Competition and Commercial Banks Risk-Taking: Evidence from Sub-Saharan Africa Region.

by

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Abstract

This study investigates the relationship between competition and the risk-taking attitude of banks. We test how this relationship manifests in the Sub-Saharan African(SSA) region's commercial banks in light of the competition-fragility view, using the generalised methods of moments. We studied 440 commercial banks in 37 SSA countries over the period 2006-2015. The results provide evidence that supports a positive relationship between competition and banks' overall risk as well as their credit risk but suggests that off-balance sheet risk reduces with competition. We, therefore, conclude that the propensity to undertake higher risk in a competitive banking environment largely accounts for fragility as argued in the competition-fragility view.

Keywords: Competition, Risk-Taking Behaviour, Lerner Index, Generalised Method of Moments, Commercial Banks

JEL Classification: G21, G29, L10

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1 INTRODUCTION

Competition is a key component for consideration in any banking system. Maintaining a competitive banking environment without compromising the stability of the system is difficult. This is the situation policy makers and regulators in the financial system of Sub-Saharan Africa (SSA) have found themselves in. The region desperately needs to grow her economies, build infrastructure, grow and process her own food, industrialise and advance in technology, among others (Watkins, 2014). Such growth requires a stable, efficient and a competitive banking system that will stimulate capital formation and distribute funds for optimal application in the economies. However, a number of obstacles have to be overcome, namely; lack of access to formal finance, weak infrastructure and lack of fund for public investment. Surmounting the problem of access to formal finance is, in fact, consistent with the arguments for a well-developed financial sector as a determining cause for economic growth (Levine, 2005; Beck, 2013). Hence, the agitation for crafting policies that will increase competition in the banking sectors of the region. However, it has also been argued, that competition has its attendant challenges that could cause financial instability.

Quite a number of studies have looked at banks' propensity to undertake risky ventures in the face of competition (see Arping, 2014; Tan, 2017). This argument as to why banks take on riskier behaviour is rooted in the competition-fragility view reflecting the belief that risk appetite associated with competition breeds instability in the banking system. Specifically, the theory postulates that the fall in banks' profits as they lose their market share during competition provides them with incentives to invest in high-risk portfolios as a means to regain their lost margins (Matutes & Vives, 2000). According to Arping (2014), banks are most likely to take risks in a competitive environment because the destabilising consequences of declining margins surpass the disciplinary impact of competition. Meanwhile, an uncompetitive banking system is deprived of the supposed efficiency theorem that is associated with competition (Hicks, 1935), even if competition may not be applicable conventionally in the banking system as is applied in other sectors of the economy (Vives, 2016). Hence, there is the argument for a competitive banking system for the purpose of engendering not only efficient banks, which translates to low costs and better income for the banks but also for an increase in the overall competitiveness in other sectors of an economy.

While evidence abounds as to the relationship between competition and banks' risk-taking behaviour in other regions of the world (Jeon & Lim, 2013b; Jiménez, Lopez, & Saurina, 2013; Liu, et al., 2012; Tan, 2017; Yeyati & Micco, 2007), to the best of our knowledge such a study is yet to be carried out in the Sub-Saharan Africa (SSA) region. This study has become imperative at a time when countries in the region are battling poverty and seeking recourse through enhancing competition in their banking sectors as a conduit for economic development. Our major preoccupation, however, is to investigate, using commercial banks data in the SSA region, if the inverse relationship between competition and stability, as found by Akande and Kwenda (2017), epitomises risk-taking attitude of banks.

The study, therefore, contributes to the extant literature in two ways. Firstly, we conducted a panel analysis of commercial banks in 37 SSA region countries to test the relationship between competition and banks' risk-taking behaviour. Specifically, the analysis of the relationship between competition and off-balance sheet risks is the first of its kind to the best of our knowledge. And secondly, we analysed whether or not risk appetite is the major cause of fragility in a competitive banking environment and particularly identified the nature of such risks to inform policy measures. We found over the study period that competition relates positively to both proxies of credit and overall banks' risks. The implication is that risk-taking behaviour of banks, especially as it relates to their loans portfolio and charter value is significant in explaining the cause of failure in a competitive banking environment. These findings highlight some grey areas requiring attention when crafting policies to stimulate competition.

The rest of this paper is organised as follows. The review of related literature and hypothesis development is in Section 2, while Section 3 deals with the methodology adopted to arrive at the results in Section 4. Section 5 summarises and concludes the study.

