




“How does the central bank recapitalization policy affect competition in commercial banks of Sub-Saharan Africa?”

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HOW DOES THE CENTRAL BANK RECAPITALIZATION POLICY AFFECT COMPETITION IN COMMERCIAL BANKS OF SUB-SAHARAN AFRICA?

Abstract

In the last two decades, central banks in Sub-Saharan African (SSA) countries have witnessed a trend of the recapitalization policy for commercial banks, and many more are bracing up to undertake the same reform. This has raised debates on whether and how it affects the competitiveness of commercial banks. Nevertheless, empirical evidence remains sparse and inclusive, especially for SSA countries. It is on this premise that this study, therefore, investigates competition in commercial banks before and after recapitalization for six selected SSA countries. The study employs the Panzar-Rosse model to analyze bank-level and macroeconomic indicators between 2000 and 2015. The results show that the H-statistic increased from -0.15, -0.28 and -0.82 before capitalization to 0.94, 0.97 and 0.7 after recapitalization for the first, second and third estimations respectively. This showed that bank competition is higher for the period after recapitalization than the period before recapitalization. The study, therefore, concludes that bank recapitalization could be necessary, especially for countries with low minimum paid-up capital. It is to the extent that banks can now be self-reliant with a higher capacity to invest, as this will significantly improve competition in commercial banks' services.

Keywords

central bank recapitalization policy, competition, Panzar-Rosse, Africa

JEL Classification

E58, G21, G32

INTRODUCTION

The limitations of commercial banks in withstanding shocks and consequent increase in banks' bankruptcy led to the recommendation for recapitalization in the Global Banking Regulatory Framework (GBRF) of December 2010 Basel III. Proponents of recapitalization posit that it enhances a stable capital adequacy ratio, accelerates consolidation, improves economies of scale, increases international competitiveness, global integration, prevention of bank failures and overall financial sector development (Soludo, 2004; Adegbaaju & Olokoyo, 2008; Biekpe, 2011; Nwosu et al., 2012). On the other hand, recapitalization increases capital requirements, constrains new entrants, breeds unhealthy rivalry among banks, and increases the likelihood of recklessness in risk-taking amongst others (Claessens et al., 2010; Sanusi, 2012). Therefore, despite the recapitalization recommendation in the GBRF, its consequences on competition may not be pre-determined, which is the motivation for this study.

The role of competition on commercial banks' behaviors in the financial ecosystem is critical because it results in reallocation and redistribution of market shares of the products, and disequilibrium of market power. Hence, the concept of bank competition is of great importance,



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since the study of market competition can help understand the social welfare implications of changes in the banking sector (Shaffer, 2004; Mirzaei & Moore, 2014). Moreover, ascertaining the degree of competition in the financial industry can improve the production efficiency of financial services, the quality of financial products and leapfrogging innovation in the sector (Burlamaqui & Kregel, 2005; Claessens, 2009; Moyo, 2018). A competitive environment, therefore, gives room for new businesses to evolve due to pressure to retain and gain more market shares and allows consumers to continuously enjoy the best possible services at a minimum cost sometimes. A litany of works has been done on commercial banks' behaviors in Sub-Saharan Africa concerning competition, efficiency, risk-taking behaviors, performance, interest rate and strategy. However, studies on recapitalization and commercial banks behaviors are almost not in existence from the literature.

1. LITERATURE REVIEW

1.1. Relationship between capital and competition

There exist three significant schools of thought that debate the relationship between increased capital requirements and the competitive conduct of firms. They are the optimistic, pessimistic and substitutive perspectives. The optimistic school of thought posits that an increase in capital increases competition. Predominant amongst them is Karl Marx theory on competition. Marx opines that "competition is the result of the self-expansion of capital and is related not only to the circulation of commodities but also to production, realization and distribution of surplus value" (Wemler, 1982). It implies that an increase in capital increases competition. Similarly, the works of Cornett and Tehranian (1994), Laderman (1994), and Wagster (1996) observed positive relationships between capital requirements and market share prices of banks in the US, Germany, Switzerland, and Netherlands.

However, there exist substitutive views such as Modigliani and Miller (1958) who pioneered the financing strategies of a firm. Modigliani and Miller (1958, 1963) studied the impact of capital structure on firm value creation and showed that capital structure does not affect firm value. Pessimistic views such as Amel et al. (2004) opined that commercial banks operating beyond a specific size have higher operating costs and operate beyond the lowest average cost, introducing inefficiencies and instability that reduce competition in the market. Similarly, the findings of Berger and Mester (1997) and Amel et al. (2004) revealed that too big banks are more inefficient

and unstable corroborating the work of Berger et al. (1993), which found that most efficient banks have a substantial cost and competitive advantages over those with average or below-average efficiency. That is, huge banks are unstable and uncompetitive. The pessimists believe that capital buildup and concentration reduce competition with attendant consequences of driving up banking costs and stifling financial inclusion. By extension, they claimed that high regulatory capital requirements could impose entry barriers for new entries, and this would restrict competition and encourage market power by existing banks (Berger et al., 1993).

