

Market structure, institutional quality and bank capital ratios: evidence from developing countries

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Abstract

Purpose – This paper investigates the role of market structure and institutional quality in determining bank capital ratios in developing economies.

Design/methodology/approach – The generalised methods of moment technique is used to control for auto-correlation and endogeneity in a sample of 79 publicly listed commercial banks. The study period is between 2000 and 2016.

Findings – Results show that market structure (proxied with bank competition) as well as institutional quality (regulatory quality) lowers bank capital in the sampled banks. This suggests that banks operating in less competitive markets with good regulatory quality do not need to engage in excessive risk-taking activities that would necessitate holding increased level of capital. Furthermore, the interaction of competition and regulatory quality reinforces the main findings, suggesting the importance of the two variables in determining bank capital ratio.

Research limitations/implications – Research has limitation in that the study investigated publicly listed commercial banks, the findings may not be applicable to non-listed banks.

Practical implications – Taking into cognisance the developing nature of the banking system in Africa, the findings from this study imply that the maintenance of an improved regulatory quality in an environment where healthy competition exists would encourage banks to hold capital ratios appropriate for their level of banking activities, that is, the banks would not engage in excessive risk-taking activities.

Originality/value – This is one of the first papers that examine the effect of market structure and institutional quality on bank capital ratios in developing countries that have bank-based financial systems.

Keywords Bank capital, Competition, Concentration, Endogeneity, Regulatory quality, Africa

Paper type Research paper

1. Introduction

Bank capital plays a significant role in maintaining the stability of any financial system because it not only supports daily operations of the bank but also reassures relevant stakeholders in the industry of the continued existence of the bank. However, some banks maintain capital in excess of what regulatory bodies specify, and extant literature provides several reasons why this is so. For example, high adjustment costs may be incurred by banks which fall short of minimum capital ratios in the process of adjusting back to the minimum. To prevent these costs, banks may decide to hold capital in excess of regulatory requirements so that they are above the minimum required at any point in time (Alraheb *et al.*, 2019).



Banks may also hold excess capital to meet up with unexpected investment opportunities and to mitigate a rise in risks associated with increase in credit facilities when efficient supervision is absent (Milne, 2002; Vithessonthi, 2014). Such risky behaviour, when it goes bad, erodes bank capital. To prevent capital erosion, regulatory bodies put in place minimum capital requirements for banks that serve as disciplinary mechanisms to dissuade banks' management from taking unnecessary risks that would adversely affect banks' capital (Anginer *et al.*, 2018). The disciplinary measure has, however, not prevented banks from engaging in excessive risks as evidenced in the sub-prime mortgage/global financial crisis of 2007–2009 where most of the troubled financial institutions had their capital ratios above the minimum required level prior to the crisis (Anginer *et al.*, 2018). Moreover, Calomiris and Jaremski (2016) argue that weaker market discipline by depositors may provide an impetus for banks to reduce capital ratios and engage in risky lending.

Market structure viewed in terms of bank competition lowers market power, earnings and franchise value, making banks engage in excessive risk-taking in order to increase capital ratios to mitigate losses that may arise from such risks (Liu *et al.*, 2013) [1]. Similarly, Allen *et al.* (2011) argue that competition encourages banks to have higher capital levels because it (competition) displays the level of commitment a bank has towards effective monitoring and attracting creditworthy customers. Extant literature also shows that customer's lending behaviour, shareholder's rights and deposit insurance influence the level of capital a bank would have. Whereas information-sensitive customers and strong shareholder's rights encourage higher capital, the presence of deposit insurance lowers bank capital (Allen *et al.*, 2011). The implication of these arguments is that strong institutions should exist alongside higher bank capital ratios. Furthermore, development of quality institutions is crucial to maintaining financial stability and resistance to local or international shocks as observed in the 2007/2008 global financial crisis (Alraheb *et al.*, 2019).

The financial system in African countries is mostly bank-based, underscoring the importance of banks in the system and the role it plays in maintaining the stability of the financial system to ensure growth of the economy (Ozili, 2018). One way of maintaining stability is for banks to have adequate capital to support its business activities (Chiaramonte and Casu, 2017; Ozili, 2018). The ripple effect of the 2007–2009 global financial crisis also made most African countries to put in place regulatory measures that would enhance financial stability through increased capital ratios. For instance, in keeping up with the BASEL III requirements concerning capital, commercial banks in Kenya were required to raise their capital to \$12.5 million by 2012, from \$3.3 million in 2008. Similarly, Zambian commercial banks had to increase their minimum capital to \$2.2 million, from \$358,240. In Algeria, the minimum capital was increased to \$155 million, from \$39 million (Oduor *et al.*, 2017). However, the presence of institution-related issues such as poor regulatory quality, inaccurate information disclosure and poor corporate governance policies poses a challenge to the maintenance of adequate capital by banks in developing countries (Alraheb *et al.*, 2019; Anginer *et al.*, 2018). This implies that banks in such countries would hold just enough capital to meet regulatory requirements which would create moral hazard especially where capital is costly (Allen *et al.*, 2012).

