

**THE IMPACT OF COMPETITION ON BANK RISK-TAKING IN  
SELECT SUB-SAHARAN AFRICAN COUNTRIES**



**Student Name : Teboho Bosiu**

**Student Number : 335903**

**Supervisor : Prof. Tendai Gwatidzo**

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## **1. Introduction**

According to the macroeconomic theory of aggregate demand, low real interest rates imply low cost of borrowing for firms which encourages them to increase the level of investment in the economy, and subsequently improve the aggregate demand. The financial sector plays a major role in ensuring that resources are efficiently transferred from surplus to deficit units. Therefore the development of the financial sector, particularly the banking sector, has the potential to benefit all the sections of the population, and contribute immensely to economic growth. However, the financial sector in sub-Saharan Africa (SSA) is generally underdeveloped with over 80% of adults unbanked in 2010 (Mlachila et al., 2013).

Mlachila et al. (2013) further note that the scale of financial intermediation in SSA remains significantly lower than in other developing regions of the world, the share of the population that is unbanked is very large, with small and medium enterprises typically tightly constrained in their access to any form of credit, and most banking systems characterized by low loan-to-deposit ratios. Lending is mainly short-term in nature, with about 60% of loans having a maturity of less than one year (Mlachila et al., 2013). These are, amongst others, the result of low income levels, large informal sectors, and low levels of financial literacy, weak contractual frameworks for banking activities, weak creditor rights and judicial enforcement mechanisms, and political risk (Mlachila et al., 2013).

In light of all these features and impediments, it is undisputable that sub-Saharan Africa needs to take measures to accelerate financial sector development if it is to realize its maximum economic growth. Some views even call for the deregulation of the banking sector to promote competition and facilitate the spread of new technologies, and subsequently increase the share of the population that has access to banking facilities, especially access to credit by small and medium enterprises. The high share of total assets accounted for by the three largest banks of SSA indicates that the market structures are typically oligopolistic, with high operational costs, interest rates and service fees (Mlachila et al., 2013).

There is, however, another view that the structure of the sub-Saharan Africa oligopolistic banking system is stable and has the potential to shield the economy against external global shocks. Moreover, the resilience of economic activity in sub-Saharan Africa during the 2008/2009 global financial crisis is due to the banking systems that were well positioned to handle the financial turmoil, given their low leverage, generally healthy capitalization levels, ample liquidity, little reliance on external funding, and little exposure to toxic financial assets

(Mlachila et al., 2013). They only, slightly, came under pressure indirectly via international trade linkages, as the global economic downturn fed into reduced exports and slower domestic economic growth, in turn adversely affecting borrowers and contributing to rising levels of nonperforming loans (NPLs). The impact of these developments on financial sector soundness in the region was relatively modest in the aggregate.

Motivated by those two views as well as the features of financial services sector in sub-Saharan Africa, this paper aims to empirically investigate the nature of the relationship between the competition and risk-taking in the banking sectors of a number of sub-Saharan African countries. There are three main theories emerging from the extant literature: the franchise value paradigm, the risk-shifting paradigm and the U-shaped relationship (Saurina Salas, Jiménez & Lopez, 2007). The franchise value paradigm refers to the phenomenon that if excessive competition exists in the banking industry, banks may adopt riskier policies to maximize profits and maintain their franchise value. The franchise value paradigm, therefore, implies that there is a positive relationship between competition and risk-taking. However, Boyd and De Nicole (2005), from now on referred to as (BDN, 2005), contested the franchise value phenomenon by suggesting that competition is negatively related to risk-taking. They argue that less competition will lead to high interest rates which could result in high default ratios through moral hazard and adverse selection, and thus increase instability. And this is known as the risk-shifting paradigm.

These two paradigms appear to be models with very contradicting outcomes. The franchise value depicts a positive relationship, while the risk-shifting depicts a negative one. Martinez-Miera and Rapullo (MMR, 2007) extended the risk-shifting paradigm model by allowing for imperfect correlation across individual firms' default properties. MMR found a U-shaped relationship between competition and risk-taking. That is, as the number of firms increases, the likelihood of bank default first declines and starts to increase once a certain threshold of competition has been reached. This paper, therefore, seeks to investigate which of these three relationships best explains the impact of competition on risk-taking in the sub-Saharan Africa banking system. Due to the features outlined above, I hypothesize a positive relationship between competition and risk-taking.

The rest of the paper is organized as follows. Section 2 briefly discusses the theoretical and empirical literature on this topic. Section 3 discusses the methodology employed. Section 4

discusses the data and descriptive statistics. Section 5 presents the results, and Section 6 concludes.

## **2. Literature Review**

A significant amount of research effort has been expended trying to better understand the relationship between competition and risk-taking in the banking sector. See for example Marcus (1984), Keeley (1990), and Boyd and De Nicoló (BDN, 2005). Debate is however far from being settled, and remains controversial. The controversy does not only emanate from empirical findings, but also from theoretical underpinnings. This section, therefore, briefly discusses both the theoretical and empirical literature surrounding the three paradigms; franchise value, risk-shifting and U-shaped relationships.

### **Theoretical literature**

The franchise value paradigm enjoys more support in the banking literature of competition and risk-taking (Marcus, 1984; Chan, Greenbaum and Thakor, 1986, Keeley, 1986). This paradigm simply states that banks limit their risk-taking in order to protect their franchise value and monopoly profits. Excessive competition would wear down these profits and the franchise value, which will likely lead to banks taking more risk, and subsequently causing financial instability. This view dates as far back as 1984 when Marcus (1984) used a one period model to illustrate that franchise value decreases as banks engage in riskier projects. Franchise value can be defined as the intrinsic value determined by the intangible assets embedded in the company that contribute to future growth, or as the present value of the future profits that a firm is expected to earn. Chan, Greenbaum and Thakor (1986) showed that excessive competition wears down the surplus that banks can earn by identifying high quality borrowers. This decline in value leads banks to reduce their screening of potential borrowers and, therefore, affects the overall credit portfolio.