2 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The debates as to whether competition is detrimental to the banking system in that it stimulates banks' risk disposition leading to fragility started in the aftermath of the Great Depression in the 1930s (Vives, 2016). The pre-1960s in the United States and pre-1980s in the European Union (Carletti, 2008) were marked by disinterest in competition by policy makers and regulators because it was viewed as impacting negatively on bank stability. Although this

perception changed with the growing evidence of efficiency being associated with competition. The events in the wake of the 2007-09 financial crisis reawakened the initial feelings of competition driving risk in the banking system. The experience in Africa saw the overwhelming implementation in the 1980s/1990s of structural adjustment programmes to liberalise banking systems in African countries. According to Mlachila et al. (2013), the post-reform period has no doubt witnessed considerably low occurrence of systemic banking crisis in the SSA region. Notwithstanding, statistics have shown rising incidence of nonperforming loans (NPLs), while there is evidence to show that competition is indeed detrimental to stability in the region (Agoraki, Delis & Pasiouras, 2011; Akande & Kwenda, 2017). Moreover, the financial crisis brought mixed views regarding the role of competition in bringing about the crisis, and in some quarters the crisis was blamed on liberalisation and excessive competition in the banking sector (Fu, Lin, & Molyneux, 2014).

The main thrust of the theories linking competition to risk-taking behaviour of banks according to the proponents of the competition-fragility view is the argument that banks, in trying to solve their portfolio problems in a competitive market environment, fail to balance attention on the deposit and asset sides of the market (Casu, Girardone & Molyneux, 2012; Vives, 2016). It holds that when banks face declining earnings while attempting to offer higher rates in the deposit market in a competitive environment, take the risk of neglecting the asset market. Consequently, the last resort will be to undertake riskier investments to compensate for the lost earnings. But Matutes and Vives (2000) argue that at higher levels of competition with apparent portfolio risk on the asset side of the market, banks have no incentives to undertake risk if there are regulatory constraints on the maximum banks can charge on their deposits, given the close complementarity between the liability and the asset sides of banks' statements of financial position. Allen and Gale (2004) concluded that banks having the liability side of their balance-sheet insured have an ultimate incentive to assume higher risk on the asset side as the market becomes more competitive. Niinimäki (2004) concurred that banks' risk-taking behaviour is a function of the structure and side of the market where competition is present. Hence, the argument is that banks have incentives to take on excessive risk with deposit insurance, as banks compete for deposits, and the rates become excessively high. Although deposit insurance is yet a popular phenomenon in the SSA region (Mlachila et al., 2016), risks are usually linked to moral hazard that is principally caused by the principal-agent relationship and negative

externalities, as information asymmetry explains generally the bias leading to banking instability aggravated by competition.

Martinez-Miera and Repullo (2010) emphasised risk-shifting effects as they argued against Boyd and De Nicolo (2005) competition-stability view where loan default is imperfectly correlated. Therefore, the risk of reduced borrowers' probability of default in a competitive environment is shifted to the banks in the form of margin effects and the only option to alleviate this is to increase risk. Arping (2014) agreed that margins fall with competition driving increased risk-taking to cope with it. Although their model identified that competition could lower risk-taking attitudes, they, however, argued that the direct destabilising effects of declining margins surpass competition disciplinary effects, especially as banks lose the incentive to build a precautionary capital buffer with increased competition, causing risk-taking appetite to increase with competition.

Empirically, Rhoades and Rutz (1982) investigated whether or not firms in monopoly markets will be more risk-averse than firms in competitive markets. Using concentration ratios for competition measures and a coefficient of variation of profit rates for risk, they found results that are consistent with the competition-fragility view. The impact of concentration and foreign penetration on competition and risk in eight Latin American countries' banks was investigated by Yeyati and Micco (2007) for the period 1992-2002, and they found a positive relationship between competition and risk. Agoraki et al. (2011) used the Z-score, nonperforming loans (NPLs) and Lerner index to study competition and risk-taking behaviour in the Central and Eastern Europe banking sector for the period 1998-2005. They found that banks with market power take on lower credit risk, hence, a lower probability of default. The Korean Mutual Savings Bank and commercial banks were studied by Jeon and Lim (2013a). They attempted to examine the effects of competition and concentration on Korean financial industry stability. Using the Boone indicator and Z-score for competition and risk measures, respectively, for the period 1999-2011, their results highlight that the nature of financial institutions plays a role in the relationship as they found less stable commercial banks with competition.

Jiménez et al. (2013) investigated the franchise value assumption role in limiting banks' risk-taking with 107 banks for the period 1988-2003 using NPLs and the Lerner index. They found that the outcome of the Lerner index supports fragility. Liu and Wilson (2013) also investigated

competition and the risk relationship in the Japanese banking sector for the period 2000-2009 using the Lerner index and Z-score. They found for regional banks that competition increased risk. Fernández, González, and Suárez (2013) included a sample of 23 African countries in their study of the effects of market concentration, regulation, and institution on 68 systemic crises in 54 countries. Using the Herfindahl-Hirschman index (HHI) plus other concentration ratios to account for competition and with the pre/during crisis growth rate value added, they found that between 1980 and 2000 the concentration of banks helped to reduce systemic failure. Marques-Ibanez, Altunbas, and Leuvensteijn (2014) also found fragility in the competition and stability relationship in their study of the United States and nine European countries for the period 2007-2009. Their study addressed the role played by securitisation and capital in the competition-risk relationship during the 2007-2009 crisis. A total of 495 of the largest listed banks' parent companies were studied with a number of banks that received assistance during the crisis as a risk measure and using the Boone indicator for competition. They showed that more intense competition was correlated with higher levels of realised risk and that as competition increases, banks that relied more heavily on securitisation had more incentives to undertake more risk[4].