This study contributes to existing literature in a number of ways. First, it is the first study that investigates the role played by competition (as a form of market structure) and regulatory quality (to capture institutional quality) in determining bank capital ratios in publicly listed commercial banks in African countries. Given the scarcity of literature from this region and other developing countries, two recent works related to our study are by Otero *et al.* (2017, 2019). While the former investigated competition, concentration and risk-taking, the latter study examined market structure, performance and efficiency, with both studies focusing on the Middle East and North African (MENA) region. Our study deviates from

these two studies by examining the role played by market structure and institutional quality on bank capital ratio in African countries. Our results provide empirical evidence from the banking sector of developing countries where banks operate in challenging environments and there is a higher probability of destabilisation due to capital erosion than in developed countries where the issues are less severe. Second, noting that previous studies mostly focused on how bank-level and macroeconomic factors affect bank capital ratio (Flamini *et al.*, 2009; Francis, 2013; Ozili, 2015), we carry out our investigation on African banks by focusing on market structure and institutional quality because the region had witnessed varying levels of positive development in the quality of institutions and the opening up of its economy to international integration. The financial and trade openness suggests more entry into the financial sector and may induce a more competitive and efficient sector that could drive bank performance that would enhance stability in the system (Otero *et al.*, 2019).

In our empirical analysis, we consider the endogeneity of bank capital and use the two-step system generalised moment method (Sys-GMM) for the investigation. The results reveal that bank competition and regulatory quality lower bank capital, suggesting that in less competitive markets where the regulatory quality is high, banks do not need to engage in excessive risk-taking activities that would necessitate holding increased levels of capital. These findings are strengthened when we investigate whether competition is conditioned on the quality of existing regulation.

The rest of the paper is structured as follows: In Section 2, we discuss related literature. Section 3 addresses the methodology employed in the study in terms of model, method and variables. Section 4 discusses the results. We conclude the paper in Section 5 with relevant policy implications.

2. Related literature

Theoretical literature provides insights on why banks hold capital in excess of what is required by regulatory authorities. One is the capital buffer theory where proponents of the theory argue that even in the absence of regulation, a bank would need to maintain an appropriate capital level because the market requires them to do so to remain in business. For instance, Berger (1995) and Berger *et al.* (1995) argue that banks have capital in excess of regulatory requirement to take advantage of unexpected profitable opportunities or to absorb unanticipated losses. Where regulation exists, banks may hold excess capital to avoid high adjustment costs and penalties that may result from being unable to meet minimum regulatory requirements (Rime, 2001). Another theory is the charter or franchise value where bank earnings are important in determining bank capital ratios. Here, bank managers build up capital from high earnings, and cost efficiency to guard against liquidation and high capital ratios indicate bank quality (Demstet *et al.*, 1996). Keeley (1990) explains bank charter value as the present value of future profits that banks expect to earn from operations and banks would choose high capital to protect its charter. Thus, reduced earnings may lead a bank to engage in risky projects to reverse the fall. The trade-off theory is also important because anticipated rise in bankruptcy costs due to an increase in asset portfolio could imply an increase in insolvency risk. To prevent this, banks increase their capital-to-assets ratio, and ultimately the capital ratio (Berger, 1995). In terms of market structure/competition, Allen *et al.* (2011) presented a model where market competition encourages banks to hold excess capital for several reasons such as indicating banks' commitment to monitoring and attracting creditworthy and information-sensitive borrowers. Higher capital ratios also depict the presence of strong shareholder rights protection, while deposit insurance reduces capital ratio. Recently, Alraheb *et al.* (2019) showed that institutional variables significantly influence bank capital ratios in MENA countries, depending on the level of financial market development. They found that institutional qualities are important in determining bank

capital ratio in countries where the stock market is less developed. This further reinforces our motivation for this study given that the financial system in the region is bank-based and research-focused on institutions is lacking from this region. In addition, Anginer *et al.* (2018), while investigating ways by which institutional environment affect bank capital and fragility, found that systemic risk lowers bank capital and is more obvious for banks operating in less developed markets where issues such as information asymmetry and inefficient supervision are present. The authors established that capital may be used to replace a weak institutional environment to reduce systemic risk. However, the extent to which this is applicable to African banks is not known. Related literature on bank competition is concerned with improving stability of the financial system while maintaining a healthy competition between financial institutions. For instance, Liu *et al.* (2013), using a competition index that indicated how much capital a bank has to cushion the effect of unforeseen losses as a proxy for fragility, show that in regional markets in the European Union, increased (decreased) competition seems to improve (worsen) stability in uncompetitive banking environments unlike what is obtainable in more competitive markets where fragility is increased. As observed by Beck and Cull (2013), the banking environment in African countries is not as competitive as the ones in more developed economies; thus, we expect results that are different from what is obtainable in developed financial systems.