Corroborating the above authors, Keeley (1990) used a state preference model with two periods to show that increased competition erodes monopoly rents and in turn increases the default risk as banks take on more risky projects. Using number of banks as a measure of competition, Broecker (1990) showed that increased competition had a negative effect on the average credit-worthiness of the banking system. Suárez (1994) used a dynamic optimization model with an infinite horizon to show that if the market power of a bank decreases, the incentive to engage in riskier policies increases significantly. Since the franchise value of the bank is a component

of bankruptcy costs, it inspires a bank to carry out prudent policies that increase the solvency of the bank.

Similar to Keeley (1990), Hellmann, Murdock and Stiglitz (2000) showed that by removing interest rates ceiling on deposits, banks' franchise value decreased and that leads to moral hazard behaviour by banks. Matutes and Vives (2000) showed, in a framework of product differentiation, that higher market power reduces a bank's default probability. Marquez (2002) showed that an increase in competition in a market scatters the borrower specific information and will result not only in higher funding costs for low-quality borrowers but also in a higher access to credit for low-quality borrowers. Allen and Gale (2004) showed that reduced franchise value as a result of more competition encouraged banks to take on more risk.

In contrast to the franchise value paradigm, the risk-shifting view is that the risk exposure of a bank can increase with increased market power. That is, as bank competition decreases, banks will earn more profits by charging high interest rates on business loans. However, in a moral hazard environment and asymmetric information, borrowers with less risky projects will be discouraged and eventually exit the market, leaving the market with highly risky projects with high probabilities of default (Akerlof, 1974). This in turn will increase the riskiness of the entire bank loan portfolio. Therefore under this view, risk is shifted from the borrower to the bank. This model was originally presented by Allen and Gale (2000), and later transformed by Boyd and De Nicoló (BDN, 2005) as a challenge to the franchise value paradigm. They showed that as the number of banks and competition increases, the level of bank risk would decline. This implies that more competition would lead to financial stability.

These two paradigms discussed thus far are linear models with opposite outcomes. In a recent paper, Martínez-Miera and Repullo (MMR, 2007) reconciled the franchise value and the risk-shifting paradigms and showed that the risk-shifting model might become a U-shaped relationship between competition and risk if there is imperfect default correlation across firms. That is, as bank competition increases, bank risk will initially go down, but at some level of competition, bank risk will start to go up.

## **Empirical Literature**

Given the importance of financial stability and the implications of financial instability in a given economy, it is not surprising that a lot has been done trying to better understand the relationship between risk-taking and banking sector competition. Using different measures of

bank risk and competition, several scholars have tested the relationship between competition and bank risk-taking to determine if it follows the franchise value, risk-shifting or a combination of both (that is, the U-shaped model).

The majority of empirical literature appear to lend most support to the franchise value paradigm. Keeley (1990), using Tobin's  $q$  (the ratio of a bank's equity market valuation to its book value) as a measure of market power, finds that higher market power means a larger solvency, and that a decline in market power increases the funding costs, supporting the franchise value paradigm. Saunders and Wilson (1996) used a sample of US banks for the period from 1973 - 1992 and find results in support of Keeley (1990). Using volatility of stock prices as their measure of risk, Brewer and Saidenberg (1996) found a negative relationship between franchise value and risk. Replicating Keeley's work for Spain, Salas and Saurina (2003) found a significant and robust negative relationship between Tobin's  $q$  and non-performing loan ratios.

Agoraki et al. (2009) use the Lerner index and non-performing loans as proxies for competition and risk to measure the impact of competition on bank risk-taking in the banking systems of Central and Eastern Europe in the period 1998-2005. They find that banks with market power tend to take on lower credit risk. Cubillas (2014) analyses the networks through which financial liberalization affects bank risk-taking in an inter-national sample of 4333 banks in 83 countries. Using Lerner index to measure competition she concludes that in developed countries financial liberalization encourages stronger bank competition that increases risk-taking incentives, whereas in developing countries bank competition increases bank risk by expanding opportunities to take risk.

Tabak et al. (2015) investigate the competitive behaviour of the Brazilian banking sector by analysing how the risk-taking behaviour of banks is affected by their degree of market power. Firstly, they find that the Brazilian banking industry is characterized by monopolistic competition. Secondly they find that the market power of Brazilian banks is negatively related to their risk-taking, irrespective of changes in banks' capital levels. They use the Panzar and Rosse (H-statistic) model to measure competition. The H-statistic enables the usage of elasticities to examine how variations in input prices affect revenues. It is defined as the sum of the input price elasticities of the reduced-form revenue equation, which reveals the competitive conditions of the banking industry.

Leroy and Lucotte (2016) re-examine the relationship between competition and bank risk across a large sample of European listed banks over the period 2004–2013 by considering both individual and systemic dimensions of risk. Systematic risk (SRISK) is measured by the expected capital shortfall of a given financial institution in the event of a crisis affecting the whole financial system. The financial institutions with the largest capital shortfall are assumed to contribute the greatest to the crisis, and therefore the most systemically risky. To measure competition, they use the Lerner index. Their results firstly indicate that competition promotes bank risk-taking and increases individual bank fragility. On the other hand they conclude that competition enhances financial stability by decreasing systemic risk.

Kabir and Worthington (2017) use Islamic banks to investigate the relationship between competition and stability/fragility in 16 different developing economies over the period 2000–2012. They gauge stability using both accounting-and-market-based measures. Accounting-based measures include the Z-score and the nonperforming loan ratio, while market-based measures include Merton's distance to default. To measure competition, they use the Lerner index. Their results support the competition–fragility hypothesis in both Islamic and conventional banks. They also conclude that the magnitude of the impact of market power on stability is greater for conventional banks than Islamic banks.

In contrast to the franchise value paradigm, many scholars have found results supporting the risk-shifting paradigm. Boyd, De Nicoló and Al Jalal (2006) use several measures of bank risk, namely; a z-score measure based on bank returns on assets (ROA), its dispersion measured as a standard deviation of (ROA) and the ratio of equity to total assets, and the Herfindahl-Hirschmann index (HHI) as a measure of bank competition to provide empirical evidence supporting the risk-shifting model. De Nicoló and Loukoianova (2007) find results supporting those of Boyd, De Nicoló and Al Jalal (2006). They find their results to be even more robust once they take bank ownership into account.

