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# The impact of competition on bank risk-taking in sub-Saharan Africa

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## About the project

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The SA-TIED programme looks at ways to support policy-making for inclusive growth and economic transformation in the southern Africa region, through original research conceived and produced in collaboration between United Nations University World Institute for Development Economics Research (UNU-WIDER), National Treasury, International Food Policy Research Institute (IFPRI), and many other governmental and research organizations in South Africa and its sub-region. A key aspect of the programme is to encourage networking and discussion amongst people involved in policy processes across the participating organizations and civil society aiming to bridge the gap between research and policy-making.

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## ABSTRACT

The impact of competition on bank risk-taking in seven sub-Saharan African countries between 2011 and 2015 is examined. First, the Lerner index is estimated, as the measure of competition. This is then regressed together with other explanatory variables on the ratio of non-performing loans (the measure of bank risk used here). After controlling for bank characteristics and macroeconomic conditions, a strong positive relationship was found between competition and bank risk-taking in the banking market in the seven countries. A weak U-shaped relationship in the banking sectors of some individual countries in the sample was, however, also found.

**JEL classification:** C51, D40

**Keywords**: competition, Lerner index, market power, risk

# 1 INTRODUCTION

According to the macroeconomic theory of aggregate demand, low real interest rates imply a low cost of borrowing for firms, which encourages them to increase the level of investment in the economy, and thus improve the aggregate demand. The financial sector plays a major role in ensuring that resources are efficiently transferred from surplus to deficit units. In this way, the development of the financial sector, particularly the banking sector, has the potential to benefit all sections of the population, and contribute immensely to economic growth. The financial sector in sub-Saharan Africa (SSA) is, however, generally underdeveloped, with over 80% of adults unbanked in 2010 (Mlachila et al. 2013). Mlachila et al. further note that the scale of financial intermediation in SSA remains significantly lower than in other developing regions of the world, 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. These characteristics are the result of, amongst other factors, low income levels, large informal sectors, low levels of financial literacy, weak contractual frameworks for banking activities, weak creditor rights, judicial enforcement mechanisms, and political risk (Mlachila et al. 2013).

In light of 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 potential economic growth. Some commentators even call for the deregulation of the banking sector, to promote competition and facilitate the spread of new technologies, and thereby increase the share of the population with access to banking facilities – especially access to credit by small and medium enterprises. The high proportion 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). Moreover, some banking sectors in SSA are characterized by significant barriers to entry for new rivals (Makhaya & Nhundu 2015).

There is, however, another view, which holds 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 being 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 came under pressure, but only slightly, 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 SSA, the objective of this paper is to empirically investigate the nature of the relationship between the competition and risk-taking in the banking sectors of a number of countries in the region. Three main theories emerge from the extant literature: the franchise value paradigm, the risk-shifting paradigm, and the U-shaped relationship (Saurina Salas et al. 2007). The franchise value paradigm refers to the phenomenon of banks, if excessive competition exists in the banking industry, possibly adopting riskier policies to maximize profits and maintain their franchise value. The paradigm thus infers a positive relationship between competition and risk-taking. However, Boyd and De Nicoló (2005) contested the franchise value paradigm by suggesting that competition is negatively related to risk-taking. They argued 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. 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 paradigm depicts a negative one. Martinez-Miera and Rapullo (2007) extended the risk-shifting paradigm model by allowing for imperfect correlation across individual firms' default properties. They 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 then 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. That is, does an increase in competition lead banks to undertake riskier projects, leading to high risk exposure? Does less competition lead to high risk exposure as a result of moral hazard and adverse selection? Or does increased competition lead to decreasing levels of risk below a certain threshold and increasing levels of risk above that threshold?

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 (2005). Debate is, however, far from being settled, and the matter remains controversial. The controversy does not emanate only 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.

### 2.1 Theoretical literature

The franchise value paradigm enjoys more support in the literature of banking competition and risk-taking (Marcus 1984; Chan et al. 1986; Keeley 1986). It 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, 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 et al. (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, which affects the overall credit portfolio.