1.2. Measures of competition

Bikker and Haaf (2002) and Bikker (2004), and Bikker et al. (2012) identified two measures of competition in the literature to include structural and nonstructural methods. The structural method measures competition in terms of market concentrations. Concentration measures the number of banks (fewness) and distribution of banks size (inequality) in a geographical location. The ratio is the index of concentration, and this is the cornerstone of the structural method. According to Bikker and Haaf (2002) concentration ratios include: the bank Concentration Ratio (CR), the Herfindahl-Hirschman Index (HHI), the Hall-Tideman Index (HTI), the Rosenbluth Index (RI), the Comprehensive Industrial Concentration Index (CCI), the Hannah and Kay Index (HKI), the U Index (U), the multiplicative Hausse Index (HI), the additive Hausse Index (Ha) and the Entropy measure (E). Some of these concentration ratio characteristics are highlighted below. According to Bikker and Haaf (2002), the features of the banking market, the relative impact larger

and smaller banks have on competition, the relative effect of size distribution, and several banks determine the validity of the ratios used.

Concentration ratios generally measure the impact of bank concentration on bank competition. The nonstructural method does not employ a concentration ratio index as a measure of competition. It, instead, measures competition in terms of contestability and not market structure by considering banks as entities, making different decisions. The building blocks include the Lerner Index (1934), the Iwata (1974) model, the Brenham (1982, 1989) model, and the Panzar and Rosse (1977, 1982, 1987) model. These models were developed to address the shortcomings of the theoretical and empirical nature of the structural models. Besides these quantitative approaches, there equally exist qualitative approaches such as consumer confidence and business sentiment surveys. Shaffer (2004) submitted that the Panzar-Rosse model is the preferred and widely used measure of competition in the literature for its data friendliness, estimation techniques and dependable robustness. Mindful of the various methods available for computing concentration/competition, the study adopts the Panzer-Rosse model to ascertain the objective. Competing models such as the Lerner and Boone models could not be employed as controls because it requires other bank-specific data that was not available in the data set. The nature of data that was available only limited the study to dynamic analysis, thereby not exploring the intra-industry analysis at the aggregate level.

1.3. Empirical evidence

Empirical studies on the impact of recapitalization on the competitive conduct behaviors of commercial banks are sparse both in developed and developing economies. However, the literature on bank competition is abundant, especially in developed economies. Recapitalization of banks is not often used as a monetary tool in most economies. Atemnkeng and Nzongang (1999), Chirwa (2001), Kamau and Were (2013), and Mirzaei et al. (2013) employed the SCP to investigate the competition of banks in Cameroon, Malawi, and Kenya. Atemnkeng and Nzongang (1999), Mirzaei et al. (2013), and Chirwa (2001) showed that market power positively and signif-

icantly affects the performance of commercial banks. Similarly, Kamau and Were (2013) used SCP and Data Envelopment Analysis (DEA) to investigate the competition and efficiency conditions of banks. The findings showed that a decrease in concentration enhances market competition and also redistributes profitability shares more evenly.

Hackethal et al. (2008) and Akande and Kwenda (2017) used the Lerner index to assess the competitive behavior of banks in Germany and Sub-Saharan Africa, respectively. Hackethal et al. (2008) revealed that both market power and average revenues declined among the German banks. Meanwhile, Akande and Kwenda (2017) showed that monopolistic competitive market power is driven by capital. Also, Simpasa (2011), Biekpe (2011), Simpasa (2013), and Fosu (2013) employed the Panzer-Rosse model to measure competition in Tanzania, Ghana, Zambia, and the African region, respectively. Simpasa (2011) showed that banks in Tanzania earned their income under oligopolistic conduct conditions. Biekpe (2011) showed that there is evidence of a non-competitive market structure in the Ghanaian banking system. It hinders efficiency in intermediation. Simpasa (2013) opined that Zambian banks earned their revenue under conditions of monopolistic competition. Fosu (2013) showed that banks in African sub-regional markets are characterized as monopolistically competitive. Fosu (2013) further argued that, except for North Africa, African banks exhibit higher competitiveness, compared to other regions. Similar, Mwega (2011) examined the competitiveness and efficiency of the Kenyan financial services sector. The study employed SCP, HHI, PR, Persistence of Profitability (POP), Conjectural Variation and DEA. The findings showed reduced concentration and enhanced competition in the period under review. The results concluded that small banks are the least competitive and most concentrated.