Soedarmono et al. (2012) examine the impact of bank competition on financial stability in Asian emerging markets over the 1994–2009 period by accounting for crisis periods. They conclude that less competition in the banking market is associated with higher capital ratios, higher income volatility and higher insolvency risk of banks. They use a measure of market power (Lerner index) for the banking industry considered as a whole (aggregate index) to conclude that market power in the banking industry increases bank risk taking. They claim that this measure is more appropriate than individual bank indices because the Asian banking

industries are characterized by complex ownership structures and pyramids. Anginer et al. (2013) use bank level measures of competition (Lerner index) and co-dependence to show a negative relationship between bank competition and systemic risk. That is, increased competition tends to motivate banks to diversify more of the risk they take, making the banking system less fragile to shocks.

Lending support to the encompassing U-shaped relationship, Tabak et al. (2012) employ the Boone indicator as their central measure of competition to examine the effects of competition on bank risk-taking behaviours in 10 countries between 2003 and 2008. The Boone indicator is the recent measure of competition developed by Boone (2008). Central to its considerations is that competition improves the performance of efficient firms and weakens the performance of inefficient ones. However, like the Lerner index, it also relies on the marginal costs. Using stability inefficiency as the dependent variable the paper discovers that competition affects bank risk-taking behavior in a non-linear relationship (inverted U-shaped), implying that both high and low competition levels enhance financial stability. Furthermore, the paper concludes that average competition diminishes financial stability.

### 3. Methodology

The main aim of this study is to test the relationship between competition and risk-taking. That is, the extent to which bank sector competition drives risk-taking. To achieve this objective I use credit risk as my main risk indicator, since it is the major driver of risk for most banks. I use banks' level of non-performing commercial loans (NPL) to measure credit risk, and set it as the dependent variable. The BankScope online database is used to obtain data for the NPL ratios. Different measures of banking sector competition have been used in the literature, and while some of them use the standard concentration measures, this paper uses the Lerner index for commercial loan products for each bank. The Lerner index captures the degree to which a firm is able to raise its price over the marginal cost. Compared to the other measures of market concentration such as the z-index, HHI etc., the Lerner index is a more accurate measure of market power (Tirole, 1988).

The Lerner index is calculated as follows:

$$Lerner\ Index = \frac{P - MC}{P} \text{-----} (1)$$



Where  $P$  denotes the price of output of a bank and  $MC$  denotes the total marginal cost of output. Following Fernandez de Guevara et al. (2005), I calculate  $MC$  from the estimation of a translogarithmic costs function with one output (total assets), three input prices (price of labor, price of physical capital, and price of borrowed funds) and technical change (proxied by a Trend). Specifically, the translog costs function estimated is as follows:

$$\ln TC_i = a_0 + a_1 \ln TA_i + \frac{1}{2} a_2 (\ln TA_i)^2 + \sum_{j=1}^3 b_j \ln w_{ji} + \frac{1}{2} \sum_{j=1}^3 \sum_{k=1}^3 b_{jk} \ln w_{ji} \ln w_{ki} + \frac{1}{2} \sum_{j=1}^3 c_j \ln TA_i \ln w_{ji} + u_1 Trend + u_2 \frac{1}{2} Trend^2 + u_3 Trend \ln TA_i + \sum_{j=1}^3 r_j Trend \ln w_{ji} + \varepsilon_i \text{-----}(2)$$

where  $TC_i$  is the bank's total costs including financial and operating costs,  $TA_i$  is total assets used as a proxy variable for banking output, and  $w$  represents input prices ( $w$ ) defined as:

$$\begin{aligned} w_1 = \text{Price of labour} &= \frac{\text{Personnel cost}}{\text{Total Assets}} \\ w_2 = \text{Price of Capital} &= \frac{\text{Operatings cost(excl.personnel costs)}}{\text{Fixed Assets}} \text{-----}(3) \\ w_3 = \text{Price of Deposits} &= \frac{\text{Financial costs}}{\text{Deposits}} \end{aligned}$$

Marginal cost is the derivative of total cost with respect to output. Differentiating equation (2) above with respect to output and rearranging yields the following marginal cost function;

$$MC_i = \frac{TC_i}{TA_i} (a_1 + a_2 \ln TA_i + \frac{1}{2} \sum_{j=1}^3 c_j \ln w_{ji} + u_3 Trend) \text{-----}(4)$$

Once the marginal costs are generated, I then use equation (1) to calculate the Lerner Index. It is worth noting that the generated Lerner index does not capture risk premia in the prices of banks' product and services, therefore breaking down its positive association with the size of monopoly rents (Iveta, 2012).

To examine the various hypotheses regarding the franchise value paradigm, the risk-shifting hypothesis of the BDN (2005) model and the U-shaped relationship in the MMR model, and given the variables outlined above, I adopt the methodology outlined in Jimenez et al. (2013) and estimate the following general regression:

$$RISK_{it} = f(\text{COMPETITION INDEX}_{it}, \text{BUSINESS CYCLE}_{it}, \text{BANK CONTROL VARIABLES}_{it}) \text{-----(5)}$$

This model tests the relationship between individual bank  $i$ 's level of risk against the level of competition at time  $t$ , while also taking into bank  $i$ 's individual characteristics and economic environment at time  $t$ . The precise model specification is:

$$\ln\left(\frac{NPL_{it}}{100-NPL_{it}}\right) = \alpha + \beta \ln\left(\frac{NPL_{it-1}}{100-NPL_{it-1}}\right) + \delta_1 COMPETE_{it} + \delta_2 COMPETE_{it}^2 + \gamma_1 GDPG_t + \gamma_2 GDPG_{t-1} + \varphi_1 ROA_{it} + \varphi_2 SIZE_{it} + \varphi_3 LOAN\ RATIO_{it} + u_i + \epsilon_{it} \text{ ----- (6)}$$

Table 1 below shows the variables used to estimate equation (6) above.

