter 2 reveal that most of the banking sectors maintain a conservative lending process that limits access to finance to few firms. This study therefore recommends a proactive approach to liberalise this process and provide a form of guarantee scheme that will enable banks more ambience in granting loan without watering down the credit process. One way will be to expedite processes to establish deposit insurance that is absent in most of the banking sectors.

Even though the degree of influence among variables differs, especially for capital regulation as alluded to in previous chapters of this thesis, we recommend that policies should not only consider these issues in isolation but address them holistically, if the banking system is to function at the optimal capacity that could engender the much anticipated growth and development in the region. Given the enormous challenge in dealing with the balancing act expected to optimise the working of these relationship we recommend a further research work as an offshoot of Chapter 6 to unbundle the management and implementation process.

8.4 Limitations of the Study

Every research work has its impediments and so is this study. The major constraint was data limitation across SSA countries and particularly in their banking sectors. Other aspects of regulations such as conduct of business regulation, etc., which would have added to the robustness of the study could not be considered because the data are not available. Data collected are predominantly bank profile data from the financial statement. Financial statements no doubt are internationally acclaimed sources of research data; they are however limited by different assumptions taking in their preparation and accordingly across countries with their attendant impacts on some of the variables employed. Differences in national standards as well pose some limitation especially as most countries are yet to adopt the uniform international financial reporting standards which impact on the banks' financial statements.

8.5 Further Research Area

Research in this area should be ongoing and our exposure from this study draws our attention to other areas that need to be covered. Further studies capturing other aspects of bank regulation such as those dealing with conduct of business are desirable for a more holistic assessment. In addition, further analysis of the impact of fiscal and monetary policies on competition and stability need some investigation. It is also desirable to investigate the possibility of determining a cut-off point for banking competition in the region without which the gains turn to be a curse for the sector and systemic stability as whole.

There have been much talk about concentration within the banking sectors of the SSA region. Hence studies considering mergers and acquisitions (M & As) and their impact on competition are encouraged. In addition, how the new developments in the SSA banking sectors, especially mobile banking, affect competition and the challenges they pose for stability and regulation are worth looking into.

Appendices

Appendix A

Country Review Summary

Table A.1: **Sample Countries Macroeconomics and Financial System Summary**

Regional or Economic Affiliation	Countries	Financial depth	Concentration	Capital	profitability	Liquidity	NPLs	Population	GDP	Inflation rate	Poverty level	Economic class	Resources	Vulnerability
CEMAC	Cameroon, Chad, Equitorial Guinea, Gabon	shallow–underdeveloped	3/70-80%	2.8–11.7%	0.8–1.2%	20–35%	9.7–20%	1.2–24.4million	-1.1–6.9%	0.6–11.7%	33–47%	low income–upper middle icome	oil & gas, agric	external shocks, terrorism, political unrest
EAC	Djibouti, Ethiopia, Kenya, Rwanda, Tanzania, Uganda	shallow–developed	1-6/50-85%	18.9–23.2%	1.7–3.7%	20–44.2%	4.8–22%	13–103.4million	4.9–10.8%	2.5–36.4%	19.3–67.9%	low income–lower middle income	mineral, agric, tourism	external shocks, weak infrastructure and governance
ECOWAS	Gambia, Ghana, Guinea, Liberia, Nigeria, Sierra Leone	small–developed	3-5/45.6–75%	16–17.5%	0.5–2.5%	10.5–53.3%	5.2–40%	2–186million	-1.7–7.5%	6.3–18%	24.2–70%	low income–lower middle income	oil & gas, agric, minerals, tourism	external shocks political urest, ebola, terrorsm
SADC	Angola, Botswana, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, Swaziland, Zambia	small–well-developed	3-5/56.5-90%	8–24.4%	1.1–4.6%	12.5–28.1%	2–9.3%	0.09–25.9million	0.5–6.5%	-0.5–25.5%	28.7–60.5%	low income–upper middle income	mineral, tourism, oil	external shocks, HIV/AIDS, drought
WAEMU	Benin, Burkina Faso, CAR, Côte d'Ivoire, Guinea-Bissau, Mali, Senegal, Togo	small–underdeveloped	3-4/50-98%	11.3–12.9%	0.9–1.9%	27.6–33.6%	14.4–17.6%	1.8–23.7million	4-8.5%	0.3–3%	40–76%	low income[a]	subsistent agric, mining, forestry	external shocks, political unrest, corruption, ebola

Source: Author's Review, AFDB, CIA-World Factbook, IMF and World Bank.

Review covers the period of this study.

Concentration is the proportion of banking sectors total assets held by largest banks.

Profitability by return on assets.

Financial depth is the level of development of the financial and banking systems.

[a]Except Côte d'Ivoire that is lower-middle income.

Appendix B

Diagnostics Test

B.1 Levels Unit Root

Table B.1: **IPS, LLC and ADF Unit Root Test**

	IPS		LLC		ADF	
	statistics	p-value	statistics	p-value	statistics	p-value
ECR	-5.44164	0.0000	-33.1423	0.0000	791.553	0.0000
LQTY	-9.69417	0.0000	-26.8801	0.0000	947.605	0.0000
AQLTY	-9.40409	0.0000	-79.2647	0.0000	832.255	0.0000
LERNERI	-8.72906	0.0000	-90.1484	0.0000	791.448	0.0000
IRS	-4.35749	0.0000	-23.4108	0.0000	745.239	0.0000
EFF	-3.3514	0.0004	-16.7139	0.0000	736.259	0.0000
ZSCORE	-4.08961	0.0000	-17.896	0.0000	759.189	0.0000

