Bank Profitability and Capital Regulation: Evidence from Listed and non-Listed Banks in Africa

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Abstract

This study investigates the determinants of African bank profitability while controlling for bank capital regulation. Using static and dynamic panel estimation techniques, the findings indicate that that bank size, total regulatory capital and loan loss provisions are significant determinants of the return on assets of listed banks compared to non-listed banks. Also, regulatory capital has a more significant (and positive) impact on the return on assets of listed banks than non-listed banks particularly when listed banks have sufficient regulatory capital ratio. We also find that higher regulatory thresholds have a negative impact on the return on asset of non-listed banks.

JEL Code: E44, G21.

Keywords: Bank profitability; Africa; Listed Banks; Panel Regression, Capital Regulation; GMM dynamic panel

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1 Introduction

The determinants of bank profitability are well examined and show that bank profitability is driven by both bank-specific and external factors (Molyneux and Thornton, 1992; Staikouras and Wood, 2003; Goddard et al., 2004; Pasiouras and Kosmidou, 2007; Athanasoglou et al., 2008). This paper re-examines the determinants of bank profitability, introducing regulatory capital ratio as an explanatory variable. Recently, bank regulators require banks to set aside sufficient risk-capital as a cushion to absorb unexpected losses and other adverse shocks that threaten bank solvency (BCBS, 2004). Accordingly, bank supervisors across African countries require banks to set aside some level of regulatory capital or risk capital for the risk they take, and also require banks to maintain and/or exceed minimum regulatory capital levels to improve the solvency and stability of the banking system. The theoretical literature shows that the objective of bank capital regulation is to maintain capital levels that minimise the risk of bank failures (Berger et al., 1995; Aggarwal and Jacques, 2001). While the impact of regulatory capital requirements on bank failure is clearly understood (Ng and Roychowdhury, 2014), the impact of regulatory capital requirements on bank profitability is not fully understood (Barth et al., 2008; Berger and Bouwman, 2013) particularly for banks in Africa and for banks that have some relation with capital market institutions.

Motivated by this concern, we study the impact of regulatory capital ratio on bank profitability in Africa. This is important given the dearth of research on profitability and regulatory capital requirements of African banks. The focus on African banks is interesting because, compared to the US and Europe, banks across African countries do not have uniform bank capital requirements. To test for the impact of regulatory capital ratios on bank profitability, our study uses minimum capital ratios reported in bank financial statement along with a simple criterion to capture sufficient regulatory capital.

We focus on listed African banks relative to non-listed African banks given that the prior understanding in the theoretical literature demonstrate that capital markets create incentives for bank

managers to report earnings in ways that meet the expectations of capital market participants including investors, investor analysts and shareholders (e.g. Healy and Palepu, 1993). Also, because listed firms (including listed banks) are considered to be more visible to investors, listed firms (including listed banks) are required to disclose large amount of information to meet the needs of various capital market participants in the form of mandatory disclosures and such disclosures may impose cost to banks which may affect bank profitability.

Further still, increased scrutiny of listed banks' regulatory capital ratios along with other disclosures by bank supervisors and securities market regulators, may compel listed banks to disclose more information and keep sufficient regulatory capital even if such requirements may significantly affect bank profitability. In light of these arguments, it is important to investigate the impact that regulatory capital ratios have on bank profitability in the case of Africa and to see if the impact of regulatory capital on bank profitability differ across listed and non-listed banks.

Our study employs a sample of 200 banks across African countries divided into 58 listed African banks and 142 non-listed African banks during the 2004 to 2013 period. In the initial analysis, regulatory capital ratio is introduced as a determinant of bank profitability. Secondly, because African banks do not uniformly adopt the Basel I or II capital accord, in an additional analysis we introduce a simple criterion to test whether African banks with at least 20% total regulatory capital are more profitable than banks that have less than 20% total regulatory capital ratio. This construct is a proxy to capture whether African banks with sufficient regulatory capital ratio are more or less profitable. The findings show that total regulatory capital ratio, loan loss provisions and bank size are significant determinants of the profitability of listed African than non-listed banks. Also, we find that bank return on asset is influenced by regulatory capital thresholds. The main message of this paper is that although total regulatory capital correlates with the profitability of listed African banks than non-listed African banks, there is a regulatory capital threshold beyond which further increases in regulatory capital ratios will have a negative impact on the profitability of listed banks in Africa.

The study contributes to the literature in the following ways. First, this paper contributes to the literature that examines the determinants of bank profitability. Unlike Flamini et al. (2009), Francis

(2013) and Ozili (2015), this paper examines the context of listed and non-listed banks in Africa. Second, this paper contributes to the literature that examines the impact of capital regulation on the profitability and performance of banks (e.g., Naceur and Kandil, 2009). Our findings show that regulatory capital ratios are positively associated with bank profitability, in the context of African banks.