**Table 1: Variable definition**

Variable	Definition
<b>Dependent Variable</b>	
$NPL_{it}$	Commercial non-performing loan ratio of bank $i$ at time $t$
<b>Explanatory Variable</b>	
$GDPG_t$	Real GDP growth rate at time $t$
$SIZE_{it}$	Market share of bank $i$ at time $t$ in terms of total loans
$LOAN\ RATIO_{it}$	Specialization of firm $i$ at time $t$ in the non-financial sector through the ratio of loans to firms over total assets
$ROA_{it}$	Return on assets of bank $i$ at time $t$
$COMPETE_{it}$	Degree of bank market competition

The main explanatory variables of interest are those that measure the degree of competition, denoted by the  $COMPETE_{it}$  term. I use the Lerner Index to measure the level of banking sector competition (i.e.,  $COMPETE_{it}$ ). To test for the MMR (2007)'s U-shaped relationship, I include the squared variable of competition ( $COMPETE_{it}^2$ ). For the franchise value paradigm, I expect the signs of  $\delta_1$  and  $\delta_2$  to be negative and significant. On the contrary, when they are both positive, evidence would be in favour of the risk-shifting paradigm. If, however,  $\delta_1$  is negative and  $\delta_2$  is positive and both significant, the evidence would be in support of the U-shaped relationship of MMR (2007).

With regards to the lagged NPL variable, I expect it to have a positive coefficient. However the coefficient is likely to be insignificant due to the relatively short period I am considering. I expect a negative and significant sign for the GDPG variable. For the return on assets (ROA) I

expect a negative coefficient because banks with high NPL ratios are likely to experience significant decline in returns. However in the long run the relationship between risk and return is generally positive.

I use a panel data covering the period 2011-2015 to estimate the above models. Panel data analysis provides flexibility in modelling differences in behaviour across individual banks, which may arise from heterogeneity of banks. In contrast however, as argued by Arellano (2003), pooled analysis assumes away heterogeneity and therefore could have significant implications on results.

There are different approaches used in estimating panel models, however the choice is mainly between fixed and random effects models. I choose random effects model because I draw my sample from the broader population of SSA banks, and intend to make broader conclusions regarding the entire region based on that sample. Also, random effects model is able to capture the impact of unobservable individual characteristics (i.e., management, corporate culture, risk tolerance, etc.) on the dependent variable. It is for these that I do not base my choice of model on available diagnostic tests such as the Hausman test. Moreover, my usage of robust standard errors to counter heteroskedasticity does not allow for the employment of such tests.

#### 4. Data and Results

The data on Sub-Saharan African banks are derived from BankScope, a global database published by Bureau Van Dijk. The data are collected for an unbalanced sample of 797 bank observations operating in South Africa, Zambia, Tanzania, Nigeria, Uganda, Angola and the Kenya between 2011 and 2015. The use of unbalanced data is justified by the unavailability of data for some banks for some of the variables. The data were analysed for inconsistencies, missing values and outliers. The final sample is shown in Table 2, which lists the total and average number of banks in the sample by country and year.

**Table 2: Total number of bank observations per country**

Year	Zambia	South Africa	Tanzania	Nigeria	Angola	Kenya	Uganda	Total by year
2011	5	15	3	18	3	11	6	<b>61</b>
2012	7	17	4	19	6	14	6	<b>73</b>
2013	20	44	29	29	18	46	23	<b>209</b>
2014	18	43	29	28	16	47	24	<b>205</b>
2015	16	41	28	25	15	43	23	<b>191</b>
<b>Total by country</b>	<b>66</b>	<b>160</b>	<b>93</b>	<b>119</b>	<b>58</b>	<b>161</b>	<b>82</b>	<b>739</b>

Note: The figures above do not represent the total number of banks operating in a country in a given year. They represent the number of banks after accounting for data limitations and outliers.

Estimating the Lerner index requires knowledge of the banks' marginal cost and bank output. Marginal cost is calculated from results of estimating Equation (2) and then differentiating it with respect to output to get Equation (4). The marginal cost [Equation (4)] is then substituted into Equation (1). The price of output is estimated by the ratio of total revenue to total assets. Table 3 below provides results of estimating Equation (2).

**Table 3: Random effects panel estimation of the translog cost function**

Random-effects GLS regression		Number of obs	=	685
Group variable: cocode		Number of groups	=	209
R-sq:	Within	= 0.9940	Obs per group: min	= 1
	Between	= 0.9956	Avg	= 3.3
	Overall	= 0.9947	Max	= 5
corr(u_i,Xb)	=0	Wald chi2(20)	=	223367.6
		Prob > chi2	=	0.0000