Besides the preceding theoretical discussion on bank capital, literature also suggests that bank-specific factors may influence the level of capital a bank holds. An example is bank size which may exert either a positive or negative effect on capital. In terms of positive effect, large-sized banks derive certain benefits for being big. For instance, lower costs of raising additional capital due to benefits resulting from economies of scale enable large-sized banks to acquire more capital at a lower cost than smaller-sized banks (De Jonghe and Öztekin, 2015). Furthermore, large banks may consider maintaining excess capital to have good ratings that will promote operations (Jackson *et al.*, 2002). However, due to the “too-big-to-fail” condition where regulators are unwilling to close big banks, a large-sized bank may choose to hold less capital than a small-sized bank, suggesting that size does not matter (Luc Laeven *et al.*, 2016). Another important factor is bank liquidity because more liquid assets and better capitalised banks are considered as safer banks (Chiaramonte and Casu, 2017). This happens when the liquidity premium required on rate of return on bank shares declines such that the reduction encourages banks to raise additional equity [2].

3. Methodology

3.1 Model and method

To examine the role of market structure and regulatory quality in determining bank capital ratio, we follow studies such as Anginer *et al.* (2018), Liu *et al.* (2013) and Schaeck and Cihak (2012) and model bank capital as a function of competition, a set of bank-specific and macroeconomic and institutional variables as presented in Eqn (1).

$$\gamma_{i,t} = \beta_0 + \beta_1\gamma_{i,t-1} + \beta_2\psi_{i,t} + \beta_3\chi_{i,t} + \beta_4\kappa_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \quad (1)$$

where γ is the capital ratio for bank i , at period t , and $\gamma_{i,t-1}$ is one period lagged bank capital. The measures for competition/market structure is captured by ψ . χ is a vector of bank-specific variables and κ captures macroeconomic and institutional variables. μ_i is time-invariant unobservable bank-specific effect, η_t is time-specific effect common to all banks but changes through time, $\varepsilon_{i,t}$ is the time-varying error term, $\beta_0 - \beta_4$ are coefficients estimates. Table 1 provides a description of the variables in Eqn 1.

We use the two-step Sys-GMM of Blundell and Bond (2000), an instrumental variable technique, over other methods such as the generalised least squares method to address potential endogeneity between capital ratio (γ) and competition (ψ) which may arise due to

S/N	Variable	Description	Source
1.	Bank capital	Ratio of equity to total assets (%)	Bankscope
2.	Lerner index	Difference between output prices and marginal costs (relative to prices) and is calculated as $\frac{P-MC}{P}$ where P is the price of banking outputs and MC is marginal costs. Higher values of the Lerner index indicate less bank competition (%)	World Bank Global Financial Development Report
3.	Bank concentration	Total assets held by 3 largest banks of a country to the total assets of all banks in the country (%)	World Bank Global Financial Development Report
4.	Bank profitability	Return on assets and is calculated as the ratio of a bank's net income to its average assets (%)	Bankscope
5.	Credit risk	Ratio of loan loss reserves to gross loan (%)	Bankscope
6.	Bank liquidity	Ratio of liquid assets to total assets (%)	Bankscope
7.	Bank size	Natural logarithm of bank total assets	Bankscope
8.	Gross domestic product	Year on year growth rate of real GDP (%)	World Bank development Indicators database
9.	Inflation	Inflation based on annual consumer price index (%)	World Bank development Indicators database
10.	Financial market development	Ratio of domestic credit to the private sector by commercial banks to GDP (%)	World Bank development Indicators database
11.	Regulatory quality	Perception of the ability of government to formulate and implement sound policies and regulations that promote private sector development. Takes a value between -2.5 and 2.5	World Bank governance Indicators database

Table 1.
Variable description
and sources

Note(s): [Table 1](#) shows the description and source of variables employed in the study. Values of the Lerner index are extracted from the Global Financial Development Report of the World Bank