B.2 P-SVAR Lag length Selection

Table B.2: **Lag Length Selection Criteria**

VAR Lag Order Selection Criteria

Endogenous variables: ECR LQATDSTF AQLTY LERNERI IRS PBTARATIO ZSCORE

Exogenous variables: C

Date: 01/14/17 Time: 15:08

Sample: 2006Q1 2015Q4

Included observations: 8616

Lag	LogL	LR	FPE	AIC	SC	HQ
0	37007.05	NA	4.39e-13	-8.588685	-8.582948	-8.586729
1	96299.30	118474.4	4.68e-19	-22.34060	-22.29470	-22.32495
2	96386.83	174.7456	4.64e-19	-22.34954	-22.26349	-22.32020
3	96486.74	199.3086	4.58e-19	-22.36136	-22.23515	-22.31832
4	96602.49	230.7264	4.51e-19	-22.37685	-22.21048	-22.32012
5	98766.75	4310.433	2.76e-19*	-22.86786*	-22.66133*	-22.79743*
6	98801.25	68.65684	2.77e-19	-22.86450	-22.61781	-22.78037
7	98839.49	76.03393	2.78e-19	-22.86200	-22.57515	-22.76418
8	98882.60	85.65135*	2.78e-19	-22.86063	-22.53362	-22.74912

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

B.3 Serial Correlation

Table B.3: **VAR Residual Serial Correlation LM Tests**

Null Hypothesis: no serial correlation at lag order h

Date: 03/16/17 Time: 16:59

Sample: 2006Q1 2015Q4

Included observations: 9870

Lags	LM-Stat	Prob
1	45.21092	0.6275
2	30.90877	0.9797
3	29.86301	0.9859
4	2768.030	0.0000
5	59.70867	0.1405

Probs from chi-square with 49 df.

B.4 Normality Test

Table B.4: **Diagonistics; VAR Normality Test Estimated from Structural Var**

	Skewness				Kurtosis				Jarque-Bera		
Component	Statistics	Chi-sq	df	Prob.	Statistics	Chi-sq	df	Prob.	Statistics	df	Prob.
1	0.948222	1479.059	1	0.0000	172.9737	11881445	1	0.0000	11882925	2	0.0000
2	16.41088	443026.6	1	0.0000	1439.607	8.49E+08	1	0.0000	8.49E+08	2	0.0000
3	3.485937	19989.64	1	0.0000	226.2924	20504714	1	0.0000	20524703	2	0.0000
4	-51.56618	4374172	1	0.0000	3830.342	6.02E+09	1	0.0000	6.03E+09	2	0.0000
5	2.153931	7631.843	1	0.0000	69.09553	1796595	1	0.0000	1804227	2	0.0000
6	-2.291313	8636.443	1	0.0000	143.9973	8175744	1	0.0000	8184380	2	0.0000
7	4.989659	40955.06	1	0.0000	393.6743	62767615	1	0.0000	62808570	2	0.0000
Joint		4895890	7	0.0000		6.98E+09	7	0.0000	6.98E+09	14	0.0000

B.5 Heteroskedasticity Tests

Table B.5: **VAR Residual Heteroskedasticity Tests: No Cross Terms**

Joint test:	Included observations: 9870				
Chi-sq	df	Prob.			
35870.81	1960	0.0000			
Individual components:					
Dependent	R-squared	F(70,9799)	Prob.	Chi-sq(70)	Prob.
res1*res1	0.165564	27.77514	0.0000	1634.115	0.0000
res2*res2	0.073524	11.10914	0.0000	725.6845	0.0000
res3*res3	0.058240	8.657006	0.0000	574.8324	0.0000
res4*res4	0.059799	8.903354	0.0000	590.2119	0.0000
res5*res5	0.176762	30.05705	0.0000	1744.638	0.0000
res6*res6	0.066450	9.964167	0.0000	655.8613	0.0000
res7*res7	0.112892	17.81429	0.0000	1114.240	0.0000
res2*res1	0.087245	13.38036	0.0000	861.1043	0.0000
res3*res1	0.057445	8.531613	0.0000	566.9845	0.0000
res3*res2	0.118531	18.82384	0.0000	1169.900	0.0000
res4*res1	0.072119	10.88025	0.0000	711.8112	0.0000
res4*res2	0.041349	6.037927	0.0000	408.1143	0.0000
res4*res3	0.110282	17.35143	0.0000	1088.482	0.0000
res5*res1	0.107252	16.81740	0.0000	1058.574	0.0000
res5*res2	0.268333	51.33866	0.0000	2648.448	0.0000
res5*res3	0.035554	5.160472	0.0000	350.9142	0.0000
res5*res4	0.123811	19.78084	0.0000	1222.013	0.0000
res6*res1	0.054677	8.096722	0.0000	539.6632	0.0000
res6*res2	0.243638	45.09190	0.0000	2404.705	0.0000
res6*res3	0.033762	4.891387	0.0000	333.2341	0.0000
res6*res4	0.059336	8.830065	0.0000	585.6418	0.0000
res6*res5	0.118407	18.80151	0.0000	1168.676	0.0000
res7*res1	0.146840	24.09340	0.0000	1449.312	0.0000
res7*res2	0.066919	10.03952	0.0000	660.4894	0.0000
res7*res3	0.051528	7.605124	0.0000	508.5856	0.0000
res7*res4	0.060156	8.959974	0.0000	593.7395	0.0000
res7*res5	0.069157	10.40026	0.0000	682.5809	0.0000
res7*res6	0.057003	8.461896	0.0000	562.6154	0.0000

Sources: Eviews output

B.6 Heteroskedasticity Tests

Table B.6: **VAR Residual Heteroskedasticity Tests: Includes Cross Terms**

Joint test:		
Chi-sq	df	Prob.
118843.4	10388	0.000

Individual components:

Dependent	R-squared	F(371,9498)	Prob.	Chi-sq(371)	Prob.
res1*res1	0.469813	22.68577	0.0000	4637.051	0.0000
res2*res2	0.313331	11.68194	0.0000	3092.58	0.0000
res3*res3	0.301214	11.03545	0.0000	2972.985	0.0000
res4*res4	0.427995	19.15565	0.0000	4224.31	0.0000
res5*res5	0.588548	36.62027	0.0000	5808.972	0.0000
res6*res6	0.259659	8.979038	0.0000	2562.834	0.0000
res7*res7	0.359781	14.38692	0.0000	3551.038	0.0000
res2*res1	0.31379	11.70688	0.0000	3097.112	0.0000
res3*res1	0.249829	8.525926	0.0000	2465.815	0.0000
res3*res2	0.380269	15.7089	0.0000	3753.254	0.0000
res4*res1	0.229815	7.639075	0.0000	2268.271	0.0000
res4*res2	0.287539	10.33225	0.0000	2838.014	0.0000
res4*res3	0.331951	12.7211	0.0000	3276.36	0.0000
res5*res1	0.602038	38.72936	0.0000	5942.114	0.0000
res5*res2	0.638246	45.16825	0.0000	6299.489	0.0000
res5*res3	0.285434	10.22638	0.0000	2817.234	0.0000
res5*res4	0.354198	14.0412	0.0000	3495.931	0.0000
res6*res1	0.22658	7.500051	0.0000	2236.344	0.0000
res6*res2	0.585978	36.23394	0.0000	5783.599	0.0000
res6*res3	0.18968	5.992727	0.0000	1872.146	0.0000
res6*res4	0.303457	11.15343	0.0000	2995.124	0.0000
res6*res5	0.376421	15.45397	0.0000	3715.272	0.0000
res7*res1	0.411847	17.92683	0.0000	4064.928	0.0000
res7*res2	0.278499	9.882002	0.0000	2748.785	0.0000
res7*res3	0.255289	8.776124	0.0000	2519.703	0.0000
res7*res4	0.177204	5.51364	0.0000	1748.999	0.0000
res7*res5	0.48689	24.29288	0.0000	4805.606	0.0000
res7*res6	0.240393	8.101996	0.0000	2372.683	0.0000

Sources: Eviews output

B.7 P-SVAR Stability Test

Table B.7: **VAR Stability Test**

Roots of Characteristic Polynomial	
Endogenous variables: ECR LQA_D_STF AQLTY LERNERI IRS EFF_SCORE ZSCORE	
Exogenous variables: C; Lag specification: 1 5; Date: 02/22/17 Time: 16:38	
Root	Modulus
0.996483	0.996483
0.982237	0.982237
0.956690	0.956690
0.935582	0.935582
0.922969	0.922969
0.905222	0.905222
0.885821	0.885821
-0.565913 + 0.565038i	0.799703
-0.565913 - 0.565038i	0.799703
0.562555 + 0.567942i	0.799391
0.562555 - 0.567942i	0.799391
0.536567 - 0.544952i	0.764773
0.536567 + 0.544952i	0.764773
-0.544854 - 0.533533i	0.762577
-0.544854 + 0.533533i	0.762577
-0.529484 + 0.547130i	0.761383
-0.529484 - 0.547130i	0.761383
0.556670 - 0.510497i	0.755307
0.556670 + 0.510497i	0.755307
-0.489433 + 0.491865i	0.693885
-0.489433 - 0.491865i	0.693885
0.494690 - 0.482038i	0.690709
0.494690 + 0.482038i	0.690709
-0.421133 + 0.423945i	0.597564
-0.421133 - 0.423945i	0.597564
0.426110 - 0.412440i	0.593023
0.426110 + 0.412440i	0.593023
-0.357522 - 0.360735i	0.507889
-0.357522 + 0.360735i	0.507889
0.360001 - 0.348949i	0.501365
0.360001 + 0.348949i	0.501365
-0.315725	0.315725
0.003877 + 0.313552i	0.313576

Table B.7: (continued)

Root	Modulus
0.003877 - 0.313552i	0.313576
0.307014	0.307014

No root lies outside the unit circle; VAR satisfies the stability condition.

Appendix C

P-SVAR Estimates

Table C.1: **Estimation Results**

Structural VAR Estimates

Model: Ae = Bu where E[uu']=I

Restriction Type: short-run pattern matrix

A =

1	0	0	0	0	0	0
C(1)	1	0	C(9)	0	0	0
0	C(4)	1	0	0	0	0
0	0	0	1	0	0	0
0	C(5)	C(7)	C(10)	1	C(13)	0
C(2)	0	0	0	0	1	0
C(3)	C(6)	C(8)	C(11)	C(12)	C(14)	1

B =

C(15)	0	0	0	0	0	0
0	C(16)	0	0	0	0	0
0	0	C(17)	0	0	0	0
0	0	0	C(18)	0	0	0
0	0	0	0	C(19)	0	0
0	0	0	0	0	C(20)	0
0	0	0	0	0	0	C(21)

Table C.2: **Estimation Results Cont'd**

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	−1.162139	0.055533	−20.92694	0.0000
C(2)	−0.076524	0.003022	−25.32461	0.0000
C(3)	−20.95516	0.059963	−349.4681	0.0000
C(4)	−0.003496	0.001589	−2.200736	0.0278
C(5)	0.012723	0.000719	17.70584	0.0000
C(6)	0.044474	0.010478	4.244662	0.0000
C(7)	−0.122468	0.004543	−26.95959	0.0000
C(8)	1.551005	0.066246	23.41297	0.0000
C(9)	−0.005307	0.001495	−3.550858	0.0004
C(10)	−0.000791	0.000109	−7.257449	0.0000
C(11)	−0.004291	0.001537	−2.791554	0.0052
C(12)	−0.640858	0.141664	−4.523784	0.0000
C(13)	−0.576586	0.013074	−44.10120	0.0000
C(14)	−28.37173	0.206486	−137.4024	0.0000
C(15)	0.021762	0.000155	140.4991	0.0000
C(16)	0.120063	0.000855	140.4991	0.0000
C(17)	0.019378	0.000138	140.4991	0.0000
C(18)	0.808594	0.005755	140.4991	0.0000
C(19)	0.008746	$6.22E-05$	140.4991	0.0000
C(20)	0.006533	$4.65E-05$	140.4991	0.0000
C(21)	0.123085	0.000876	140.4991	0.0000

Table C.3: **Estimation Results Cont'd**

Log likelihood	118793.4			
LR test for over-identification:				
Chi-square(7)	3790.699		Probability	0.0000

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
−1.162139	1.000000	0.000000	−0.005307	0.000000	0.000000	0.000000
0.000000	−0.003496	1.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000
0.000000	0.012723	−0.122468	−0.000791	1.000000	−0.576586	0.000000
−0.076524	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000
−20.95516	0.044474	1.551005	−0.004291	−0.640858	−28.37173	1.000000

Estimated B matrix:

0.021762	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.120063	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.019378	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.808594	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.008746	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.006533	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.123085

Appendix D

Response to Structural one S.D. Innovation ± 2 S.E.