In light of these arguments we posit the following hypothesis:

H1: There is a significant association between the level of competition in the banking industry of the SSA region and the region's banks risk-taking behaviour.

In summary, the literature advances strong arguments to support increased risk with increased competition. However, a major shortcoming of most of the studies is using Z-score to proxy for bank risks which even though it has been established as a good surrogate for bank risk in literature, it does not provide an explanation as to specific risks that banks faced in the ordinary course of their businesses. We also found that majority of these studies were predominantly based in the United States, Europe, and some emerging markets, however, they are scarce, if

[4] Kouki and Al-Nasser (2014) studied the implication of market power on stability in 127 banks in 31 African countries for the period 2005-2010, and argued against the competition-stability views. They provided evidence to show that market power had benefits for risk. Recent studies by Maghyereh and Awartani (2016) used the Z-score and NPLs for stability as well as the Lerner index for competition to test for the average relationship between competition and stability. This study covered the period 2001-2011 and 70 Gulf Cooperation Council countries. The authors' results align with the competition-fragility view as they found that as competition increases instability abounds.

not non-existent in the SSA region. Besides, Akande and Kwenda (2017) found evidence to support the competition-fragility view in a study of the competition and stability relationship in the SSA region's commercial banks substantiating an African study of Kouki and Al-Nasser (2014). The implication of our study is to disentangle Z-score by looking at the specific risks of banks in order to know how much competition impacts them. Thus enhancing the investigation as to whether the risk-taking behaviour of banks largely accounts for the competition-fragility views in the literature that was found in the region, and specifically identifying the nature of such risks in order to highlight areas for policy in crafting banking competition policies.

3 METHODOLOGY

Different approaches have been employed in the literature to investigate the relationship between competition and risk in the banking system. Commonly used methods include OLS, see (Fernández et al., 2013; Jeon & Lim, 2013a; Rhoades & Rutz, 1982; Yeyati & Micco, 2007) among others; fixed and random effects regression (Kouki & Al-Nasser, 2014); probit regression (Marques-Ibanez et al., 2014); and generalised method of moments (GMM) (Agoraki et al., 2011; Jiménez et al., 2013). We follow the GMM approach (Arellano & Bond, 1991; Arellano & Bover, 1995) for the regression of risk on competition because it provides a more robust approach than the other methods mentioned. Based on the literature reviewed and data availability on the various forms of risks that banks face, our risk measures are credit risk and off-balance sheet risk while our choice of the Lerner index for as a competition measure is informed by its strong theoretical basis and ability to gauge bank-level competition as well as been one of the two most superior measures of competition (Berger, Klapper, & Turk-Ariss, 2009; Liu, Molyneux & Wilson, 2013; Kouki & Al-Nasser, 2014).

3.1 Model Specification

3.1.1 Competition

Our measure of competition is based on the Lerner index developed by Lerner (1934) and used in several banking competition studies (such as Berger et al., 2009; Kouki & Al-Nasser, 2014). It is rooted in the Cournot oligopoly theory that is based on competition as a static state and measures the extent to which banks are able to charge prices above marginal costs.

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

$$LI_i = \frac{P_i - MC_i}{P_i} \tag{1}$$

Where P_i is the estimate of average price of bank production in country i, which is proxy by the ratio of bank total revenue to total assets (Berg & Kim, 1994; Berger et al., 2009; Carbó, Humphrey, Maudos, & Molyneux, 2009; Shaffer, 2004). To estimate MC_i, the first derivative of the translog cost function[5] with respect to $QT\ Y_i$ is computed.

We modelled the translog cost function, used generally in finance (Kouki & Al-Nasser, 2014; Vives, 2016), using second-order Taylor series expansion of banks cost in natural logarithm, expressing the specific production model for the translog production function[6]. While we rely on the intermediation approach for measuring bank output (Ajisafe & Akinlo, 2013; Sealey & Lindley, 1977), the total cost of banks consists of one output, QTY, and three inputs, W_1, W_2, and W_3, representing price of labour (ratio of personnel expense to total assets), price of physical capital (non-interest expense to fixed assets), and price of fund (interest expense to total deposits), respectively. Hence, the reduced translog cost function is arrived at as:

$$\begin{aligned} ln(C) &= \beta_0 + \beta_1 ln(QTY_{it}) + \frac{1}{2}\beta_2 ln(QTY_{it}^2) + \sum_{k=1}^{3}\theta_k ln(W_{kit}) + \sum_{k=1}^{3}\iint_k ln(QTY_{it}) ln(W_{kit}) \\ &+ \frac{1}{2}\sum_{k=1}^{3}\sum_{j=1}^{3}\varnothing_{kj} ln(W_{kit}) ln(W_{jit}) + \mu_{it} \end{aligned} \tag{2}$$