reverse causality in [Eqn \(1\)](#). The method in addition takes into account serial correlation between the lagged dependent variable ($\gamma_{i,t-1}$) and other variables in the regression model [[3](#)]. Furthermore, the Sys-GMM controls for unobserved heterogeneity and considers the issue of unit roots in the macroeconomic data ([Binder et al., 2005](#)). The Sys-GMM is preferred over the difference GMM because it reduces potential bias in finite samples and yields more consistent coefficient estimates ([Roodman, 2009](#)). We report important test statistics such as the Arellano and Bond AR (1), AR (2) and the Hansen test to validate the use of the Sys-GMM estimator. While the AR (1) and AR (2) checks for the absence of first- and second-order serial correlation in differenced residuals of the model, Hansen test checks for overidentifying restrictions and nonexistence of correlation between the error term and instruments used in the model with a null of valid instruments. It is equally important to note that [Eqn \(1\)](#) is a partial adjustment model that accounts for adjustment costs which arises when banks try to adjust to meet capital requirements. High adjustment costs may prevent banks from instantaneous change in capital when they fall short of regulatory requirements, making them liable to penalties ([Brei and Gambacorta, 2016](#); [Etudaiye-Muhtar et al., 2017](#); [Ozili, 2015](#)). To avoid this situation, banks would need to increase the capital ratio, and a positive and significant coefficient of the lagged capital ratio would indicate the presence of adjustment costs.

3.2 Data

[Eqn \(1\)](#) and method described in [Section 3.1](#) is used to analyse bank-specific and country-level data obtained from Bankscope and World Bank Development Indicators for the period 2000

to 2016. Number of banks in the sample is driven by data availability [4]. We follow [Punt and Van Rooij \(2003\)](#) and use only publicly listed commercial banks because the observed group is homogenous and allows for better estimates. To remove duplicate bank-specific information, data are collected from consolidated statements in Bankscope, while macroeconomic and institutional quality data are from World Bank database for the same period. We include banks with at least three years of observations only following the procedures of [Etudaiye-Muhtar et al. \(2017\)](#) and [Vithessonthi \(2014\)](#) in anticipation of a small sample size and to guard against small cross-sectional variations. We address the potential effect of outliers in the data by employing a robust regression estimation technique to estimate regression coefficients following the technique of [Frank and Goyal \(2009\)](#) and [Verardi and Croux \(2009\)](#) [5]. Our final sample size consists of an unbalanced panel of 79 banks from 24 countries (see [Appendix 1](#)).

3.3 Discussion of variables

Our main independent variables of interest are market structure and institutional quality. We use bank-specific and macroeconomic variables that have been established by literature to affect bank capital as control variables. [Table 1](#) presents a summary of variable description and source.

3.3.1 Market structure and institutional quality. Our variable for market structure is based on the credit market model developed by [Allen et al. \(2011\)](#), where bank capital changes due to creditors' behaviour in the credit market rather than regulatory requirements. In the model, market forces make banks hold capital levels well above the required amount even though it may be costly for them to do so. Competition is seen to encourage banks to hold higher capital levels because it signifies commitment to entice and monitor creditworthy customers. Furthermore, market structure and profits are two factors necessary to maintain financial stability. For instance, [Otero et al. \(2017, 2019\)](#) both show that market power drives performance in banks in the MENA region (a developing region with similar characteristics with banks in the present study). This suggests that such banks, upon earning more profits, build up their capital ratio to indicate financial stability and entice creditworthy customers. This position is in line with the assertion of [Schaeck and Cihak \(2012\)](#) that a bank becomes attractive to borrowers if its capital is observable because of the higher level of capital, which improves its ability to attract good credit and suggests a positive coefficient for bank competition. Nonetheless, studies also show that the existence of the too-big-to-fail syndrome (especially in situations where there are a few large banks) encourages banks to hold less capital, a situation explained by the moral hazard issue ([De Jonghe and Oztekin, 2015](#); [Schaeck and Cihak, 2012](#)). Based on these arguments, we use bank concentration ratio and Lerner index as our variable for market structure following [Otero et al. \(2017, 2019\)](#) who also used two indicators for bank competition. Although several measures are available to capture market structure, our choice of these two variables is due to their availability for banks in the sample [6]. Higher values of bank concentration imply a less competitive market, while that of Lerner index suggests a more competitive market. Regulatory quality, which measures the perception of the ability of government to formulate and implement sound policies and regulations that promote private sector development (banking sector inclusive), is our proxy for institutional quality. This takes a value between -2.5 and 2.5 as obtained from World Development Governance Indicators (WGI) provided by [Kaufmann et al. \(2011\)](#). Higher values of this variable indicate higher quality of regulation and formulation, and we expect a positive effect on bank capital.

