

Bank competition or concentration: Which is more important for access to finance in Africa?

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Abstract

Utilising data covering the period 2001-2016 from 45 African countries, this study investigated the impact of bank competition/or concentration on access to finance. The two-step system, Generalised Methods of Moment (GMM) analysis, found that low competition, as proxied by the Lerner Index or Boone Indicator, diminishes firms' access to finance. Besides, relying on a fixed-effect Panel threshold model, the study revealed a concave relationship between firms' access to finance and competition in Africa. This finding implies the existence of a threshold after which competition becomes detrimental to firms' access finance. Notwithstanding, to support development, the study recommends that authorities consider policies to de-concentrate the banking sector, thus promoting access to finance in Africa.

Keywords: Competition; concentration; access to finance; generalised method of moments.

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1. Introduction

Banking competition has been emphasised in literature as a fundamental component of the banking system, especially its importance in ensuring access to finance (Love and Martínez Pería, 2014; Mudd, 2013; Tan, 2013). Aware of the potentials of competition in the banking system for credit expansion and development, the African banking systems have witnessed some reforms. These reforms ranged from liberalisation, restructuring, and privatisation to recapitalisation to engender competition (Boateng *et al.*, 2018; Senbet and Otchere, 2006). Though competitive (Akande and Kwenda, 2017; Kouki and Al-Nasser, 2014), African banking systems have high operating costs and high-interest rate spread (Mlachila *et al.*, 2013b) thus unable to facilitate access to finance in the region. Hence, access to banking services highly constrained (Mlachila *et al.*, 2013a; Mlachila *et al.*, 2013b) with businesses, especially small and medium scale enterprises (SMEs) that account for the bulk of employment and GDP of the economies (Nunoo and Andoh, 2011; Park and Shi, 2016) unable to access the needed finance for growth (Feldmann, 2015; Fowowe, 2017; Kauffmann, 2005; Quartey *et al.*, 2017).

The significance of access to finance for the growth of an economy is emphasised by the Schumpeterian finance-growth model. Access to financing became a crucial ingredient of the investment component of a country's GDP. Countries in perpetual acute supply risk have persistent income inequality and slower economic growth (Beck *et al.*, 2009). Financial constraints are impediments that numerous economies suffer from, although to varying degrees, while alleviating access to financing is a bigger problem in developing economies faced with a higher degree of financial exclusion (Mertzanis, 2017). Global pieces of evidence are suggesting that firms, especially small-medium enterprises (SMEs) that are considered engines of growth, are facing substantial shortages of financing (Demary *et al.*, 2016; Fatoki and Asah, 2011; Maudos, 2013; Quartey *et al.*, 2017). The quest to addressing the issue of financing constraints have given rise to the debate as to which structure of the banking system is more beneficial. Carbo-Valverde *et al.* (2009) documented conflicting evidence of the theories at the forefront of this debate, the information and market power hypotheses. While the information hypothesis proposes a concentrated banking system, the market power hypothesis recommends competition in the banking system better serves the financing need as it results in lower borrowing costs. Hitherto, empirical evidence to date has not proved differently (Ayalew and Xianzhi, 2019; León, 2015a; Love and Martínez Pería, 2014), among others.

Meanwhile, Information asymmetry suggested the likelihood of a non-linear relationship between competition or concentration and access to financing, see (Beck *et al.*, 2004).

Surmounting the problem of access to formal financing is consistent with the findings of the proponents of the supply-leading hypothesis (Ang, 2008; Beck, 2013; King & Levine, 1993; Levine, 2005; Patrick, 1966; Schumpeter, 1911, among others) that emphasised the significance of the financial sector for economic development. Filling the void in the literature by exploring the relationship between competition and access to financing in Africa (Léon, 2015b) will explain further action plans to solve the malaise of poverty and underdevelopment resulting from lack of financial resources to drive the necessary component of development. The few African studies, Diagne (2011) and Ayalew and Xianzhi (2019) that have considered this area disagree that competition constrains access to financing in Africa, but with convergence in certain areas. Both studies employed the World Bank Enterprise Survey Data (WBESD). In contrast, Diagne (2011) studied the impact of banks entry in Senegal and found access to short-term bank loans to have expanded with banks entry for medium and large firms. They concluded overall that competition did not improve access to financing for small firms. Meanwhile, Ayalew and Xianzhi (2019) based their studies on 27 African countries' firm-level analyses to conclude that bank competition is not conducive to access to financing, but that it increases firms' financing needs.

This study contributes to extant literature of competition and access to financing relationships in Africa in several ways. First, this paper differs from the above two studies that employed micro survey data, to consider country-level macro time-series data to account for this relationship and the inclusion of bank concentration in the variables. Secondly, the paper expanded the scope of existing studies by increasing the panel of countries in this study to 45 from the 27 previously considered. And ultimately, attempted a non-linear estimation of competition and access to financing relationship conjectured in the information asymmetry theory. To the best of our knowledge, this is the first to do this in this area.