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

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

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

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

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

Substituting $equation$ (3) for marginal cost in $equation$ (1), the degree of competition is computed using;

$$LI = \frac{P_{it} - \frac{1}{QTY_{it}}\left(\beta_1 + \beta_2 ln(QTY_{it}) + \sum_{k=1}^{3} \prod_k ln(W_{kit})\right)}{P_{it}} \quad (4)$$

3.1.2 Generalised Method of Moments(GMM)

As indicated, we used the Arellano and Bond (1991) and Arellano and Bover (1995) version of GMM modelled in Akande and Kwenda (2017) to regress the relationship between competition and commercial banks' risk-taking attitude in the SSA region. There are quite a number of motivations for adopting this approach, such as the need to account for possible endogeneity and deal with the incidence of cross-sectional dependence[7] as the method is assumed to be identically and independently distributed (iid). Furthermore, increasing usage of the panel data technique, which permits individual cross-section dynamics in finance and economic studies, has favoured the application of dynamic panel data analysis. Moreover, it is able to deal with the inclusion of lagged endogenous variables in a model with individual effects that the conventional dynamic panel data (DPD) estimators such as first difference, pooled OLS and GLS, among others, are inefficient at handling. In addition, GMM is a normality free regression technique, with great adaptability and data generating process assumptions with dependent variables been instrumented by their lagged variables. The choice of panel analysis helps to study banking sectors of countries in the SSA region that would otherwise not have been studied because of inadequate information[8]. Baltagi (2008) argued that panel analysis accommodates the creation and analysis of more difficult behavioural models. Moreover, the technique is efficient, and provides for an additional degree of freedom when compared to time series and cross-sectional data and offers more explanatory analysis.

[7] Although we are able to relax this assumption given the number of the panels.
[8] Banking sectors with inadequate data could be studied in a panel data analysis and still have good inferences made for them.

Panel analysis generally means more variability, fewer collinearity problems and controlled heterogeneity within individual data sets (Baltagi, 2008).

Given our unbalanced panel analysis, Arellano and Bover (1995) orthogonal deviation option as recommended by Roodman (2006) is applied. For the validity of the GMM instruments, the Hansen J statistics is used in a robust estimation (Mileva, 2007), while the Arellano-Bond test of serial correlation insists that the null hypothesis must be acceptable in the order of two for the absence of serial correlation and a necessary condition for the study to employ the corresponding moment condition.

The relationship between competition and risk-taking for the SSA region's commercial banks is estimated using the following equation;

$$\Re_{kit} = \sigma_{kit} + \lambda_{kit-1} + \pi_{kit} LI_{kit} + \phi_{kit} \Sigma X_{kit} + \upsilon_{kit} \quad (5)$$

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

3.2 Data and Variable Description

Besides the gross domestic product (GDP) annual growth rate, inflation and the corruption perception that were collected from world development indicators (WDI) and Transparency International, data for this study were mainly sourced from BankScope. An unbalanced panel of 440 commercial banks from 37 SSA countries[9] for years 2006 to 2015 were considered

[9]We considered the 46 SSA countries captured in the World Bank Development Indicator (WDI) but excluded countries are those considered as outlier either based on the level of development of development of their financial systems (e.g. South Africa (Allen, Otchere, & Senbet, 2011)), data integrity and/or availability (e.g. Zimbabwe) or they are war ravaged and are without functional banking sectors (e.g. Sudan) and so came down to 37 countries.

because of data availability as well as to accommodate entry and exit of banks during the period. Table 4 in the appendix shows the list of countries and the number of banks per country that are contained in the sample. The focus on commercial banks ensures uniformity in our choice of banks, as quite a good number of other deposit money banks still enjoy government support at one time or the other.

For bank risk measures this study focuses mainly on credit and off-balance sheet risks. Based on competition-fragility theories, we expect competition to be positively related to risk-taking of banks. Measures of risks used in this study are majorly credit risks and off-balance sheet risks. These risks measures follow Chiou and Porter (2015) measures of credit and off-balance sheet risks. Credit risks are measured as the ratios of annual loan loss provision to total loans and leases(*LLPRATIO*) and annual loan loss provision to total equity capital(*LLPERATIO*). The main concern of credit risk is the quality of banks' assets, which has been traditionally focused on banks' loan portfolio. Chiou and Porter (2015) argue that attention to banks' risk measures has extended to considering all banks assets due to the possibilities of potential default risk. In addition, the interest for off-balance sheet stems from the fact that bank managers employ it to conceal potential risks that threaten going concerns, especially in a competitive banking system, hence, it is used to gauge banks' sensitivity to a competitive banking environment. In the case of off-balance sheet risks, they are measured as the ratios of off-balance sheet assets to total assets(*OBSARATIO*) and total equity(*OBSERATIO*) respectively.