The remainder of this paper is organised as follows. Section 2 reviews the extant literature. Section 3 presents the data, sample selection criteria and methodology. Section 4 presents the empirical results. Section 5 concludes.

2. Literature Review

2.1. Determinants of bank profitability

2.1.1. Theoretical literature

Theoretical models typically document that bank profitability is influenced by both internal and external determinants such as bank loan to asset ratio, bank provisioning policy, capital adequacy, bank size, economic environment, etc. Bourke (1989) argues that, because loans to individual borrowers and firms are risky, banks with welldiversified loan portfolios will have higher liquidity and higher profitability. Miller and Noulas (1997), on the other hand, suggest that banks that loan to individual borrowers and firms in high risk environments will experience decreasing profitability when these loans are unpaid by debtors. Duca and McLaughlin (1990) and Cooper, Jackson, & Patterson (2003) suggest that changes in credit risk reflect the quality of bank loan portfolios, and a decline in the quality of bank loan portfolios affects the performance (and profitability) of banks whose assets consists mainly of loans. Expected changes in the credit risk to bank loan portfolios are also reflected in loan loss provisions while actual or realized credit risk is reflected in non-performing loans.

The impact of capital on bank profitability is ambiguous in the theoretical literature. For instance, Berger (1995) demonstrates that lower bank capital ratios indicate that a bank is risky and faces higher expected cost of financial distress while Molyneux (1993) argues that banks with higher equity capital levels have lower cost of capital which has a positive impact on bank profitability. Bank size reflects potential diseconomies of scale in the banking sector. Akhavein, Berger, & Humphrey (1997) argue that a positive relation between size and profitability is expected if there are significant economies of scale while a negative relation may be expected if increased diversification lowers credit risk and thus lower returns. Eichengreen and Gibson (2001) also argue that an increase in bank size may improve bank profitability up to a certain limit beyond which a negative relationship between bank size and profitability may be expected.

2.1.2. Empirical evidence

The empirical literature has attempted to confirm (or refute) many of the determinants proposed in theoretical models of bank profitability, focusing on both bank-specific and external determinants (Abreu & Mendes, 2001; Athanasoglou et al., 2008; Demirguc-Kunt & Huizinga, 1999; García-Herrero, Gavilá, & Santabárbara, 2009; Goddard et al., 2004; Molyneux & Thornton, 1992; Micco, Panizza, & Yanez, 2007; Naceur & Goaied, 2008; Pasiouras & Kosmidou, 2007; Staikouras & Wood, 2003). Bank managers can influence bank-specific profitability determinants (e.g. loan loss provisions, cost to income ratio, loan to asset ratio, etc.), to achieve some desired level of profitability. External determinants, on the other hand, are variables that are outside the control of bank managers but have some impact on bank profitability in predictable ways such as institutional factors, legal factors, and other macroeconomic factors (Demirguc-Kunt & Huizinga, 2000).

The size of a bank is associated with economies of scale (Athanasoglou et al., 2008). Boyd and Runkle (1993) argue that large firms have economies of scale which lowers the cost of gathering and processing information, and such cost reductions contribute to improved firm profitability. Short (1979), Goddard et al. (2004), and Athanasoglou et al. (2008) find a positive relationship between bank size and bank profitability and conclude that larger banks are more profitable than smaller banks because they are able to raise capital less expensively. Other empirical studies such as Pasiouras and

Kosmidou (2007) who examine 584 commercial banks from 15 EU countries during 1995 to 2001 period, find that larger banks are more profitable than smaller banks. In contrast, Boyd and Runkle (1993) investigate the relationship between bank size and bank performance for US banks during the 1971 to 1990 period, and find a negative relationship between size and return on assets. Micco et al. (2007) control for bank size while investigating the relationship between bank ownership and bank performance in developed and developing countries. They investigate the determinants of bank performance during the 1995 to 2002 period, and find a negative relation between bank size and bank performance measured as return on assets.

Few African studies document evidence for the impact of bank size on bank profitability. For instance, Flamini et al. (2009) investigate the determinants of bank profitability across 41 sub-Saharan African countries during the 1998 to 2006 period, and find a positive relationship between profit and size while Francis (2013) in a similar sub-Saharan study documents a negative relation. Barros and Caporale (2012) show that larger banks have lower cost thus improving bank performance (or profitability) during the 2000–2010 banking consolidation in Nigeria. Ozili (2015) examines the determinants of bank profitability during the 2006 to 2013 period, and finds a positive relation between bank size and profitability among Nigerian commercial banks while Naceur (2003) investigates 10 banks in Tunisia during the 1980 to 2000 period, and finds a negative relationship between bank size and profitability. Taken together, the impact of bank size on bank profitability is mixed in the literature.