3.3.2 Bank-specific variables (profitability, risk, liquidity and bank size). In terms of profitability, higher profit levels enable banks to increase their capital ratios to protect themselves against possible liquidation and signal positive information to the market about bank value ([Etudaiye-Muhtar et al., 2017](#); [Rime, 2001](#)). This suggest a positive relationship

with bank capital, which is consistent with the pecking order theory and for regions with less developed financial markets such as the ones in this study (Alraheb *et al.*, 2019). We use the return on assets as our measure for bank profitability. Risk is another important factor that banks consider when determining the level of capital to hold (Schaeck and Cihak, 2012). For example, risk-based capital standards such as the Basel Committee Accord may destabilise a bank's capital ratio and the bank would need to readjust. In addition, banks may engage in excessive risk-taking to improve its earnings, and therefore the capital ratio (Vithessonthi, 2014). In this paper, we proxy risk with the ratio of loan loss reserves to gross loan and expect a positive association with bank capital. Bank liquidity measures a bank's financial strength because it acts as a buffer for distress and bank runs. Nonetheless, there has to be a balance between liquidity and bank capital in order to prevent a situation where liquidity affects bank capital negatively (Vithessonthi, 2014). These two positions imply that the effect of liquidity on bank capital is unclear. Our proxy for liquidity is the ratio of liquid assets to total assets. Relating to size, larger-sized banks have incentives such as lower costs of capital that enable them obtain additional capital and prevent taking on excessive risk (Konishi and Yasuda, 2004). Additionally, to maintain good ratings, large banks would need to have capital in excess of market-determined reserves (Jackson *et al.*, 2002). Consequently, we expect bank size to have a positive coefficient. Size is measured at the natural logarithm of total assets.

3.3.3 Macroeconomic variables. Macroeconomic variables affect bank capital ratios mainly in two ways: procyclical or countercyclical, depending on business cycle fluctuations (Brei and Gambacorta, 2016; Durafe and Jha, 2018). During an economic boom, banks tend to increase their capital ratio to benefit from potential investment opportunities/take advantage of increased credit activities (Durafe and Jha, 2018; Schaeck and Cihak, 2012). Furthermore, banks may decide to use an expansionary monetary policy regime to increase capital ratios (Laeven and Majoni, 2003). Nevertheless, a thriving economy also implies a lower loan default rate, so banks do not necessarily need to increase capital ratio and may decide to lower the ratio (Ayuso *et al.*, 2004; Brei and Gambacorta, 2016). We use the growth rate of real GDP to capture the effect of business cycles on bank capital. We also include inflation as a control variable because literature establishes a negative relationship between inflation and bank capital. For instance, Hortlund (2005) argues that inflation increases bank debt, leading to a reduction in bank capital. This situation continues until leverage-induced increasing returns are sufficient to hold them at constant levels. Inflation is measured as annual percentage of consumer price index. In terms of financial market development, a re-balancing of the capital ratio of banks is possible when there is positive development in financial markets. Leaning on the finance-growth theory, banks would take advantage of lower costs of funding attributable to development of the markets, thus obtaining additional capital at minimal cost (Bena and Ondko, 2012; Levine, 2005). However, financial liberalisation may also have the opposite effect, that is, lower bank capital. This occurs usually in markets where information asymmetries and excessive risk-taking by banks exist and mostly in markets where efficient supervision is not available (González and González, 2014; Vithessonthi, 2014). In this type of market, efficient supervision is also absent. The two different positions imply that the expected relationship between bank capital and financial market development is ambiguous. We use the ratio of domestic credit to the private sector by commercial banks to GDP as our proxy for financial market development.

4. Empirical results

4.1 Descriptive statistics and correlation

Table 2 presents the descriptive statistics of variables outlined in Table 1. The average values of the main variables of interest, that is, Lerner index and bank concentration are 0.309 and

Table 2.
Descriptive statistics

Variable	Mean	Standard deviation	Minimum	Maximum
Bank capital	11.647	5.912	-4.21	83.21
Bank concentration	53.408	14.943	32.521	100
Lerner index	0.309	0.093	-0.084	0.459
Bank profitability	1.944	1.667	-9.92	7.36
Credit risk	6.011	5.898	0.19	45.16
Bank liquidity	24.901	27.784	0.35	81.6
Bank size	5.444	0.975	3.55	6.436
Gross domestic product	4.311	2.973	-24	14.047
Inflation	7.295	5.304	-1.086	36.908
Financial market development	45.745	34.803	7.137	160.125
Regulatory quality	0.455	0.144	0.004	0.836

Source(s): Bank-level and country-level data as outlined in the data section

53.408, respectively. For bank concentration, approximately 53% of total bank assets are held by the three largest banks, implying a less competitive market. Nonetheless, the Lerner index of 0.309 shows a competitive market, implying that high concentration does not necessarily translate to high market power. This is in line with the position of [Leon \(2014\)](#) that the different measures used to capture competition do not give the same interpretation, that is, do not give the same inferences. Regulatory quality has a mean of 0.455, with a maximum of 0.836 buttressing the low quality of regulation in the system.

The correlation matrix in [Table 3](#) shows that the variables generally have low correlations, implying that multicollinearity is not an issue. Most variables are seen to have values less than 0.5, with the only exception being bank concentration and Lerner index. However, this is not a problem since the two market structure variables do not enter the regression equation at the same time. Bank capital is negatively correlated with bank concentration, while it has a positive correlation with Lerner Index with values of -0.254 and 0.097 , respectively. However, without controlling for other variables that affect bank capital, it would be inappropriate to make inferences on the nature of the relationship between market structure and bank capital using correlation matrix. Consequently, we run [Eqn \(1\)](#) using the two-step Sys-GMM, an instrumental variable technique as outlined in the method section.