Poshakwale and Qian (2011) studied the impact of financial reforms on the competitiveness and production efficiency of the Egyptian banking sector. The findings showed a positive and significant effect of reforms on competitiveness and production efficiency. Similarly, Zhao and Murinde (2011) investigated the impact of bank

reforms on competition, risk-taking and efficiency in Nigeria. The study employed conjectural variations, and the results show that, as competition increases, excessive risk-taking decreases and efficiency improves. Studies on recapitalization and bank competition in SSA are very scanty and almost nonexistent. Gudmundsson et al. (2013) also investigated the role of capital on bank competition and stability in Kenya. The study employed the Lerner index and the Panzar and Rosse model, and the findings showed a significantly non-linear effect of core capital on the competition. Gudmundsson et al. (2013) noted that an increase in core capital on competition is a “phase impact” reduces competition to a point, then increases. Nwosu et al. (2012) investigated the impact of bank recapitalization on the risk-taking behaviors of commercial banks in Nigeria and showed that an increase in bank capital promotes bank stability. Using Bone Indicator, Amidy and Wilson (2014) investigated the impact of globalization and institutional quality on bank competition on African banks. The results showed that globalization enhances bank competition, given more robust governance structures and institutional quality.

Somoye (2008) showed that recapitalization impact is marginal in Nigeria. While Mullings (2003) and Olweny and Shiphoh (2011) argued that the effects of capital requirements on the stability of banks are overwhelming. Hauner and Peiris (2005), however, showed that bank consolidation impact in Uganda is uncertain. However, Akomea and Adusei (2013) argued that recapitalization encourages high concentration in Ghana. Kukurah et al. (2014) empirically showed that recapitalization does not necessarily translate to excellent bank performance. Also, Seelanatha (2010) studied the competition and performance of Sri Lankan banks, and the findings revealed market power exists in the industry. Mullings (2003) used the Seemingly Unrelated Regression (SUR) model to show that capital requirements are significant determinants in the bank performance of Jamaican banks. Similarly, Rahman (2012) examined the impacts of banking sector reforms in Bangladesh and the study employed CAMELS measures. The findings revealed a mixed result for bank types: local banks failed to achieve satisfactory improvement, but foreign

banks did. There exist several works that examined the competitive conduct behaviors of commercial banks, as in Mugume (2010), Akande and Kwenda (2017), Marete and Kihara (2018), Mongi (2015) and Buchs and Mathisen (2005).

From the above review, it is evident that there are limited empirical works that analyze the relationship between recapitalization and competition. This study contributes to the literature in two main ways: First, it employs the Panzer-Rosse model in a new way to test H-statistics before and after an event, such as bank recapitalization in this case. Second, it analyzes the relationship between bank capitalization and competition for six SSA countries – Ghana, Kenya, Nigeria, South Africa, Sierra Leone, and Uganda. Previous studies concentrated on the gains of consolidation to bank performance, without taking cognizance of counterfactual ex-ante and ex-post events. It is imperative to ascertain the state of competitiveness before and after recapitalization. It is on this premise that this study investigates the effect of recapitalization on bank competition for a panel of six SSA countries.

Aim and hypothesis

The key question the study seeks to address is to investigate the extent to which recapitalization has affected bank competition in SSA. Therefore, the study is aimed at examining the effect of recapitalization on bank competition for a panel of six SSA countries: Nigeria, Ghana, Kenya, South Africa, Uganda, and Sierra Leone. For empirical purposes, the key hypothesis of the study is stated in its null form as:

H_0 : *There is no significant difference in bank competition before and after the recapitalization periods of the selected SSA countries.*

2. METHOD

The study adopts the Panzer-Rosse model to ascertain the objective, which investigates the impact of recapitalization on bank competition in selected Sub-Saharan African countries. The t-test of significance is further used to establish whether there exists a significant difference between the scores before and after recapitalization.

2.1. Model specification

The Panzar-Rosse model is the most widely applied assessment of the competition in the banking literature (Leon, 2015). The Panzar-Rosse model was developed by the conjugal works of John C. Panzar and James N. Rosse Panzar and Rosse (1977) and Panzar and Rosse (1987). They provided a framework for knowing the degrees of competition by classifying the market as follows: monopoly, oligopoly, monopolistic competition and perfect competition with the aid of the H-statistic. The theoretical framework of Panzar-Rosse is based on the long-run income for commercial banks, where the bank’s objective is profit maximization using the constructed “H-statistic” to assess the competitive nature of banking markets and the market power of banks. The H-statistic is the sum of elasticities of input prices subject to the profit-maximizing level of revenue. Building from the works of Bikker and Haaf (2002), Bikker et al. (2012), Mwega (2011), Mlambo and Ncube (2011), and Simpasa (2011) with the assumption of an n-input single-output production function, the P-R equation is thus specified:

$$\ln TR_i = \alpha + \sum_{i=1}^n \beta_i \ln w_i + \sum_{j=1}^j \gamma_j \ln C_j + \varepsilon_i, \quad (1)$$

where TR is total revenue, w_i is the price of the i^{th} input factor, (wherein interest expenditure, price of capital and price of labor represents the input prices), α is the intercept, β and γ are coefficients, C_j is the j^{th} bank-specific control factor on the following assumption that,

$$E(\varepsilon | w_1, \dots, w_n, C_1, \dots, C_j) = 0. \quad (2)$$

Following Bikker et al. (2006), the dependent variable of equation (1) should be (the logarithm of) interest income or total income. That is income in levels rather than scaled with total assets.