The ratio of total equity to total assets (*EQCAPRATIO*) is used in two ways: firstly, as a measure of capital, and secondly, as a measurement of risk. Capital requirements have constituted a major variable in competition and risk studies (Agoraki et al., 2011), and we expect it to be negatively related to bank risk. As a risk measure, it is a measure of capital risk (Tan, 2017) and according to Chiou and Porter (2015) a bank's overall risk that controls for differences in the risk propensities that banks face. Coccorese (2013) and Bikker and Groeneveld (1998) argue that high *EQCAPRATIO* may suggest a high level of risky loan portfolios.

Performance[10] proxies are: return on assets (*ROA*) and return on equity (*ROE*). We expect a negative relationship with the risk-taking appetite of banks. They have been employed in this study to serve their different purposes in relation to bank risk-taking and have been used in a number of studies see (Chiou & Porter, 2015; Naceur & Omran, 2011), among others. We also expect liquidity(*LAR*) to be negatively related to bank risk. This is because a low level of liquidity implies higher loan exposure, which increases default risk and reduces stability. Furthermore, we expect bank size(*SIZE*) to be negatively related to risk. Although Berger (1995) argued that economies of scale and market power meant that larger banks are synonymous with lower risk, the relationship between risk and size is unclear in the literature. Stern and Feldman (2004), Herring and Carmassi (2009) and Demirgüç-Kunt and Huizinga (2010) provide evidence to show that higher returns induced by risky projects entice larger banks' managers to take on more risk confident that governments will not let them fail, hence the 'too big to fail' (TBTF) concept.

GDP annual growth (*GDPG*) and inflation (*INF*) are the macroeconomics variables employed. They are expected to be positively related to the SSA commercial banks' risk-taking. Agoraki et al. (2011), Berger and Udell (2004) and Dell'Ariccia and Marquez (2006) were of the opinion that banks tend to lend excessively in times of boom and are much more cautious during recessions, while Lown and Morgan (2006) and Buch, Eickmeier, and Prieto (2010) argued that the economy and financial systems suffer more adversely during inflation. Moreover, the period of inflation is usually associated with distorted decisions, aggravated information asymmetry, and high price volatility.

Given Chen et al. (2015) findings of corruption driving risks in the banking system, we control for the impact of corruption(*COP*) given the high incidence of corruption in the region. Transparency International defines corruption perception as the perception of both the administrative and political environment to corrupt practices. The index ranges from 0 to 100, and the closer to 100 the better for an economy. An economy with very a low corruption perception index may face some vulnerability in its banking system.

[10] The use of both ROA and ROE as performance measures in this study is to meet the concerns of various stakeholders while also robustness of the results.

4 EMPIRICAL RESULTS

This section presents the results of the relationship between competition and risk of the SSA countries' commercial banks. Extant literature provides evidence that competition may be good or bad for the banking sector. Specifically, empirical works have supported stability and fragility of the banking sector due to competition. Given the views of competition-fragility proponents, we expect competition in the SSA commercial banking markets to have a direct relationship with banks' risk-taking, and more so because the recent financial crisis[11] was partly blamed on excessive competition.

Table 1, Summary Descriptive Statistics, provides an insight into the nature of data used in the study. Columns 3 to 6 provide the summary of the Lerner index. The index ranges from 0 to 1 with 0 and 1 representing perfect competition and monopoly[12], while indices close to 0 or 1 denote monopolistic competition or oligopolistic competition, respectively. The results show market power ranging between 0.0000 in 2013 and 0.9980 in 2012 giving the minimum and the maximum indices across the sampled banks over the study period of 2006-2015, suggesting a mixed market structure. The mean and the standard deviation, however, suggest a competitive commercial banking sector having a mean index below 0.4000. The means are closer to the minimum than the maximum in all the years considered and the standard deviations substantiate our claim by not been fundamentally far from the mean. This market structure is consistent with various literature that has found monopolistic competitive banking systems across regions and in emerging markets (see Apergis, 2015; Apergis & Polemis, 2016; Günalp & Çelik, 2006).

Insert Table 1

The other parts of Table 1 are the mean of the risk measures, EQCAPRATIO, LLPRATIO, LLPERATIO, OBSARATIO and OBSERATIO. There is also the mean of other bank-specific variables, SIZE, representing the log of total assets used as a control variable, ROA and ROE as performance measures, and LAR, liquidity ratio. Others include the means of GDP annual growth, and COP. Taking a staggered insight into the mean of these listed variables, we found a resilient banking system. The EQCAPRATIO tends to support this assertion as its mean over the period suggest that most banks have capital above the Basel regulatory benchmark of 10%.

[11] Financial crisis of 2007-2009.