Corroborating the arguments of 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 the 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 et al. (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 higher access to credit for low-quality borrowers. Allen and Gale (2004) showed that reduced franchise value as a result of more competition encourages 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 will, in turn, 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 (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 (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.

## 2.2 Empirical literature

Given the importance of financial stability and the implications of financial instability in a given economy, it is not surprising that substantial efforts have been made 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 them (that is, the U-shaped model).

The majority of empirical literature appears to lend greater 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, found 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 to 1992 and found results in support of Keeley. 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) used 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) analysed the networks through which financial liberalization affects bank risk-taking in an international sample of 4333 banks in 83 countries. Using the Lerner index to measure competition Cubillas concluded that in developed countries financial liberalization encourages stronger bank competition, which increases risk-taking incentives, whereas in developing countries bank competition increases bank risk by expanding opportunities to take risk.

Tabak et al. (2015) investigated 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 found that the Brazilian banking industry is characterized by monopolistic competition; secondly, that the market power of Brazilian banks is negatively related to their risk-taking, irrespective of changes in banks' capital levels. They used 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, and 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-examined 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 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 used the Lerner index. Their results indicated that competition promotes bank risk-taking and increases individual bank fragility, but the study concluded that competition enhances financial stability by decreasing systemic risk.

Kabir and Worthington (2017) used Islamic banks to investigate the relationship between competition and stability/fragility in 16 developing economies over the period 2000–2012. They gauged 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 used 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 ones.

In contrast to the franchise value paradigm, many scholars have found results supporting the risk-shifting paradigm. Boyd et al. (2006) used 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) found results supporting those of Boyd et al. (2006). They found their results to be even more robust once bank ownership is taken into account.

Soedarmono et al. (2012) examined the impact of bank competition on financial stability in Asian emerging markets over the 1994–2009 period by accounting for crisis periods. They concluded that less competition in the banking market is associated with higher capital ratios, higher income volatility, and higher insolvency risk of banks. They used a measure of market power (the Lerner index) for the banking industry considered as a whole (aggregate index), concluding 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) used bank-level measures of competition (the Lerner index) and co-dependence to show a negative relationship between bank competition and systemic risk. That is, increased competition tends to motivate~~s~~ 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) employed the Boone indicator, developed by Boone (2008), as their central measure of competition to examine the effects of competition on bank risk-taking behaviours in ten countries between 2003 and 2008. Central to the indicator’s considerations is the idea that competition improves the performance of efficient firms and weakens the performance of inefficient ones, but, like the Lerner index, it also relies on marginal costs. Using stability inefficiency as the dependent variable, the paper discovered that competition affects bank risk-taking behaviour 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 credit risk is used as the main risk indicator, since it is the major driver of risk for most banks. Banks' level of non-performing commercial loans (NPL) are used to measure credit risk, which is set 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 in Equation 1:

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

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), $MC$ is calculated 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 shown in Equation 2:

$$lnTC_i = a_0 + a_1 lnTA_i + \frac{1}{2}a_2(lnTA_i)^2 + \sum_{j=1}^{3} b_j lnw_{ji} + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} b_{jk} lnw_{ji} lnw_{ki} + \frac{1}{2}\sum_{j=1}^{3} c_j lnTA_i lnw_{ji} + u_1 Trend + u_2 \frac{1}{2} Trend^2 + u_3 Trend lnTA_1 + \sum_{J=1}^{3} r_j Trend lnw_{ji} + \varepsilon_i \quad (2)$$

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 in Equation 3:

$$\begin{aligned} w_1 = Price\ of\ labour &= \frac{Personnel\ cost}{Total\ assets} \\ w_2 = Price\ of\ capital &= \frac{Operatings\ cost(exl.personnel\ costs)}{Fixed\ assets} \\ (w_3 = Price\ of\ deposits &= \frac{Financial\ costs}{Deposits} \end{aligned} \quad (3)$$