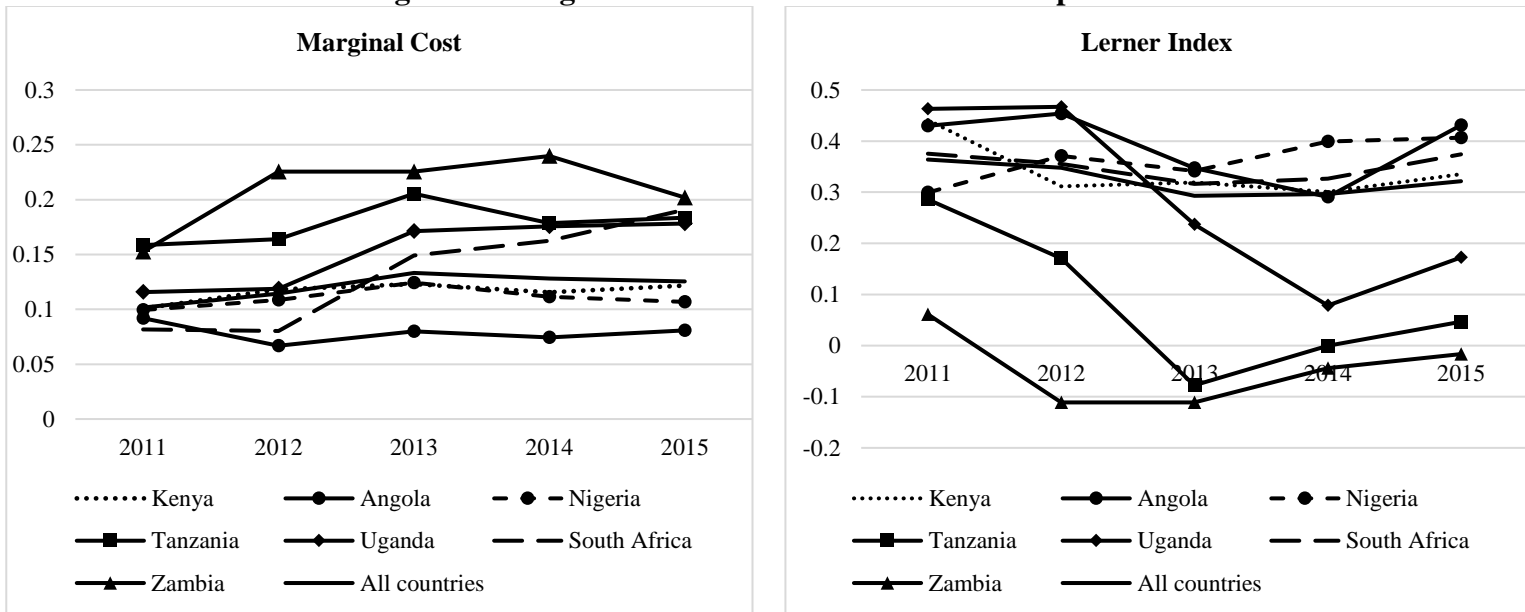
  

<b>lnTC</b>	<b>Coef.</b>	<b>Std. Err (robust)</b>	<b>z</b>	<b>P&gt;z</b>	<b>[95% Conf. Interval</b>	
lnTA	1.01***	0.04	28.19	0.000	0.94	1.08
0.5(lnTA) <sup>2</sup>	0.00	0.00	-1.40	0.160	-0.01	0.00
lnw <sub>1</sub>	0.89***	0.14	6.40	0.000	0.62	1.17
lnw <sub>2</sub>	0.31***	0.10	3.14	0.002	0.11	0.50
lnw <sub>3</sub>	-0.10	0.09	-1.11	0.268	-0.28	0.08
0.5(lnw <sub>1</sub> ) <sup>2</sup>	0.20***	0.04	4.75	0.000	0.12	0.28
(lnw <sub>1</sub> )(lnw <sub>2</sub> )	-0.01	0.02	-0.53	0.596	-0.05	0.03
(lnw <sub>1</sub> )(lnw <sub>3</sub> )	-0.10***	0.02	-4.44	0.000	-0.14	-0.06
0.5(lnw <sub>2</sub> )(lnw <sub>2</sub> )	-0.06***	0.01	-5.44	0.000	-0.08	-0.04
(lnw <sub>2</sub> )(lnw <sub>3</sub> )	0.01	0.01	1.12	0.261	-0.01	0.04
0.5(lnw <sub>3</sub> ) <sup>2</sup>	-0.03***	0.01	-4.92	0.000	-0.04	-0.02
0.5(lnTA)(lnw <sub>1</sub> )	0.02	0.02	1.13	0.258	-0.01	0.05
0.5(lnTA)(lnw <sub>2</sub> )	-0.03***	0.01	-3.12	0.002	-0.06	-0.01
0.5(lnTA)(lnw <sub>3</sub> )	-0.04***	0.01	-3.03	0.002	-0.06	-0.01
Trend	0.07	0.06	1.27	0.205	-0.04	0.19
0.5Trend <sup>2</sup>	0.00	0.01	0.47	0.640	-0.01	0.02
Trend(lnTA)	0.00	0.00	-0.07	0.947	0.00	0.00
Trend(lnw <sub>1</sub> )	0.00	0.01	0.34	0.731	-0.02	0.03
Trend(lnw <sub>2</sub> )	-0.01	0.01	-0.80	0.424	-0.02	0.01
Trend(lnw <sub>3</sub> )	0.02**	0.01	2.51	0.012	0.00	0.03
_cons	0.60	0.41	1.47	0.142	-0.20	1.39
<b>sigma_u</b>	0					
<b>sigma_e</b>	0.146287					
<b>rho</b>	0	(fraction of variance due to u_i)				

\*\*\*, \*\* and \* represent 1%, 5% and 10% significance level respectively

For all sample countries the marginal costs are derived from these results using Equation 4 and ultimately used to calculate the Lerner Index using Equation 1. Figure 1 shows the evolution of marginal costs and of the Lerner index of market power over the sample period and country differences are also apparent. Lerner Index values range between 0 and 1, with values closer to 1 indicating an uncompetitive market where a bank is able to charge higher prices of output over the marginal cost, while values closer to 0 indicate a highly competitive market where a bank is unable to charge higher prices of output over marginal costs. The banking sector in the Zambia and Tanzania seem to have higher marginal costs and Angola the lowest.