The results showed that concentration reduces access to finance as 3-bank asset concentration is negatively related to both access to finance, bank credit to deposit, and domestic credit to private sector. The result further revealed competition measured by Boone indicator to be positively related to access to finance. The competition results validated the results of concentration been

negatively related to access to finance. Thus implied that banking concentration or market power hinders businesses access to finance for growth. It is further interesting to note that both concentration and competition variables related to bank credit to deposit and domestic credit to private sector in the same manner. While the former has been employed in literature, the later has not been used to the best of our knowledge, thus providing an alternative variable to measuring access to finance. Literature documented lack of access to finance for businesses in Africa, especially for SMEs, which may have been accounted for by the concentrated banking system despite been averred as competitive.

Moreover, further findings of the study suggested that the relationship between bank competition and firms' access to finance is non-linear, concave, indicating the existence of a threshold after which competition becomes detrimental to access to finance. Suggesting that while competition is good for access to finance some level of market power may be desirable. Therefore, evidence indicated that bank competition is better for access to finance in Africa but showed a threshold beyond which it could be detrimental. Policymakers hence need be exercise some caution when devising measures to stimulate competition within the region.

The rest of the paper is structured as follows: Section 2 deals with bank competition or concentration in Africa, briefly reviews of literature in section 3, while sections 4, 5 and 6 deal with methods, results and conclusion respectively.

2. Bank competition or concentration and access to financing in Africa

The market structure of banking in Africa is that of a mix report. At the same time, some literature laments the concentrated nature of the African banking system (Mlachila *et al.*, 2013a; Mlachila *et al.*, 2013b), few works of literature averred that the banking system is competitive with a range of competitive indices. Kouki and Al-Nasser (2014) documented Lerner indices ranging from 58% in Sudan and 74% in Mauritania, with 62.21% average between 2005 and 2010 for 31 African countries. Country-level competition studies found monopoly (Abdelkader and Mansouri, 2013) and oligopoly (Simpasa, 2011) banking market conditions in Tanzania, and monopolistic competitive condition in Nigeria (Ajisafe and Akinlo, 2013) and South Africa (Mlambo and Ncube, 2011). Moyo *et al.* (2014) argued a weakly contestable banking market with Akande and Kwenda (2017), monopolistic competition in the SSA. The contestable market theory assuaged this dilemma that a banking system could be concentrated yet competitive, see (Baumol *et al.*, 1982).

According to Léon (2015b), only indirect evidence exists of the relationship between concentration and access to financing in Africa. However, Diagne (2011) had earlier considered the implication of bank entry in the West Africa Economic and Monetary Union (WAEMU) for access to financing and, recently, Ayalew and Xianzhi (2019)'s evidence of competition and access to financing relationships from 27 African countries. While the former found that bank entry that signifies competition's presence has at least expanded access to financing for medium and large-scale firms, the later documented that competition increases credit constraints. Yet for individual African country study of Malawi, Kabango and Paloni (2011) reported an increase in concentration resulting from financial liberalisation culminating in crowding out of new entrants, aggravating the problem of access to financing. Although their study coverage differs, conflicting evidence suggested that much still needed to be done to ascertain the relationships in Africa.

The few other studies incorporating empirical literature on Africa that failed to consider access to credit in the relationship between competition and access to financing did not document evidence to the contrary. O'Toole (2014) reported that the liberalisation of the African financial sector has not yet impacted the constraint of access to financing. Before that, Kpodar (2005) explained that the hindrance of financing and growth in Africa is possibly due to the banking system's contraction, supporting the market power hypothesis. Further literature representing a small number of African economies found evidence with conclusions that could be described as mixed, (see Beck *et al.*, 2009; Beck *et al.*, 2004; Love and Martínez Pería, 2014; Mertzanis, 2017), justifies a further study in this area.

3. Literature review and hypothesis development

The banking system's primary role is financial intermediation, mobilising fund from surplus (supply-side) and channel them to the deficit side (demand-side) for productive investment purposes. How much of the mobilised funds on the supply-side ends up on the demand-side for credit creation becomes the preoccupation of this study.

The problem of economic growth is in the literature associated with solving the puzzle of access to financing. The argument is consistent with the findings of the proponents of the supply-leading hypothesis of finance and growth (see Ang, 2008; Beck, 2013; King and Levine, 1993; Levine, 2005; Patrick, 1966; Schumpeter, 1911, among others) that highlight the importance of the financial sector for economic development.

Banking competition and concentration, among others, are critical determinants of access to financing, which, in literature, is governed by market power and information hypotheses. Under the structure-conduct-performance (SCP) theory, market power proposed that interest rates increase with a concentration in the banking system, thereby constraining credit access. Consistent with Guzman (2000) proposition that monopoly banks possibly contract capital accumulations due to propensity to ration capital.

The SCP hypothesis advocated that any deviation in perfect competition amounts to less financing access by borrowers (Beck *et al.*, 2004). Therefore, the absence of competition suggests a collusive or concentrated banking system, notwithstanding competition in concentration advised in literature. Market power is synonymous with banking concentration; as a result, it can be assumed that a concentrated banking system is detrimental to access to credit as increased market power increases the interest rate. Meanwhile, cognisance of information asymmetry leading to the risk of adverse selection and moral hazards consistent with non-transparent firms, information hypothesis holds that market power may reduce information constraints as those positively influence access to financing.