4.2 Regression estimates (market structure, regulatory quality and bank capital)

In [Table 4](#), we report the results obtained from [Eqn \(1\)](#) in columns 1 for bank concentration, and in 2 for Lerner index. The dependent variable in both columns is bank capital. The two market structure variables have different coefficient signs and statistical significance in line with the assertion of [Leon \(2014\)](#) and inferences made from the descriptive statistics and correlation matrix.

The coefficient for bank concentration is negative and statistically significant (-0.035 , $p < 0.01$) in column 1. This suggests that the less competitive nature of banks in the study, as noted in the descriptive statistics, leads to a lower bank capital ratio. The result is consistent with the assertions of [Schaeck and Cihak \(2012\)](#) and [Uhde and Heimeshoff \(2009\)](#) that banks tend to hold higher capital ratios when operating in competitive environments and conversely for banks in less competitive settings. From the moral hazard view, the too-big-to-fail syndrome that encourages banks to hold less capital may be applicable to the banks in this study given that 53.408% of the total assets are held by the three largest banks in the study (see [Table 2](#)). Regulatory authorities view them as too big to fail and would put in place measures to prevent such from happening ([Mishkin, 1999](#)). The Lerner index, although positive, has a non-significant effect on bank capital, implying that market power does not

Table 3.
Correlation matrix

Variables	1	2	3	4	5	6	7	8	9	10	11
(1) Bank capital	1.000										
(2) Lerner index	0.097**	1									
(3) Bank concentration	-0.254*	-0.603***	1								
(4) Bank profitability	0.361*	0.048	0.044	1							
(5) Credit risk	-0.049	0.198***	-0.243***	-0.325***	1						
(6) Bank liquidity	0.424	-0.043	0.044	0.019	-0.016	1					
(7) Bank size	0.072**	-0.063	0.058	-0.122**	-0.081*	0.077*	1				
(8) Gross domestic product	0.117**	0.026	-0.136***	0.185***	-0.057	0.038	-0.083**	1			
(9) Inflation	0.231***	-0.071	-0.015	0.329***	0.039	0.180***	-0.045	-0.015	1		
(10) Financial market development	-0.272***	-0.095***	0.304***	-0.334***	-0.047	-0.119***	0.177***	-0.279***	-0.279***	1	
(11) Regulatory quality	-0.191***	0.057	0.290***	0.010	-0.204***	-0.024	-0.039	-0.136***	-0.312***	0.447***	1

Note(s): *, ** and *** represents 1%, 5% and 10% significant levels, respectively

	1	2
Bank capital _(t-1)	0.654*** (0.024)	0.121*** (0.013)
Bank concentration	-0.035*** (0.006)	-
Lerner index	-	2.612 (1.606)
Bank profitability	0.647*** (0.036)	0.885*** (0.142)
Credit risk	0.023 (0.017)	0.018 (0.043)
Bank liquidity	-0.017* (0.009)	-0.014 (0.028)
Bank size	0.514*** (0.144)	0.323*** (0.118)
Gross domestic product	-0.017 (0.010)	-0.089*** (0.032)
Inflation	-0.048*** (0.009)	-0.073*** (0.021)
Financial market development	0.001 (0.003)	0.006 (0.010)
Regulatory quality	-0.022*** (0.006)	-0.100*** (0.020)
<i>F</i> -statistics <i>p</i> -value	0.000	0.000
Time dummy	Yes	Yes
AR (1) <i>p</i> -value	0.027	0.063
AR (2) <i>p</i> -value	0.635	0.348
Hansen <i>p</i> -value	0.445	0.314
Number of banks	79	79

Note(s): Table 4 reports coefficient estimates of Eqn (1), with small sample adjustment and corrected standard errors in parenthesis using the two-step system GMM technique. Dependent variable in both columns is bank capital. Variables are as defined in Table 1. Columns 1 and 2 present results when bank concentration and Lerner index are used as measures of market structure, respectively. *** and * refer to 1% and 10% level of significance, respectively. The insignificance of AR (2) indicates the absence of second-order serial correlation in first-differenced errors. The *p*-value of Hansen is also insignificant, implying that instruments are valid and are not overidentified

Table 4.
Regression estimates

have any influence on capital ratio. Liu *et al.* (2013) and Alraheb *et al.* (2019) found similar results for banks in 10 European countries and the MENA region, respectively. The different results obtained from the two variables further affirm Leon (2014) that they do not necessarily give the same inference. Overall, the results show that bank concentration is a more important determinant of bank capital for this study than the Lerner index, which is more of a measure of pricing market power (Leon, 2014). The institutional variable represented by regulatory quality shows a negative and statistically significant coefficient in both columns (-0.022 , $p < 0.01$; and -0.100 , $p < 0.01$), suggesting that bank capital reduces with improvement in the quality of regulation. It is possible that with stronger regulatory quality, banks would have no need to engage in excessive risk activities, necessitating an increase in capital ratio (Ozili, 2018; Vithessonthi, 2014).