Another determinant of bank profitability is asset quality. Existing studies use two proxies for bank asset quality: non-performing loans and loan loss provisions (e.g. Bolt, De Haan, Hoeberichts, Van Oordt, & Swank, 2012; Dietrich & Wanzenried, 2011; Ozili, 2015; Vong & Chan, 2009). Non-performing loans or problem loans are bank loans that materialize as losses or are in the process of doing so. When loan loss materializes, banks lose the interest income associated with that loan category and the loss is written-off and charged against bank profit in the income statement, lowering bank profit. Higher non-performing loans or loan losses will further decrease bank profit. Bolt et al. (2012) show that loan losses and costs are negatively associated with bank profitability during

recessionary periods. Loan loss provision is another proxy for asset quality and is considered to have some impact on bank profitability. Vong and Chan (2009), Dietrich and Wanzenried (2011) and Ozili (2015) argue that banks operating in environments with declining credit quality will report higher loan loss provisions, and higher loan loss provisions will reduce bank net interest income and overall profitability. Consistent with this argument, Vong and Chan (2009) examine the determinants of profitability among banks in Macao from 1993 to 2007, and find a significant negative relationship between loan loss provisions and bank profitability. Similarly, Dietrich and Wanzenried (2011) investigate 372 commercial banks in Switzerland over the period from 1999 to 2009, and find a significant negative relation between loan loss provisions and bank profitability. Ongore and Kusa (2013) also find a negative and significant relation between bank profitability and asset quality for commercial banks in Kenya while Ozili (2015) documents a negative but insignificant relation between return on assets and loan loss provisions for Nigerian commercial banks.

Bank loans are the largest component of bank total assets and generate substantial interest income to banks. Provided that bank loans are well-diversified, banks with higher loan to asset ratios should have higher profit levels; hence, a positive relation is expected (Abreu & Mendes, 2001). Consistent with this argument, Abreu and Mendes (2001) examine the profitability of some European banks during the 1986 to 1999 period, and find a positive relation between loan to asset ratio and bank profitability in Portugal, Spain, France and Germany. Staikouras and Wood (2003) examine the performance of banks in 13 European countries and observe an inverse relation between loan to asset ratio and profitability while Vong and Chan (2009) also find a negative relation between loan to asset ratio and profitability for Chinese banks. To date, the empirical literature documents mixed conclusions on the relationship between loan to asset ratio and bank profitability.

Bank profitability is expected to be positively correlated with economic cycle fluctuations (Bolt et al., 2012). During economic upturns, the probability of default on bank loans is relatively low. The low probability of loan default often associated with good economic periods leads to higher interest income and improved bank profitability because borrowers face favorable economic conditions that allow them to easily repay bank loans when they are due. During economic downturns, the probability

of default on bank loans is relatively high and interest income to the loan portfolio is low because bank debtors may find it difficult to repay the interest and principal; hence, a positive relationship between bank profitability and macroeconomic fluctuations is expected. For instance, Bikker and Hu (2002) examine cyclical patterns in bank profitability from OECD countries during the 1979 to 1999 period, and find a positive correlation between bank profitability and the economic cycle. Demirgüç-Kunt and Huizinga (1999) find similar evidence. Two sub-Saharan African studies provide conflicting evidence. Flamini et al. (2009) find a positive relation between bank profitability and gross domestic product while Francis (2013) documents a negative relation. In a country-specific African study, Ozili (2015) finds a negative relationship between the state of the business cycle and bank profitability. Amuakwa-Mensah and Marbuah (2015) find a negative relation between GDP growth and bank profitability measured as net interest margin.

2.2. Bank capital regulation and listed firms

Prior empirical studies document mixed evidence for the impact of capital adequacy on bank profitability (e.g. Angbazo, 1997; Berger, 1995; Bourke, 1989; Goddard et al., 2004; Hassan & Bashir, 2003; Molyneux & Thornton, 1992; Ozili, 2015). The objective of bank capital regulation is to ensure that banks have sufficient capital for the risks they take and to ensure that banks have sufficient risk capital to serve as a cushion to absorb unexpected losses and other adverse shocks that threaten the solvency of a bank (BCBS, 2004). Beltratti and Stulz (2009) posit that banks with sufficient regulatory capital ratios perform better because they have sufficient capital to absorb adverse shocks and/or unexpected losses that would otherwise lower bank profitability and/or performance, particularly, during periods of financial distress. This view is consistent with the positive relation between risk and return in the theoretical literature (e.g. Campbell, 1993; Connor & Korajczyk, 1988; Mandelker, 1974), and predicts that banks that engage in risky activities to increase profitability would keep higher regulatory capital ratios for the risk they take. Thus, banks with higher regulatory capital ratios would be more profitable than banks with lower regulatory capital ratio.