Empirical works on the relationship between banks' market structure, be it competition or concentration, and access to financing has a historical basis. An extensive body of empirical studies has reported the significant role of bank competition in ensuring access to financing (Clarke *et al.*, 2006; Lin *et al.*, 2012; Love and Martínez Pería, 2014; Mudd, 2013; Rice and Strahan, 2010; Tan, 2013). Specifically, Beck *et al.* (2004) explored the relationship between competition and access to financing within an international context for different categories of small to large firms in 74 countries. They found that bank concentration increases access to financing obstacles in developing countries with low institutional development. Their results showed that competition from foreign-owned banks supported by a more efficient credit registry was advantageous for firms to access required financial needs. Lack of access to financing exacerbate income inequality and slows down economic growth. It was the submission of Beck *et al.* (2009) in their study of the measurement, impacts and policies on access to financial services. The researchers documented that more than half of the developing countries' population lacks access to financial services, which literature has proposed to have originated from the banking systems' market structure. A study of 27 countries across Central Asia and Eastern Europe by Bernini and Montagnoli (2017) found that competition is detrimental to firms' access to financing. However, the study noted that it favours firms that can

provide collateral evidence with audited financial statements. This study utilised firm-level data from 2005 to 2009 and was biased to product market competition on both the market demand and supply side.

Bernini and Montagnoli (2017) also evidenced that competition increases the pressure of firms' financial needs but that the firms become discouraged from making loan applications due to high loan costs and complex loan approval processes. Ayalew and Xianzhi (2019) documented in an African study that large proportions of firms become discouraged in making loan application despite the banks' high loan application approval rates. Meanwhile, an earlier study by Leon (2015) of 69 developing countries indicated that competition reduces borrowers' discouragement and lessens the severity of loan approval.

Hoxha (2013) found evidence that competition facilitates better firm performance for businesses that rely on external financing. Where firms become discouraged in making a loan application in a competitive environment (Bernini and Montagnoli, 2017), could result in the erosion of the gains of increases in performance within a competitive banking system. Bank competition is good or bad for access to financing (Chong *et al.*, 2013). Studying small and medium enterprises in China, Chong *et al.* (2013) posited competition might improve or deter businesses' access to financing. They found that lower market concentration worsens access to financing constraints, consistent with Beck *et al.* (2004).

Liberalisation was meant to open up the financial systems of economies and pave the way for more competitive banking industry to enhance financial inclusion for economic growth in Africa. O'Toole (2014) conducted a panel analysis of 57 transitional and developing countries' firm-level data and documented that financial liberalisation reduces the probability of credit constraints. On the contrary, Kabango and Paloni (2011) examined financial liberalisation in Malawi. They reported that notwithstanding the expansion in credit resulting from liberalisation, the result was a more concentrated banking system. The study's findings were substantiated by O'Toole (2014), who documented that financial liberalisation worsened credit constraints in the case of Sub-Saharan Africa. It was noted that financial liberalisation might not on its own orchestrate competition in the banking system (Delis, 2012). Similarly, banks could be competitive in a concentrated banking environment, according to the contestable market theory (Baumol *et al.*, 1982).

Other empirical literature on bank market structures and access to financing relationships, Leon (2015), found competition to alleviate financing access in

developing countries, with concentration measures, failed to explain difficulties with financing access. Earlier, a similar study in Europe that focused on SMEs showed that competition positively affects the number of lending relationships with weak evidence of concentration dampening it (Mercieca *et al.*, 2009). Intermediation costs were also a significant constraint for financing access (Ayalew and Xianzhi, 2019; Bernini and Montagnoli, 2017). Léon (2015a), explored market power and financial intermediation costs at 94 banks in West Africa from 2004 to 2009 and found consistency within the market power hypothesis. The implication is that banks with high market power may have the advantage of charging high-interest margins which, in turn, hurts access to financing. Interest-free Islamic banking is presumed to not only alleviate access to financing, but their creation is also expected to increase competition. Studies by Léon and Weill (2018) found that Islamic banking does not solve financial constraints. They tested firm-level data from 2006 to 2009 and found that Islamic banking has no impact on credit access, but development and conventional banks do. The ownership structure is also noted by Mertzanis (2017), to significantly influence firms' access to financing with evidence from 136 countries using WBES survey data. Mertzanis (2017) specifically found that private and foreign ownership provide a more robust prediction of firm' access to financing in developing countries.