Marginal cost is the derivative of total cost with respect to output. Differentiating equation (2) above with respect to output and rearranging yields the marginal cost function in Equation 4:

$$MC_i = \frac{TC_i}{TA_i}(a_1 + a_2 lnTA_i + \frac{1}{2}\sum_{j=1}^{3} c_j lnw_{ji} + u_3 Trend) \quad (4)$$

Once the marginal costs are generated, Equation 1 is used to calculate the Lerner index. It is worth noting that the generated Lerner index does not capture risk premium in the prices of banks' product and services, thus 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 Boyd and De Nicoló (2005) model and the U-shaped relationship in the Martínez-Miera and Repullo model, and given the variables outlined above, the methodology outlined in Jimenez et al. (2013) was adopted here and the general regression in Equation 5 was estimated:

$$RISK_{it} = f(COMPETITION\ INDEX_{it}, BUSINESS\ CYCLE_{it}, BANK\ CONTROL\ VARIABLES_{it}) \quad (5)$$

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 shown in Equation 6:

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

Table 1 shows the variables used to estimate Equation 6.

***Table 1: Variable definition***

| Dependent variable | Definition |
|---|---|
| $NPL_{it}$ | Commercial non-performing loan ratio of bank $i$ at time $t$ |
| **Explanatory variable** | **Definition** |
| $GDPG_t$ | 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. The Lerner index is used to measure the level of banking sector competition (i.e., $COMPETE_{it}$). To test for Martinez-Miera and Rapullo's (2007) U-shaped relationship, the squared variable of competition ($COMPETE_{it}^2$) was included. For the franchise value paradigm, the signs of $\delta_1$and $\delta_2$ were expected to be negative and significant. 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 Martinez-Miera and Rapullo.

With regards to the lagged NPL variable, it was expected to have a positive coefficient, but the coefficient is likely to be insignificant, due to the relatively short period considered here. A negative and significant sign for the gross domestic product growth rate (GDPG) variable was expected. For the return on assets (ROA), a negative coefficient was expected, because banks with high NPL ratios are likely to experience a significant decline in returns. In the long run, however, the relationship between risk and return is generally positive.

A panel data covering the period 2011–2015 was used 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, but the choice is essentially between fixed and random effects models. The random effects model was chosen, because the sample was drawn from the broader population of SSA banks, and the intent was to make broader conclusions regarding the entire region based on that sample. Also, the 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. For these reasons, the choice of model was not based on available diagnostic tests such as the Hausman test. Moreover, the use made here of robust standard errors to counter hetoroskedacity does not allow for such tests to be employed.

# 4 DATA AND RESULTS

The data on SSA banks are derived from BankScope, a global database published by Bureau Van Dijk. The data are collected from an unbalanced sample of 797 banks operating in South Africa, Zambia, Tanzania, Nigeria, Uganda, Angola and 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: 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 | **61** |
| 2012 | 7 | 17 | 4 | 19 | 6 | 14 | 6 | **73** |
| 2013 | 20 | 44 | 29 | 29 | 18 | 46 | 23 | **209** |
| 2014 | 18 | 43 | 29 | 28 | 16 | 47 | 24 | **205** |
| 2015 | 16 | 41 | 28 | 25 | 15 | 43 | 23 | **191** |
| **Total by country** | **66** | **160** | **93** | **119** | **58** | **161** | **82** | **739** |

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 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 |