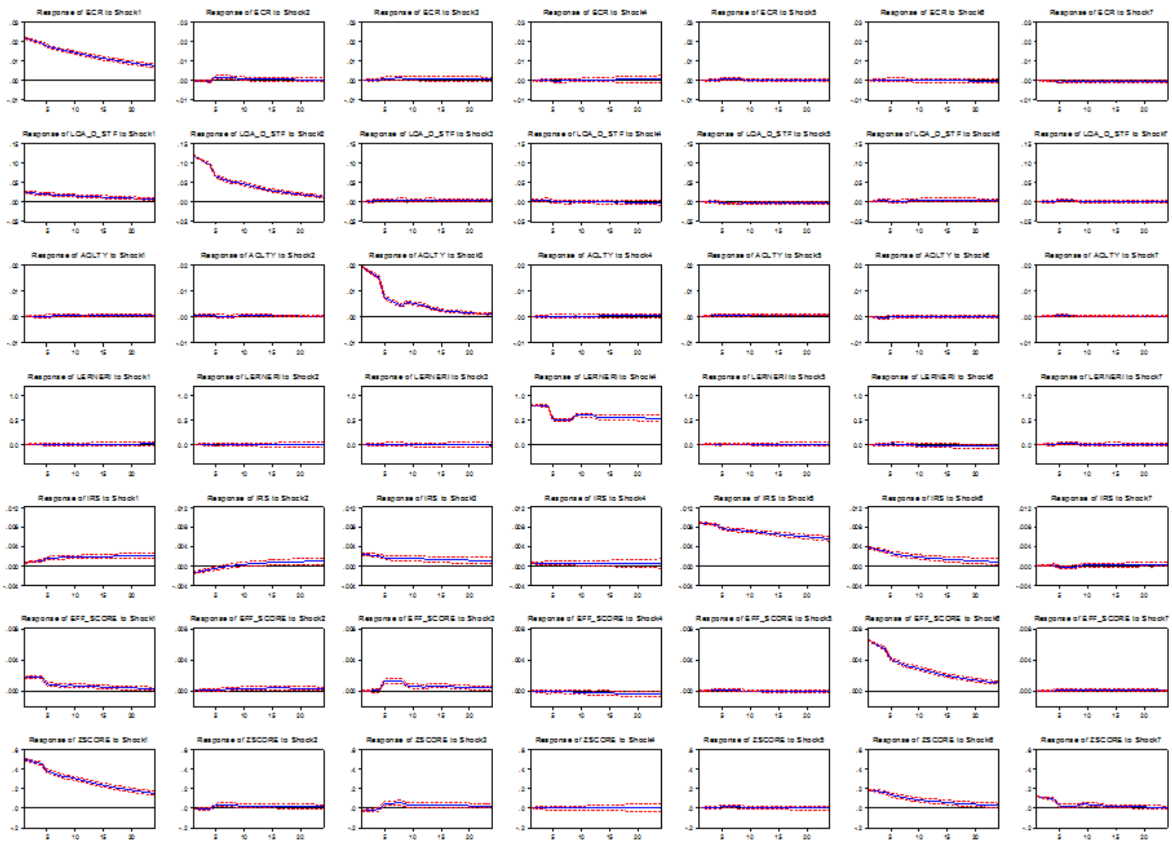


Figure D.1: **Structural Innovation**

Appendix E

P-SVAR Variance Decomposition

E.1 Variance Decomposition of Capital

Table E.1: **Variance Decomposition of ECR**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest Rate Spread	Efficiency	Stability
1	0.021762	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.030227	99.99293	0.001794	0.002170	0.000566	$8.77E-05$	0.001914	0.000536
3	0.036370	99.97787	0.005595	0.006764	0.001876	0.000306	0.005918	0.001668
4	0.041273	99.95617	0.011035	0.013340	0.003925	0.000668	0.011578	0.003279
5	0.045039	99.65804	0.174962	0.073565	0.005488	0.028798	0.023581	0.035569
6	0.048212	99.45050	0.286255	0.125603	0.005473	0.047561	0.029237	0.055372
7	0.050926	99.29409	0.367512	0.172803	0.004981	0.060885	0.031541	0.068185
8	0.053275	99.16903	0.430126	0.216725	0.004594	0.070758	0.032001	0.076763
9	0.055358	99.14669	0.433238	0.236731	0.006170	0.072249	0.029806	0.075114
10	0.057199	99.12980	0.432901	0.253976	0.008315	0.072799	0.027996	0.074212
11	0.058834	99.11689	0.430269	0.268771	0.011033	0.072721	0.026487	0.073828
12	0.060292	99.10694	0.426108	0.281371	0.014323	0.072222	0.025226	0.073811
13	0.061591	99.08763	0.426439	0.296018	0.017421	0.072111	0.024256	0.076125
14	0.062755	99.06944	0.426075	0.309893	0.021366	0.071857	0.023386	0.077987
15	0.063801	99.05186	0.425253	0.323068	0.026181	0.071504	0.022625	0.079507
16	0.064742	99.03454	0.424141	0.335604	0.031883	0.071085	0.021982	0.080766
17	0.065593	99.01939	0.421899	0.346734	0.038739	0.070531	0.021503	0.081206
18	0.066362	99.00463	0.419455	0.356813	0.046358	0.069923	0.021144	0.081674
19	0.067058	98.99016	0.416887	0.365886	0.054738	0.069283	0.020897	0.082154
20	0.067689	98.97586	0.414251	0.373998	0.063872	0.068627	0.020752	0.082637
21	0.068261	98.96129	0.411742	0.381320	0.073694	0.067977	0.020673	0.083306
22	0.068780	98.94650	0.409280	0.387959	0.084321	0.067341	0.020688	0.083909
23	0.069252	98.93142	0.406886	0.393981	0.095746	0.066724	0.020789	0.084458
24	0.069682	98.91596	0.404575	0.399443	0.107962	0.066131	0.020972	0.084960