Holistically, conflicting evidence abound in empirical literature as both evidence testing the alternative theories of market power, and information hypotheses generally provided conflicting results. Only limited literature has provided evidence within an African context and was not dedicated to the region. Hence this study tests the hypotheses;

H10: bank concentration does not influence access to financing; and

H20: bank competition does not influence access to financing

4. Method

To test the preceding hypotheses, the study employed the dynamic Generalised Method of Moment (GMM) model to analyse a panel of 45 African countries for which sufficient data are available. Panel data analysis permits removing unobserved heterogeneity for each observation in the sample and the alleviating of multicollinearity among variables (Anderson and Cheng, 1982; Anderson and Hsiao, 1982; Fauzi *et al.*, 2013). Several issues, such as multicollinearity, endogeneity, are responsible for the inconsistencies in OLS estimation (Maddala and Lahiri, 2009). The study builds on the baseline empirical model of Beck *et*

al. (2004) in examining the conflicting theories of the effects of banks market structures and access to financing; information and market power hypotheses, using generalised methods of moments (GMM) (Anderson and Cheng, 1982; Anderson and Hsiao, 1982; Arellano and Bover, 1995). The GMM yields consistent estimates for dynamic panel data analysis. As a result, the relationship between competition/concentration and access to financing in the African region is assumed to take the following general form of linear dynamic panel model;

$$\gamma_{it} = \omega_i + \rho_i \gamma_{i,t-1} + x'_{it} \rho + \epsilon_{it} \quad (1)$$

Where, $t = \tau+1, \dots, T$ and ϵ_{it} is assumed to be serially uncorrelated. The estimating regression model is derived from equation (1) and is written as:

$$\gamma_{it} = \omega_i + \beta_{kit} \varphi_{kit} + \delta_{kit} \vartheta_{kit} + \epsilon_{it} \quad (2)$$

Where γ represents access to financing measures, bank credit to deposit (BC2D) and domestic credit to private sector (DC2PS) respectively, k indicates the number of regressions, it represents country i in time t , φ stands for concentration measures – 5 bank assets concentration (BAC) and 3 bank assets concentration (CONC) and ϑ denotes competition variables, Boone indicator (BIND) and Lerner index (LERNER), while β , δ and ϵ are the parameters to be determined and the error terms respectfully.

3.1 Data source and variable description

The study's data was sourced from the World Bank Global Financial Development Dataset (GFDD) for the period 2001 to 2016. The convenience sampling method was adopted that ensures that the selection of countries and the period of studies depend on the availability of data. Forty-five out of the 54 African countries were successfully harnessed in an unbalanced panel data used in the regression analysis. The main data requirement relates to access to financing, competition, and concentration; therefore, two sets of data were collected for each of the variables for robustness.

In the case of access to financing, the main variable for consideration is domestic credit to private sector (DC2PS). The alternative data collected is the percentage of bank credit to bank deposit (BC2D). Domestic credit to private sector describes the financial resources that the banks in a country provide to the private sector. This, according to the World Bank GFDD, include loans, purchases of non-equity securities and trade credits and other accounts receivable, which establish a claim for repayment and which, in some instances includes credit to public enterprises. Bank credit to bank deposit represents the financial resources

that the domestic money banks make available to the private sector as a share of total deposits.

The private sector's emphasis reflects the real sector of an economy that engages in productive activities requiring financing for investments. The two surrogates represent measures of financing to the private sector for investment purposes. That is after accounting for the various access constraints that encompass a range of considerations by banks, such as firms' leverage ratio (Hansen 1999), credit information (Jappelli and Pagano, 2000; Tffaily, 2017), collateral with audited financial statements (Bernini and Montagnoli, 2017), among others. Domestic credit to private sector has been used in literature to measure access to financing, see (Adu-Asare Idun and QQ Aboagye, 2014; Beck *et al.*, 2004; Capolupo, 2017; Claessens and Laeven, 2005; Kwenda, 2017). The Bank credit to bank deposit was used in this study for robustness purposes, as it represents the amount of money set aside for credit to the private sector from the available deposit. The authors are not aware of its usage in extant literature. It allows for testing the impact of banking market structure on how much banks could keep aside credit for the private sector. Credit availability will also determine what is given out as domestic credit to private sector.

Measuring the structure of banking market has been synonymous to concentration ratio, CR_n , (Deidda, 2005; Dietrich *et al.*, 2010; Laeven and Majnoni, 2005). Notable concentration ratio used is CR_3 , which is a 3-bank assets concentration ratio described by GFDD as bank concentration (%), denoting assets of the three largest commercial banks as a share of total commercial banking assets. An alternative measure is the CR_5 , the 5-bank assets concentration indicating the proportion of the total commercial banking assets that are controlled by the five largest banks. The structural model principles encapsulated in the SCP and the market power hypothesis is that concentrated banking is consistent with credit constraints. Both measures have been employed to measure concentration previously in literature with mixed results (Deidda, 2005; Dietrich *et al.*, 2010; Laeven and Majnoni, 2005).