The panel model to be estimated is therefore given as:

$$\begin{aligned} Ltotrev_{ij} = & \alpha_0 + \alpha_1 Lintexp_{ij} + \alpha_2 lPriceofkl_{ij} + \\ & + \alpha_3 lpricelabour_{ij} + \alpha_4 Leqtyasst_{ij} + \\ & + \alpha_5 Lnplass_{ij} + \alpha_6 Lassets_{ij} + \alpha_7 gdpgrate_{ij} + \quad (3) \\ & + \alpha_8 inflate_{ij} + \alpha_9 ldeposits_{ij} + \\ & + \alpha_{10} lendrate_{ij} + \alpha_{11} Creditrisk + \varepsilon_i, \end{aligned}$$

where $Ltotrev$ is the log of total revenue, $Lintexp$, $lPriceofkl$ and $lpricelabour$ represents the input prices and are the log of interest expenditure, price of capital and price of labor, respectively. The control variables are the log of equity divided by an asset ($Leqtyasst$), a log of non-performing loans divided by an asset ($Lnplass$), a log of the asset ($Lasset$), GDP growth rate ($gdpgrate$), inflation($inflate$), log of deposits($ldeposits$), lending rate($lendrate$) and Credit risk. Equation (3) was estimated to derive the coefficients of the input prices, which constitutes the input price elasticities.

Competition is, however, ascertained with the H-statistic, which is calculated as the sum of input price elasticities. The H-statistic is therefore given as:

$$H^r = \sum_{i=1}^n \beta_i. \quad (4)$$

Table 1 illuminates the interpretation of the H-statistic.

Table 1. Interpretation of the Panzar-Rosse H-Statistics

Source: Bikker and Haaf (2002).

Value of H-Statistic	Industry Structure Type
$H \leq 0$	Monopoly
$0 < H < 1$	Monopolistic Competition
$H = 1$	Perfect Competition

Increasing criticism of structural measures of competition has given more popularity to the Panzar-Rosse model, which stands out as a non-structural measure. The popular HHI has been flawed by the fact that its index increases with variance, it is sometimes ambiguous and the problem of entry sensitivity by small banks. Andrade (2017) submits three reasons for which the Panzar-Rosse model has been much more widely used in empirical bank studies: First, the method is simple, transparent and yet sustains its efficiency. Second, data availability becomes much less of a constraint, since data on revenues are more likely to be observable than output prices that are required in competing models. Finally, the non-necessity to define the location of the market a priori suggests that the potential bias induced by the misspecification of market boundaries is avoided.

3. RESULTS

3.1. Data sources and description

The study utilizes panel data for six countries that have recapitalized banks and have at least three years before and after the recapitalization between 2000 and 2015 (time scope of the study). The bank-level data were gotten from Bank focus (formerly Bank Scope), while others were obtained from the International Financial Statistics (IFS) and World Development Indicators (WDI) databases. The bank-level data were limited to the SSA countries that recapitalized and also to the available data in the Bank Scope database. However, the range of the data obtained was

good enough to establish and test the impacts of recapitalization on the competitive behaviors of commercial banks in Sub-Saharan Africa. The data used include both bank indicators such as return on assets, assets, deposits, equity, number of non-performing loans, total loans, credit risk, loan quality, revenue, cost, profitability, operating cost, interest expenditure, non-interest expenditure, price of labor, price of capital and macroeconomic indicators such as GDP growth rate, inflation rate, lending rate.

A descriptive analysis of the data presented in Table 2 shows the summary statistics for the whole period (2000–2015), before recapitalization and after recapitalization. Table 2 further shows

Table 2. Summary statistics of data

Source: Authors' computation from Stata Output.