E.2 Variance Decomposition of Liquidity

Table E.2: **Variance Decomposition of LQATDSTF**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest Rate Spread	Efficiency	Stability
1	0.122772	4.243349	95.63448	$3.36E-34$	0.122170	$4.45E-37$	$4.50E-32$	$2.13E-34$
2	0.167375	4.260891	95.58084	0.005487	0.139578	$1.82E-05$	0.012459	0.000727
3	0.197844	4.279196	95.50363	0.017334	0.157931	$7.04E-05$	0.039532	0.002309
4	0.220739	4.298169	95.40601	0.034615	0.177139	0.000169	0.079264	0.004635
5	0.231419	4.630365	95.01799	0.052354	0.161338	0.035171	0.072161	0.030626
6	0.239961	4.920460	94.67455	0.072724	0.150181	0.066654	0.069021	0.046415
7	0.246866	5.180337	94.35915	0.094901	0.142942	0.096186	0.070461	0.056022
8	0.252493	5.416644	94.06321	0.118169	0.139250	0.124635	0.076347	0.061743
9	0.257977	5.579098	93.85135	0.134520	0.133552	0.135467	0.106453	0.059559
10	0.262580	5.726213	93.65041	0.151211	0.129031	0.145235	0.139948	0.057952
11	0.266463	5.860168	93.45951	0.167975	0.125389	0.154158	0.176022	0.056772
12	0.269753	5.982561	93.27819	0.184600	0.122418	0.162385	0.213931	0.055914
13	0.272418	6.105292	93.09266	0.205967	0.120586	0.172538	0.245973	0.056980
14	0.274677	6.218526	92.91559	0.227108	0.119535	0.182575	0.279015	0.057652
15	0.276596	6.322932	92.74705	0.247787	0.119234	0.192497	0.312451	0.058046
16	0.278231	6.419105	92.58710	0.267817	0.119660	0.202303	0.345773	0.058245
17	0.279644	6.505452	92.44027	0.284664	0.119759	0.211598	0.380355	0.057899
18	0.280856	6.584738	92.30254	0.300381	0.120230	0.220615	0.413890	0.057606
19	0.281898	6.657475	92.17363	0.314965	0.121037	0.229370	0.446172	0.057356
20	0.282796	6.724136	92.05322	0.328430	0.122149	0.237874	0.477049	0.057138
21	0.283569	6.785648	91.93951	0.341674	0.123996	0.246156	0.505956	0.057056
22	0.284238	6.841864	91.83337	0.353993	0.126211	0.254249	0.533350	0.056958
23	0.284817	6.893164	91.73448	0.365408	0.128773	0.262155	0.559165	0.056852
24	0.285319	6.939906	91.64249	0.375952	0.131664	0.269872	0.583368	0.056744

E.3 Variance Decomposition of Asset Quality

Table E.3: **Variance Decomposition of AQLTY**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest Rate Spread	Efficiency	Stability
1	0.019383	0.002081	0.046905	99.95095	$5.99E-05$	$1.93E-38$	$2.76E-35$	$1.31E-37$
2	0.026360	0.001277	0.060695	99.92723	0.000309	0.003454	0.005754	0.001279
3	0.031083	0.000959	0.075847	99.88875	0.000752	0.011474	0.018172	0.004043
4	0.034598	0.001160	0.092124	99.83690	0.001413	0.024046	0.036280	0.008078
5	0.035420	0.004109	0.092397	99.80536	0.004515	0.034009	0.036623	0.022989
6	0.035981	0.010665	0.092769	99.77470	0.007877	0.045106	0.036149	0.032734
7	0.036359	0.021886	0.093016	99.74195	0.011512	0.057096	0.035457	0.039080
8	0.036607	0.038673	0.093061	99.70494	0.015407	0.069718	0.035079	0.043121
9	0.037034	0.046664	0.097212	99.67322	0.018024	0.086960	0.034969	0.042949
10	0.037394	0.054100	0.102469	99.63699	0.020765	0.106898	0.035533	0.043240
11	0.037701	0.060772	0.108795	99.59663	0.023636	0.129380	0.036844	0.043947
12	0.037967	0.066535	0.116171	99.55242	0.026638	0.154244	0.038967	0.045025
13	0.038123	0.075757	0.121025	99.50541	0.030414	0.179147	0.040360	0.047882
14	0.038243	0.085796	0.125396	99.45807	0.034440	0.204561	0.041498	0.050237
15	0.038334	0.096697	0.129233	99.41059	0.038695	0.230241	0.042374	0.052171
16	0.038403	0.108517	0.132513	99.36311	0.043157	0.255958	0.042996	0.053751
17	0.038468	0.119215	0.136255	99.31636	0.047556	0.282391	0.043644	0.054579
18	0.038523	0.129805	0.139918	99.26934	0.052042	0.309214	0.044281	0.055398
19	0.038570	0.140173	0.143526	99.22226	0.056605	0.336319	0.044912	0.056202
20	0.038611	0.150214	0.147101	99.17530	0.061239	0.363616	0.045544	0.056987
21	0.038643	0.160554	0.150267	99.12843	0.066020	0.390697	0.046102	0.057929
22	0.038670	0.170806	0.153202	99.08225	0.070906	0.417490	0.046584	0.058765
23	0.038693	0.180969	0.155903	99.03684	0.075888	0.443902	0.046991	0.059506
24	0.038713	0.191046	0.158369	98.99229	0.080954	0.469848	0.047326	0.060162