This study had recourse to the non-structural bank market structure model of Lerner index (Berger *et al.*, 2009; Demirgüç-Kunt, 2010; Kouki and Al-Nasser, 2014) and Boone indicator (Babalola, 2012; Boone, 2008b; Boone, 2008a; Schaeck and Cihák, 2014) for competition measures. Among others, the choices were based on data availability besides their usage in literature emphasising their merits (Demirgüç-Kunt, 2010; Liu *et al.*, 2013; Liua and Mirzaeia, 2013; Rojas, 2011). Lerner index, a bank-level measure of banking systems' market

power, relates output pricing and marginal costs with index ranging from 0 to 1. An increase in the Lerner index indicates a deterioration of the competitive conduct of financial intermediaries. Unlike the Lerner index, Boone indicator is a macro index that measures competition based on profit-efficiency in the banking market calculated as the elasticity of profit to marginal cost. The smaller the indicators, the more competitive the banking system is expected to be. Both Lerner index and Boone indicator have been employed in competition and access to financing literature (Léon, 2015; Love and Martínez Pería, 2014).

As described above, the summary statistics of the data employed are contained in Table 1 with the graph of the mean of the variables in Figure 1. The 5-bank asset concentration (BAC) has a mean of 86% with minimum and maximum values 33% and 100% respectively. The volatility in terms of the standard deviation at 13.9, suggesting a highly concentrated banking system as the mean is not fundamentally different from the maximum value.

TABLE 1: SUMMARY STATISTICS

	BAC	BCONC	BC2D	DC2PS	BIND	LERNERI
Mean	0.856413	0.754721	0.707382	0.242908	-0.07604	0.304311
SD	0.138797	0.185158	0.269222	0.254153	0.189127	0.122809
Min	0.334155	0.233243	0.813778	0.491388	-2.54086	-0.385713
Max	1.00	1.00	1.37331	1.60125	1.60741	0.639984
Obs	487	648	706	704	648	498
Unique	402	552	706	702	606	498
Label	5-BAC	BCONC	BC2D	DC2PS	BIND	LERNERI

Source: Authors' estimation.

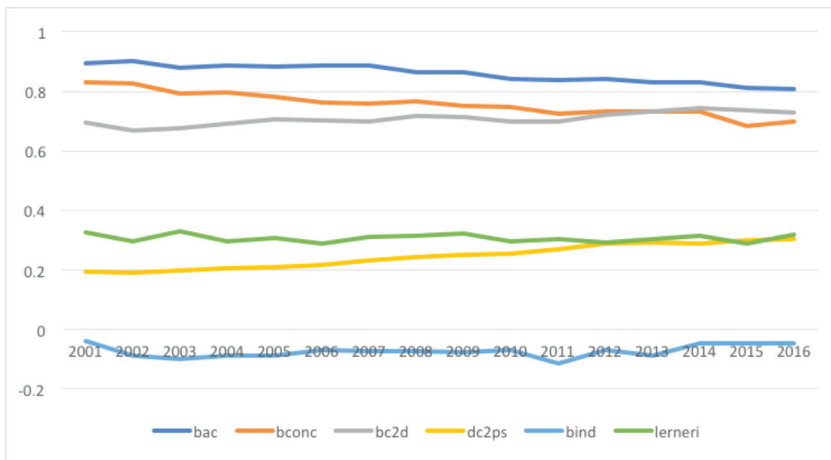
Notes: 5-bank asset concentration (BAC); 3-bank asset concentration (BCONC); bank credit to deposit (BC2D); domestic credit to the private sector (DC2PS); Lerner index (LERNERI) and Boone indicator (BIND).

This was corroborated by the 3-bank asset concentration (BCONC) with a maximum of 100%, although it was 23% minimum. Although less concentrated than the BAC, it has a mean 75%, and at a standard deviation of 18.5, the dispersion around the mean still skewed the concentration more to the maximum than to the minimum values. Despite a gradual downward trend of concentration in the banking system presented by the statistics and supported by the pictorial representation in Figure 1, the banking system is adjudged highly concentrated (Mlachila *et al.*, 2013a; Mlachila *et al.*, 2013b). The Lerner index and Boone indicator (BIND) showed a monopolistic competitive market with an overall average market power of 0.304311 and -0.07604 for LERNERI and BIND

respectively. The contestable market theory could explain why the banking systems are much concentrated yet competitive, (see Abdelkader and Mansouri, 2013). The bank credit to deposit (BC2D) and domestic credit to the private sector (DC2PS) presents a more realistic statistic. While BC2D is relatively high with a mean of 71%, the DC2PS is conversely low with an average of 24%. It could be inferred from the discrepancies that most of the banking system's credit does not end up with the private sector for productive investment purposes. The low growth in DC2PS may be attributable to constraints in access to financing, notwithstanding that the banking systems on the continent have been accused that their credits have been largely directed at governments and their agencies (Mlachila *et al.*, 2013a).

FIGURE 1: MEASUREMENT VARIABLES

4. Results



We started by estimating the spearman's rank correlation to investigate which of competition and concentration best serve access to financing in Africa. The correlation results reported in Tables 2 and 3 for concentration and competition, respectively. The correlation between BAC and BC2D in Table 2 revealed that concentration might be less favourable for access to financing, the finding echoed by BCONC and BC2D relationship. DC2PS and BAC, as well as DC2PS relationships, did not exhibit a significant departure from what was previously observed as the coefficients were mostly negative and significantly correlated. This result showed a general pattern in the two pairs' correlation coefficient, providing evidence to suggest that concentration hurts access to

financing, inconsistent with hypothesis one but substantiates for the market power hypothesis.