Description	Overall mean	Mean before recapitalization	Mean after recapitalization	Pr(T > t)
Return on asset (%)	19.46917 (16.86712)	17.54035 (15.43059)	22.28821 (18.61783)	0.1769
Assets (USD)	80255.94 (143374.6)	37006.59 (84652.51)	143466.5 (184184)	0.0002***
Deposits (USD)	59712.07 (106357.4)	27578.62 (63844.96)	106676.3 (135868.4)	0.0002***
Equity (USD)	9229.172 (17523.61)	2564.607 (5261.61)	18969.69 (23725.41)	0.0000***
Number of Non-Performing loans	1304.26 (2255.9)	569.1735 (1001.664)	2378.616 (3041.213)	0.0001***
Total loans (USD)	47311.19 (91119.47)	22854.68 (58133.77)	83055.31 (116482.1)	0.0012***
Gross Domestic Product growth rate (%)	5.889688 (4.907622)	6.212982 (5.424049)	5.417179 (4.058289)	0.4381
Inflation rate (%)	9.418854 (7.569918)	10.21474 (7.05092)	8.255641 (8.225291)	0.2148
Lending rate (%)	19.42031 (5.618832)	20.4714 (5.81438)	17.8841 (5.002807)	0.0259**
Credit risk indicator	0.5842163 (1.135424)	0.4783276 (0.1581948)	0.7389768 (1.773327)	0.2716
Loan quality indicator	0.0649238 (0.0579723)	0.0606337 (0.0519336)	0.0711939 (0.0660253)	0.3835
Revenue (USD)	6745.895 (15817.44)	4897.654 (17007.31)	9447.171 (13660.32)	0.1675
Cost (USD)	3133.611 (6201.969)	1118.826 (2364.146)	6078.296 (8540.256)	0.0001***
Profitability (USD)	1227.542 (2328.918)	665.2467 (1461.77)	2049.357 (3040.28)	0.0037***
Operating cost (USD)	1127.985 (2797.771)	244.3181 (1037.61)	2419.498 (3885.74)	0.0001***
Interest expenditure (USD)	2948.151 (6101.857)	1542.11 (4063.337)	5003.134 (7839.041)	0.0057***
Non-interest expenditure (USD)	2434.368 (5740.932)	881.5796 (1957.678)	4703.829 (8236.815)	0.0011***
Price of labor (ratio of operating expense to total assets)	0.0403877 (0.1032121)	0.0336684 (0.0802321)	0.0502084 (0.1303025)	0.4435
Price of capital (ratio of operating expense to fixed assets)	14.46661 (24.49712)	12.06606 (25.11745)	17.97511 (23.43645)	0.2478

Note: * p < 0.10, ** p < 0.05, *** p < 0.01. Standard deviation values are in parentheses.

the probability values of the t-test of the significance of variables before and after recapitalization. As expected, all of the bank-level indicators increased significantly after recapitalization, except return on assets, revenue, credit risk, loan quality, price of labor and price of capital that equally increased but not significantly. However, the macroeconomic indicators had no significant difference before and after recapitalization. It is worth noting that mean cost and profitability for the period after recapitalization increased by 450% and 200%, respectively, when compared to the period before.

Country specific summary statistics for the six countries across key variables employed is illustrated in Appendix A.

3.2. Presentation of panel unit results

The Fisher-type panel unit root test was performed for the variables that were employed in the panel regression to estimate the Panzar-Rosse H-statistic. The null hypothesis of this test is that all variables contain a unit root. All variables were stationary at level with drift, while variables such as GDP growth rate, price of labor and credit risk

were equally stationary at level with the trend as well as without drift or trend. The results therefore established that the variables were mean-reverting and consequently suitable for robust analysis (Table 3).

3.3. Impact of recapitalization on competitiveness of commercial banks in SSA

The study estimated four equations: the first two adopted the revenue as a dependent variable with eleven regressors and then a reduced model with eight regressors. The third equation employed return on assets (ROA) as a dependent variable for the full model with eleven regressors. The first three equations employed the Panzer-Rosse model to estimate the level of competitiveness before and after bank recapitalization (wherein a Hausman specification test was done, and the results suggested that random and not fixed-effect model be used). The fourth equation simply runs a pooled regression combining both periods but employs interactive dummies for the three key indicators; log of interest expense, price of capital and price of labor and used revenue as a dependent variable. It

Table 3. Panel unit root results

Source: Authors' computation from Stata Output.

Description	With trend	With drift	No trend & No drift	Order of Integration
ltotrevass	1.3108 (0.9006)	-3.0157 (0.0024)***	0.6477 (0.7392)	At level
Leqtyasst	0.9100 (0.8154)	-1.8784 (0.0345)**	1.8991 (0.9670)	At level
Lnplass	1.3877 (0.9129)	-4.1282 (0.0001)***	-0.8248 (0.2076)	At level
Lassets	1.8012 (0.9597)	-0.1887 0.0425**	3.2681 (0.9988)	At level
gdpgrate	-3.3892 (0.0009)***	5.1630 (0.0000)***	-2.3435 (0.0125)**	At level
inflation	0.1263 (0.5499)	-5.1762 (0.0000)***	-2.7353 (0.0049)***	At level
ldeposits	-0.9270 0.1802	-0.9270 (0.0180)**	3.1433 (0.9983)	At level
lpricelabour	-9.3900 (0.0000)***	-6.3825 (0.0000)***	-9.4254 (0.0000)***	At level
lendrate	-0.4488 (0.3282)	-3.9218 (0.0002)***	-0.4538 (0.3264)	At level
Credit risk	-6.9362 (0.0000)***	-9.3416 (0.0000)***	-8.0224 (0.0000)***	At level
Lintexp	0.8736 (0.8058)	-3.1660 (0.0016)***	0.4573 (0.6748)	At level
lPriceofkl	0.8764 (0.8065)	-3.3557 (0.0010)***	0.1954 (0.5769)	At level

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Probability values are in parentheses.

serves as a robustness check to confirm the results of the Panzer-Rosse model with different proxies for the dependent variable used.