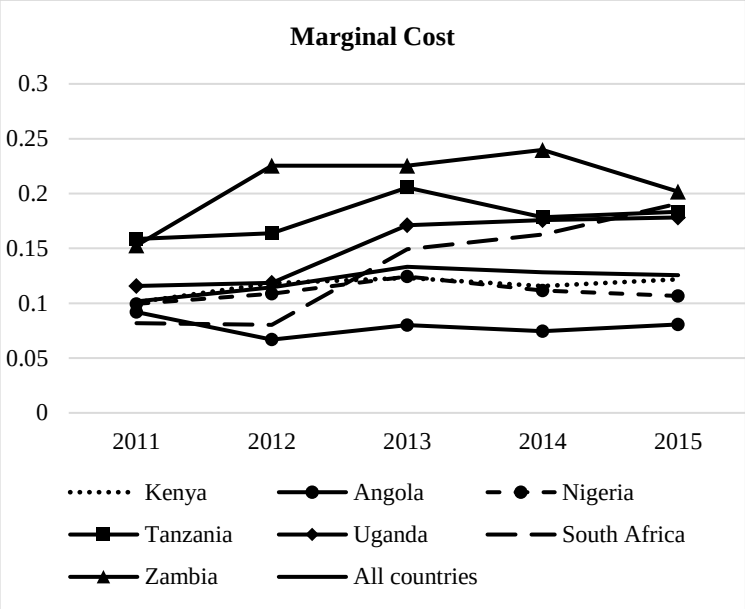
| lnTC | Coef. | Std. Err (robust) | z | P>z | [95% Conf. | Interval |
|---|---|---|---|---|---|---|
| lnTA | 1.01*** | 0.04 | 28.19 | 0.000 | 0.94 | 1.08 |
| $0.5(\ln TA)^2$ | 0.00 | 0.00 | -1.40 | 0.160 | -0.01 | 0.00 |
| $\ln w_1$ | 0.89*** | 0.14 | 6.40 | 0.000 | 0.62 | 1.17 |
| $\ln w_2$ | 0.31*** | 0.10 | 3.14 | 0.002 | 0.11 | 0.50 |
| $\ln w_3$ | -0.10 | 0.09 | -1.11 | 0.268 | -0.28 | 0.08 |
| $0.5(\ln w_1)^2$ | 0.20*** | 0.04 | 4.75 | 0.000 | 0.12 | 0.28 |

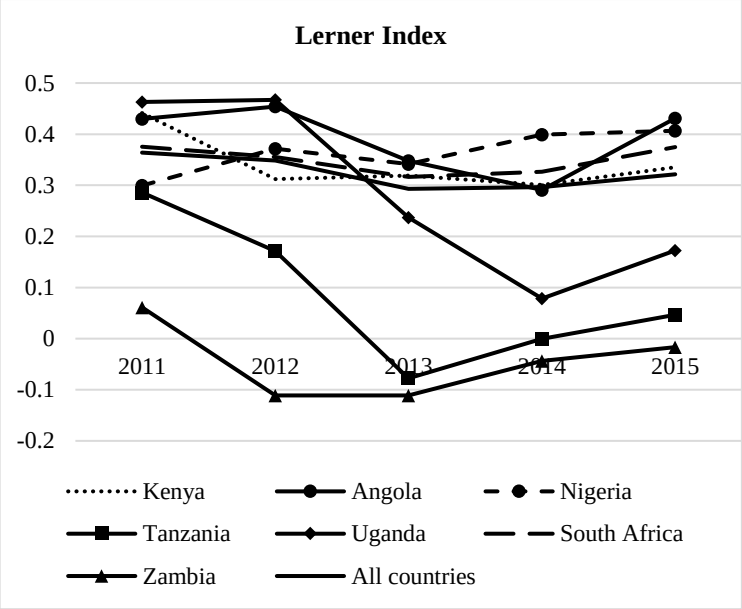
| lnTC | Coef. | Std. Err (robust) | z | P>z | [95% Conf. Interval | lnTC |
|---|---|---|---|---|---|---|
| $(lnw_1)(lnw_2)$ | -0.01 | 0.02 | -0.53 | 0.596 | -0.05 | 0.03 |
| $(lnw_1)(lnw_3)$ | -0.10*** | 0.02 | -4.44 | 0.000 | -0.14 | -0.06 |
| $0.5(lnw_2)(lnw_2)$ | -0.06*** | 0.01 | -5.44 | 0.000 | -0.08 | -0.04 |
| $(lnw_2)(lnw_3)$ | 0.01 | 0.01 | 1.12 | 0.261 | -0.01 | 0.04 |
| $0.5(lnw_3)^2$ | -0.03*** | 0.01 | -4.92 | 0.000 | -0.04 | -0.02 |
| $0.5(lnTA)(lnw_1)$ | 0.02 | 0.02 | 1.13 | 0.258 | -0.01 | 0.05 |
| $0.5(lnTA)(lnw_2)$ | -0.03*** | 0.01 | -3.12 | 0.002 | -0.06 | -0.01 |
| $0.5(lnTA)(lnw_3)$ | -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 |
| $0.5Trend^2$ | 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 |
| $Trend(lnw_1)$ | 0.00 | 0.01 | 0.34 | 0.731 | -0.02 | 0.03 |
| $Trend(lnw_2)$ | -0.01 | 0.01 | -0.80 | 0.424 | -0.02 | 0.01 |
| $Trend(lnw_3)$ | 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 |
| sigma_u | 0 | | | | | |
| sigma_e | 0.146287 | | | | | |
| rho | 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.