TABLE 2: SPEARMAN'S RANK CORRELATION FOR ACCESS TO FINANCING AND CONCENTRATION

Year	2001	2002	2003	2004	2005	2006
BC2D&BAC	-0.317	-0.282	-0.418**	-0.287	-0.131	0.013
BC2D&BCONC	-0.113	-0.175	-0.360	-0.310	-0.263	-0.191
DC2PS&BAC	-0.506**	-0.444**	-0.468**	-0.329	-0.187	-0.202
DC2PS&BCONC	-0.309*	-0.306*	-0.424***	-0.344**	-0.284*	-0.272*
Year	2007	2008	2009	2010	2011	2012
BC2D&BAC	0.034	0.069	-0.134	-0.098	-0.032	0.153
BC2D&BCONC	-0.110	-0.236	-0.362**	-0.269*	-0.250	-0.206
DC2PS&BAC	-0.322*	-0.126	-0.176	-0.171	-0.012	0.031**
DC2PS&BCONC	-0.298*	-0.33**	-0.186	-0.107	-0.041	-0.167
Year	2013	2014	2015	2016		
BC2D&BAC	0.045	0.108	-0.187	-0.100		
BC2D&BCONC	-0.198	-0.010	-0.474***	-0.409***		
DC2PS&BAC	0.022**	0.095*	-0.026	-0.125		
DC2PS&BCONC	-0.168	-0.149	-0.130	-0.29*		

Source: Author's estimation.

Notes: ***, **, * denotes 1%, 5% and 10% significance levels, respectively. 5-bank asset concentration (BAC); 3-bank asset concentration (BCONC); bank credit to deposit (BC2D); domestic credit to the private sector (DC2PS); Test of H0: the variables are independent.

Table 3 reported the correlation results for competition and access to financing variables. Against the second hypothesis of this study, competition as measured by Boone indicator, BIND has 10 out of the 16 years correlation coefficient to be negative and significantly correlated with BC2D, providing evidence that competition may also be harmful to access to financing. This finding is similar to that of the correlation between competition, Lerner index, and BC2D, but most of the negative correlation coefficients are insignificant, suggesting a mix of correlation sign. Similar results were displayed with almost equal signs of correlations in DC2PS and the two competition measures, BIND and LERNERI. The mixed results of correlation between competition and access to financing variables pose a challenge of concluding whether or not competition hurts access to financing.

TABLE 3: SPEARMAN'S RANK CORRELATION FOR ACCESS TO FINANCING AND COMPETITION

Year	2001	2002	2003	2004	2005	2006
BC2D&BIND	-0.081	-0.035	0.041	0.116	-0.001	-0.016
BC2D&LERNERI	0.008	-0.360	-0.293	-0.150	-0.350*	-0.376**
DC2PS&BIND	-0.035	-0.086	0.207	0.113	0.060	0.120
DC2PS&LERNERI	-0.208	-0.208	-0.306*	-0.108	-0.087	-0.196
Year	2007	2008	2009	2010	2011	2012
BC2D&BIND	-0.068	-0.184	-0.231	-0.157	-0.007	0.077
BC2D&LERNERI	-0.477***	-0.201	-0.100	-0.030	0.250	0.198
DC2PS&BIND	0.028	-0.122	-0.059	-0.026	0.107	-0.102
DC2PS&LERNERI	-0.345**	-0.273	-0.079	0.078	0.099	0.218
Year	2013	2014	2015	2016		
BC2D&BIND	0.095	-0.003	0.249	0.249		
BC2D&LERNERI	0.038	0.102	0.115	-0.139		
DC2PS&BIND	-0.102	-0.065	0.192	0.172		
DC2PS&LERNERI	0.097	0.183	0.178	0.026		

Source: Author's estimation.

Notes: ***, **, * denotes 1%, 5% and 10% significance levels, respectively. Test of H_0 : the variables are independent; bank credit to deposit (BC2D); domestic credit to the private sector (DC2PS); Lerner index (LERNERI) and Boone indicator (BIND).

Further, this study implemented an unbalanced panel data analysis with the efficient two-step system Generalised Method of Moments (GMM) robust to standard errors with orthogonal deviation for missing data. The technique can resolve panel data bias with the ability to handle unbalanced panel data analysis (Arellano and Bover, 1995; Roodman, 2006). The regression results are presented in Table 4 below.

TABLE 4: REGRESSION RESULTS

VARIABLES	Model 1	Model 2
	GMM Bank credit to deposit	GMM Domestic credit to private sector
5-bank asset concentration	0.633 (0.64)	9.452*** (3.5)
3-bank asset concentration	-0.850** (0.41)	-8.908*** (3.16)
Boone index	0.816* (0.47)	0.276* (0.16)
Lerner index	-0.442 (0.66)	0.178 (0.49)
Constant	1.008** (0.5)	-1.693** (0.81)
Observations	393	396
No. of id	31	31
No of instrument	13	27
Wald Stat.	0.004	0.04
AR ²	0.24	0.25
Hansen Stat	0.618	0.796

Source: Author's estimation.

