Bank Competition in Africa: Do Institutional Quality and Cross-border Banking Matter?

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Bringing Rigour and Evidence to Economic Policy Making in Africa

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List of abbreviations and acronyms

BMCE	Banque Marocaine du Commerce Extérieur
CBB	Cross-border Banking
CPI	Consumer Price Index
EAC	East African Community
ECOWAS	Economic Community of West African States
GDP	Gross Domestic Product
ICRG	International Country Risk Guide
IQ	Institutional Quality
NEIO	New Empirical Industrial Organization
SCP	Structure Conduct Performance
SADC	Southern African Development Community
UBA	United Bank for Africa

Abstract

This study analyses the implications of cross-border banking (CBB) and institutional quality (IQ) for bank competition in Africa. We apply a two-step estimation procedure using bank-level panel data for 29 African countries. In step one, the Boone indicator and the Lerner index are used to gauge bank competition in a given country in Africa. In the second step, we analyse the sources of bank competition, placing emphasis on the impact of CBB and IQ. The results suggest that competition increased in the period 2002-2005, before decreasing somewhat between 2006 and 2007 and increasing again thereafter. The results also show that cross-border banking enhances bank competition in African countries with stronger governance structures and institutional quality. Our results are robust to an array of controls, including an alternative methodology, variable specifications, and the regulatory environments that banks operate in.

1. Introduction

A sound banking sector competition is of great economic importance because it provides for the efficient production of financial services, improves the quality of financial products and the degree of financial innovation (Claessens and Laeven 2004). In addition, literature has identified six reasons why competition in the financial sector is important: firstly, for firms and households to access financial services (Beck et al, 2004); secondly, for proper functioning of the financial sector (Claessens and Laeven, 2005); thirdly, for stability of the financial system (Boyd et al, 2009); fourthly, for efficient management of financial intermediaries (Berger and Hannan, 1989); fifthly, for improvement of monetary policy transmission through the interbank market rates (van Leuvensteijn et al, 2010); and finally, for overall industrial and economic growth (Allen and Gale, 2004). Competition can stimulate innovation, lower prices and increase the quality of products and services produced, which in turn enhance choice and welfare. Furthermore, Zarutskie (2011) contends that competition enables banks to either specialize in certain types of lending, or improve their screening abilities for borrowers in particular segments of credit market, and this enables banks to become more cost efficient relative to their competitors. Dick and Lehnert (2010) provide evidence to suggest that competition increases banks' lending and also lowers loan default.

In Africa, the issue of competition in the financial services sector has important implications, especially for enhancing productive efficiency, financial stability, and effective regulation and supervision. These implications, according to Kasekende et al (2009), have possible positive spillover effects to the rest of the economy, or indeed from one African country to the rest of the continent. Thus, efficient lending strategies of some banks in response to competition increases banks' profitability level relative to their competitors. Consequently, the development of reliable and easily understandable indicators of competition is a highly relevant endeavour (Carbó et al, 2009). In Africa, however, an understanding of the underlying mechanisms that drive the evolution of competition is important to government agencies tasked with ensuring that competitive outcomes prevail.

In the banking industry, assessment of competition has a long empirical tradition (Casu and Girardone, 2006; Degryse et al, 2009). However, evidence related to bank competition in Africa is scarce. The international evidence on competition presented in previous studies includes a small number of large African countries (Claessens and Laeven, 2004; Clarke et al, 2003; Turk-Ariss, 2010). Given the importance of bank

competition to Africa economic development, (African Competitiveness Report, 2009), a reliable, appropriate and easily understandable measure of competition is needed. Kodongo et al (2015) show that the institutional quality is important to a bank at the planning phase of banks' foreign expansion decisions and that banks consider going abroad due to competitive pressures currently exerted by their stronger, more efficient competitors as well as by their domestic competitors having expanded abroad. More so, most previous studies do not account for the political and institutional factors that are likely to shape competition in countries characterized by a variety of imperfections, which is caused by a lack of development, weak institutions, poor governance and barriers to entry. The existence of cross-border banks can increase competition, which is beneficial to bank stability (Boyd and De Nicolo, 2005). Carlson (2004) is of the view that cross-border banks are less likely to survive and the duration of survival is also relatively much shorter. The entry of cross-border banks or foreign banks has several implications for the host countries, especially sub-Saharan African (SSA) countries: toughen inter-bank competition as well as ensure greater use of advanced technologies to improve business skills and services, increase financial service access, may bring about great stability, improve the development of the local banking supervision and legal regulations, increase transparency and the availability of international capital, and boost financial and economic performance of borrowers (Clarke et al, 2003; Claessens, 2009; Mishkin, 2007; Cull and Peria, 2013; Chopra, 2014). However, the effects of cross-border banking on competition in Africa appear to be varying and also dependant on some conditions, including efficient accounting standards; collection of collateral; improved information; strong institutions; privatization of state-owned banks; and the removal of entry barriers (Sacerdoti, 2005; Demetriades and Fielding, 2012). This is the gap which this study addresses. We measure competition and analyse the cross-border banking and institutional quality effects on bank competition in Africa.

Apart from an extension in the scope of the current literature, this study makes the following two important contributions regarding developing and emerging economies. First, we estimate competition among banks in Africa by applying a new measure of competition, the Boone indicator. This approach to measure competition is innovative in the sense that competition can be measured for various products such as the loan markets and for several types of banks, such as commercial, savings, merchant, development and co-operative banks. Another merit of the use of Boone indicator is that it requires relatively little data and also allows the estimation of competition on an annual basis where the development of competitive environment can be examined and analysed over the period (van Leuvensteijn et al, 2010). In addition, we employ Lerner index as alternative measure of bank competition. The Lerner index represents the price mark-up over marginal cost, and to avoid any bias emanating from a bank exercising market power in the deposits market, and given that there is no consensus in the literature regarding how best to assess the degree of bank market power (Carbó et al, 2009), this study employs three different specifications of Lerner: a conventional Lerner (Berger et al, 2009), a funding-adjusted Lerner (Maudos

and De Guevara, 2007), and efficiency-adjusted Lerner (Koetter et al, 2012). Secondly, we use the results in the first objective to analyse factors that explain the differences in bank competition. Here, we evaluate how cross-border banking and the various countries' institutional strength shape bank competition in Africa.

Our results suggest that competition increased in the period 2002-2005, before decreasing somewhat between 2006 and 2007 and increasing again thereafter. Differences across regional groups are observed. In central Africa and part of southern African countries, competition on the average was high between 2003 and 2005, but started decreasing thereafter to 2008. In northern countries, the trend is rather different. The bank competition is at its lowest in 2005, but gradually increases after 2007. Finally, in the southern African countries, bank competition is relatively stable even though the observed estimates are lower than that of northern African countries in 2006 and 2007. On the determinants of bank competition, the results suggest that cross-border banking enhances bank competition in African countries with stronger governance structures and institutional quality. These results are robust to an array of controls, including an alternative methodology, variable specifications and the regulatory environments that banks operate in.

The rest of the study is organized as follows. Section 2 describes the recent evolution of banking in Africa and discusses salient literature. In section 3, we present the estimable models and the data set; while Section 4 discusses the empirical results. Section 5 concludes and offers policy implications.

# 2. Evolution of Banking in Africa and literature review

Banking in Africa: Some stylized facts

African banking sector has undergone changes over the past two decades. During the 1980s, banking in Africa was dominated by government-owned banks. Restrictive regulation, financial liberalization, institutional and regulatory upgrades and globalization have changed the face of financial systems across the region. Most countries now have deeper and more stable financial systems, though challenges of concentration and limited competition and high cost persist (Beck and Cull, 2014). One common characteristic of African banking sector is that a large number of banks invest in government securities instead of lending to the private sector. For example, in 2011, credit to the private sector averaged 78% of GDP (compared to 132.5% for other emerging markets in East Asia and the Pacific). Prior to the 2008 financial crisis, the ratio of liquid to total liabilities of sub-Saharan African (SSA) banks averaged around 30%, while that of other developing countries was around 4% (Allen et al, 2014). There is also evidence to suggest that non-competitive market structure in some of the economies has hampered financial intermediation (Biekpe, 2011).

In promoting competition in African banking systems, cross-border banks played an important role during the period. For example, South Africa's Standard Bank currently operates in 15 sub-Saharan African countries. Togo-based Ecobank tripled its affiliate network in Africa between 2000 and 2013 from 11 to 32 countries, while Nigeria's United Bank for Africa (UBA) increased its footprint from one to 19 countries. Morocco's Attijariwafa Bank has a presence in 12 African countries, and Morocco's BMCE went from two to 18 countries over the same period. In addition, several commercial banks domiciled in Kenya have recently extended their portfolio across Kenyan borders, with more than 11 banks having foreign operations by the end of 2012 (see Figure 1). While cross-border bank penetration has increased from already high levels over the past decade, the composition of the foreign bank population has changed substantially. Banks from emerging markets, and critically from inside Africa, have gained importance over the past years.

The influx of foreign banks seems to have several advantages that are specific to Africa: international banks can help foster governance; they can bring in much-needed technology and experience that should translate into increased efficiency in financial intermediation; and they can help exploit scale economies in small host countries.

Figure 1: Ownership structure of banks in Africa
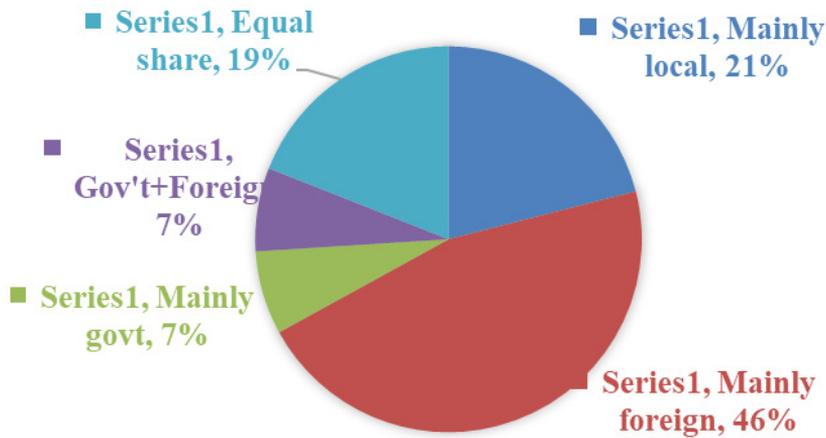
Source: Beck et al (2014)

On how quality of institution influences competition, Claessens and Van Horen (2014) suggest that banks which are used to working in countries with strong (weak) institutions, a relative high (low) institutional quality in the host country positively impact the cross-border bank entry. Economic expansion, legal, cultural and geographical proximity to the host country play a key role in attracting foreign banks to emerging markets and for that matter, increase bank competition in the host country in Africa (Hryckiewicz and Kowalewski, 2010). Nonetheless, especially in Africa, with many small, risky, and opaque enterprises, the dark side of foreign bank entry can become obvious, even more so in countries in which foreign banks have captured almost 100% of the banking market. The absence of a sound contractual and institutional, informational framework reduces the feasibility of small business lending further and thus the positive effect of foreign bank entry (Claessens and Van Horen, 2014).