E.4 Variance Decomposition of Lerner Index

Table E.4: **Variance Decomposition of LERNERI**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest Rate Spread	Efficiency	Stability
1	0.808594	0.000000	0.000000	0.000000	100.0000	0.000000	0.000000	0.000000
2	1.141820	0.000429	$2.17E-06$	0.000525	99.99663	$1.86E-05$	0.002347	$5.18E-05$
3	1.396418	0.001355	$9.91E-06$	0.001635	99.98940	$5.85E-05$	0.007379	0.000165
4	1.610183	0.002707	$2.65E-05$	0.003217	99.97894	0.000116	0.014659	0.000332
5	1.688829	0.002464	0.010870	0.003148	99.94398	0.001629	0.019860	0.018052
6	1.762844	0.002277	0.018527	0.002908	99.92316	0.002864	0.021011	0.029257
7	1.832838	0.002189	0.023995	0.002710	99.91081	0.003888	0.020268	0.036136
8	1.899298	0.002223	0.027932	0.002666	99.90336	0.004749	0.018944	0.040122
9	1.992410	0.002023	0.026899	0.003422	99.90221	0.004559	0.023881	0.037010
10	2.080848	0.001870	0.025942	0.004538	99.89799	0.004414	0.030807	0.034435
11	2.165195	0.001765	0.025068	0.005973	99.89113	0.004303	0.039479	0.032277
12	2.245922	0.001708	0.024281	0.007683	99.88202	0.004216	0.049645	0.030450
13	2.313435	0.002069	0.024434	0.009674	99.87364	0.004419	0.056585	0.029180
14	2.378419	0.002564	0.024564	0.011828	99.86409	0.004590	0.064494	0.027865
15	2.441090	0.003192	0.024687	0.014113	99.85347	0.004736	0.073228	0.026574
16	2.501632	0.003952	0.024813	0.016500	99.84187	0.004863	0.082653	0.025348
17	2.563468	0.004513	0.024660	0.018801	99.82864	0.004870	0.094104	0.024408
18	2.623427	0.005148	0.024527	0.021149	99.81456	0.004882	0.106150	0.023586
19	2.681640	0.005854	0.024415	0.023520	99.79978	0.004898	0.118665	0.022866
20	2.738224	0.006630	0.024326	0.025898	99.78446	0.004915	0.131535	0.022237
21	2.792153	0.007634	0.024351	0.028356	99.76900	0.004971	0.144209	0.021477
22	2.844648	0.008725	0.024404	0.030811	99.75326	0.005020	0.156963	0.020817
23	2.895793	0.009898	0.024485	0.033254	99.73731	0.005064	0.169744	0.020248
24	2.945663	0.011149	0.024592	0.035679	99.72121	0.005103	0.182505	0.019759

E.5 Variance Decomposition of Interest Rate Spread

Table E.5: **Variance Decomposition of IRS**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest Rate Spread	Efficiency	Stability
1	0.009962	0.424718	2.195366	5.674827	0.346585	77.06254	14.29596	$2.87E-31$
2	0.013926	0.520141	1.897677	5.512281	0.334013	78.06907	13.66606	0.000756
3	0.016871	0.622093	1.642639	5.360766	0.322142	78.97063	13.07935	0.002373
4	0.019283	0.729236	1.425739	5.219649	0.310952	79.77632	12.53340	0.004705
5	0.021038	1.146416	1.258377	4.993837	0.330809	80.25495	11.98066	0.034947
6	0.022587	1.492974	1.113565	4.821707	0.347432	80.69755	11.47813	0.048644
7	0.023978	1.796912	0.993265	4.683300	0.362103	81.09342	11.01725	0.053751
8	0.025240	2.072900	0.896505	4.567905	0.375509	81.44026	10.59258	0.054340
9	0.026428	2.320667	0.822368	4.493330	0.373191	81.75674	10.18348	0.050224
10	0.027525	2.553930	0.769030	4.426835	0.370818	82.02273	9.809191	0.047463
11	0.028544	2.775712	0.733058	4.366578	0.368450	82.24498	9.465400	0.045822
12	0.029496	2.987995	0.711543	4.311312	0.366129	82.42924	9.148664	0.045114
13	0.030381	3.189073	0.699348	4.252761	0.368441	82.58594	8.861315	0.043119
14	0.031213	3.383146	0.697038	4.197859	0.370851	82.71514	8.594089	0.041879
15	0.031997	3.570931	0.702864	4.146313	0.373363	82.81982	8.345371	0.041334
16	0.032738	3.752955	0.715328	4.097874	0.375979	82.90277	8.113680	0.041415
17	0.033443	3.931151	0.734026	4.054683	0.377050	82.96382	7.896195	0.043080
18	0.034111	4.104266	0.756983	4.014392	0.378180	83.00750	7.693596	0.045081
19	0.034747	4.272519	0.783271	3.976726	0.379380	83.03612	7.504625	0.047361
20	0.035351	4.436092	0.812107	3.941449	0.380660	83.05167	7.328149	0.049869
21	0.035927	4.594567	0.842591	3.907555	0.382610	83.05698	7.163587	0.052108
22	0.036477	4.748664	0.874410	3.875534	0.384678	83.05269	7.009454	0.054572
23	0.037001	4.898521	0.907102	3.845261	0.386863	83.04008	6.864955	0.057213
24	0.037503	5.044259	0.940284	3.816619	0.389164	83.02032	6.729362	0.059990