Overall R square is high for all regressions as they are all greater than 0.83, showing that the explanatory variables represent at least 83% of the dependent variable – total revenue or ROA. The probability chi-square for all four regressions is 0.0000, which implies that the overall models for all estimations are significant at the 1% significant level. To test for the long-run equilibrium condition, the Wald test was carried out. The result of the Wald test before recapitalization indicated that the Wald chi-square was equal to 387.40 and after recapitalization the Wald chi-square was 180.38. The probability of Wald chi-square ($\text{Prob} > \text{chi-square} = 0.0000$) for both periods is highly significant, indicating that commercial banks in the selected Sub-Saharan Africa market are in the long-run equilibrium. This also validates the condition for the employment of the Panzar-Rosse model to test for competitiveness in the banking industry.

The study employed the Arellano-Bond tests for first-order and second-order serial correlation tests in the residuals and the Sargan test of over-identifying restrictions to ascertain the validity of the instrument. The results suggest that the null hypothesis of no second-order serial correlation cannot be rejected, hence the instruments are valid. And the null hypothesis that there is no first-order serial correlation in the error term can be rejected at a 5% level of significance, suggesting that the test for second-order serial correlation in the regressions are reliable.

Meanwhile, Table 4 shows that price of capital, price of labor, log of equity divided by asset, the log of non-performing loans divided by asset, the log of deposit and lending rate are significant determinants of total revenue and ROA in all three estimations for the period before recapitalization. Though the third estimation differs slightly in that the log of interest expenses is also a significant determinant of ROA, while the lending rate is not.

On the other hand, the log of interest expense and the log of equity on the total asset are significant determinants of the log of total revenue in the first equation. The log of interest expense, price of la-

bor, the log of equity on the total asset and inflation rate are significant determinants of the log of total revenue in the second equation and then log of interest expense. The lending rate is a significant determinant of the log of ROA in the third equation.

The last column in Table 4 combines both periods and shows that price of capital, price of labor, the log of equity divided by asset, the log of deposit and credit risk are significant determinants of total revenue. Noteworthy is the fact that the three interactive dummies introduced in this last equation are not significant at a 5% significant level, given that their probability values are all less than 0.05.

H-statistic, which is the sum of the three critical inputs as specified above, suggests that competition improves after recapitalization as evident in all three estimations. H-statistic was -0.15 , -0.28 and -0.82 before capitalization and then 0.94 , 0.97 and 0.7 after recapitalization for the first, second and third estimations, respectively. Recall that when H-statistic is 1, it is said to represent perfect competition, $0 < \text{H-statistic} < 1$ represents monopolistic competition and $\text{H-statistic} < 0$ represents monopoly power. It, therefore, suggests that the banking industry moved from a monopoly power before bank recapitalization to a monopolistic competition after bank recapitalization.

4. DISCUSSION

This result was surprising at face value because it is expected that recapitalization should lead to mergers and then to fewer banks with more significant market share and consequently steeper barriers to entry, which are characteristics of anti-competition. However, it is noted that the positive relationship between the increase in capital and the increase in competition has been established by the Marx theory of competition and capital structure. It is further posited that recapitalization could increase competition due to three reasons. The first point is validated by the major criticism of the Herfindahl-Hirschman Index (HHI) as against the Panzer-Rosse model. Roberts (2014) and DeVany and Kim (2003) posit that HHI erroneously assumes market share direct-

Table 4. Panzar-Rosse estimation results for competition

Source: Authors' computation from Stata Output.