Literature review

Previous literature on competition in banking focuses on market structure-performance linkages originating from the Structure-Conduct-Performance (SCP) paradigm and the Chicago Revisionist School (Demsetz, 1973; Hannan, 1991). The SCP paradigm on one hand suggests that a small number of banks are able to collude either implicitly or explicitly, or use independent market power to charge higher prices by paying lower rates on deposits while charging higher rates on loans so as to earn abnormal profits. The other efficient structure view contested that finding evidence of a positive relationship between concentration [1] and profitability (or price

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1 It is measured either by the concentration ratio or the Herfindahl index).

cost margin) does not necessarily infer collusive behaviour as it may simply reflect the relationship between size and efficiency. Larger banks gain from scale and other efficiency advantages; therefore, more concentrated markets are inherently more profitable. However, Casu and Girardone (2006) and Degryse et al (2009) argues that the extent to which banks are able to earn high profits through the exercise of individual or collective market power, or as a consequence of superior efficiency, continues as a theme in salient literature.

Later research draws on the theory of contestable markets and its new empirical industrial organization (NEIO) counterpart to emphasize the influence of potential as well as actual competition. The focus is on competitive conduct of firms in response to changes in demand and supply conditions. Bresnahan (1982) and Lau (1982) posit that the mark-up test involves estimating a structural model, incorporating demand and cost equations together with the profit-maximizing condition, where marginal revenue equals marginal cost. The parameters of the model can be estimated using data either at industry level or at firm level, and can be used to derive an indication of the nature of a given firm's conjectural variation. This, in turn, indicates whether price-setting conduct by each firm is consistent with perfect competition, monopolistic competition or monopoly. The Rosse–Panzar test is based on empirical observation of the impact on firm-level revenues of variations in the prices of the factors of production that are used as inputs in the production processes of a group of competing firms (Panzar and Rosse, 1987). Built into the test is an explicit assumption of profit-maximizing behaviour on the part of the firms. Panzar and Rosse (1987) show that the H-statistic, defined as sum of the elasticities of a firm's total revenue with respect to each of its factor input prices, differ under perfectly competitive, imperfectly competitive and monopolistic market conditions. The market is deemed a monopoly where the value of H-statistic is equal to or smaller than zero, a value between zero and one points to monopolistic types of competition, and a value of one indicates a perfect competitive market. These measures have been widely applied in banking research (Claessens and Laeven, 2004; Goddard and Wilson, 2009).

A number of studies suggest that industry structure and regulatory environment are important determinants of bank competition. Barth et al (2004) find that tightening entry requirements reduces bank efficiency, which leads to higher net interest margin and overhead costs. Restrictions on foreign bank participation lead to an increase in financial instability. Demirguc-Kunt et al (2004) and Goddard et al (2011) argue that restriction on foreign bank entry and the scope of bank activities leads to a lack of competition. Thus, countries with liberal policies toward foreign bank involvement in domestic banking and fewer restrictions on entry and scope of activities tend to be more competitive, more stable and more efficient (Hasan and Marton, 2003; Claessens and Laeven, 2004).

Current literature draws on the insights afforded by the SCP and NEIO literature to assess the relationship between the elasticity of performance and marginal cost. The Boone (2008) indicator gauges the strength of the relation between efficiency (measured in terms of average or marginal cost) and performance (measured in

terms of market share or profitability). In general, this indicator is based on the efficient structure view, which associates performance with differences in efficiency. Under this hypothesis, more efficient banks (i.e., banks with lower marginal costs), achieve superior performance at the expense of their less efficient counterparts. As a consequence, there is a monotonic increase in the degree of competition when firms interact more aggressively and when entry barriers decline. Financial reforms and the quality of institutions are also important factors in promoting bank competition. Delis (2012) finds that financial reforms increase bank competition in countries with stronger institutions. This is not the case in banking industries located in countries with weak institutions and a low level of institutional development. Structural and institutional impediments are of particular importance to banks in developing countries. Cross-border banking enhances competition as it allows free entry and exit of foreign banks, integrates national economies, governance, and produces complex relations of mutual interdependence (Norris, 2000). Research shows that Cross-border banking is positively linked with higher competition in host countries (Claessens et al, 2000, and Claessens and Laeven, 2004). However, evidence related to cross-border banking and institutional quality effects on bank competition in Africa is scarce. This is where the current study seeks to contribute.

3. Data and methodology

In this section, we apply two different indicators to gauge bank competition in Africa. We employ two-stage estimation approach. In stage one, bank competition in a given country is measured using Boone indicator and Lerner index. In the second stage, the determinants of competition is analysed focusing on cross-border banking and institutional quality. In order to ensure the robustness of our findings, and considering the fact that the literature on market structure is inconclusive regarding the best measure of competitive environments (Carbó et al, 2009), the study employs three additional indicators to measure the degree of market power: conventional Lerner index (Berger et al, 2009) a funding-adjusted Lerner index (Maudos and De Guevara, 2007) and an efficiency-adjusted Lerner index (Koetter et al, 2012).

Stage 1: Estimating the level of competition

Boone indicator

The Boone indicator is based on the efficient structure hypothesis that links performance with differences in efficiency. Thus the indicator suggests that increased competition allows banking market to transfer considerable portions of assets from low profit to a market of higher profits. This means that as the banking industry becomes more competitive, given some level of efficiency of each bank, the profits of the more efficient banks increases relative to the less efficient ones. The empirical estimation of Boone model for bank i is:

$$\ln s_{it} = \alpha + \beta \ln(mc_{it})$$

$$(1)$$

Where: s_{it} measures the loan market share of bank i at time t; the parameter β is the Boone indicator; and mc_{it} is the marginal cost. Following Tabak et al (2012) market share, s_{it} is regressed on the marginal cost to obtain information on how market share co-varies with costs. That is, efficiency gains lead to lower output prices, which in turn increases market shares. As marginal cost cannot be observed directly, mc_{it} is derived from a trans-log cost function:

$$\ln Cost_{it} = \beta_0 + \beta_1 \ln q_{it} + \frac{\beta_2}{2} \ln q_{it}^2 + \sum_{k=1}^{3} \gamma_{kt} \ln W_{k,it} + \sum_{k=1}^{3} \phi_k \ln q_{it} \ln W_{k,it} +$$

$$\sum_{k=1}^{3}\sum_{j=1}^{3} \delta_{ij} \ln W_{k,it} \ln W_{j,it} + \sum_{i=1}^{3} (\delta_i /2) \ln W_{t,ij}^2 + \sum_{k=1}^{2} \eta_k trend^k +$$

$$\sum_{i=1}^{3} \varsigma_i \ln W_{t,ij} trend + v \ln q_{tj} trend + \varepsilon_j$$

(2)

Where: $Cost_{it}$ is the bank's total costs including financial and operating cost; and q_{it} represents a proxy for bank output measured as total assets. W_1, W_2 and W_3 indicate the input price of deposit funds, labour and capital, and are calculated as the ratio of interest expenses to total deposits and money market funds, labour cost to total assets, and other operating expenses to total assets, respectively. The cost function is estimated separately for each bank and year in the sample. Once the cost function is estimated, its first derivative with respect to the output evaluated for each bank in the sample is the marginal cost:

$$mc_{it} = \frac{\cos t_{it}}{q_{it}} \left[\beta_1 + \beta_2 \ln q_{it} + \sum_{k=1}^{3} \phi_k \ln W_{k,it} + v Trend_{it} \right]$$

(3)

In the empirical setup, a bank-specific effect is included to allow for heterogeneity. Again, as the study analyses competition over time, the Boone indicator is estimated model as follows:

$$\ln s_{it} = \alpha + \sum_{t=1}^{T} \beta_t d_t \ln mc_{it} + \sum_{t=1}^{T-1} \gamma_t d_t + \mu_{it}$$

(4)

Where: s_{it} measures the loan market share of bank i at time t; mc_{it} is derived from a trans-log cost function: is the marginal cost as estimated in equations 2 and 3; d_t is a time dummy; and μ_{it} is the error term. As the Boone indicator is time dependent, β_t is estimated separately for each year for each country reflecting changes in competition over time. Market share may reduce marginal cost due to the market power. However the influences on a bank's market power through higher market share could cause it to adjust its marginal cost.[2] It is expected that banks with low marginal cost gain market share (that is, β <0). Competition thus tends to increase this effect as more efficient banks outperform less efficient ones. This implies that the more negative β is, the more intense competition becomes. However, in some cases, a positive value for β is possible, implying that the higher a bank's marginal cost, the higher its market share. This may arise if the market is characterized by collusion or because banks are competing on quality.

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2 This is because, if higher marginal cost leads to higher prices, output is reduced and market share declines (Schaeck & Cihák, 2014).

Merits and demerits of Boone indicator

The main advantage of Boone indicator is that it is able to link costs to profitability and ensures that both costs and profits are continuous and monotonic. Leon (2014) argues that in almost all cases, higher competition implies that the value of β is larger in absolute terms, and thus β serves as a continuous indicator of competition. The indicator avoids some key drawbacks of price-cost margin measures like Lerner index and that of identification shortfalls of Panzar-Rosse model (Boone, 2008). Xu et al (2014) reveal that the presence of binding interest rate regulation makes the Boone indicator measure of competition more robust than other NEIO measures. Despite these numerous merits of Boone indicator, it has some demerits. The indicator focuses on only one important relationship affected by competition. For example, efficiency gain may not be translated into lower prices in the short term as a bank may invest these gains in the form of product development in order to overcome or cope with competition in the future. According to Van Leuvensteijn et al (2010) these distortions are more paramount when the Boone indicator is assessed on yearly basis instead of the estimation covering the entire sample period like Panzar–Rosse. Again, the β is expected to be negative. However, the coefficient may be positive when firms compete in quality (Tabak et al, 2012). Notwithstanding these setbacks, the Boone indicator is the only measure of competition that captures the market dynamics and can be easily computed using limited number of observations.

Lerner index

Three different specifications of Lerner index are employed to measure the pricing power of banks in Africa. The index provides a direct measure of the degree of market power as it represents the mark-up of price over marginal cost, and it is a measure of competition according to Berger et al (2009) computed at the bank level as:

$$Lerner_{it} = (\Pr ice_{it} - MC_{it}) / \Pr ice_{it}$$

(5)

Where: $\Pr ice_{it}$ is the price of the total assets. mc_{it} is the marginal cost of producing an additional unit of output as derived from the trans-log cost function specified in equations 2 and 3. The index is therefore interpreted as follows: the Lerner index with higher value implies higher pricing power and less competitive market conditions.

There are two possible setbacks associated with the conventional Lerner index estimated above. First, the mc_{it} estimation following Equation 2 is likely to reflect some form of monopoly power emanating from deposit markets based on the bank's ability to fund at a relatively low price. In pricing their loans, bank managers cover their funding costs, factor in a risk premium to reflect the uncertainty surrounding the loan contracting problem and charge an extra premium to reflect their market power (Turk-Ariss, 2010). This means that a form of deposit market power is already reflected in the loan pricing. According to Maudos and De Guevara (2007), adding financing

costs and consequently the price of deposits in the cost function captures the effect of market power in banking and this may bias the results. They argue that excluding funding costs in Equation 2 will lead to what they term a 'raw' pricing power that is not biased by market power which had already been obtained in the deposit market while securing funds. Therefore, a version of Equation 2 is estimated to exclude financing costs in the trans-log cost function. After calculating an operating mc_{it} for each bank at each time period following Equation 3, but including only two factors, a funding-adjusted Lerner index is derived from the structural model specified in Equation 2.

The second issue with the conventional Lerner is that it implicitly assumes full bank efficiency and therefore does not account for the possibility of banks failing to fully exploit output pricing opportunities because of market power. Following Koetter et al (2012), an efficiency-adjusted Lerner index is constructed by using the estimated total operating cost (TOC) function in Equation 2, the corresponding marginal cost (MC) function in Equation 3, the estimated profit $(P\hat{B}T)$ function and the total assets (Q) in a single structural model as:

$$(A\hat{R}_{Q,it} - MC_{Q,it}) / A\hat{R}_{Q,it}$$

(6)

Where: $A\hat{R}_{Q,t}$ is the average revenue computed as $\mathcal{R}/Q$, where $\mathcal{R} = PBT + TOC$. In contrast to the conventional Lerner index in Equation 5, efficiency-adjusted Lerner allows estimation of both bank efficiency and degree of market power simultaneously.