E.6 Variance Decomposition of Efficiency

Table E.6: **Variance Decomposition of EFFSCORE**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest Rate Spread	Efficiency	Stability
1	0.006742	6.101375	$1.14E-33$	$2.24E-32$	$2.02E-34$	$5.06E-34$	93.89863	$3.07E-31$
2	0.009256	6.624173	0.003698	$7.30E-05$	0.003781	0.000409	93.36785	$1.53E-05$
3	0.011015	7.153219	0.011566	0.000276	0.012531	0.001368	92.82099	$4.70E-05$
4	0.012370	7.685921	0.022868	0.000645	0.026200	0.002886	92.26139	$9.14E-05$
5	0.013113	7.287125	0.021966	0.881153	0.024996	0.004326	91.77128	0.009155
6	0.013721	6.987500	0.029802	1.633902	0.026349	0.005198	91.30252	0.014724
7	0.014224	6.748697	0.048887	2.304586	0.030105	0.005728	90.84369	0.018310
8	0.014644	6.549961	0.079695	2.917262	0.036139	0.006040	90.39019	0.020715
9	0.015002	6.463449	0.107832	2.982915	0.051370	0.005783	90.36786	0.020786
10	0.015305	6.403195	0.137314	3.022820	0.069758	0.005557	90.34032	0.021035
11	0.015563	6.362647	0.167222	3.043096	0.091388	0.005386	90.30888	0.021380
12	0.015784	6.337248	0.196785	3.048439	0.116330	0.005291	90.27414	0.021762
13	0.015975	6.306230	0.232884	3.136799	0.141457	0.005174	90.15511	0.022344
14	0.016140	6.279927	0.270674	3.224585	0.169290	0.005084	90.02768	0.022764
15	0.016283	6.256940	0.309680	3.311988	0.199689	0.005014	89.89361	0.023078
16	0.016407	6.236244	0.349491	3.399150	0.232502	0.004959	89.75433	0.023326
17	0.016515	6.221815	0.386550	3.452301	0.268746	0.004954	89.64210	0.023540
18	0.016608	6.210143	0.422324	3.497475	0.307435	0.004974	89.53389	0.023758
19	0.016689	6.200733	0.456517	3.535294	0.348488	0.005021	89.42998	0.023970
20	0.016761	6.193195	0.488903	3.566373	0.391819	0.005096	89.33045	0.024169
21	0.016824	6.185965	0.520381	3.599667	0.436915	0.005173	89.22757	0.024332
22	0.016879	6.179445	0.550302	3.630003	0.483952	0.005262	89.12657	0.024467
23	0.016928	6.173424	0.578636	3.657798	0.532804	0.005360	89.02740	0.024583
24	0.016972	6.167736	0.605381	3.683419	0.583340	0.005464	88.92998	0.024684

E.7 Variance Decomposition of Stability

Table E.7: **Variance Decomposition of ZSCORE**

Period	S.E.	Capital	Liquidity	Asset Quality	Lerner Index	Interest Rate Spread	Efficiency	Stability
1	0.551130	83.10672	0.015842	0.268073	0.004342	0.010342	11.60696	4.987722
2	0.765669	83.55284	0.016599	0.226233	0.003462	0.011480	11.51578	4.673607
3	0.921540	83.96311	0.017394	0.191529	0.002778	0.012782	11.42189	4.390524
4	1.046061	84.34058	0.018223	0.163104	0.002261	0.014259	11.32617	4.135404
5	1.124879	84.61344	0.100682	0.321526	0.001969	0.030350	11.30256	3.629470
6	1.190574	84.82975	0.173144	0.469054	0.001800	0.041549	11.20046	3.284241
7	1.246080	85.00349	0.240065	0.610220	0.001887	0.049734	11.05902	3.035581
8	1.293435	85.14309	0.303692	0.746914	0.002325	0.055910	10.89870	2.849366
9	1.336664	85.40411	0.320543	0.758697	0.002442	0.057824	10.68164	2.774746
10	1.374589	85.64353	0.333996	0.767415	0.002554	0.058487	10.48916	2.704859
11	1.408041	85.86462	0.344563	0.773092	0.002665	0.058348	10.31681	2.639902
12	1.437686	86.06973	0.352647	0.775919	0.002776	0.057704	10.16140	2.579824
13	1.463520	86.23284	0.365960	0.798109	0.003325	0.056974	10.03544	2.507348
14	1.486449	86.37875	0.378551	0.821085	0.004046	0.056238	9.915839	2.445495
15	1.506848	86.50928	0.390500	0.844693	0.004953	0.055514	9.802842	2.392216
16	1.525033	86.62596	0.401873	0.868822	0.006062	0.054816	9.696503	2.345965
17	1.541396	86.73821	0.410954	0.886812	0.006971	0.054145	9.593136	2.309773
18	1.556055	86.84185	0.418982	0.902823	0.007986	0.053456	9.497883	2.277022
19	1.569207	86.93775	0.426028	0.916857	0.009111	0.052771	9.410110	2.247373
20	1.581024	87.02667	0.432162	0.928954	0.010347	0.052107	9.329244	2.220520
21	1.591620	87.10728	0.437825	0.940636	0.011929	0.051474	9.255715	2.195145
22	1.601159	87.18114	0.442893	0.951364	0.013675	0.050891	9.187618	2.172422
23	1.609754	87.24874	0.447426	0.961249	0.015590	0.050360	9.124610	2.152024
24	1.617507	87.31053	0.451480	0.970396	0.017677	0.049881	9.066356	2.133677