Variables	Equation 1 with revenue as a dependent variable		Equation 2 with revenue as a dependent variable		Equation 3 with ROA as the dependent variable		Equation 4 with interactive dummies
	Before recapitalization	After recapitalization	Before recapitalization	After recapitalization	Before recapitalization	After recapitalization	
lintexp	-0.09 (0.20)	0.86*** (0.16)	-0.20 (0.18)	0.88*** (0.13)	-0.67* (0.36)	0.57* (0.30)	0.02 (0.18)
lpriceofkl	-0.44*** (0.06)	-0.07 (0.08)	-0.42*** (0.06)	-0.08 (0.06)	-0.74*** (0.10)	-0.06 (0.15)	-0.46*** (0.09)
lpriceoflabour	0.38*** (0.07)	0.15 (0.09)	0.34*** (0.06)	0.17** (0.07)	0.59*** (0.12)	0.19 (0.17)	0.31*** (0.11)
lnplass	0.59*** (0.14)	-0.07 (0.25)	0.53*** (0.14)	-0.18 (0.18)	0.61** (0.25)	-0.18 (0.49)	0.32 (0.25)
leqtyass	1.26*** (0.37)	0.83** (0.33)	1.14*** (0.38)	0.58*** (0.21)	3.77*** (0.72)	0.86 (0.66)	1.49*** (0.45)
lloanass	-1.05 (0.87)	-0.02 (0.28)	-	-	0.45 (1.57)	0.66 (0.56)	0.25 (0.37)
gdpgрте	-0.01 (0.01)	0.01 (0.03)	-0.01 (0.02)	0.01 (0.03)	-0.01 (0.03)	-0.02 (0.06)	0.01 (0.03)
inflr	0.01 (0.02)	-0.03 (0.02)	0.01 (0.02)	-0.03* (0.02)	0.02 (0.03)	-0.03 (0.03)	0.02 (0.02)
ldeposits	1.26*** (0.26)	0.22 (0.18)	1.49*** (0.25)	0.15 (0.16)	1.48*** (0.47)	0.53 (0.34)	0.66*** (0.23)
lendinrate	-0.05** (0.02)	0.00 (0.05)	-	-	-0.07 (0.04)	0.23** (0.10)	-0.02 (0.05)
credrisk	1.58 (2.88)	-0.12 (0.14)	-	-	-0.61 (5.19)	-0.27 (0.26)	-0.51** (0.21)
l.dummy lintexp	-	-	-	-	-	-	-0.12 (0.10)
l.dummy lpriceofkl	-	-	-	-	-	-	0.14 (0.10)
l.dummy lpriceoflabour	-	-	-	-	-	-	0.10 (0.10)
Constant	2.63 (2.75)	1.95 (2.18)	0.99 (1.27)	1.65 (1.30)	9.14* (4.96)	-7.98* (4.20)	3.60 (2.31)
Observations	57	39	57	39	55	37	92
Within R2	0.7354	0.7315	0.6722	0.7274	0.3198	0.1533	0.1346
Between R2	0.9955	0.9877	0.9955	0.9852	0.9711	0.8746	0.9016
Overall R2	0.9732	0.9552	0.9668	0.9534	0.8740	0.8348	0.7860
Prob > chi2 or Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
H-Statistic	-0.15	0.94	-0.28	0.97	-0.82	0.7	

Note: H-statistic is calculated by summing up the three input price elasticities in each case. Standard errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.

ly translates to market power and ignores bank behavior. Furthermore, Mason (1939) and Bain (1956) opined that the more concentrated an industry is, the easier it is for firms to operate in an uncompetitive manner and so the structure, conduct and performance of firms in a given market reflect market concentration. More so, the use of the Panzer-Rosse model ascertains competition via firm behavior by measuring the transmission of input prices on firms' revenues. According to Panzer and Rosse, therefore, the results show that competition has increased after recapitalization because the increase in total revenue is now induced by higher input prices.

This leads us to the second justification, which is that recapitalization increased the capital base of banks (rise in paid-up capital) and therefore the capacity to invest. It means that they now have more potential to take more risk (as shown in the summary statistics) to invest in inputs if the output (revenue) must increase. This is empirically supported by Gudmundsson et al. (2013) who investigated the role of capital on bank competition and stability in the Kenyan banking industry from 2000 to 2011. The study employed the Lerner index and the Panzar and Rosse H- statistic to show that an increase in core capital reduces competition up to a point. Then competition increases, implying that the benefits of raising capital requirements on competitiveness start to be realized once consolidation in the banking sector starts to take place.

Finally, it is on why some SSA countries recapitalized. To minimize concentration on government funds in banks, which are "cheap funds", and allow banks to run as complete private institutions

that have the potential to do the real business of banking, real sector support and core intermediation business. It is therefore expected that when banks divest from their concentrated public funds' holdings with less dependent on government patronage, arising from the sufficient private investments, then competition inherent in private-sector machinery will be forced to unleash and manifest. It is, therefore, on this premise that it has been submitted that bank recapitalization in the selected Sub-Saharan African countries improved competition.

Recapitalization will act as a built-in stabilizer and shock absorber, which will make banks self-reliant on government funds and higher capacity to invest. These will translate into a menu of service options for banks customers, which underscores the improved competition in the financial ecosystem. It is however important to note that these effects may be country-specific and economies considering recapitalization, require an empirical appraisal and not just follow the band-wagon effect. In addition, it is important to submit that high concentration may not always mean low competition and high profit due to a collusion problem or if there are natural monopolies. Demsetz (1968) shows that the existence of natural monopolies does not imply monopoly price and output due to an elastic supply of potential bidders and prohibitive collusion costs. Further studies could therefore analyze margins within the banking industry to see if high margins are linked to bigger companies within the context of recapitalization. This is because if higher margins are linked only to bigger companies then Demsetz's argument holds.

CONCLUSION

Theoretically, increased capital should improve capacity to invest, take risks and manage loans, as well as minimize the probability of failure as the banks become 'too big to fail'. Empirically, however, the few studies that exist provide contrasting results on how recapitalization affects bank competition. The purpose of this study is to provide empirical evidence on the extent to which recapitalization affects competition with a particular interest in SSA economies. With the aid of the P-R model, the results show that competition after bank recapitalization was much better than the period before it. Therefore, banks' competitive behavioral conduct improves after recapitalization. The regression results further show that price of capital, price of labor, log of equity divided by asset, the log of non-performing loans divided by asset, the log of deposit and lending rate are significant determinants of total revenue and ROA in all three estimations for the period before recapitalization.