Taken together, the two variables (competition and institutional quality) suggest that high regulatory quality in less competitive markets dissuades banks from engaging in excessive risk-taking activities that would necessitate holding capital ratio in excess of regulatory requirements. In addition, the concentrated market may increase the information asymmetry problem common in less developed financial markets. This makes it difficult for banks to monitor and screen borrowers, and they would be unable to differentiate between high- and low-quality debtors (Ariss, 2010). However, while a high regulatory quality may be sustained, there is a need to encourage healthy competition that can lead to an increase in bank capital because a reduced capital ratio may affect bank stability.

In line with the pecking order theory, the results show positive and statistically significant coefficients for bank profitability in both columns (0.647 , $p < 0.01$; 0.885 , $p < 0.01$), implying that banks increase their capital ratios following improved earnings to guide against unforeseen circumstances (Alraheb *et al.*, 2019). Consistent with Konishi and Yasuda (2004) and Jackson *et al.* (2002), the coefficients of bank size in columns 1 and 2 are positive and statistically significant (0.514 , $p < 0.01$; 0.323 , $p < 0.001$, respectively), suggesting that

large-sized banks benefit from economies of scale when raising additional capital. In addition, large banks would need to have capital in excess of market-determined reserve order to maintain good credit ratings, thus the positive coefficients. Although bank liquidity serves as a buffer to prevent bank runs, the results in Table 4 (column 1) for bank concentration show an inverse relationship between liquidity and bank capital ($-0.017, p < 0.1$), indicating that more liquid banks would have lower capital ratios. A bank that is highly liquid does not necessarily need to have excess capital ratios because the risk of a bank run is low (Vithessonthi, 2014).

The sign and level of significance of gross domestic product coefficient in the Lerner index column ($-0.089, p < 0.01$) implies that the variable is countercyclical, inferring that in a booming economy, there is lower probability of loan default; thus, there is no need for banks to increase capital ratio and may decide to lower the ratio, in line with the arguments of Ayuso *et al.* (2004) and Brei and Gambacorta (2016). Inflation has negative and statistically significant coefficients in both columns ($-0.048, p < 0.01$; $-0.073, p < 0.01$), consistent with the argument of Hortlund (2005) that it increases bank debt leading to a reduction in bank capital. This situation remains until leverage-induced increasing returns are sufficient to hold them at constant levels. We do not find support for either the finance-growth or financial liberalisation theory, because the coefficient for financial market development is insignificant in both columns.

To validate the results in Table 4, we report p -values of F -statistics, AR (2), Hansen and lagged bank capital. The significance of F -statistics at 1% significance level in the two columns implies the joint significance of all variables in explaining bank capital. The non-significance of AR (2) shows the absence of serial correlation in differenced residuals, while that of Hansen indicates that the instruments used are valid and the model is not over-identified. Furthermore, the positive and significant coefficients for the lagged bank capital justify the use of a dynamic model and the presence of adjustment costs that may hinder a bank from instantaneous change in capital ratio, consistent with earlier arguments of Brei and Gambacorta (2016), Ozili (2015) and Etudaiye-Muhtar *et al.* (2017).

4.3 Indirect effect of market structure and regulatory quality on bank capital

In the preceding section, we investigated the direct effect of market structure and institutional quality on bank capital ratio. In this section, we interact the two variables to determine their indirect effect and test the hypothesis that strong institutions and healthy competition existing side by side should encourage banks to hold capital in excess of what is required by regulatory authorities. To do this, we remodify Eqn (2) to include an interactive term (market structure*regulatory quality), and the results are presented in Table 5.

$$\gamma_{i,t} = \beta_0 + \beta_1\gamma_{i,t-1} + \beta_2\psi_{i,t} + \beta_3\chi_{i,t} + \beta_4\kappa_{i,t} + \beta_5\delta_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \quad (2)$$

where $\delta_{i,t}$ represents the interaction of market structure and competition for bank i at period t . All other variables remain as defined in Table 1. Results from Eqn (2) are presented in Table 5.