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

ROA, is however weak over the periods, ranging from 0.01 to 0.02, even though ROE provides a better outlook with a minimum average of 6.9% in 2015 for the sampled banks in the region. Based on Table 1 the COP, corruption perception seems to be commendable on the average though with much improvement desired. The index of COP, that range from 1 - 100% according to Transparency International, increases as the perception of corruption in the economic environment in which the banks operate improves, which should mean a better avenue for banking business and investment. We expect this to impact positively on the banking sector's stability.

4.1 Econometric Analysis

Competition is regressed on some measures of bank risks in the SSA region's commercial banks. Having analysed the summary statistics in the previous subsection, we provide a robust correlation analysis over the study period between the endogenous and exogenous variables of interest in Table 2. Overall, we found a weak association with mixed signs and few significances between the variables.

We present the regression of other banks' specific variables on their risk measures, mainly to highlight other possible factors that may contribute to risk in the banking sectors of the region. The two-step system GMM with orthogonal deviation was applied to the dynamic panel data model. This has been proven to resolve panel data bias with the ability to handle unbalanced panel data analysis.

Insert Table 2

The GMM regression results are presented in Table 3. Our results meet the various requirements of the regression models as shown in Table 3. In particular, for the GMM, the overall fitness of the result is good as indicated by the Wald test probability, AR2 confirms the absence of serial correlation, and the result of the Hansen J statistics gives us the confidence that the instruments are not overidentified. We, therefore, can analyse and further discuss the results going forward. A cursory look at the results shows that all the lagged values of the risk measures exhibit positive and strong significance, signifying past risks impact on current risk-taking propensities. We found competition to be strongly significant and positively related to the proxies of credit risk, i.e., loan loss provision ratio (LLPRATIO) and loan loss provision to

equity ratio (LLPERATIO) in model 1 and 2, respectively, and to the overall risk of default, EQUCAPRATIO in model 5, implying that increase in competition increases the risk of loan default while also putting the equity and overall capital of the banks in some precarious circumstances. This result is consistent with our hypothesis that competition is significantly associated banks risk-taking behaviour in the SSA region. The results are not consistent with Tan (2017) who found competition to be negatively related to credit risk in the Chinese banking system. Specifically, the results show that a 1% increase in competition increases loan defaults by 0.00622%, loan default risk in relation to equity by 0.179% as overall risk increases by 0.122%. We, however, found competition to be inversely related to the two proxies of off-balance sheet risks; namely, OBSARATIO and OBSERATIO, with the former relating to total assets and the latter to equity. The implication is that competition does not pose any complicity for off-balance sheet risk in the region, as a percent increase in competition lowers their risk both for assets and equity by 0.21% and 2.18%, respectively.

With respect to size and bank capital, size exhibits a positive and strong significance in relation to all the risk proxies. A percent increase in bank size signals 0.484%, 2.52%, 6.97%, 9.49% and 1.52% respective increases in LLPRATIO, LLPERATIO, OBSARATIO, OBSERATIO, and EQUCARATIO. Hence, as bank size increases so does its credit and other associated risks. Although bank capital is strongly significant in relation to the measures of credit and off-balance sheet risks, it rather shows some mixed signs. While it is positively related to LLPRATIO and OBSARATIO, implying an increase in those forms of risk, it is inversely related to LLPERATIO and OBSERATIO with the reverse implication being the case.

Liquidity ratio, LAR, is strongly significant both in signs and magnitude in relation to the measures of risks. In fact, it is positively related to all the risk factors suggesting that increasing liquidity in the banking sectors of the SSA region meant some risk to the system. For want of generality, a percent increase in LAR will increase LLPRATIO by 1.52%, LLPERATIO by 0.672%, OBSARATIO by 3.12%, OBSERATIO by 2.274% and EQUCAPRATIO by 1.14%. While ROA shows a negative and significant relationship with LLPRATIO and LLPERATIO, it is significantly positive in relation to OBSARATIO, OBSERATIO, and EQUCAPRATIO. We noted, however, that ROE is not significant to explain OBSERATIO while it is also weakly significant at 10% to explain EQUCAPRATIO. Both measures of performance are expected to be negatively related to the risk proxies.

Insert Table 3

Except for EQUCAPRATIO, the COP results produce a negative and significant relationship with the risk measures in the SSA region's commercial banks. In essence, improvement in corruption perception lowers credit and off-balance sheet risk, but not immediately certain is the direct relationship with overall risk. Both GDPG and INF are significant to explain the risks that the commercial banking sectors of the SSA region face. While GDPG produces an inverse relationship with all the risk measures considered, except for OBSARATIO, the relationship for inflation shows that it is directly related to all the credit risks but inversely related to off-balance sheet risks and the overall default risks.