**Figure 1: Marginal Cost and Lerner Index of Competition**

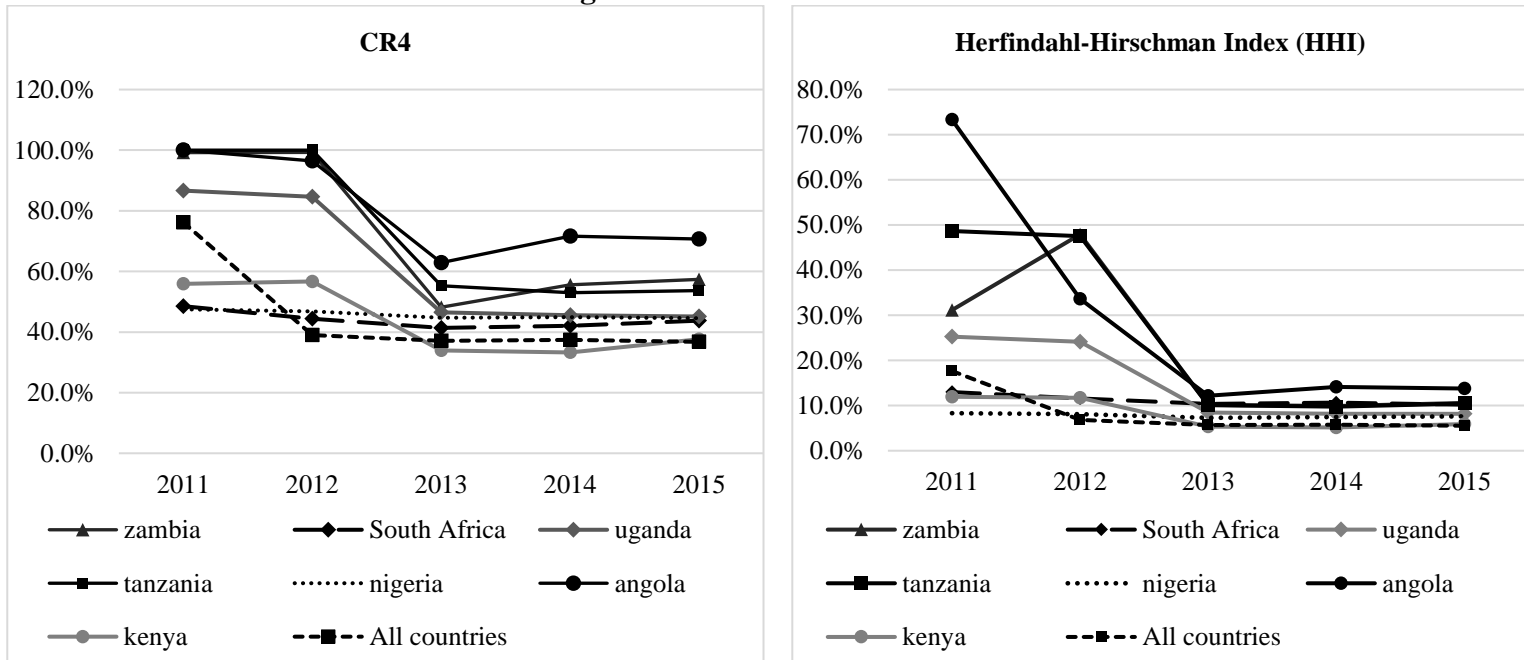


Marginal costs remained stable in all countries over the sample period, except for Zambia, Uganda and South Africa. Despite Zambian banks displaying the highest average marginal costs, they experienced a decline in marginal costs between 2014 and 2015, while in South Africa and Uganda marginal costs increased faster than in most of the other countries over the entire sample period. In Angola, banks displayed the lowest marginal costs over the entire period despite the highest Lerner Index. While the Lerner Index declined between 2012 and 2014 in Angola, marginal costs remained stable, thus indicating that the average price of assets were declining. Similarly Uganda, Tanzania and Zambia displayed a decline in the Lerner Index between 2011 and 2013 whilst the corresponding marginal costs were increasing, thus indicating that the price of assets were growing slower than the marginal costs.

It is interesting to note that Tanzanian and Zambian banks on average displayed negative values of Lerner Index at some points in the sample period. This could mean that the prices of output

for some banks were below the marginal costs, that is to say, some banks actually experienced losses in those years. Solis and Maudó (2008) posit that negative values of Lerner Index denote super competition and may occur when banks price below marginal cost. Comparing these results with the common concentration measures such as the CR4 and HHI (Figure 2), they demonstrate that, despite being more concentrated (particularly between 2010 and 2013), commercial banks enjoy a lower market power.

**Figure 2: Concentration Ratios**



In general, the values of HHI show a noticeable trend of decline from 2011 to 2013, followed a relatively constant trend there afterwards, meaning that market concentration has generally declined between 2011 and 2015. Since data were not available for most of the banks in the beginning years of the period (particularly for Tanzania and Angola), it is important to note that these results may not represent the accurate picture and therefore should be read with caution. Nonetheless, it is interesting to note that for South Africa, Kenya and Nigeria (they had more data available in the beginning years of the sample period), the values of HHI show a moderate decrease over the entire sample period. They are almost constant.

I also use the four largest bank concentration ratio (CR4) to calculate the market concentration of the whole banking sector. CR4 of banking sector are defined as the sum of the ratios of total assets of the four largest banks to the total assets of all the banks in a given year. The CR4 values depict a similar trend as the HHI values (Figure 2); a decrease between 2011 and 2013, and a relatively constant trend thereafter.

The Lerner Index constructed above is used in the estimation of equation (6). It represents the variable  $COMPETE_{it}$ . I use the World Bank database for data on GDP growth rates. Data on the rest of the variables is sourced from BankScope database, and the all the variables are as explained in table 1 above. Table 4 below presents the statistical summary of the variables in Equation (6).

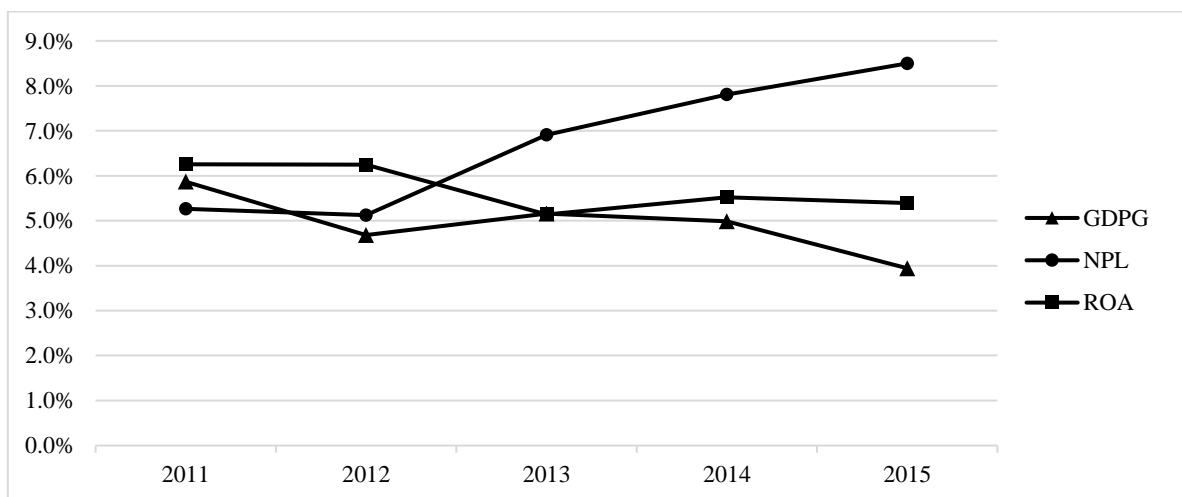
**Table 4: Summary of Descriptive Statistics**

Variable	Mean	s.d	Min	Max
$NPL_{it}$	0.072	0.087	5.12%	8.50%
$COMPETE_{it}$	0.256	0.289	23.71%	30.79%
$GDPG_t$	0.048	0.006	3.94%	5.87%
$ROA_{it}$	0.055	0.081	5.14%	6.25%
$LOAN\ RATIO_{it}$	0.520	0.194	48.86%	52.73%

On average, the ratio of non-performing loans to total loans is 7.2% over the entire period for all the banks of the seven banks. It was highest (8.5% on average) in the year 2015, corresponding to an average growth rate of GDP of 3.9% in that year, and lowest (5.1% on average) in the year 2012, while the average growth rate of GDP was 4.7% in that year.