The study, therefore, concludes that there is a high correlation between bank recapitalization and the improvement in the competition of selected African countries. So, this study agrees with the optimistic proponents' perspectives. Though bank recapitalization leads to Mergers & Acquisitions by forcing some banks to merge or be bought over, which may lead to loss of jobs and the fall of concentration of banks. The fundamental idea for perfect competition is that price should equal marginal cost, and the P-R model examines the transmission of prices. Therefore, the study infers that bank recapitalization increases the rate at which banks adjust prices towards the marginal cost. Hence, there is a need for bank recapitalization, especially wherein the prevailing capital requirements are low. Nevertheless, it is also important to note that some literature such as Covarrubias et al. (2019) argue that there exists good concentration (driven by tougher price competition, intangible investment, and increasing productivity of leaders) and bad concentration (caused by increasing barriers to entry and characterized by lower investment, higher prices and lower productivity growth). It is therefore also important to x-ray which concentration an economy is experiencing as good concentration breeds development.

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APPENDIX A

Table A1. Years of recapitalization and respective new minimum bank capital

No.	Country	Year of recapitalization	New bank minimum capital
1	Nigeria	2005	₦25 billion a
2	Ghana	2011	GH¢ 60 million
3	Kenya	2013	KES 1 billion
4	South Africa	2008	250 million Rands
5	Uganda	2012	UGX: 10 billion
6	Sierra Leone	2008	Le 9billion

Table A2. Summary statistics of variables employed for selected countries

Description	Nigeria	Ghana	Kenya	South Africa	Uganda	Sierra Leone
Revenue (USD)	5,805.78 (4,066.37)	804.56 (889.50)	922.35 (758.48)	32,355.94 (26,510.29)	540.48 (720.31)	46.26 (89.77)
Return on Assets (USD)	28.46 (18.52)	20.15 (17.61)	24.46 (15.67)	26.79 (12.8)	16.86 (12.68)	0.09 (0.15)
Equity (USD)	9,818.25 (7,364.6)	7,869.24 (17,011.67)	1,492.99 (1,254.19)	33,810.98 (26,997.3)	2,324.27 (4,413.36)	59.31 (37.78)
GDP growth rate	7.54 (7.26)	6.26 (2.7)	4.36 (2.39)	3.29 (1.77)	6.51 (2.21)	7.39 (7.93)
Total loan (USD)	30,524.27 (24,223.04)	21,988.73 (54,333.29)	6,527.41 (4,606.97)	222,164.3 (95,531.41)	2,503.66 (3,747.37)	158.78 (93.27)
Cost (USD)	3,764.16 (2,669.23)	588.12 (797.84)	478.01 (383.54)	13,082.72 (9,864.33)	833.72 (1,480.9)	54.93 (86.16)
Profitability (USD)	1,407.89 (1,228.34)	359.76 (665.25)	372.67 (347.79)	5,538.83 (2,410.32)	-331.78 (932.48)	17.86 (36.27)
Assets (USD)	69,228.27 (51,404.77)	46,320.37 (116,325.3)	11,019.8 (8,028.9)	347,512.7 (136,651.9)	6,927.05 (10,112.02)	527.5 (288.4)
Liquidity (USD)	0.56 (0.12)	1.44 (3.46)	0.76 (0.06)	0.9 (0.2)	0.6 (0.14)	0.46 (0.1)
Non-interest p (USD)	1,933.45 (1,392.63)	518.95 (1,098.07)	337.6 (221.2)	11,636.35 (9,725.37)	156.52 (173.04)	23.29 (40.56)

Table A2 (cont.). Summary statistics of variables employed for selected countries

Description	Nigeria	Ghana	Kenya	South Africa	Uganda	Sierra Leone
Operating expenditure	6,275.59 (3,925.09)	397.92 (354.24)	10.96 (4.29)	82.7 (23.9)	0.43 (0.24)	0.26 (0.19)
Price of labor	0.15 (0.21)	0.09 (0.06)	0.001 (0.001)	0.0003 (0.0001)	0.00015 (0.00008)	0.0007 (0.0007)
Inflation rate	11.54 (3.81)	16.1 (6.8)	9.73 (5.55)	5.79 (2.29)	7.25 (5.02)	6.1 (12.5)
Deposits	52,323.44 (37,848.31)	36,836.74 (93,037.96)	8,779.48 (6,314.4)	256,295.5 (98,909.6)	3,698.12 (4,328.53)	339.1 (185.7)
Lending rate	18.47 (2.72)	26.82 (4.65)	16.08 (2.8)	11.67 (2.53)	21.17 (2.016)	22.3 (2.22)
Credit risk	0.42 (0.09)	1.13 (2.77)	0.6 (0.03)	0.63 (0.16)	0.43 (0.1)	0.29 (0.062)
Number of Non-Performing loans	1,775.29 (1,003.8)	594.39 (1,233.9)	332.69 (64.27)	5,049.96 (3,084.96)	49.42 (59.89)	23.79 (24.47)

Note: Standard deviation values are in parentheses.