The regulatory capital ratio of listed banks is subject to greater scrutiny because listed banks are more visible to investors and regulators. Listed firms (including banks) are required by stock market

regulators to disclose large amounts of information to meet the needs of various capital market participants and users, compared to non-listed firms (Healy & Papelu, 1993). Such disclosures may impose substantial costs to listed banks and, subsequently, may reduce bank profitability, depending on the size of the bank, needs of stock market participants, extent of compliance with mandatory disclosures requirements, and level of capital market development (Cooke, 1992; Raffournier, 1995). The difficulty in isolating the impact of the costs (or benefits) of disclosure, and the impact of regulatory capital ratios on bank profitability makes listed African banks an interesting and natural setting to investigate profitability determinants of banks whose financial reporting are subject to: (i) greater scrutiny because they are more visible, (ii) greater disclosure requirements and (iii) facing greater scrutiny of minimum regulatory capital ratios in a region considered to have less developed capital markets, weak capital markets incentives and less sophisticated users of financial reports.

3. Data and Methodology

3.1 Data

The sample consists of African banking institutions from 2004 to 2013. Data on banks' financial statements are obtained from the Bankscope database for 18 countries. Data for real gross domestic product growth rate is obtained from World Economic Forum archived in the World Bank database. To be included in the sample, African banks must have all necessary bank-level financial data for the explanatory variables for at least three years and data for the dependent variable for at least seven years. Banks that did not meet these conditions were excluded from the sample. Next, we did not eliminate 2008 bank-year observations to adjust for the impact of the 2008 financial crisis. The countries in the sample include: South Africa, Ghana, Egypt, Tunisia, Morocco, Kenya, Uganda, Zambia, Tanzania, Ethiopia, Togo, Angola, Cameroun, Algeria, Mauritius, Namibia, Botswana and Senegal. The resulting sample yields 200 banking institutions from 18 countries. For the listed and non-listed bank category, the sample consists of 58listed banks and 142 non-listed banks. See Table 1a for a summary of the distribution of banks across Africa.

3.2. Methodology

With regard to bank profitability, an alternative approach would be to adopt the stochastic frontier approach which takes into account profit inefficiencies among banks and also to take into account the low quality of banking data in transition economies (in line with Kumbhakar & Lovell, 2003 and Parmeter & Kumbhakar, 2014). We take an alternative approach to look at how listed bank status impacts profitability of banks meanwhile the stochastic frontier approach requires the specification of the distribution of inefficiency, which some may not be amenable to. Hence, the approach we adopt here can be thought of as a reduced form while a more structural approach would require input and output prices to account for other profit inefficiencies.

To test the determinants of bank profitability, we consider both static and dynamic model specifications:

$$ROA_{i,t} = \beta_1 + \beta_2 LOTA_{i,t} + \beta_3 TRC_{i,t} + \beta_4 NPL_{i,t} + \beta_5 LLP_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 \Delta GDP_{j,t} + e_{i,t}, \quad (1a)$$

$$ROA_{i,t} = \beta_1 + \beta_2 ROA_{i,t-1} + \beta_3 LOTA_{i,t} + \beta_4 TRC_{i,t} + \beta_5 NPL_{i,t} + \beta_6 LLP_{i,t} + \beta_7 SIZE_{i,t} + \beta_8 \Delta GDP_{j,t} + e_{i,t,} \quad (1b)$$

where the subscript i,t represents bank i, located in country j, in year t. ROA is the ratio of pre-tax profit to total assets. SIZE is the natural logarithm of total assets. LLP is the ratio of loan loss provisions to total assets. LOTA is the ratio of net loans to total assets. NPL is the ratio of non-performing loans to gross loans. ΔGDP is change in gross domestic product. TRC is total regulatory capital ratio where total regulatory capital ratio is a sum of Tier 1 and Tier 2 capital.[1]

The above models are a modified version of the cross-sectional model used by Demirguc-Kunt and Huizinga (1999) and Pasiouras and Kosmidou (2007). The dependent variable is return on assets (ROA). Golin (2001) points out that ROA is a common and important ratio to measure bank profitability across the literature. With respect to non-performing loans (NPLs), the expectation is that higher NPLs are associated with lower bank profitability because, when loan losses materialize, banks will lose the interest income associated with the loan category; thus, decreasing bank profit. Hence, a