Merits and demerits of Lerner index

The main advantages of Lerner index to the other measures of bank competition are that: it is simple to calculate, easy to interpret and it does not require stringent data. As the index provides a firm-year specific measure of competition, it offers the possibility of analysing the evolution of bank pricing behaviour over a period (Berger et al, 2009). Lerner index is flexible and does not require the definition of any market. It also allows competition to be measured separately for the different banking markets. Similar to Boone indicator, Lerner index can be computed with limited number of observation. Even though the index is simple and straightforward to interpret, it has some limitations. Lerner index is actually a measure of pricing power and not a proxy for competition. For example, an increase of average market power over a period of time can be consistent with an increase in the intensity of competition. Studies posit that price-cost margins increase with more intense competition (Bulow and Klemperer, 2002). Current research have shown that even if individual Lerner index decreases with competition, the average degree of market power may either increase or decrease due to the reallocation effect from inefficient to efficient firms (Boone et al, 2013).

Stage 2: Assessing the determinants of competition

The second stage of the analysis uses the competitive measures as the dependent variable in a model that seeks to explain how cross-border banking and institutional quality influence bank competition. Similar to previous literature, the estimable model includes variables to capture activity restrictions and entry barriers. The approach is based on the assumption that competitive conduct of banks, in each of the selected banking industries, depends on the institutional quality, (Delis, 2012), the cross-border banking expansion (Kodongo et al, (2015), bank-specific variables (Van Leuvensteijn et al, 2010) and activity, regulatory and macroeconomic variables (Claessens and Laeven, 2004). The general model used is as follows:

$$Competition_{itj} = \beta_1 Competition_{itj-1} + \beta_2 Cbb_{itj} + \beta_3 Ipe_{itj} + \sum_{j=3}^{k} \beta_j X_{itj} + \beta_4 (Cbb_{itj} * X_{itj}) + \beta_5 (Ipe_{tj} + X_{itj}) + \varepsilon_{it} \quad (7)$$

Where: $Competition_{itj}$ is the competition indicator measured by the Boone indicator of bank i in a country j at period t; $Competition_{itj-1}$ is the competition of the same bank i in country j at period t in the previous period; Cbb_{itj} is the cross-border banking of bank i of country j at period t; Ipe_{tj} is the institutional and political environment of country j at period t. $X_{i,j}$ is a set of $\{k\}$ variables controlling for bank-specific characteristics and respective countries' macroeconomic environments; $(Cbb_{itj} * X_{tj})$ is the interaction between cross-border banking of bank i of country j at period t and bank-specific and macroeconomic variables of bank i in country j at period t; $(Ipe * X_{itj})$ is the interaction between the institutional and political environment of a country j at period t and bank-specific and macroeconomic variables of bank i in country j at period t; $b's$ are the parameter vectors; and ε_{it} ▪is the error term. The disturbance term ε_{it} has two components comprising: μ_i, an unobserved time-invariant bank-specific effect and v_{it} a disturbance term. We address any concerns related to possible endogeneity of bank competition, cross-border banking, and institutional quality with an instrumental variable strategy by using the two-stage least square (2SLS) estimator. To explicitly account for dynamic effects, we specify our estimation equation (i.e., Equation 7) to account for dynamic effects. Since the autocorrelation induces dynamic correlation with the error term, we follow Anderson and Hsiao (1982) and Arellano and Bond (1991) in using a set of instruments based on lagged to identify the parameters. The following diagnostic tests are conducted and reported in tables 3, 4, 5, 6, 7, 8, 9, 10 and 11.[3]

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3 The following diagnostic tests are conducted and reported: Sargan N*R2 test are reported for overidentifying restrictions measures of instruments' exogeneity. The R2 measures the goodness of fit while the p-value of F-test measures the significance of identifying instruments. The Wu-Hausman F-test and Durbin-Wu-Hausman chi2 specification compare the difference between the IV and the OLS estimators.

Cross-border banking or foreign bank is measured as a dummy variable, taking the value of 1 where the shareholding proportion of the local banks by foreign banks is 50% or more and 0 otherwise. The measure considers cross-border banks to be foreign-owned if they are controlled by shareholder or group of shareholders from outside the licensing jurisdiction. Control over a bank can be exercised if an individual or entity holds more than 50% of shares in a bank, subsidiary or branch. It should be noted that in some cases where there is no majority shareholder, the bank is still classified as foreign-owned when a foreign minority shareholder has a controlling stake in a bank.

A number of indexes are used to assess institutional and political environments of selected African countries. The strength and quality of a country's institutions reflect the ability of policy authorities to identify various forms of anticompetitive conduct in banking and impose sanction where appropriate. The study employs four indexes obtained from the International Country Risk Guide (ICRG). Transparency is an inverse of corruption within the political system. The quality of the judicial system and the general observance of the law is denoted by law quality. Corruption, especially financial corruption, makes financial markets less efficient by generating networking effects that lead to anticompetitive behaviour. It is expected that in countries with high corruption (i.e., low transparency), competitive conditions tend to be very low, and this is more pronounced for large banks with greater political power. The corruption variable captures the extent to which public power is exercised for private gain. Bureaucratic quality represents the quality of administrative infrastructure. The quality and relevance of laws enacted is denoted as the legislative quality. Higher values for these indexes reflect higher institutional quality. Variables measuring transparency and legal quality range in value from zero to six. Bureaucratic quality and legislative strength variables range from zero to four. Banks view institutional quality as pre-determined in that they observe the level of institutional strength and quality in the previous periods and set their lending rates and overall strategy accordingly. This therefore means that a change in institutional quality today affects the bank competition in the next period. Thus, all the institutional variables in Equation 7 are lagged.

A number of additional control variables which prior studies have shown to affect the level of bank competition (Van Leuvensteijn et al, 2010; Delis, 2012) have been included. For bank-level controls, the ratio of equity to total assets (bank equity) is used as a measure of the level of capitalization. The logarithm of total assets is employed as a proxy for bank size. GDP growth and inflation are included in the regression to account for differences in macroeconomic environments, and the general economic development. The banking system is less likely to be competitive when it is subject to high inflation, in that prices of financial services such as interest rates will be less informative. Accordingly, inflation is defined as the rate of annual growth in the consumer price index (CPI). The banking freedom index provides the overall measures of the openness of the banking sector and the extent to which banks are free to operate their businesses. Capital index measures overall capital stringency. It

ranges from 0 to 9, with a higher value indicating greater stringency. Property right is included as a measure of risk of expropriation. It measures the degree to which the individual countries laws protect and enforces private property rights.

Activity restrictions, entry into banking requirements, and bank supervisory power are used as regulatory variables. Activity restrictions measure the degree to which national authorities allow banks to engage in activities that generate non-interest income. It indicates the limits imposed on commercial banks to participate in securities markets, insurance and real estate activities. The measure varies from 4 to 16 with higher scores indicating more restrictions. The entry requirement indicates the severity (range from 0 to 8) of entry regime with higher values indicating more restrictiveness.[4] The official supervisory power describes whether the supervisory authorities have the power to take specific actions to prevent and correct problems and it ranges from 0 to 16 with the higher score indicating more supervisory power.

Apart from the variables described above, the instrumental variable technique also allows for explicit specification of instruments. Two main instruments are used in this study; these are the ratio of loan to assets (loan) and the lagged institutional variables. As discussed, the institutional variables enter into Equation 7 lagged once. Thus, these variables are treated as exogenous (Delis, 2012) and in line with Bond (2002), imply that all lags are potentially valid instruments. The first instrument is a control variable previously identified to affect bank competition (Van Leuvensteijn et al, 2010). For example, the size of the loan portfolio may be indicative of banks chosen investment strategy, i.e., some banks choose to make more loans and grow rapidly which may provide them with the ability to capture the market power (less competition) in the loan market (see Table A3 in the Appendix for summary of variables definition and sources).

Data sources

Micro bank level and macro-country level data are used. Bank level data (financial statements) is taken from BankScope database maintained by Fitch/IBCA/Bureau Van Dijk. Series are yearly, and cover a sample of 319 banks across 29 countries in Africa during the eight-year period, 2002–2009. We focus the study on the African banking sector. Given the relationship between finance and the real economy, the benefits of conducting research in these sectors have a chance to make an impact beyond African countries. The benefits and the subsequent impact of research on emerging economies like Africa on economic growth cannot be merely measured in absolute dollar terms, but in the number of people that are elevated from a desperate subsistence level to a more adequate standard of living (Bekaert and Harvey, 2003). This period covers both the stable period (2000-2006) and the world financial crisis (2007-2009). The sample includes all commercial banks, cooperative banks, development banks,

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4 Moreover, the higher score also indicates the quality of new entrants and is therefore less likely to experience banking system crises and thus enhancing bank lending.

savings banks, real estate and mortgage banks for which annual data is available for some period of the years during the period 2002-2009. To ensure that banks that are important players in the deposit and/or loan markets are not omitted, medium- and long-term credit banks and specialized government institutions are included, as they remain important in African countries. Observations with outliers such as zero and/or negative capitalization are dropped. Also, observations for capitalization above the 98th percentile were dropped. In addition, loan growth rate observations above the 98th percentile of the distribution were equally dropped. This is to correct for mergers, acquisitions and start-ups during the study period. Macro-economic data is obtained from World Bank: World Development Indicators database (2014). Regulatory and supervisory variable are obtained from Barth et al (2013), data on banking freedom and property rights are sourced from Heritage Foundation (2014), and governance and institutional quality data are obtained from ICRG.

4. Empirical results

Measurement of bank competition in Africa

Equation 4 is estimated in order to derive a Boone indicator for each bank in our sample. Figure 1 shows the trend in bank competition over time by plotting the average Boone indicator estimates across (i) all sample; (ii) northern (iii) central; and (iv) southern Africa countries. This categorization of countries is made by the World Bank.[5] This allows us to examine whether there are regional differences in competition over time. On the whole, the estimates show that competition steadily increases in the period 2002-2005, but declines between 2006 and 2007 and then marginally increases thereafter. These findings are consistent with Fosu (2013) results that suggest that there is existence of monopolistic competition across Africa sub-regional banking sector, and further argue that the recent structural reforms within Africa may have had significant effect as far as banking sector competition is concerned. Differences across regional groups are observed. In central Africa and part of southern African countries, competition on the average was high between 2003 and 2005, but started decreasing thereafter to 2008. This finding corresponds with the computation of bank competition using Lerner index for Equation 5. Competition proxied by the Lerner index shows a relatively similar result compared to that of the Boone Indicator. Competition increases gradually between 2002 and 2005, falls in the period 2006-2007, and then increases thereafter. In the northern African countries, the trend is rather different. The bank competition is at its lowest in 2005, but gradually increases after 2007. Finally, in the southern African countries, bank competition is relatively stable even though the observed estimates are lower than that of northern African countries in 2006 and 2007.

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5 Countries included in analysis for northern region of Africa are Algeria, Egypt, Morocco, Sudan, and Tunisia; that of central African countries included are Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Ethiopia, Ghana, Kenya, Mali, Mauritania, Nigeria, Rwanda, Senegal, Sierra Leone and Uganda; while Angola, Botswana, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, and Zimbabwe are included for southern African countries. There are other forms of grouping such as economic unions such as Economic Community of West African States (ECOWAS), the East African Community (EAC) and the Southern African Development Community (SADC). Data availability made such grouping impossible.