Notes: Corrected standard errors in parentheses.

The result of the GMM in models 1 and 2 show that 5-bank asset concentration (BAC) is not significantly related to bank credit to deposit (BC2D) but strongly significant and positively related to domestic credit to private sector (DC2PS). Conversely, 3-bank asset concentration (BANC) is strongly significant and negatively related to BC2D and DC2PS. Although the results are mixed, further evidence suggested a negative relationship between concentration and access to financing implying that access to financing is a constraint at a higher level of bank concentration. This is substantiated by a less concentrated measure of 5-bank asset concentration being positively related to access to finance (DC2PS). The result is consistent with the market power theory and the findings of Beck *et al.* (2004) and Chong *et al.* (2013) who documented that financial access constraints increased with high bank concentration. It does not conform with the proposals of the information hypothesis held in favour of more concentration better access to financing (Ayalew and Xianzhi, 2019). In the case of competition, LERNERI is neither significant to explain BC2D, nor is it significant to explain DC2PS. The case is slightly different for BIND with

BC2D and DC2PS relationships that provided a positive but weakly significant relationships, suggesting that increasing BIND, which implies a reduction in competition, is positively related to access to financing in Africa. In this context, access to financing is exacerbated by banks' increasing market power and, following the concentration and access to financing relationship described above and suggesting further support for market power hypothesis. This result is not in tandem with Bernini and Montagnoli (2017), whose findings in Eastern Europe and Central Asia's emerging economies showed that competition is detrimental for access to financing.

The foregoing results provided evidence suggesting that concentration is negatively related to access to financing and that higher level of competition favours access to financing. This aligned with the primary aim to empirically determine which of bank concentration and competition is more relevant for access to financing in Africa as indicated by the two hypotheses tested above. The results provided evidence that suggested that the two phenomena are relevant and at different extremes.

While concentration exhibited a negatively strong significance with access to financing providing support for the market power hypothesis, competition, although weakly significant, was positive to explain access to financing, giving credibility to the market power hypothesis. The implication is that competition appears to be more preferred to concentration for access to financing. These results suggest a non-linear relationship with the variables consistent with the information asymmetry hypothesis since the absence of concentration means competition. As a result, we tested a third hypothesis to further probe this relationship by exploring a non-linear relationship between the variables.

An extension of the information hypothesis is the information asymmetries, whose proponents explained the opacity of customer credit information increases with bank concentration (Beck *et al.*, 2004). It suggests a non-linear relationship between concentration and access to financing. In this context, low concentration means less opacity of information and favours access to financing and conversely. Since low concentration is consistent with high competition and the opposite being high concentration to low competition, it suffices to assume that competition will also have a non-linear relationship with access to financing.

H3₁: Competition has a non-linear relationship with access to financing.

To analyse the third hypothesis suggested by the information asymmetry and supposed by the mixed results analysed above, a balanced panel data model was

fitted for 32¹ Sub-Saharan Africa countries $\{y_{it}, q_{it}, x_{it}; 1 \leq i \leq n, 1 \leq t \leq T\}$. Where the subscripts i and t index member country and time, respectively. The endogenous, y_{it} , and threshold variable, q_{it} , are both scalars, while the exogenous variable, x_{it} , is a k vector. The model is specified as:

$$y_{it} = \mu_i + \beta'_1 x_{it} I(q_{it} \leq \gamma) + \beta'_2 x_{it} I(q_{it} > \gamma) + \varepsilon_{it} \quad (3)$$

Re-expressing eq (1)

$$y_{it} \begin{cases} \mu_i + \beta'_1 x_{it} + \varepsilon_{it} & q_{it} \leq \gamma \\ \mu_i + \beta'_2 x_{it} + \varepsilon_{it} & q_{it} > \gamma \end{cases} \quad (4)$$

Another solid way of expressing equation (3) is to set

$$x_{it}(\gamma) = \begin{pmatrix} x_{it} I(q_{it} \leq \gamma) \\ x_{it} I(q_{it} > \gamma) \end{pmatrix} \quad (5)$$

In addition, $\beta = (\beta'_1 \ \beta'_2)'$ so that eq. (3) equals

$$y_{it} = \mu_i + \beta' x_{it}(\gamma) + \varepsilon_{it} \quad (6)$$

Differing regression slopes describe the regimes, β_1 and β_2 . To identify the regimes, the elements of x_{it} and threshold variable q_{it} are required to be time-invariant (Hasen, 1999). Additionally, ε_{it} is assumed to be independent and identically distributed with mean zero and finite variance σ^2 . The details of the fixed-effect panel threshold model's estimation procedure for the single and multiple cases are explained in Wang (2015).

Table 5 showed the results of the non-linear relationship between competition and access to finance, demonstrated by the single-predictor model for the period 2001-2016. The single-threshold model's estimator (TH-1 or TH-21) is -0.62 with 95% confidence interval [-0.63, -0.61]. The F -statistic is significant at a reasonable level of significance, therefore the linear model is rejected; and the study subsequently fits a double-threshold model. The threshold effects test indicated that a single threshold model could not be rejected with a probability of 0.442.