It is interesting to note that on average when the combined economies of the seven countries were growing faster, there were less non-performing loans, reflected in the low value of average NPL. Similarly when the growth rate of the economies of these countries were slow, non-performing loans were generally high. This trend (illustrated in Figure 3) confirms the general expectation that during economic hardships, borrowers are likely to find it difficult to service their debts, hence an increase in problematic loans (non-performing loans) for banks.

**Figure 3: Evolution of NPL, GDPG and ROA: 2011-2015**



Similarly, the average return on assets exhibits a negative association with the non-performing loan ratios. It was highest (6.3%) in 2011 when the NPL was relatively lower (5.1%), and relatively lower (5.4%) in 2015 when the NPL was highest (8.5%). This gives credence to an expectation that when banks' issued loans are largely defaulting, returns on the overall portfolio of loans will tend to decline.

In contrast the average return on assets exhibits a positive association with the growth rate of GDP. This also confirms the general expectation that during periods of economic distress/prosperity, banks are likely to realize lower/higher returns on assets. The average maximum return (6.3%) was realized in the year 2011, when the growth rate of GDP was also at its highest. On the other hand when the average growth rate of GDP was at its lowest in 2015, the average return on assets was 5.4%, second to its lowest value. It's noteworthy to point out that there are some negative returns on assets for some of the banks in the sample, meaning that they experienced losses at some points in time during the period examined. This could partly explain the some negative values of the Lerner Index.

The Lerner Index was 25.6% on average. The highest average value (30.8%) was recorded in 2011, indicating that the combined banking sector of the seven sub-Saharan African countries was less competitive, while the lowest average value (23.7%) was recorded in 2013, indicating that the banking sector was more competitive. Interestingly, non-performing loans ratio was lowest (5.3%) in 2011 when the banking sector was less competitive, and highest (8.5%) in 2015 when the banking sector was more competitive. This could be an early indicator of the franchise value paradigm in the Sub-Saharan banking sector. Lastly, the overall ratio of loans to total assets in the sample data is 52.0%. The largest ratio (52.7%) was recorded in 2014, while the smallest (48.9%) was recorded in 2012.

All the variables constructed and described above are used in the estimation of Equation 6. As explained earlier I choose to use the random effects model to estimate the impact of competition on bank risk-taking. The choice is based on my assumption that the banks in these seven countries are representing the bigger sample of the entire Sub-Saharan Africa, and my intention to make broader conclusions regarding the entire region. Also, random effects model is able to capture the impact of unobservable individual characteristics on the dependent variable. In the case of banks, unobservable characteristics include management, corporate culture, risk



tolerance, etc. I use robust standard errors to correct for heteroskedasticity. Table 5 presents the estimated results.

**Table 5: Random Effects Estimation Results of Equation 6**

Country	Whole Sample	South Africa	Nigeria	Tanzania	Zambia	Uganda	Kenya	Angola
	<b>Coefficient</b>							
$\ln\left(\frac{NPL_{it-1}}{100-NPL_{it-1}}\right)$	-0.024	0.182	0.346*	0.197	-0.018	0.133	0.189**	0.557*
$COMPETE_{it}$	-2.833***	-1.967	-1.904**	0.191	0.190	-5.25***	0.271	11.17
$COMPETE_{it}^2$	-1.298***	-2.903	0.841	0.051	0.161	4.841	-5.66***	-1.37
$GDPG_t$	-21.24*	-41.86	-10.21	-4.579	16.76	-15.28	35.95	19.67
$GDPG_{t-1}$	-18.45	4.722	17.34	14.53	-28.36	-14.65	52.88***	-3.80
$ROA_{it}$	6.672*	13.83**	-4.83	-9.95***	-18.67***	21.95***	3.481	-59.48**
$SIZE_{it}$	-0.885	2.203	1.410	-0.698	0.506	-2.321	-6.10**	-2.77
$LOAN\ RATIO_{it}$	0.808	0.354	3.505	1.588*	0.012	-1.817	0.327	6.18***
<b>R-sq (overall)</b>	0.1596	0.3489	0.454	0.2067	0.6446	0.1360	0.4648	0.3968
<b>Prob&gt;Chi</b>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<b>rho</b>	0.000	0.106	0.000	0.483	0.033	0.5057	0.000	0.000

\*\*\*, \*\* and \* represent 1%, 5% and 10% significance level respectively

To test the hypotheses we run the bank-level risk variable on competition and other control variables for each sample countries as well as for the whole sample of countries (the latter result we shall call the Whole Sample results). In the whole sample regression most of the coefficients are significant with the correct signs. Most importantly,  $COMPETE_{it}$ , which is my main variable of interest, is highly significant at 1% level of significance. Since the  $COMPETE_{it}$  variable is measured using the Lerner Index, the negative sign of the  $COMPETE_{it}$  coefficient implies that an increase in the Lerner Index reduces the level of bank-level risk. But an increase in the Lerner Index implies a reduction in competition. The negative relationship between the Lerner Index and risk levels therefore implies that a reduction in competition (measured by an increase in the Lerner Index) results in a reduction in risk levels. This means competition and risk level move in the same direction. That is, they are positively related. The negative sign therefore indicates that a decrease in competition (i.e., an increase in the Lerner Index) influences banks to take less risk, to fund less risky projects or to be more prudent in the screening processes of their loan applicants. Together with the negative and significant coefficient of  $COMPETE_{it}^2$ , these support the franchise value paradigm which states that as the level competition increases banks are likely to undertake risky projects in an attempt to safeguard their profits.