Figure A1: Trend in bank competition for regions of Africa over time
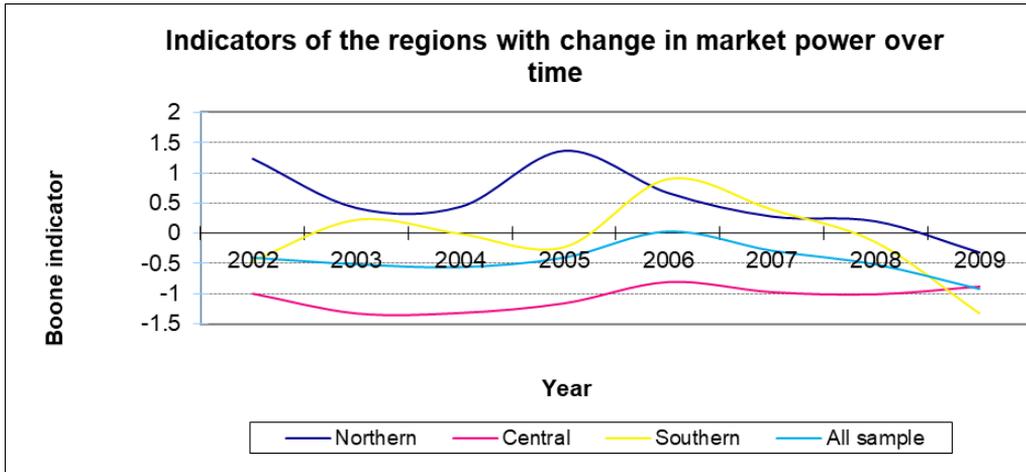
Source: Bankscope and author's own calculation. The data comprises 319 banks across 29 countries over the period 2002-2009.

Figure A1 presents the trend in bank competition over time by plotting the average Boone indicator estimates across: (i) all sample; (ii) northern; (iii) central; and (iv) southern African countries. Countries included in the analysis for northern region of Africa are Algeria, Egypt, Morocco, Sudan, and Tunisia; that of central African countries included are Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Ethiopia, Ghana, Kenya, Mali, Mauritania, Nigeria, Rwanda, Senegal, Sierra Leone and Uganda; while Angola, Botswana, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, and Zimbabwe constitute southern African countries.

In order to explain these different levels of competition, we turn to the yearly estimations of the Boone indicator as presented in Table 1. Generally, the estimated Boone indicators for each country are negative and do not differ significantly from each other. However, positive β_t values are occasionally obtained. One possible explanation according to Van Leuvensteijn et al (2010) is that competition on quality may lead to both higher marginal cost and higher market share.

Table 1: Estimates of bank competition using Boone method

Countries	2002	2003	2004	2005	2006	2007	2008
Algeria	-0.4282	-0.2505	0.0851	0.1324	-0.4152	-0.5289	-1.305
Egypt	0.9112	0.2949	0.2321	-0.1811	0.6981	0.3074	-0.6028
Morocco	-0.0542	-0.5619	-0.8328	-0.0423	-1.0608	-0.1866	0.5419
Sudan	5.3657	2.8622	2.8565	5.8035	3.8058	1.3357	1.5787
Tunisia	0.3995	-0.2376	-0.1358	1.1404	0.3306	0.4765	0.7898
Benin	-3.9892	-3.3947	-1.5437	-4.8123	-2.3722	-2.9497	-2.5617
Burkina Faso	4.0529	0.7714	0.1586	-0.2702	-0.3007	-0.6419	-1.0513
Cameroon	0.1995	0.9451	-1.6111	-0.301	0.2221	0.4899	0.3612
Cote d'Ivoire	-0.3261	0.8975	1.0353	0.251	-0.935	-0.8448	-0.7326
Ethiopia	.....	-2.5026	-2.5184	-2.1072	-2.1841	-3.4275	-2.8187
Ghana	-4.4918	-4.7215	-3.1684	-3.244	-2.4152	-1.6122	-0.9443
Kenya	0.6385	0.1804	-0.6539	-0.743	-1.0393	-0.8843	-1.1045
Mali	-1.7549	-3.3587	-3.0669	-3.8446	-2.4829	-2.5738	-1.4188
Mauritania	-0.9417	-1.7375	-1.3357	-1.8743	-0.5262	-1.2596	-2.0886
Nigeria	-1.5259	-1.5413	-1.559	-1.3344	0.1058	-0.0522	0.5282
Rwanda	1.3071	-0.3875	-0.8452	-0.542	-0.5571	-1.5486	-1.6728
Senegal	-2.3707	0.8152	0.1352	2.2306	1.8327	2.3498	0.4799
Sierra Leone	-0.795	-1.3456	-0.5357	0.3291	0.2608	0.194	-1.5246
Uganda	-2.9929	-3.1281	-2.897	0.0696	-0.9371	-0.8697	0.4083
Angola	-0.2966	0.4676	-1.1467	-0.4687	-0.4522	-1.2438	-2.1936
Botswana	1.895	3.7451	3.5279	3.8907	2.7496	2.7959	1.4226
Malawi	-3.3783	-2.4837	-2.6662	-2.5198	-1.4568	-2.2863	-4.1239
Mauritius	1.5671	0.2612	-0.3185	-0.9284	-0.5467	-1.4696	-1.3229
Mozambique	0.5126	-1.5158	-1.5732	-1.1611	-1.6439	-0.9373	-2.1481
Namibia	.....	.....	7.8478	4.1969	3.7951	3.0401	2.4705
South Africa	-2.2906	-0.5794	-2.0574	-1.7863	3.8781	3.4365	4.249
Swaziland	0.074	0.7275	0.8368	1.2403	1.6616	2.0219	1.7056
Tanzania	-0.0364	-1.853	-1.0866	-1.6703	-1.8527	-1.7963	-1.4442
Zimbabwe	-2.1993	3.1759	-3.5222	-3.1614	2.7753	0.2995	.....

Source: Author's own estimation.
The data comprises 319 banks across 29 countries over the period 2002-2009.
Information not yet available.

Table 1 represents the mean values (by country and year) of bank-level estimates of competition obtained using Boone (2008) method. This is estimated using the following equation:
$$\ln s_{it} = \alpha + \sum_{t=1}^{T} \beta_t d_t \ln mc_{it} + \sum_{t=1}^{T-1} \gamma_t d_t + \mu_{it}$$

Contrary to the criticisms on the functioning of the banking industry of Benin (e.g., World Bank, 2005 report), the estimates of the Boone indicator suggest that bank

competition is more intense here than any other country in the sample. This reflects significant changes in Benin's legal and regulatory frameworks (regarding licensing, bank activities, organizational and capital requirements) during the sample period. Bank competition improves in Malawi, Ghana, Ethiopia and Mali, respectively. The improvement of the competitive environment in these countries is likely to be driven by the deregulation and liberalization of the entire financial sector. For example, in Ghana, two very important reforms to the banking industry within the past two decades include the Bank of Ghana Act, 2002, which was enacted to give the central bank more independence and the Banking Act, 2004, which was passed to replace the obsolete law - Banking Law, 1989 (PNDC Law 225).

Bank competition is low in Tanzania, Mozambique, Uganda, Zimbabwe, Nigeria, Rwanda, and Kenya. Simpasa (2011) argues that Tanzanian banking sector is dominated by large foreign banks preventing competition even though state-dominated banking sector has been dismantled. Mwega (2011), on the other hand, suggests that small banks in Kenya are mostly least competitive. The level of bank competition in Egypt, Cameroon, South Africa, Tunisia and Senegal is largely driven by excessive regulation of the banking industry during late 1990s[6] as well as the dominance of the few state-owned banks. For example, even though the Government of Egypt successfully privatized the Bank of Alexandria in 2006, the banking system is still dominated by two large state-owned commercial banks, National Bank of Egypt and Bank Misr. These banks, together with three largest private commercial banks, represent approximately half of Egyptian banking system's assets and deposit (Allen at al., 2014). On South Africa, Simbanegavi et al (2015) suggest that even though the banking sector competition is low, the banks in South Africa are not operating as a cartel.

Within the sample period, three varieties of the Lerner index are constructed: a conventional Lerner, a funding-adjusted Lerner and efficiency-adjusted Lerner index. The figures from the conventional version vary by more than 25% across the regions, with banks in northern Africa, on average, pricing their product at around 37% above marginal cost. Similarly, figures from the funding-adjusted and efficiency-adjusted version of the Lerner index show 63% over the marginal cost with the northern banks being the banks that exhibit highest market power (inverse of competition). These figures demonstrate that on average, the funding-adjusted and efficiency-adjusted Lerner index are larger than that of the conventional Lerner index, suggesting that the latter underestimates the degree of competition. These results justify the alternative use of various specifications in the analysis.

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6 For example, in South Africa, the Bank Act (94 of 1990) forced a number of smaller banks to seek financial assistance from their foreign shareholders by 2002.

Table 2: Average bank competition in Africa

	Countries	Boone indicator	Conventional	Funding-adjusted	Efficiency-adjusted
			Various specification of Lerner index		
North	Algeria	-0.3626	0.6566	0.7734	0.7216
	Egypt	0.1921	0.2619	0.7697	0.7524
	Morocco	-0.3539	0.5204	1.0521	1.0578
	Sudan	3.3726	0.4368	0.4835	0.4498
	Tunisia	0.3948	-0.0041	0.6601	0.6132
	Average	0.6486	0.3743	0.7478	0.7189
Central	Benin	-3.0891	0.0448	0.5246	0.4429
	Burkina Faso	0.2489	0.1500	0.6134	0.5427
	Cameroon	0.0636	0.2325	0.6820	0.5929
	Cote d'Ivoire	-0.2134	0.2751	0.3106	0.2667
	Ethiopia	-2.5571	0.4822	0.7741	0.7445
	Ghana	-2.5973	0.3549	0.5887	0.5611
	Kenya	-0.5338	0.3467	0.6380	0.6118
	Mali	-2.4479	0.4137	0.5772	0.5113
	Mauritania	-1.3880	-0.0598	-0.0723	-0.2173
	Nigeria	-0.6685	0.2517	0.6698	0.6491
	Rwanda	-0.7526	-0.1803	0.3142	0.2734
	Senegal	0.6659	0.3463	0.4614	0.4171
	Sierra Leone	-0.6173	0.6134	0.4763	0.4395
	Uganda	-1.4781	0.3625	0.5374	0.5058
	Average	-1.0975	0.2596	0.5068	0.4530
South	Angola	-0.7976	0.4242	0.6342	0.5531
	Botswana	2.0714	0.5032	0.7280	0.7117
	Malawi	-2.8811	0.0545	0.6696	0.6562
	Mauritius	-0.3576	0.0630	0.5024	0.4678
	Mozambique	-1.1908	0.3251	0.5236	0.5002
	Namibia	3.8584	-0.5828	0.6928	0.6674
	South Africa	0.6928	0.4639	0.6668	0.6392
	Swaziland	1.1811	0.7867	0.6046	0.5965
	Tanzania	-1.3914	0.2880	0.5260	0.4910
	Zimbabwe	-0.4387	0.4314	0.7540	0.6480
	Average	0.0747	0.2757	0.6302	0.5931

Source: Author's own estimation.
The data comprises 319 banks across 29 countries over the period 2002-2009.

This table represents the level of competition among selected banks in Africa. The degree of competition is proxied by the Boone indicator and the Lerner index. The Boone indicator assumes that competition increases the performance of efficient banks and erodes the performance of inefficient ones. The indicators with more negative values mean higher competition. The Lerner index is the price mark-up over marginal cost, with the higher scores indicating a lower level of competition. Three variations of the Lerner index are reported: a conventional Lerner, a funding-adjusted and an efficiency-adjusted Lerner.