¹ The sample size defers from our initial 45 unbalanced panel of countries because the nonlinear panel estimation model requires a balanced panel.

TABLE 5: FIXED-EFFECT PANEL THRESHOLD ESTIMATION

	Dependent variable: DC2PS	
	(1)	(2)
	1 threshold	2 thresholds
Dome-to-p- thresholds		
0	0.193*** (0.031)	0.242*** (0.036)
1	0.095*** 0.000	0.164*** (0.033)
2		0.090*** (0.022)
_cons	-0.233*** (0.065)	-0.218*** (0.065)
R^2	0.17	0.18
Thresholds		
Th-1	-0.6226	-0.6226
Th-21		-0.6226
Th-22		-1.0217
Threshold-effect test		
<i>F-statistic (p-value)</i>		
Single	19.86(0.025)	19.86(0.025)
Double		6.68(0.442)

Notes: Th-1 is the estimator in a single threshold model. Th-21 and Th-22 denote the two estimators in a double-threshold model. Th-1 and Th-21 are the same, and (0), (1) and (2) represent the various thresholds.

The findings of a single-predictor model with a single threshold presented in Table 5 imply that, if the competition is in the first region (below -0.6226) and increases by 1%, access to financing will improve 19.3%. Moreover, the study's findings suggested that if competition is in the second region (above or equal to -0.622) and increases by 1%, access to financing will improve by approximately 9.5%. Overall, the study's findings suggested that higher levels of competition are associated with increased access to financing. These findings imply a 'concave' relationship between competition and access to financing – implying that as concentration rises the positive effect on access to financing by competition becomes smaller and smaller. This is according to theories that

² Indicated by lower level of BIND meaning high competition and low concentration.

explained that increasing bank concentration tends to elevate the cost of credit, thereby constraining access to financing. The concave relationship between bank concentration and access to financing is in tandem with the market power theory, which holds that increasing competition should result in lower prices, consequently more access to financing.

Overall, the study found evidence suggesting that both competition and concentration significantly influence access to financing in Africa, supporting the market power hypothesis signifying that a competitive banking system is more favourable for access to financing. In particular, the non-linear results indicating a concave relationship between competition and access to financing. Juxtaposing the results with some African studies the study found consistencies with Diagne (2011) who documented expansion in bank credit to medium and large firms in Senegal arising from competition that resulted from bank market entry to WAENU. The case is different in respect of Ayalew and Xianzhi (2019) whose evidence of 27 African countries supported the information hypothesis that propounds that competition worsens financing access. The African banking environment is characterised by a concentrated banking system against the competitive banking environment, which poses a challenge to financing access. Literature documented that the bulk of credit created by the banks does not eventually arrive at the private sector but concentrated in the governments and their agencies and the few oil sectors of most of the economies (Mlachila *et al.*, 2013a; Mlachila *et al.*, 2013b).

These are the few sectors competing for the available funds, and because of the concentrated nature of the banking system, they can sustain the status quo with the majority of the SMEs still suffering financial deprivation. Policies redirecting these trends must be devised and encouraged, especially as competition favours financing access. Otherwise, the lower cost of financing that comes with a competitive banking system will not benefit the economies' relevant sectors with the result that development will remain continually elusive.

5. Summary and conclusion

This paper tested which between competition and concentration is more conducive to access to financing in Africa, given the lack of the relevant literature in Africa and the conflicting theoretical and empirical studies in the study area. Such research has become expedient for economic growth in Africa in the light of the financing and growth hypothesis. Two hypotheses were initially tested using GMM with both results supporting the market power hypothesis but at

different extremes, as they negated the study hypothesis that they both do not influence access to financing in Africa.

Concentration supports the market power hypothesis that higher market power constraint financing access and competition suggest that access constraint is alleviated with less market power. The study further tested the information asymmetry theory of a non-linear relationship between competition and/or concentration and access to financing using the Fixed-effect panel threshold estimation approach and found a concave relationship further supporting the market power hypothesis. Consequently, the study concludes that both concentration and competition exact influence on access to financing. The results suggested that a more competitive banking environment is most favourable for financing access in the African economy but with evidence but indicating a threshold beyond which it could be detrimental.

Since competition has a positive, although diminishing effect on access to finance, policies that will allow or promote competition in Africa should be implemented, however, this should be done cautiously as ‘higher levels’ of competition have lower impact on finance access. As competition grows, the number of ‘risky’ borrowers rises, resulting in a rising number of bad loans, which leads to institutions tightening lending criteria. While competition should be encouraged, it must be accompanied by measures to safeguard financial institutions against ‘risky’ or bad borrowers.

For the economies to thrive, policies supporting not only a more competitive banking environment should be pursued, but also those ensuring that credits are directed at the real sectors of the respective economies, ensuring that the gain of competition is internalised within the productive sectors of the economies. Further studies need to be conducted to ascertain the threshold or the point to which competition exerts an adverse effect on finance access.

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