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 was 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 was growing more slowly than the marginal costs.

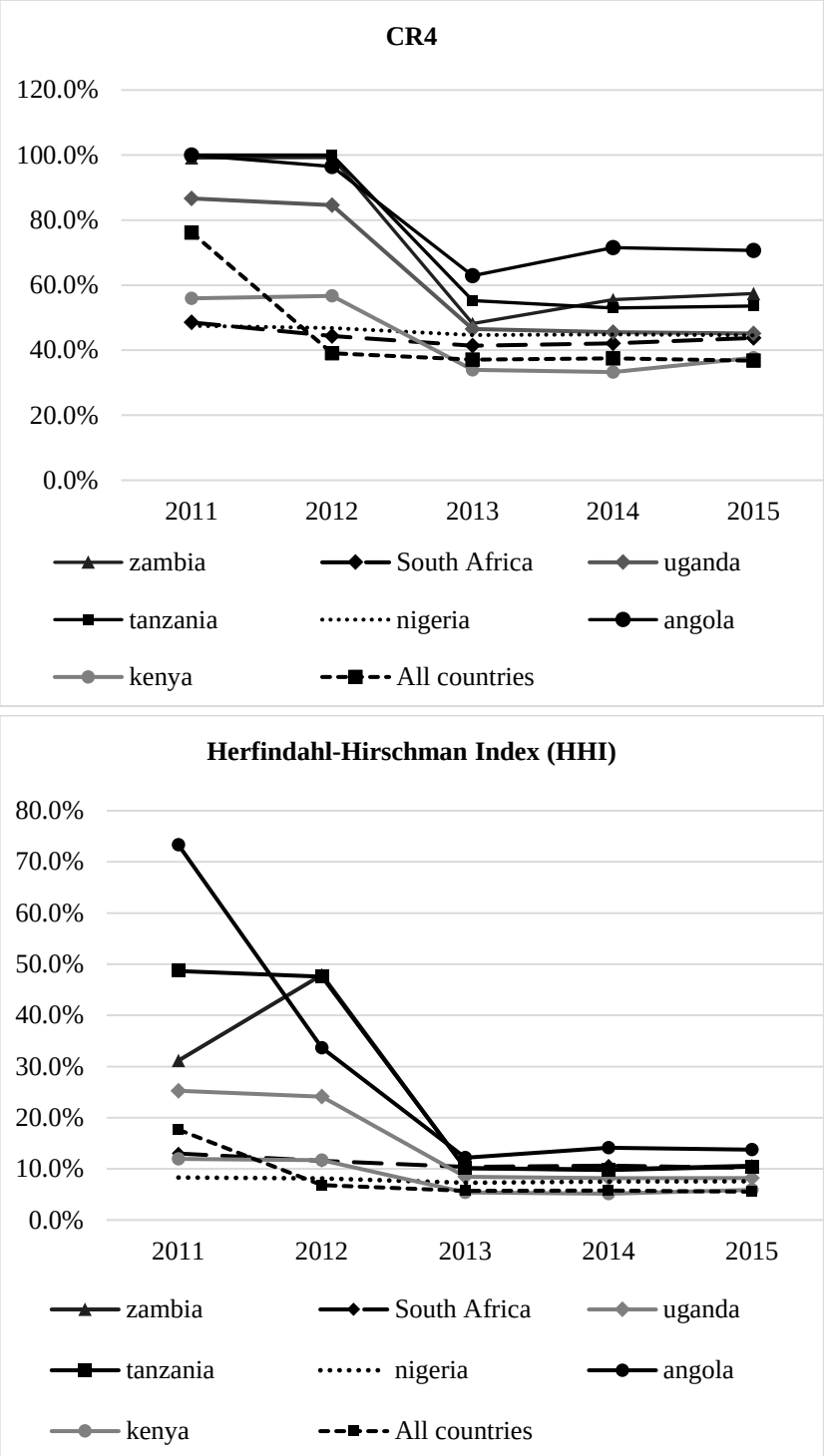
*Figure 1: Marginal cost and Lerner index of competition*