Table 3 presents the pair-wise correlation coefficient as a preliminary analysis of the relationship between the measures of competition and the determinants. The correlation coefficient between Boone indicator and Lerner indexes (except the conventional version which is negative) is positive and statistically significant. This result shows that Lerner index (the funding-adjusted and efficiency-adjusted Lerner index) and Boone indicator move in one or the same direction and that the conventional Lerner index measures the pricing power of the firm (Boone, 2008). All the measures of institutional quality have a positive relation with Boone indicator which suggests that institutions in Africa do not necessarily have the strength to promote bank competition. Next is the pair-wise correlation coefficient between cross-border banking and the various specification of competition (Boone indicator and Lerner indexes). CBB has a negative on many of the measures of competition. This result suggests that in African countries where banks are allowed to operate across borders, competition tends to be enhanced. Banks with large market share are able to mobilize finest resources, benefits from the economies of scale, produce at lower cost and thereby increase market power. On the correlation between macroeconomic and competition, we notice that it is only GDP growth that has a negative and significant coefficient with Boone indicator. Thus, the improvement of the economic activities brings about a positive impact on the banking sector competition.

Table 3: Pair–wise correlation coefficient between selected variables

	Boone indicator	Conventional	Funding-adjusted	Efficiency-adjusted	Burea. qty	Corrupt	Law qty	Leg. Qty	CBB	Bank size	Equity	GDP growth	Inflation
Boone indicator	1												
Conventional	-0.0327	1											
Funding-adjusted	0.0894*	0.4190*	1										
Efficiency-adjusted	0.0924*	0.3648*	0.9133*	1									
Burea. qty	0.0468*	-0.0817*	0.3915*	0.3770*	1								
Corrupt	0.0202	0.0514*	0.0740*	0.0888*	-0.0302	1							
Law qty	0.0974*	-0.2020*	0.2469*	0.2261*	0.0707*	0.3246*	1						
Leg. Qty	0.2083*	0.0107	0.0133	-0.0093	0.0159	0.4172*	0.4675*	1					
CBB	-0.0672*	0.0002	-.1247*	-0.1154*	-0.1037*	0.1354*	0.0728*	0.147*	1				
Bank size	0.2558*	0.1193*	0.4148*	0.3794*	0.1803*	0.0328	0.1411*	0.094*	-0.1056*	1			
Equity	0.0107	0.0933*	-0.0758*	-0.0939*	-0.0688*	-0.0184	-0.0637*	0.129*	-0.0719*	0.128*	1		
GDP growth	-0.0786*	0.0314	-0.0191	-0.0017	-0.1606*	0.0801*	0.1392*	0.079*	-0.0011	-0.078*	0.3033*	1	
Inflation	0.0216	0.0172	0.0198	-0.0151	-0.006	-0.1423*	-0.0157	0.0078	0.0068	0.0595*	0.0275	-0.073*	1

Source: Bankscope and author's own calculation.

The data comprises of 319 banks across 29 countries over the period 2002-2009.

Source: Bankscope and author's own calculation.

The data comprises 319 banks across 29 countries over the period 2002-2009.

Determinants of competition

Table 4 presents the regression results using the Boone indicator (measure of competition) as the dependent variable. The columns in Table 4 relate to different empirical approaches to institutional quality index used (Column 1 for transparency, column 2 for bureaucracy, column 3 for law quality and column 4 for legislative quality). With the exception of GDP growth, the results show that in general, all the variables considered in the study significantly influence bank competition. Starting with column (1), the results show that the size of the bank affects all the Boone indicators positively, implying that larger banks have more market power (inverse of competition). The result is consistent with the argument that larger banks, to a large extent, are efficient, having greater ability to employ better technology, to gather resources and charge higher rent. This gives them the ability to accrue more power. These findings also conform to the view that in Africa, and developing countries as a whole, bank competition decreases especially when large banks use internally generated funds to diversify into non-interest generating activities (Amidu and Wolfe, 2013). On bank equity ratio, the results suggest that competition flourishes in an economy where stringent capital levels are required and enforced. Likewise, transparency has a negative and statistically significant relationship with the Boone indicators. The negative coefficient for transparency (an inverse measure of corruption), re-enforces the argument that competition is very intense in African countries with low corruption. Stability in the monetary conditions appears to enhance competition. In column (2), bureaucratic quality enters the regression with a positive and significant coefficient. This result suggests that bureaucracy in African countries does not promote competitive environments for banks to operate. Legal quality (column 3) increases competition, while the reverse is true of legislative strength (column 4). The overall results suggest that bank competition is more intense in banking industries located in countries with stronger governance structures and institutional quality in respect to transparency and legal strength.

Table 4: Determinants of bank competition with institutional quality

Panel A	(1)	(2)	(3)	(4)
Boone indicator-1	0.7116**	0.6954***	0.6992***	0.6763***
	(0.1683)	(0.0166)	(0.0168)	(0.0173)
Bank size	0.1136***	0.1055***	0.1132***	0.1017***
	(0.0167)	(0.0167)	(0.0166)	(0.0167)
Capitalization	-0.2045*	-0.1428	-0.1707	-0.2225
	(0.1685)	(0.1665)	(0.1693)	(0.1663)
Transparency	-0.1442***			
	(0.0475)			
Bureaucratic quality		0.1557***		
		(0.0464)		
Law quality			-0.0118	
			(0.0261)	
Legislative quality				0.1786***
				(0.0445)
GDP growth	-0.8462	-0.9225	-1.1239	-1.5690*
	(0.9211)	(0.9099)	(0.9322)	(0.9051)
Inflation	-0.0077***	-0.0063***	-0.0065***	-0.0068***
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Panel (B) Diagnostics tests				
Sargan N*R2 test	0.004	0.109	0.074	0.206
Observations	1383	1383	1383	1383
R2 (uncentred)	64.92	65.53	65.52	65.88
F-test (P-value)	206.19***	210.09***	207.97***	212.71***
Wu-Hausman test	42.898***	31.039***	9.416***	0.3503
Durbin-Wu-Hausman	41.990***	30.638***	9.441***	0.3535
Anderson Canon test	1009.8***	1365***	1339.5***	1152.44***
Cragg-Donald Wald	1854.04	5.0005	2.004	3424.034

The dependent variable is the degree of competition which is proxied by the Boone indicator with more negative value showing higher competition. Bank size is proxied by the natural logarithm of total assets valued in US dollars. The ratio of banks' equity capital to total assets is used as a proxy to measure the degree of capitalization. Transparency represents an inverse of corruption within the political system, and the quality of the judicial system and the general observance of the law is denoted by law quality. Bureaucratic quality represents the quality of the selected countries' bureaucracy. The quality of legislative organ of the governance represents the legislative strength. The GDP growth accounts for the differences in economic development across countries. Inflation is the rate of inflation based on the CPI. The parameters are estimated with small sample adjusted standard errors in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Panel B reports diagnostic test: Sargan $N*R^2$ test are reported for overidentifying restrictions measures of instruments' exogeneity. The R^2 measures the goodness of

fit while the p-value of F-test measures the significance of identifying instruments. The Wu-Hausman F-test and Durbin-Wu-Hausman chi-squared specification compare the difference between the IV and the OLS estimators. Bank and country fixed effects are excluded from the estimation.

Next is the analysis of the determinants of bank competition where Boone indicator and Lerner indexes are the dependent variables. The findings are presented in Table 5. Column 1 represents the results for the Boone indicator, and columns 2, 3 and 4 for conventional, funding-adjusted and efficiency-adjusted Lerner index, respectively. The relationship between cross-border banking and the Boone indicator is negative and statistically significant with the lagged. This finding suggests that where bank expand through cross-border, bank competition tend to improve in the host country. However, this relationship does not hold when conventional Lerner index is used as a measure of competition. Here, competition tends to flourish in a country where funding and efficiency-adjusted cross-border bank operate. This means that cross-border banks that efficiently finance its assets with non-deposit funds increase competition. Our results therefore suggest that not all cross-border banks promote competition in the host country. Competition only increases with specific cross-border banks. Similarly, the results suggest that cross-border banks with a year of experience promote competition. The results of other variables remained unchanged.

Table 5: Determinants of bank competition with cross-border banking

Panel A	Boone Indicator (1)	Conventional Lerner Index (2)	Funding-Adjusted Lerner Index (3)	Efficient-Adjusted Lerner Index (4)
Boone indicator-1	0.7135***			
	(0.0155)			
Lerner index-1		0.9155***	0.9686***	0.9055***
		(0.0106)	(0.0556)	(0.0650)
Cross boarder banking	2.3571**	-0.0085	-0.2303**	-0.2387*
	(0.9979)	(0.1113)	(0.1019)	(0.1406)
Cross boarder banking1	-2.354896**	0.0135	0.2145***	0.2212
	(0.9994)	(0.1114)	(0.1012)	(0.1393)
Capitalization	-0.2722*	0.0054	-0.0266	-0.0328
	(0.1542)	(0.0181)	(0.0227)	(0.0302)
Bank size	0.1029***	0.0022	-0.0325**	-0.0310
	(0.0158)	(0.0017)	(0.0164)	(0.0230)
GDP growth	0.2878	0.2246**	0.1989	0.2560
	(0.8819)	(0.1028)	(0.1224)	(0.1592)
Inflation	-0.0059**	0.0003	0.0001	-0.0007*
	(0.0023)	(0.0004)	(0.0004)	(0.0003)
Panel (B) Diagnostics tests				
Sargan N*R2 test	0.168	16.924***	4.40**	0.833
Observation	1547	1483	1154	1148
R2 (uncentred)	0.656	0.9265	0.98	0.9583
F-test (P-value)	212.73***	638.91***	323.19***	199.78**
Wu-Hausman test	15.210***	0.1325	9.3500***	4.001*
Durbin-Wu-Hausman	15.198***	0.1338	9.3795***	4.0334**
Anderson Canon test	770.925***	739.401***	16.887***	15.569***
Cragg-Donald Wald	761.414	730.354	8.472	7.802

The dependent variable in column 1 is the Boone indicator; the dependent variable in columns 2, 3 and 4 is the conventional version of Lerner index, the funding-adjusted version of Lerner index and efficiency-adjusted Lerner index, respectively. Bank size is proxied by the natural logarithm of total assets valued in US dollars. The ratio of banks' equity capital to total assets is used as a proxy to measure the degree of capitalization. Transparency represents an inverse of corruption within the political system, and the quality of the judicial system and the general observance of the law is denoted by law quality. Bureaucratic quality represents the quality of the

selected countries bureaucracy. The quality of legislative organ of the government represents the legislative strength. The GDP growth accounts for the differences in economic development across countries. Inflation is the rate of inflation based on the CPI. The parameters are estimated with the small sample adjusted standard errors in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Panel B reports diagnostic test: Sargan N*R^2 test are reported for overidentifying restrictions measures of instruments' exogeneity. The R^2 measures the goodness of fit while the p-value of F-test measures the significance of identifying instruments. The Wu-Hausman F-test and Durbin-Wu-Hausman chi-squared specification compare the difference between the IV and the OLS estimators. Bank and country fixed effects are excluded from the estimation.

The institutional quality regressions with Boone indicator and Lerner index are reported in Table 6. The results are very similar to those presented in Table 4.[7] Specifically, in column 1 of Table 6, the bank equity ratio, transparency and law quality continue to have negative and significant coefficients. Similarly, in columns 2, 3, and 4, the legislative quality continues to obtain negative signs on Boone indicator. Thus, banks competition increases with banks that operate in countries with a high level of transparency and strong and growing economy. To conclude this section, it is interesting to analyse the effect of the stance of general price level on competition. Though the coefficient is statistically insignificant in column 2, the negative sign for columns 1, 3 and 4 of Tables 4, 5 and 6 indicate that increases of the general price level of goods and services will reduce banks market power in Africa.