4.2 Discussion of Findings

In this section, we discuss the results in order to be able to suggest possible policy implications. The significant, positive and persistent relationship of risk measures in the immediate past period with the present, suggests that a risky banking system in the past period has a tendency to replicate and/or even increase such a pattern in the present and future unless something is done policy-wise to reverse the trend. The results of the relationship between competition and credit as well as the overall default risk conform with our expectations and provide evidence that is consistent with the competition-fragility view (Agoraki et al., 2011; Akande & Kwenda, 2017; Ariss, 2010; Beck, De Jonghe & Schepens, 2013; Fu et al., 2014; Yeyati & Micco, 2007). This is evidence that an increase in risk actually contributes substantially to instability in the banking system. The increase in credit risk associated with an increase in competition in the region may as well account for rising burden of NPLs that have laced the assets portfolio of the banks (Mlachila et al., 2013). Closer attention must be paid to this risk if competition must produce benefits for the region. Macroprudential policies must be strengthened and the right form of deposit insurance schemes, that does not exacerbate the NPLs burden, must be adopted by these SSA countries. Competition increasing the overall risk of default is also an issue for major policy consideration. Although there is no imminent bank systemic failure anticipated in the SSA region (Mlachila et al., 2013), measures must be taken to prevent such a failure, as an increase in overall risk of default, in addition to the poor quality of the asset portfolio, increases systemic risk substantially. We note that competition does not pose any immediate negative

effects for off-balance sheet risk. This is a positive result that must be sustained to further ensure a more stable banking system.

Also, we found evidence to support the literature (Demirgüç-Kunt & Huizinga, 2010; Herring & Carmassi, 2009; Stern & Feldman, 2004) that argues for large banks taking more risk as size becomes uniformly significant and positively related to all the risk measures employed. A reasonable bank size is needed for the ongoing viability of the banking system, however, this must be managed to avoid the negative side of undertaking excessive risk that could threaten their going concerns. We found mixed evidence based on our results for increased capital increasing risks for banks, thus, partly supporting Chiou and Porter (2015) studies on bank capital and risk-taking behaviour. Liquidity is positive and significantly related to all the risk measures indicating that the more liquid the banks, the more chances of risk both in terms of credit, off-balance sheet and capital risk. This result negates our expectation of liquidity being negatively related to bank risk. This may be because banks with high liquidity use this strength to take on riskier loans which attract higher interests and premiums that enhance banks' profitability.

The two performance measures showed mixed results with the risk measures. While ROA is positive and significantly related to capital and off-balance sheet risks; in relation to assets and equity risks, it is found to be negative with the credit risk measures. ROE produces similar results but rather insignificant to explain some of the risks. We, in fact, expect the performance measures to reduce the risk of banks. While our expectations are partly dashed, we noticed that the weak performance of the banking sector in terms of ROA according to the summary statistics in Table 1 may have accounted for the nature of the results. As expected, corruption perception reduces risks of credit and off-balance sheet engagement. The summary statistics suggest an upward improvement in corruption perception in the region. This tempo must be sustained as it positively reduces loan defaults. As against the literature[13], the macroeconomics variables largely show a negative relationship with the risk measures. This is good for the system especially in terms of GDPG, as the results show that banks are prudent with their asset portfolio management and avoid indiscriminate granting of credit during periods of boom. Inflation did show a direct relationship with credit risk, as argued, periods of inflation is synonymous with distorted decisions, aggravated information asymmetry and high price

[13] See Agoraki et al. (2011); Berger and Udell (2004); Dell'Ariccia and Marquez (2006); Lown and Morgan (2006).

volatility during which banks suffer more adversely. Therefore, keeping inflation in check is favourable and macroeconomic policies should be geared towards this.

Based on the results and discussions thereof, we can conclude that bank risks, especially those of credit and capital risks, play significant roles in causing banking system fragility in a competitive banking environment.

5 SUMMARY AND CONCLUSION

We considered the relationship between competition and bank risk-taking in the SSA region's commercial banks in this study. A number of studies reported in the literature reviewed argued that competition increases the risk of banks, as banks strive to compensate for margins lost because of competition. To avoid the pitfalls of conventional DPD estimators and as well account for endogeneity, the robust orthogonalised version of GMM was used to analyse this relationship. We proxy competition with the Lerner index and focused on credit risk, off-balance sheet risk and overall risk measures for bank risk taking. The choice of the risk measures is borne out by the most common risks faced by banks in this area coupled with data available for the study. We found that credit and overall default risk are positively related to competition in the region. The study concludes that these risks significantly contribute to fragility in a competitive banking environment. Therefore, we highlight them for the attention of policy makers and regulators alike as part of the key areas requiring attention in the quest for robust competitive banking systems.