It is interesting to note that Tanzanian and Zambian banks on average displayed negative values of the 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 Maudo (2008) posit that negative values of the 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 generally declined between 2011 and 2015. Since data were not available for most of the banks in the early years of the period (particularly for Tanzania and Angola), it is important to note that these results may not represent the accurate picture and 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 early years), the values of HHI show a moderate decrease over the entire sample period. They are almost constant.

The concentration ratio (CR4) of the four largest banks was used to calculate the market concentration of the whole banking sector. The CR4 of the banking sector is 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 $COMPETE_{it}$. The World Bank database is used for data on GDP growth rates; data on the other variables is sourced from the BankScope database, and all the variables are as explained in Table 1. Table 4 presents the statistical summary of the variables in Equation 6.

***Table 4: Summary of descriptive statistics***

| Variable | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|
| $NPL_{it}$ | 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 seven countries. It was highest (8.5% on average) in 2015, corresponding to an average growth rate of GDP of 3.9% in that year, and lowest (5.1% on average) in 2012, when the average growth rate of GDP was 4.7%.

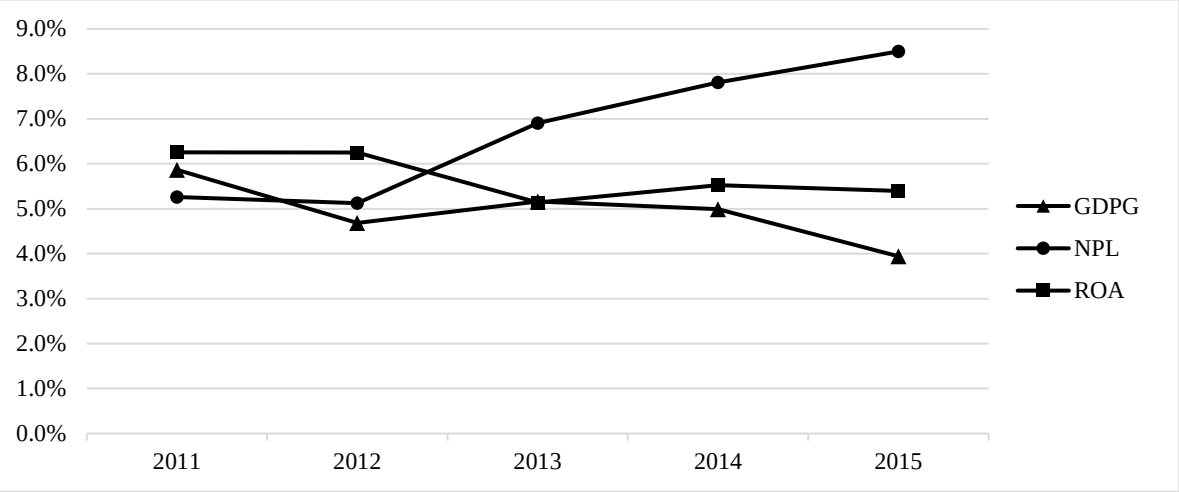
It is interesting to note that, on average, when the combined economies of the seven countries were growing faster, there were fewer non-performing loans, reflected in the low value of average NPL. Similarly, when the growth rate of the economies of these countries was slow, NPLs were generally high. 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. Similarly, the average ROA exhibits a negative association with the NPL 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 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 ROA was 5.4%, its second-lowest value. It is worth noting that there are some negative ROAs 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 some of the 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 then, while the lowest average value (23.7%) was recorded in 2013, indicating that the banking sector was more competitive. Interestingly, the NPL 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 SSA 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.