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7 The objective is to assess whether a Boone indicator and different version of estimating the Lerner index will be affected by various institutional quality differently.

Table 6: Determinants of bank competition using Boone indicator and Lerner index

Panel A	Boone Indicator (1)	Conventional Lerner Index (2)	Funding-Adjusted Lerner Index (3)	Efficient-Adjusted Lerner Index (4)
Boone indicator-1	0.6773***			
	(0.0173)			
Lerner index-1		0.8592***	0.7361***	0.6353***
		(0.0225)	(0.0347)	(0.0247)
Capitalization	-0.4191**	0.7504***	0.7413***	0.5256***
	(0.1726)	(0.2456)	(0.2002)	0.1922)
Bank size	0.0909***	0.0117***	0.0195***	0.0217***
	(0.0168)	(0.0038)	(0.0039)	(0.0034)
Transparency	-0.2233***	0.0271***	0.0162*	0.0182**
	(0.0528)	(0.0099)	(0.0083)	(0.0083)
Bureaucratic quality	0.1441***	-0.0057	0.0256***	0.0396***
	(0.0467)	(0.0076)	(0.0076)	(0.0075)
Legislative quality	0.3347***	-0.0547***	-0.0629***	-0.0557***
	(0.0548)	(0.0181)	(0.0159)	(0.0154)
Law quality	-0.0729**	0.0209**	0.0376***	0.0355***
	(0.0315)	(0.0095)	(0.0089)	(0.0086)
GDP growth	-0.4317	-1.6855***	-1.684***	-1.1144**
	(0.9329)	(0.6247)	(0.4940)	(0.4677)
Inflation	-0.0087***	-0.0010	-0.0014**	-0.0013***
	(0.0024)	(0.0008)	(0.0006)	(0.0003)
Panel (B) Diagnostics tests				
Sargan N*R2 test	0.034	2.704	3.733*	1.844
Observation	1381	1331	1308	1302
R2 (uncentred)	0.659	0.855	0.9634	0.959
F-test (P-value)	169.73***	207.84***	119.58***	121.41***
Wu-Hausman test	16.8011***	5.6823***	11.1715***	4.7422***
Durbin-Wu-Hausman	64.9379***	22.6660***	43.825***	18.969***
Anderson Canon test	1005.778***	16.933***	18.34***	20.608***

The dependent variable in column 1 is the Boone indicator; the dependent variable in columns 2, 3 and 4 is the conventional version of Lerner index, the funding-adjusted version of Lerner index and efficiency-adjusted Lerner index respectively. Bank size is proxied by the natural logarithm of total assets valued in US dollars. The ratio of banks' equity to total assets is used as a measure of capitalization. Transparency represents an inverse of corruption within the political system, and the quality of the judicial system and the general observance of the law is denoted by law quality. Bureaucratic quality represents the quality of the selected countries bureaucracy. The quality of

legislative organ of the government represents the legislative strength. The parameters are estimated with the small sample adjusted standard errors in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Panel B reports diagnostic test: Sargan N*R^2 test are reported for overidentifying restrictions measures of instruments' exogeneity. The R^2 measures the goodness of fit while the p-value of F-test measures the significance of identifying instruments. The Wu-Hausman F-test and Durbin-Wu-Hausman chi-squared specification compare the difference between the IV and the OLS estimators.

The sensitivity of competition to institutional quality and cross-border banking

This subsection analyses the sensitivity of competition to the interaction of cross-border banking and institutional quality. Previous studies suggest that larger banks are efficient and access cheaper sources of finance, which enable them to absorb the effects of institutional and competition policies. The results of the sensitivity analysis are presented in Table 7. The results suggest that cross-border banks operating in Africa are more sensitive to institutional quality in promoting bank competition. This means that the institutional strength of a country is more effective in promoting competition, especially when cross-border banks are prevalent. This implies that in order to ensure competition, enforcement and supervision frameworks must accompany improvements in regulation.

Table 7: The sensitivity of competition to cross-border banking and institutional quality

Panel A	(1)	(2)	(3)	(4)
Boone indicator-1	0.6948***	0.6947***	0.6972***	0.6760***
	(0.0166)	(0.0168)	(0.0169)	(0.0173)
Cross-border banking	0.0837	-0.8679***	-0.2914	-0.5230**
	(0.1641)	(0.1566)	(0.1803)	(0.2487)
Bank size	0.1078***	0.1272***	0.1171***	0.1042***
	(0.0168)	(0.0170)	(0.0168)	(0.0170)
Capitalization	-0.1283	-0.1606	-0.1497	-0.2154
	(0.1673)	(0.1676)	(0.1698)	(0.1669)
Bureaucratic quality	0.1789**			
	(0.0768)			
CBB*Bureaucratic quality	-0.0267			
	(0.0944)			
Transparency		-0.3395***		
		(0.0630)		
CBB*Transparency		0.4880***		
		(0.0789)		
Law quality			-0.0524	
			(0.0344)	
CBB*Law quality			0.0941*	
			(0.0523)	
Legislative quality				0.1113*
				(0.0607)
CBB*Legislative quality				0.1531**
				(0.0740)
GDP growth	-0.8903	-0.1655	-1.1347	-1.6770*
	(0.9253)	(1.0048)	(0.9322)	(0.9043)
Inflation	-0.0064***	-0.0061**	-0.0065**	-0.0067***
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Panel (B) Diagnostics tests				
Sargan N*R2 test	0.081	0.146	0.031	0.108
Observation	1379	1379	1379	1379
R2 (uncentred)	0.6552	0.6532	0.6537	0.6601
F-test (P-value)	177.33***	178.39***	175.93***	180***
Wu-Hausman test	31.542***	18.781***	9.0165***	0.715
Durbin-Wu-Hausman	31.168***	36.9842***	9.055***	1.4453

The dependent variable is the degree of competition which is proxied by the Boone indicator with more negative values showing higher competition. Cross-border banking is measured as a dummy variable, taking the value of 1 where the shareholding proportion of the local banks by foreign banks is 50% or more and 0

otherwise. Bank size is proxied by the natural logarithm of total assets valued in US dollars. The ratio of banks' equity capital to total assets is used as a proxy to measure the degree of capitalization. Transparency represents an inverse of corruption within the political system, and the quality of the judicial system and the general observance of the law is denoted by law quality. Bureaucratic quality represents the quality of the selected countries bureaucracy. The quality of legislative organ of the government represents the legislative strength. The GDP growth accounts for the differences in economic development across countries. Inflation is the rate of inflation based on the CPI. The parameters are estimated with the small sample adjusted standard errors in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Panel B reports diagnostic test: Sargan N*R^2 test are reported for overidentifying restrictions measures of instruments' exogeneity. The R^2 measures the goodness of fit while the p-value of F-test measures the significance of identifying instruments.

Determinants of bank competition: Regulatory and supervisory environments

After analysing the relationship between the institutional quality and the cross-border banking, on the one hand, and the bank competition on the other, the next section provides precise inference on the relationship of interest. Here, the regulatory and supervisory environments in developing and emerging countries are considered thoroughly. There are two reasons for these considerations: first, banks operating in developing economies could derive some benefits resulting from institutional reforms such as adherence to regulatory capital requirements like capital stringency, and from governmental controls and influence like banking and financial freedom. Thus, we should not over rely and lay more emphasis on the effect of institutional quality and the cross-border banking strategies if these reforms are not explicitly included in the model. Second, the effect of all institutional reforms cannot possibly be isolated as there are expectations that they are deeply embedded in the fundamentals of banks operations. As a result, the only aspects of the regulatory and supervisory framework that may directly bias the findings are controlled in the estimation. Pasiouras (2008) also added that the creation of market disciplining mechanisms, the development of powerful supervisory agencies and strict adherence to capital adequacy standards improve banks' technical efficiency. Below are the three specific regulatory initiatives as well as the resulting effect that holding these variables constant may have on the relationship between competition, cross-border banking and institutional quality.

First of all, the Heritage Foundation index of banking and financial freedom "Banking freedom" is incorporated into the model to assess the extent to which the banking freedom index influence the relationship of interest. The index is a measure of banking security as well as a measure of independence from government control. The

result of the regression with the inclusion of "Banking freedom" as a control variable is presented in Table 8. There is some level of evidence to suggest that higher banking freedom increases banks' market power, especially when large banks operate in a country with high bureaucratic quality and strong legislative body. The result of the relationship of interest remains unchanged.

Table 8: Determinants of bank competition: Controlling for banking freedom

Panel A	(1)	(2)	(3)	(4)	(5)
Boone indicator-1	0.6840***	0.6530***	0.6614***	0.6367***	0.6364***
	(0.0180)	(0.0178)	(0.0183)	(0.0186)	(0.0187)
Cross-border banking	0.0414	0.0539	0.0169	-0.0208	0.0027
	(0.0558)	(0.0552)	(0.0549)	(0.0553)	(0.0562)
Bank size	0.1518***	0.1397***	0.1456***	0.1338***	0.1322***
	(0.0180)	(0.0176)	(0.0176)	(0.0177)	(0.0177)
Equity ratio	-0.2141	0.0167	-0.0259	-0.0989	-0.2783
	(0.1666)	(0.1654)	(0.1693)	(0.1651)	(0.1734)
Transparency	-0.2149***				-0.3164***
	(0.0519)				(0.0578)
Bureaucratic quality		0.2141***			0.1770***
		(0.0461)			(0.0465)
Law quality			0.0035		-0.0512
			(0.0260)		(0.0312)
Legislative quality				0.1905***	0.3635***
				(0.0440)	(0.0552)
Banking freedom	0.0125***	0.0101***	0.0098***	0.0102***	0.0149***
	(0.0022)	(0.0021)	(0.0021)	(0.0021)	(0.0022)
GDP growth	0.5084	-1.2968	-1.6265**	-2.0257**	-0.7446
	(1.0129)	(0.9032)	(0.9385)	(0.9028)	(0.9367)
Inflation	-0.0066***	-0.0052**	-0.0055**	-0.0057**	-0.0079***
	(0.0024)	(0.0023)	(0.0023)	(0.0023)	(0.0023)
Panel (B) Diagnostics tests					
Sargan N*R2 test	0.002	0.055	0.035	0.129	0.024
Observation	1352	1352	1352	1352	1352
R2 (uncentred)	0.6504	0.6241	0.6575	0.664	0.664
F-test (P-value)	165.59***	171.39***	167.92***	172.58***	143.41***
Wu-Hausman test	28.939***	40.4825***	11.9825***	1.2373	18.6539***
Durbin-Wu-Hausman	56.139***	39.733***	12.0093***	2.4996	88.5994***
Anderson Canon test	931.59***	1334.25***	1308.59***	1123.47***	931.81***
Cragg-Donald Wald	987.56	5.0004	2.0004	2190.977	493.052

The dependent variable is the degree of competition which is proxied by the Boone indicator with more negative value showing higher competition. Cross-border banking is measured as a dummy variable, taking the value of 1 where the shareholding

proportion of the local banks by foreign banks is 50% or more and 0 otherwise. Bank size is proxied by the natural logarithm of total assets valued in US dollars. The ratio of banks' equity capital to total assets is used as a proxy to measure the degree of capitalization. Transparency represents an inverse of corruption within the political system, and the quality of the judicial system and the general observance of the law is denoted by law quality. Bureaucratic quality represents the quality of the selected countries bureaucracy. The quality of legislative organ of the government represents the legislative strength. Higher values of banking freedom signify higher freedom from government controls. The GDP growth accounts for the differences in economic development across countries. Inflation is the rate of inflation based on the CPI. The parameters are estimated with the small sample adjusted standard errors in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Panel B reports diagnostic test: Sargan N*R^2 test are reported for overidentifying restrictions measures of instruments' exogeneity. The R^2 measures the goodness of fit while the p-value of F-test measures the significance of identifying instruments. The Wu-Hausman F-test and Durbin-Wu-Hausman chi-squared specification compare the difference between the IV and the OLS estimators. Bank and country fixed effects are excluded from the estimation.