The coefficient for the interaction term in Table 5 is negative and statistically significant in column 1 ($-0.001, p < 0.01$), suggesting that the direct effect on bank capital by market structure and regulatory quality is accentuated when the two variables exist alongside each other. This provides support for the results presented in Table 4 that high regulatory quality in less competitive markets dissuades banks from engaging in excessive risk-taking activities that would necessitate holding capital ratio in excess of regulatory requirements. Column 2 for Lerner index has an interactive term that is not significant. Furthermore, we observe that signs and significance of coefficients of control variables in the regression equation are not qualitatively different from what was reported in Table 4.

	1	2
Bank capital _(t-1)	0.654*** (0.013)	0.473*** (0.083)
Bank concentration	-0.164*** (0.012)	-
Lerner index	-	-14.543 (10.663)
Bank profitability	0.629*** (0.043)	0.998*** (0.174)
Credit risk	-0.003 (0.018)	0.039 (0.048)
Bank liquidity	-0.017** (0.008)	-0.022 (0.029)
Bank size	0.327*** (0.086)	0.428*** (0.169)
Gross domestic product	-0.032*** (0.007)	-0.113*** (0.036)
Inflation	-0.051*** (0.008)	-0.072*** (0.025)
Financial market development	0.003 (0.003)	0.013 (0.011)
Regulatory quality	-0.038** (0.019)	-0.182*** (0.054)
Market structure*regulatory quality	-0.001*** (0.000)	0.339 (0.217)
F-statistics <i>p</i> -value	0.000	0.000
Time dummy	Yes	Yes
AR (1) <i>p</i> -value	0.010	0.023
AR (2) <i>p</i> -value	0.736	0.483
Hansen <i>p</i> -value	0.248	0.363
Number of banks	79	79

Note(s): Table 5 reports coefficient estimates of Eqn (2), with small sample adjustment and corrected standard errors in parenthesis using the two-step system GMM technique. Dependent variable in both columns is bank capital. Variables are as defined in Table 1. Columns 1 and 2 present results when bank concentration and Lerner index are used as measures of market structure, respectively. *** and ** refer to 1% and 10% level of significance, respectively. The insignificance of AR (2) indicates the absence of second-order serial correlation in first-differenced errors. The *p*-value of Hansen is also insignificant, implying that instruments are valid and are not overidentified

Table 5.
Interaction effects
(competition
regulatory quality)

5. Conclusion

Given the developing nature of the African financial system, this paper empirically investigates the nexus between market structure, institutional quality and bank capital ratio for a sample of 79 banks in 24 African countries for the period 2000–2016. The descriptive statistics suggests that the banking sector is concentrated and non-competitive. Controlling for endogeneity and autocorrelation, the regression results show that concentration and regulatory quality lowers bank capital ratio. Consistent with prior studies on less developed financial systems, our results imply that regulatory quality in less competitive markets (our sample) lowers bank capital, an indication that banks in such markets are dissuaded from engaging in excessive risk-taking activities that would necessitate holding capital ratio in excess of regulatory requirements. Our results have important policy implications for regulatory authorities and bank management. While improved regulatory quality should be maintained, banks should be encouraged to engage in healthy competition to improve the intermediation process. This would motivate banks to hold capital ratios appropriate for their level of banking activities and not engage in excessive risk-taking activities that would erode capital. Noting that our sample is taken from publicly listed commercial banks, further research may investigate and compare results from non-listed banks to determine if there is any difference in findings between the two categories.

Notes

1. Market structure in this study relates to how competitive the banking sector is. We use the two terms interchangeably.
2. Liquidity premium reduces when the share of funds invested in cash and near-cash equivalents increase, thereby reducing bank liquidity risk.

3. See [Roodman \(2009\)](#) for a detailed explanation of the method.
4. [Anginer et al. \(2018\)](#) also stopped in 2016 because data from Bankscope database were discontinued in January 2017. In terms of data availability, [Boateng et al. \(2018\)](#) used a similar approach.
5. Econometrics literature also establishes that GMM is robust with respect to heteroskedasticity and non-normality of data (e.g. [Antoniou et al., 2008](#))
6. In using these two variables, we take note of the view of [Leon \(2014\)](#) that although the two variables are measures used to capture competition, they may not give the same interpretation that is, do not give the same inferences.

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(The Appendix follows overleaf)

Appendix 1

The countries and sample banks in each country for the study are as below

S/N	Country	Sample no.
1.	Botswana	3
2.	Burkina Faso	1
3.	Cote d'Ivoire	4
4.	Egypt	7
5.	Gambia	1
6.	Ghana	5
7.	Kenya	7
8.	Libya	1
9.	Malawi	3
10.	Morocco	5
11.	Mozambique	1
12.	Namibia	1
13.	Niger	1
14.	Nigeria	8
15.	Republic of Benin	1
16.	Rwanda	2
17.	Senegal	1
18.	South Africa	8
19.	Sudan	1
20.	Tanzania	4
21.	Tunisia	8
22.	Uganda	2
23.	Zambia	1
24.	Zimbabwe	3

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