***Figure 3: Evolution of non-performing commercial loans, gross domestic product growth rate and return on assets, 2011–2015***




All the variables constructed and described above are used in the estimation of Equation 6. As explained earlier, the random effects model was chosen to estimate the impact of competition on bank risk-taking, based on the assumption that the banks in these seven countries represent those of the entire SSA – about which it was the intention to make broad conclusions. Also, the 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. Robust standard errors to correct for heteroskedasticity are used. Table 5 presents the estimated results.

***Table 5: Random effects estimation results of Equation 6***

| Country | Whole sample | S Africa | Nigeria | Tanzania | Zambia | Uganda | Kenya | Angola |
|---|---|---|---|---|---|---|---|---|
| | | | | Coefficient | | | | |
| $ln\left(\frac{NPL_{it-1}}{100-NPL_{it-1}}\right)$ | -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*** |
| R-sq (overall) | 0.1596 | 0.3489 | 0.454 | 0.2067 | 0.6446 | 0.1360 | 0.4648 | 0.3968 |
| Prob>Chi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| rho | 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, the bank-level risk variable on competition and other control variables was run for each sample country as well as for the whole sample of countries (the latter result shall be hereafter called

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 the main variable of interest here, 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 that 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 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. The coefficient is insignificant for all the individual countries, however. On the other hand, the coefficient of ROA is significant for the whole sample and 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 the whole sample are positive and significant. The positive coefficients could be confirming the general long-term positive relationship between risk and return, while 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 specialization of a bank) variable, we find the coefficient to be insignificant for the whole sample and all the 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 specialization 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. However for Uganda, the more specialized in loans that 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 proportion (50.6%) 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 a low cost of borrowing for firms, which encourages them to increase the level of investment in the economy, and thus 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 banking, has the potential to benefit all 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 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. A counter-argument could be that the current oligopolistic structure does not necessarily imply less competition, and therefore that 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 SSA countries. Using data for seven SSA banking systems, the relationship between risk and competition was examined. The dependent variable is the ratio of non-performing loans ratios. The Lerner index is used as the 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 SSA countries. This could indicate 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 gross domestic product growth rate results weakly indicate that periods of economic prosperity/distress are associated with less/more problematic loans. On the other hand, the return on investment results indicate the general long-term positive relationship between risk and return in Uganda, South Africa and the whole sample, while indicating that banks with high non-performing loan ratios are likely to experience significant decline in returns in Nigeria, Tanzania, Zambia and Angola.

The results for the LOAN RATIO variable (a proxy for the specialization of a bank) mostly indicate that the specialization 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. However 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 SSA banking systems should be pursued cautiously. More importantly, in pursuing such policies, a clear definition

of what is regarded as competitive should be carefully considered. In banking systems defined by a franchise value paradigm, such as South Africa, excessive competition could lead to financial instability. In banking systems such as those of Tanzania and Zambia, however, there may be more room to manoeuvre in pursuing policies aimed at increasing competitiveness, since an increase in competition is not proven to lead to financial instability.

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