Next, some unresolved issues in the financial literature on whether stringent capital has led to more competition, financial development, more stable financial systems, and improved banking efficiency are further investigated. As a result, additional control variables "capital stringent/requirement" is included to re-estimate the benchmark model to control for regulation on competition. The result is presented in Table 9. The results show that capital stringency, to a very large extent, explains the cross-country variations in bank competition. Initial capital stringency has positive relationship with competition. More stringent initial capital requirement hinder and reduce bank competition. These findings support Pasiouras (2008) assertion that capital requirements, restrictions on bank activities, official disciplinary power, explicit deposit insurance scheme, higher deposit insurer power, liquidity and diversification guidelines and economic freedom have a significant impact on ratings and thus competition. These findings show that regulatory initiative, which restricts banking activities, imposes severe entry requirements and requires high regulatory capital influences competition level of banks in Africa.

Table 9: Determinants of bank competition: Controlling for capital stringent

Panel A	(1)	(2)	(3)	(4)	(5)
Boone indicator	0.7096***	0.6926***	0.6920***	0.6630***	0.6620***
	(0.0167)	(0.0164)	(0.0167)	(0.0172)	(0.0172)
Cross-border banking	0.0629	0.0372	0.0154	-0.0343	0.0034
	(0.0558)	(0.0548)	(0.0545)	(0.0547)	(0.0557)
Bank size	0.1229***	0.1172***	0.1219***	0.1075***	0.0988***
	(0.0169)	(0.0167)	(0.0167)	(0.0166)	(0.0168)
Capitalization	-0.3581**	-0.1990	-0.1949	-0.3477*	-0.5546***
	(0.1670)	(0.1659)	(0.1679)	(0.1652)	(0.1720)
Transparency	-0.2087***				-0.3595***
	(0.0475)				(0.0541)
Bureaucratic quality		0.1366***			0.0795*
		(0.0465)			(0.0469)
Law quality			0.0275		-0.0157
			(0.0269)		(0.0319)
Legislative quality				0.2592***	0.4555***
				(0.0463)	(0.0565)
Capital stringent	0.1114***	0.0966***	0.1066***	0.1318***	0.1572***
	(0.0184)	(0.0181)	(0.0188)	(0.0186)	(0.0197)
GDP growth	2.1375**	0.5372	0.2134	0.3138	1.5460
	(1.0500)	(0.9430)	(0.9516)	(0.9285)	(0.9536)
Inflation	-0.0084***	-0.0066***	-0.0068***	-0.0072***	-0.0104***
	(0.0024)	(0.0023)	(0.0024)	(0.0023)	(0.0024)
Panel (B) Diagnostics tests					
Sargan N*R2 test	0.025	0.033	0.026	0.112	0.001
Observation	1379	1379	1379	1379	1379
R2 (uncentred)	0.6552	0.6624	0.6616	0.6712	0.6691
F-test (P-value)	180.35***	183.23***	182.23***	189.84***	156.61***
Wu-Hausman test	38.3588***	25.633***	8.069***	1.318	17.3394***
Durbin-Wu-Hausman	73.482***	25.437***	8.110***	2.663	82.8118***
Anderson Canon test	1017.95***	1361.42***	1332.82***	1129.45	991.73***

The dependent variable is the degree of competition which is proxied by the Boone indicator with more negative value showing higher competition. Cross-border banking is measured as a dummy variable, taking the value of 1 where the shareholding proportion of the local banks by foreign banks is 50% or more and 0 otherwise. Bank size is proxied by the natural logarithm of total assets valued in US dollars. The ratio of banks' equity capital to total assets is used as a proxy to measure the degree of capitalization. Transparency represents an inverse of corruption within the political system, and the quality of the judicial system and the general observance of the law

is denoted by law quality. Bureaucratic quality represents the quality of the selected countries bureaucracy. The quality of legislative organ of the government represents the legislative strength. Capital stringent is the regulatory capital requirements. The GDP growth accounts for the differences in economic development across countries. Inflation is the rate of inflation based on the CPI. The parameters are estimated with the small sample adjusted standard errors in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Panel B reports diagnostic test: Sargan $N*R^2$ test are reported for overidentifying restrictions measures of instruments' exogeneity. The R^2 measures the goodness of fit while the p-value of F-test measures the significance of identifying instruments. The Wu-Hausman F-test and Durbin-Wu-Hausman chi-squared specification compare the difference between the IV and the OLS estimators. Bank and country fixed effects are excluded from the estimation.

In addition, even though the legal protection of private property and the judicial efficiency in enforcing these laws affect bank performance in both developed and developing economies, studies show that they differ across countries and even within firms in the same countries (La Porta et al, 2002; Doidge et al, 2007). Thus, limiting expropriation risk could have independent positive impact on bank profitability as well as bank competition, especially where it promotes less volatile capital flows, enhances stable ownership partners in banks and increases access to external capital. Here, "property rights" is included as a measure of risk of expropriation. Though the coefficient of property rights is positive and significant statistically, the positive sign suggest that market power of banks improves in a country where the government and the legal systems protect individual and corporate property rights. The result is presented in Table 10.

Table 10: Determinants of bank competition: Controlling for risk expropriation

Panel A	(1)	(2)	(3)	(4)	(5)
Boone indicator	0.6711***	0.6552***	0.6536***	0.6374***	0.6445***
	(0.0184)	(0.0182)	(0.0186)	(0.0187)	(0.0188)
Cross-border banking	0.1139**	0.0883	0.0687	0.0382	0.0613
	(0.0558)	(0.0549)	(0.0544)	(0.0551)	(0.0562)
Bank size	0.1387***	0.1257***	0.1341***	0.1215***	0.1134***
	(0.0172)	(0.0171)	(0.0169)	(0.0171)	(0.0176)
Capitalization	-0.0266	0.0593	0.0760	-0.0021	-0.1887
	(0.1707)	(0.1693)	(0.1722)	(0.1701)	(0.1795)
Transparency	-0.2511***				-0.2920***
	(0.0523)				(0.0591)
Bureaucratic quality		0.1324***			0.0678
		(0.0512)			(0.0541)
Law quality			-0.0034		-0.0444
			(0.0260)		(0.0320)
Legislative quality				0.1517***	0.3111***
				(0.0449)	(0.0551)
Exploration risk	0.0177***	0.0098***	0.0130***	0.0114***	0.0136***
	(0.0027)	(0.0028)	(0.0025)	(0.0026)	(0.0032)
GDP growth	0.5310	-1.0790	-1.2442	-1.6052**	-0.4381
	(1.0127)	(0.9039)	(0.9330)	(0.9013)	(0.9415)
Inflation	-0.0061**	-0.0051**	-0.0048**	-0.0059**	-0.0075**
	(0.0024)	(0.0023)	(0.0023)	(0.0023)	(0.0024)
Panel (B) Diagnostics tests					
Sargan N*R2 test	0.0001	0.055	0.058	0.129	0.018
Observation	1352	1352	1352	1352	1352
R2 (uncentred)	0.6502	0.6591	0.6584	0.6257	0.6594
F-test (P-value)	166.33***	169.50***	168.65***	171.64	140.3
Wu-Hausman test	35.786***	39.735***	7.857***	1.151	18.42***
Durbin-Wu-Hausman	68.747***	39.021***	7.899***	2.325	87.60***
Anderson Canon test	929.64***	1330.57***	1308.65***	1114.22***	901.02***
Cragg-Donald Wald	980.64	4.0002	2.0004	2088.42	444.213

The dependent variable is the degree of competition which is proxied by the Boone indicator with more negative value showing higher competition. Cross-border banking is measured as a dummy variable, taking the value of 1 where the shareholding proportion of the local banks by foreign banks is 50% or more and 0 otherwise. Bank size is proxied by the natural logarithm of total assets valued in US dollars. The ratio of banks' equity capital to total assets is used as a proxy to measure the degree of capitalization. Transparency represents an inverse of corruption within the political system, and the quality of the judicial system and the general observance of the law

is denoted by law quality. Bureaucratic quality represents the quality of the selected countries bureaucracy. The quality of legislative organ of the government represents the legislative strength. Higher score of property right indicate certainty of legal protection of property right and limited expropriation risks. The GDP growth accounts for the differences in economic development across countries. Inflation is the rate of inflation based on the CPI. The parameters are estimated with the small sample adjusted standard errors in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Panel B reports diagnostic test: Sargan $N*R^2$ test are reported for overidentifying restrictions measures of instruments' exogeneity. The R^2 measures the goodness of fit while the p-value of F-test measures the significance of identifying instruments. The Wu-Hausman F-test and Durbin-Wu-Hausman chi-squared specification compare the difference between the IV and the OLS estimators. Bank and country fixed effects are excluded from the estimation.

Furthermore, activity restriction, entry requirements, and supervision power variables, representing regulatory environment, are incorporated to re-estimate the benchmark model. This is to control for regulation on bank competition in Africa. The results suggest that activity restrictions, entry requirements and bank supervisory power, to a very large extent, explain the cross-country variations in competition. Activity restriction and supervisory power have negative relationship with the competition. This means that fewer activity restriction and effective supervisory power promote banking sector competition in Africa. These findings support Claessens and Laeven (2004) assertion that less restrictions on bank activities and official disciplinary power has a significant impact on competition. The positive coefficient of entry requirement shows that a country with rigid entry requirements provides an avenue for incumbent banks to have market power, leading to less competition. The result is presented in Table 11.