Appendix F

Data Exploration

F.1 Data Distribution

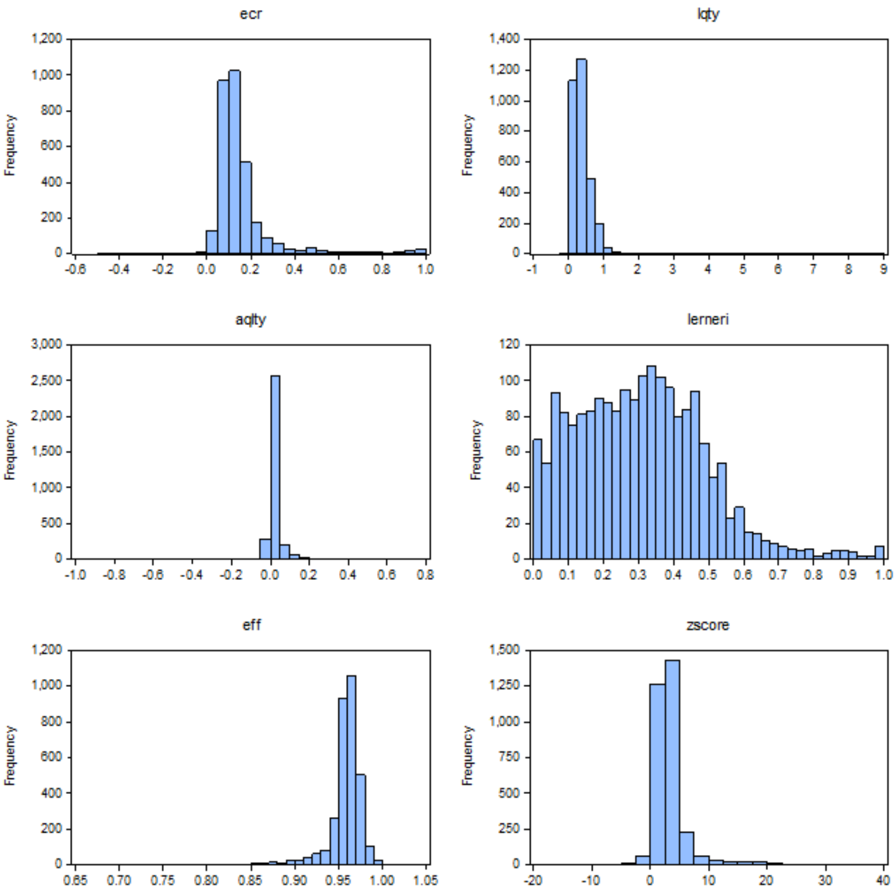


Figure F.1: **Data Exploration: Histogram**

F.2 Graph Matrix

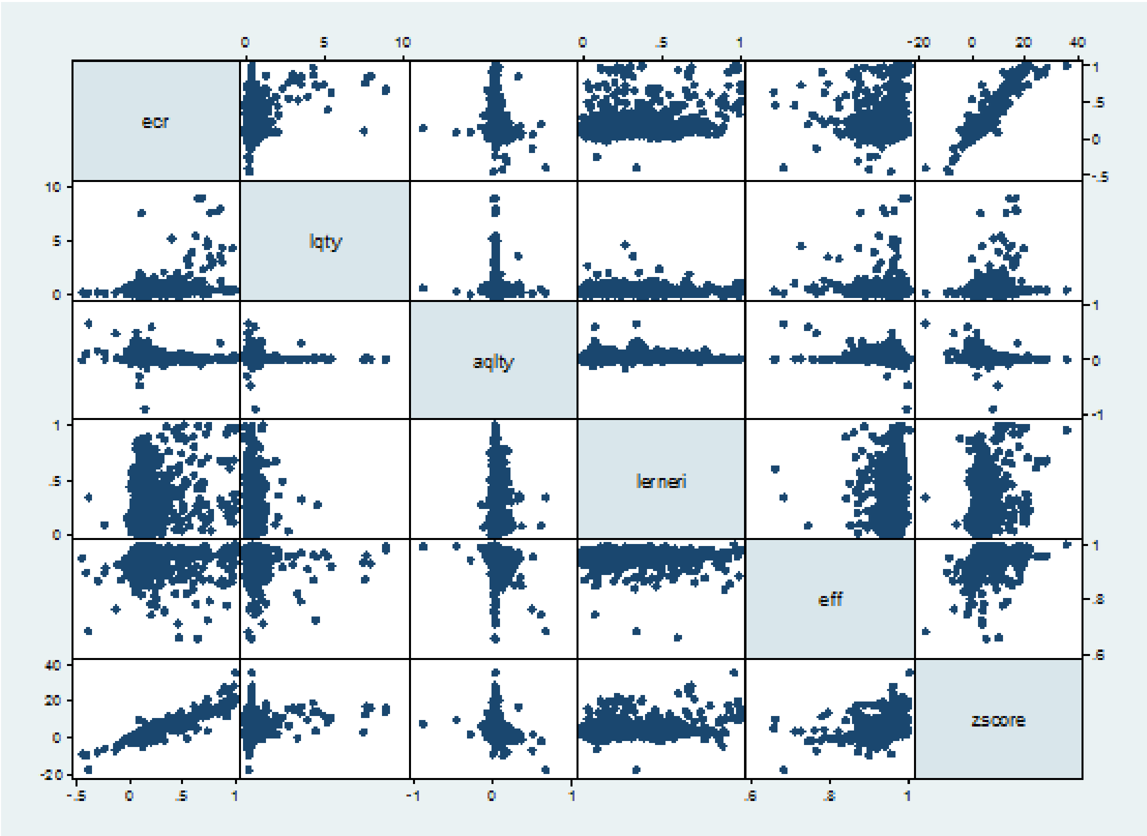


Figure F.2: **Data Exploration: Graph Matrices**

Appendix G

Ethical Clearance Letter

UNIVERSITY OF KWAZULU-NATAL™
INYUVESI YAKWAZULU-NATALI

23 September 2016

Mr Joseph Olorunfemi Akande (215079817)
School of Accounting, Economics & Finance
Westville Campus

Dear Mr Akande,

Protocol reference number: HSS/1578/016D
Project title: Competition, Regulation and Stability of Sub-Saharan Africa Commercial Banks

Full Approval – No Risk / Exempt Application

In response to your application received on 05 September 2016, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. 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.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

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

Yours faithfully

....
Dr Shamila Naidoo (Deputy Chair)

/ms

Cc Supervisor: Dr Farai Kwenda
Cc Academic Leader Research: Dr Harold Ngalawa
Cc School Administrator: Ms Seshni Naidoo

Humanities & Social Sciences Research Ethics Committee
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