Insert Table 4

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Table 1: Summary Descriptive Statistics of Variables Employed

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

Note: From column 7 to the far right shows the mean of other variables in the model

Table 2: Correlation Results

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
llpratio & li	0.0731	0.039	0.0259	0.0517	0.0661	0.0292	-0.0521	-0.501	0.0246	0.0202	-0.0374
p-value	0.3477	0.5935	0.6994	0.4203	0.2883	0.6217	0.3617	0.0000	0.6375	0.6988	0.0493
llperatio &li	0.0888	0.0403	0.1237	0.0109	0.0483	0.0266	0.0149	0.0466	0.024	0.0227	0.0197
p-value	0.2537	0.5798	0.0646	0.8647	0.4373	0.6532	0.7938	0.3917	0.6454	0.6623	0.3009
obsaratio & li	-0.0806	-0.1747	-0.1287	-0.0402	-0.012	0.0035	0.0318	-0.071	-0.0678	-0.0494	-0.006
p-value	0.3236	0.0168	0.0861	0.5447	0.8516	0.9545	0.5821	0.196	0.1993	0.3504	0.7573
obseratio & li	-0.0155	0.0305	-0.0319	-0.0391	0.0373	-0.0703	0.0332	-0.0746	-0.0203	-0.0105	-0.0046
p-value	0.8501	0.6785	0.6717	0.556	0.5616	0.2508	0.565	0.1745	0.7014	0.8427	0.8142
eqcapratio & li	-0.1935	-0.3251	-0.05	-0.2209	-0.3223	-0.3091	-0.2535	-0.0024	-0.0819	-0.0479	-0.1427
p-value	0.0078	0.0000	0.4328	0.0002	0.0000	0.0000	0.0000	0.9624	0.0899	0.3162	0.0000

Table 3: GMM Regression Results

	Model 1	Model 2	Model 3	Model 4	Model 5
VARIABLES	Llpratio	llperatio	obsaratio	obseratio	eqcapratio
li	6.22e-05***	0.00179***	-0.00210***	-0.0218***	0.00122***
	(7.22E-06)	(9.92E-05)	(5.11E-05)	(0.00334)	(0.000165)
size	0.00484***	0.0252***	0.0697***	0.0949**	0.0152***
	(0.00016)	(0.000991)	(0.00111)	(0.0469)	(0.00343)
eqcapratio	0.0228***	-0.0597***	1.183***	-3.507***	
	(0.00145)	(0.005)	(0.0103)	(0.465)	
lar	0.0152***	0.00672***	0.312***	2.274***	0.114***
	(0.000582)	(0.00251)	(0.00456)	(0.27)	(0.0138)
roa	-0.488***	-1.999***	0.259***	10.92***	0.758***
	(0.00544)	(0.0255)	(0.0156)	(2.452)	(0.0966)
roe	3.36e-05***	-0.000216***	0.000130***	0.00161	-0.000201*
	(4.94E-06)	(3.05E-05)	(7.15E-06)	(0.00273)	(0.000113)
cop	-0.000157***	-0.000464***	-0.00168***	-0.00806**	0.000208
	(1.51E-05)	(7.48E-05)	(0.000146)	(0.00344)	(0.000188)
gdpg	-0.0319***	-0.288***	0.0781***	-1.684**	-0.0805**
	(0.0027)	(0.0168)	(0.0149)	(0.764)	(0.0342)
inf	0.000434***	0.000510***	-0.00289***	-0.0320***	-0.000309**
	(2.10E-05)	(7.44E-05)	(6.63E-05)	(0.00513)	(0.00015)
L.llpratio	0.449***				
	(0.00272)				
L.llperatio		0.0200***			
		(0.000819)			
L.obsaratio			0.000701***		
			(3.94E-05)		
L.obseratio				0.000901***	
				(7.36E-05)	
L.eqcapratio					0.770***
					(0.0167)
Constant	-0.0471***	-0.165***	-0.891***	0.601	-0.206***
	(0.00195)	(0.0117)	(0.013)	(0.607)	(0.0427)
Observations	2,169	2,174	2,024	2,024	2,510
Number of id	385	387	368	368	420
Wald x^2 (10)	102465.91	16909.67	50990.1	635.3	4520.78
P rob > x^2	0.000	0.000	0.000	0.000	0.000
AR2(prob.)	0.336	0.642	0.178	0.592	0.242
Hansen J(prob.)	0.311	0.158	0.192	0.738	0.470

Note: Standard errors in parentheses; Probability values = *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Appendix

Table 4: Number of Banks per SSA Countries

S/No.	Country	Bank
1	Angola	21
2	Benin	10
3	Botswana	10
4	Burkina Faso	10
5	Cameroon	12
6	Central African Republic	2
7	Cape Verde	6
8	Chad	5
9	Djibouti	5
10	Ethiopia	12
11	Equatorial Guinea	3
12	Gabon	7
13	Ghana	28
14	Guinea	4
15	Guinea-Bissau	1
16	Ivory Coast	17
17	Kenya	42
18	Lesotho	4
19	Liberia	6
20	Malawi	12
21	Mali	9
22	Mauritania	9
23	Mauritius	20
24	Mozambique	14
25	Namibia	8
26	Niger	5
27	Nigeria	20
28	Rwanda	8
29	Senegal	15
30	Seychelles	6
31	Sierra Leone	10
32	Swaziland	4
33	Tanzania	35
34	The Gambia	8
35	Togo	7
36	Uganda	25
37	Zambia	20
	Total	440