Table 11: Determinants of bank competition: Controlling regulatory variables

Boone indicator	0.6774***	0.6726***	0.6693***	0.6526***
	(0.0173)	(0.0174)	(0.0177)	(0.0180)
Bank size	0.0905***	0.0918***	0.0976***	0.1028***
	(0.0170)	(0.0169)	(0.0172)	(0.0173)
Capitalization	-0.3148	-0.4797***	-0.4452**	-0.5594***
	(0.1913)	(0.1747)	(0.1745)	(0.1996)
Cross-border banking	0.0128	-0.0070	0.0068	-0.0461
	(0.0564)	(0.0568)	(0.0566)	(0.0576)
Transparency	-0.2118***	-0.2248***	-0.2708***	-0.3383***
	(0.0533)	(0.0528)	(0.0582)	(0.0602)
Bureaucratic quality	0.1512***	0.1309***	0.1863***	0.2108***
	(0.0471)	(0.0472)	(0.0506)	(0.0512)
Law quality	-0.0726**	-0.0466	-0.0827***	-0.0410
	(0.0317)	(0.0331)	(0.0318)	(0.0332)
Legislative quality	0.2991***	0.2989***	0.3582***	0.3047***
	(0.0634)	(0.0561)	(0.0558)	(0.0631)
Activity restriction	-0.0283			-0.0189
	(0.0246)			(0.0263)
Entry requirements		0.1619***		0.2824***
		(0.0551)		(0.0660)
Supervision power			-0.0258**	-0.0614**
			(0.0126)	0.0148382
GDP growth	-0.0357	0.2350	-0.2451***	1.4869
	(0.9993)	(0.9574)	(0.9401)	(1.0479)
Inflation	-0.0086***	-0.0083***	-0.0089***	-0.0085***
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Panel (B) Diagnostics tests				
Sargan N*R2 test	0.013	0.008	0.041	0.033
Observation	1379	1379	1379	1379
R2 (uncentred)	0.6602	0.6619	0.6583	0.6335
F-test (P-value)	148.61***	149.7***	148.09***	133.51***
Wu-Hausman test	13.219***	13.18***	15.123***	16.375***
Durbin-Wu-Hausman	64.048***	63.87***	72.788***	78.581***
Anderson Canon test	988.13***	992.252***	951.34***	913.42***
Cragg-Donald Wald	573.455	581.96	504.60	444.37

The dependent variable is the degree of competition which is proxied by the Boone indicator with more negative value showing higher competition. CBB is measured as a dummy variable, taking the value of 1 where the shareholding proportion of the local banks by foreign banks is 50% or more and 0 otherwise. Bank size is proxied by the natural logarithm of total assets valued in US dollars. The ratio of banks' equity capital to total assets is used as a proxy to measure the degree of capitalization. Transparency represents an inverse of corruption within the political system, and the quality of

the judicial system and the general observance of the law is denoted by law quality. Bureaucratic quality represents the quality of the selected countries bureaucracy. The quality of legislative organ of the government represents the legislative strength. Activity restriction, entry requirements, and supervision power represent regulatory environment. The GDP growth accounts for the differences in economic development across countries. Inflation is the rate of inflation based on the CPI. The parameters are estimated with the small sample adjusted standard errors in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Panel B reports diagnostic test: Sargan $N*R^2$ test are reported for overidentifying restrictions measures of instruments' exogeneity. The R^2 measures the goodness of fit while the p-value of F-test measures the significance of identifying instruments. The Wu-Hausman F-test and Durbin-Wu-Hausman chi-squared specification compare the difference between the IV and the OLS estimators.

5.0 Conclusion and policy implications

Over the past two decades, governments in African countries have embarked on a variety of financial sector reforms involving deregulation and relaxation of entry barriers to foreign banks. In this regard, this study measures the level and determinants of bank competition in Africa banking, focusing on cross-border banking and institutional quality. A two-stage approach is employed. In stage one, the Boone indicator as well as the various Lerner index are used to measure the extent of competition in a given country. On the whole, the estimates show that bank competition in Africa steadily increases in the period 2002-2005, but declines between 2006 and 2007 and then marginally increases thereafter. There is also observed differences across the regional groups. In central Africa and part of southern African countries, competition is high, on average, between 2003 and 2005, but starts decreasing thereafter to 2008. In the northern region, competition is at its lowest in 2005. Competition in southern African countries is stable though the observed estimates are lower than that of northern African countries in 2006 and 2007. These results are robust across different measures of competition.

In the second stage, the Boone indicator and different measures of Lerner index are used as the dependent variables to explain the factors that influence bank competition in Africa. Cross-border banking and institutional quality enhance competition in countries with stronger governance structures. The findings highlight the importance of institutional quality in ensuring competition in emerging and African countries. Transparency and the rule of law increase bank competition in African countries. Our results on the relationship between cross-border banking and competition reveal that competition tends to flourish in a country where funding-adjusted and efficiency-adjusted cross-border bank operate. On the regulatory influence, the result reveal that regulatory initiative which restricts banking activities imposes severe entry requirements and requires high regulatory capital and influences competitive level of banks in Africa. On a whole, the study concludes that cross-border banking enhances bank competition in African countries with stronger governance structures and institutional quality. These results are robust to an array of controls including alternative methodology, variable specifications and the regulatory environments that banks operate in.

Our results have implications for policy makers and government agencies charged with maintaining competition in the banking sector. In introducing any competitive code of conduct in the banking sector, policy makers should bear in mind the capacity of bureaucrats and the quality of the judiciary to supervise and adjudicate rules and regulations.

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Table A1 shows the average of country-level variables on institutional quality. Transparency represents an inverse of corruption within the political system, and the quality of the judicial system and the general observance of the law is denoted by law quality. Bureaucratic quality represents the quality of the selected countries bureaucracy. The quality of legislative organ of the governance represents the legislative strength.

Table A2: Bank-specific variables: Averages for the period 2002–2009

Countries	Revenue	Interest cost	Price of labour	Price of capital	Bank size	Capitalization
Algeria	0.0597	0.0238	0.0070	0.0122	4112.90	0.1253
Egypt	0.0807	0.0572	0.0118	0.0066	3811.39	0.1053
Morocco	0.0600	0.0227	0.0104	0.0102	8048.41	0.0839
Sudan	0.0942	0.0579	0.0244	0.0260	1561.69	0.1300
Tunisia	0.0693	0.0479	0.0156	0.0088	1367.00	0.1470
Benin	0.0833	0.0241	0.0178	0.0293	291.00	0.0982
Burkina Faso	0.1042	0.0255	0.0196	0.0319	256.04	0.0807
Cameroon	0.0904	0.0264	0.0147	0.0150	515.83	0.0725
Cote d'Ivoire	0.1011	0.0239	0.0220	0.0401	566.99	0.0977
Ethiopia	0.0764	0.0215	0.0093	0.0112	538.85	0.1082
Ghana	0.1657	0.0820	0.0314	0.0373	248.56	0.1138
Kenya	0.1221	0.0380	0.0265	0.0330	337.48	0.1663
Mali	0.0894	0.0155	0.0190	0.0284	323.11	0.1077
Mauritania	0.1020	0.0241	0.0211	0.0334	124.61	0.2280
Nigeria	0.1386	0.0583	0.0233	0.0379	2139.35	0.1610
Rwanda	0.1206	0.0431	0.0279	0.0410	76.22	0.1420
Senegal	0.0878	0.0218	0.0150	0.0290	426.78	0.0847
Sierra Leone	0.1832	0.0348	0.0437	0.0578	36.42	0.1910
Uganda	0.1347	0.0304	0.0362	0.0272	176.82	0.1367
Angola	0.1017	0.0298	0.0184	0.0246	1274.59	0.8821
Botswana	0.1408	0.1099	0.0173	0.0194	538.57	0.1776
Malawi	0.2029	0.0682	0.0478	0.0540	99.10	0.1418
Mauritius	0.0973	0.0579	0.0109	0.0304	962.95	0.1868
Mozambique	0.1585	0.0407	0.0374	0.0555	331.50	0.1397
Namibia	0.1261	0.0875	0.0215	0.0178	899.69	0.3483
South Africa	0.1736	0.1566	0.0202	0.0490	18251.52	0.1997
Swaziland	0.1356	0.0470	0.0349	0.0294	149.84	0.1552
Tanzania	0.1089	0.0332	0.0215	0.0340	249.42	0.1177
Zimbabwe	0.6164	0.3498	0.0994	0.0813	2227.26	0.1848

Source: Bankscope and author's own calculation.
The data comprises 319 banks across 29 countries over the period 2002-2009.

Table A2 presents the mean value of bank-specific variables of the selected banks. Revenue is measured as total income divided by total assets. Interest cost, price of labour and capital indicate the input price of deposit funds, labour and capital and these are, respectively, calculated as the ratio of interest expenses to total deposits and money market funds, labour cost to total assets, and other operating expenses to total. The bank size is the average total assets, and bank equity represents average capitalization of respective countries' banks. The mean values of the selected banks over the period 2002-2009 are in percentage terms except for bank size which is in US$ millions.

Table A3: Summary of variables definition and sources

Variables	Definition	Sources
Boone indicator	It is a measure of elasticity of market share to the marginal cost. It measure the bank market power which is the inverse of competition.	The author used bank level data from BankScope maintained by Fitch/IBCA/Bureau Van Dijk to compute Boone indicator.
Lerner index	The Lerner index is a measure of market power or price mark-up over marginal cost. It provides a separate value for each bank in the industry. It is a direct inverse of competition.	The author used bank level data from BankScope maintained by Fitch/IBCA/Bureau Van Dijk to compute Lerner index.
Cross-border bank	Cross-border bank is a bank having commercial presence outside its home country, by way of at least one branch or subsidiary. It is measured as a dummy variable, taking the value of 1 where the shareholding proportion of the local banks by foreign banks is 50% or more and 0 otherwise.	The author used bank level data from BankScope maintained by Fitch/IBCA/Bureau Van Dijk to compute cross-border banking.
Transparency	It is an inverse of corruption within the political system. The corruption variable captures the extent to which public power is exercised for private gain.	The International Country Risk Guide (ICRG).
Law quality	The quality of the judicial system and the general observance of the law.	The International Country Risk Guide (ICRG).
Bureaucratic quality	This represents the quality of administrative infrastructure	The International Country Risk Guide (ICRG)
Legislative quality	The quality and relevance of laws enacted is denoted as the legislative quality.	The International Country Risk Guide (ICRG).

Bank equity	This is a ratio of equity to capital and is used as a measure of the level of capitalization.	The author used bank level data from BankScope maintained by Fitch/IBCA/Bureau Van Dijk to compute bank equity ratio.
Bank size	The logarithm of total assets is employed as a proxy for bank size.	The authors used bank level data from BankScope maintained by Fitch/IBCA/Bureau Van Dijk to compute bank size.
GDP growth	GDP growth measures business cycle fluctuation.	World Bank: World Development Indicators database (2014).
Inflation	Inflation is the rate of inflation based on the consumer price index.	World Bank: World Development Indicators database (2014).
Banking freedom	The index provides the overall measures of the openness of the banking sector and the extent to which banks are free to operate their businesses.	Heritage Foundation (2014).
Property right	It measures the degree to which the individual countries laws protect and enforces private property rights.	Heritage Foundation (2014).
Capital index	Capital index measures overall capital stringency.	Barth et al. (2014).
Supervisory power	Describes whether the supervisory authorities have the power to take specific actions to prevent and correct problems.	Barth et al. (2014).
Activity restrictions	Measure the degree to which national authorities allow banks to engage in activities that generate non-interest income.	Barth et al. (2014).

Figure A1: Trend in bank competition for regions of Africa over time
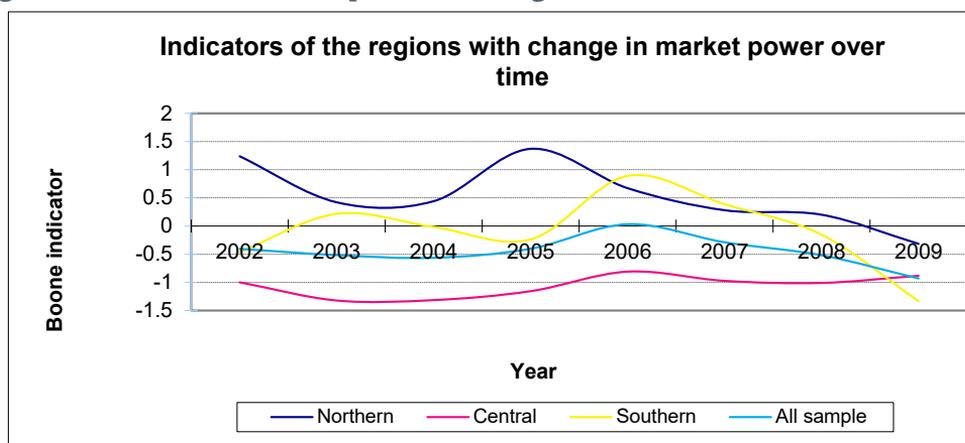
Source: Bankscope and author's own calculation. The data comprises of 319 banks across 29 countries over the period 2002-2009.

Mission

To strengthen local capacity for conducting independent,
rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

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