Individually, Nigeria and Uganda have negative and significant coefficients of the competition variable, preliminarily supporting the franchise value paradigm. However, since the coefficient of the squared competition variable is positive yet insignificant, it is inconclusive whether the results indicate the franchise value or the encompassing U-shaped paradigm. Kenya and Angola have positive and negative coefficients of the competition and squared competition variables respectively. If both variables were both significant, that would indicate an inverted U-shaped relationship. Also in support of the franchise value paradigm, both the coefficients of the competition and the squared competition variables for South Africa are negative but insignificant. For Tanzania and Zambia, both coefficients are positive but insignificant. This could be indicative of the risk-shifting paradigm.

The GDPG coefficient is negative and significant for the whole sample, indicating that periods of economic prosperity/distress are associated with less/more problematic loans. However, the coefficient is insignificant for all the individual countries. On the other hand the coefficient of ROA is significant for the whole sample and almost all the individual countries except for Zambia and Kenya. Interestingly, the ROA coefficients for Nigeria, Tanzania, Zambia and Angola are negative and significant while those of Uganda, South Africa and Whole Sample are positive and significant. The positive coefficients could be confirming the general long-term positive relationship between risk and return, while on the other hand the negative coefficients could be confirming that banks with high NPL ratios are likely to experience significant decline in returns.

When it comes to the relationship between risk-taking and the LOAN RATIO (a proxy for the specialisation of a bank) variable, we find the coefficient to be insignificant for the Whole Sample and all the other individual countries except Tanzania and Angola. The inclusion of this variable was meant to be indicative of the ability of banks to monitor and screen borrowers, or the willingness to take more risk. The results mostly indicate that the specialisation of banks in loans meant that they are willing to take more risk and, without prudent monitoring and screening processes, expose themselves to problematic loans. But for Uganda, the more specialised in loans banks are, the less their problem with the loans ratio. This could be indicative of prudent monitoring and screening of borrowers.

In all the regressions,  $\rho$  represents the proportion of variation in the dependent variable that is due to the unobservable bank-specific characteristics. As the results indicate, 0% of the

variation is due to bank-specific characteristics in Nigeria and the Whole Sample regressions. The Ugandan banking sector has the highest (50.6%) proportion of variation in risk influenced by bank-specific characteristics, followed by Tanzania (48.3%), South Africa (10.6%) and Zambia (3.3%).

## **5. Conclusion**

Macroeconomic theory of aggregate demand suggests that low real interest rates imply low cost of borrowing for firms which encourages them to increase the level investment in the economy, and subsequently improve the aggregate demand. Financial sector plays a major role in ensuring that resources are efficiently transferred from surplus to deficit units. Therefore the development of the financial sector, particularly banking, has the potential to benefit all the sections of the population, and contribute immensely to economic growth. However, according to Mlachila et al. (2013), the financial sector in sub-Saharan Africa (SSA) is generally underdeveloped.

Understanding the market structure of the financial services sector is critical to the identification of accurate developmental needs, and effective policy-making. In particular, understanding the levels of risk-tolerance will assist in tracking the investment decisions and access to finance in the banking sector. Furthermore, this will inform the kind of incentives necessary to develop the sector and ensure that it is accessible by a larger proportion of the population, and avoid unnecessary over-or-under regulation that may hinder development.

For instance, the oligopolistic nature of the SSA banking sector may trigger calls for the deregulation of the sector to promote competition and facilitate the spread of new technologies, and subsequently increase the share of the population that has access to banking facilities, especially access to credit by small and medium enterprises. On the other hand, a counter argument could be that the current oligopolistic structure does not necessarily imply less competition, and therefore deregulating to increase competition may not be the correct remedy. Furthermore, increasing competition could have negative or positive consequences on the entire sector depending on the type of relationship existing between risk and competition.

Against this backdrop, the main objective of this study was to empirically investigate the nature of the relationship between competition and risk-taking in the banking sectors of select of sub-Saharan African countries.

Using data for seven sub-Saharan African banking systems, I examine the relationship between risk and competition. My dependant variable is the ratio of non-performing loans ratios. I use the Lerner Index as my main explanatory variable, after controlling for macroeconomic conditions and bank characteristics. The results indicate a strong positive (franchise value) relationship between competition and risk-taking in the overall sample that includes all the seven sub-Saharan countries. This could be an indication that less competition influences SSA banks to fund less risky projects or to be more prudent in the screening processes of their loan applicants. Individually, the South African banking system weakly supports the franchise value paradigm. In contrast, the banking systems of Tanzania and Zambia weakly indicate the risk-shifting paradigm. Nigerian and Ugandan banking systems weakly support the U-shaped paradigm, while Kenya and Angola weakly indicate an inverted U-shaped relationship.

Regarding other explanatory variables, the GDPG results weakly indicate that periods of economic prosperity/distress are associated with less/more problematic loans. On the other hand the ROA results indicate the general long-term positive relationship between risk and return in Uganda, South Africa and Whole Sample, while indicating that banks with high NPL ratios are likely to experience significant decline in returns in Nigeria, Tanzania, Zambia and Angola.

The results for the LOAN RATIO (a proxy for the specialisation of a bank) variable mostly indicate that the specialisation of banks in loans meant that they are willing to take more risk and, without prudent monitoring and screening processes, expose themselves to problematic loans. But for Uganda, the more specialised in loans banks are, the less their problem with the loans ratio. This could be indicative of prudent monitoring and screening of borrowers.

Moreover, the results indicate that any policy direction aimed at increasing the competitiveness of the sub-Saharan African banking systems should be pursued cautiously. More importantly, in pursuing such policies, a clear definition of what is regarded as competitive should be well considered. In banking systems defined by franchise value paradigm such as South Africa, excessive competition could lead to financial instability. However in banking systems such as those of Tanzania and Zambia there may be more room to manoeuvre in pursuing policies aimed at increasing competitiveness since an increase in competition does not prove to lead to financial instability.

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