[1] Tier 1 capital includes shareholders' equity capital and retained earnings while Tier 2 capital is includes revaluation reserves, hybrid capital instruments, subordinated term debt, general loan loss reserves and undisclosed reserves.

negative sign on NPL is expected. Ongore and Kusa (2013) also find a negative relationship between NPL and ROA. With respect to loan to asset ratio (LOTA), we predict a positive relationship between LOTA and ROA. With respect to loan loss provisions (LLP), bank provisions are charged against interest income, and higher loan loss provisions will lower bank net interest income; thus reducing bank operating profit. Hence, a negative relation between bank provisions and profitability is expected. This is consistent with Dietrich and Wanzenried (2011) and Ozili (2015). TRC is total regulatory capital ratio that banks have to set aside for the risks they take and to absorb loss. If the regulatory capital ratio of banks is commensurate with the risk banks face, higher TRC will be associated with higher profitability due to the positive relation between risk and return; hence, a positive relationship between TRC and ROA is expected. With respect to bank size (SIZE), larger banks have economies of scale advantages and thus should be more profitable compared to smaller banks; hence, a positive relationship between SIZE and ROA is predicted. Consistent with prior studies, bank size is measured as the natural logarithm of bank total assets. ΔGDP control for economic cycle fluctuations, and is consistent with Demirgüç-Kunt and Huizinga (1999) and Flamini et al (2009). A positive relationship between ΔGDP and profitability is expected. In the current study, we use change in gross domestic product to control for economic cycle fluctuations to detect whether economic cycle fluctuations are significantly associated or correlated with bank profitability.

To compare profitability determinants across listed banks and non-listed banks, the LISTED dummy variable is introduced into the model in equation (2). LISTED takes the value of one if the bank is listed and zero if the bank is non-listed. The interaction between LISTED and the bank-level determinants are the variables of interest. The expanded model is given as:

$$ROA_{i,t} = \beta_1 + \beta_2 LOTA_{i,t} + \beta_3 TRC_{i,t} + \beta_4 NPL_{i,t} + \beta_5 LLP_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 \Delta GDP_{j,t} + \beta_8 LISTED + \beta_9 LISTED*SIZE_{i,t} + \beta_{10} LISTED*LOTA_{i,t} + \beta_{11} LISTED*TRC_{i,t} + \beta_{12} LISTED*NPL_{i,t} + \beta_{13} LISTED*LLP_{i,t} + e_{i,t}. \quad (2a)$$

$$ROA_{i,t} = \beta_1 + \beta_2 ROA_{i,t-1} + \beta_3 LOTA_{i,t} + \beta_4 TRC_{i,t} + \beta_5 NPL_{i,t} + \beta_6 LLP_{i,t} + \beta_7 SIZE_{i,t} + \beta_8 \Delta GDP_{j,t} + \beta_9 LISTED + \beta_{10} LISTED*SIZE_{i,t} + \beta_{11} LISTED*LOTA_{i,t} + \beta_{12} LISTED*TRC_{i,t} + \beta_{13} LISTED*NPL_{i,t} + \beta_{14} LISTED*LLP_{i,t} + e_{i,t}. \quad (2b)$$

Additionally, to discern if there is any effect on profitability due to sufficient regulatory capital, banks with at least 20% regulatory capital ratio are considered to have sufficient regulatory capital while banks with less than 20% regulatory capital ratio are considered to have weak regulatory capital ratio.

To determine the regulatory capital threshold, we use insight from theory. In theory, higher regulatory capital ratios reduce banks' ability to increase return on assets and return on equity although it helps banks to remain solvent in the face of unexpected losses that threatens the solvency of banks. On the other hand, lower regulatory capital ratios allow banks to increase return on assets and return on equity although it increases the insolvency risk of banks. Hence, we predict some regulatory capital thresholds – 10, 15, 20, 25 and 30% thresholds – and use a 20% regulatory capital threshold, as an attempt to find a regulatory capital threshold that is not too high and not too low. Also, to further justify the choice of 20% regulatory capital threshold, we further base our choice of regulatory capital threshold on country-level 'bank regulatory capital to risk-weighted assets' for some selected African countries. We use the 10 African countries that have full country-level data for bank regulatory capital to risk-weighted assets ratio from 2004 to 2014 and take the average of the ratio for each country. This gives us a mean of 20.14% which we round to 20%. (see Appendix A1). Hence, we use the 20% regulatory capital threshold. The RC dummy variable is introduced into the model in (1) and (2), and takes the value one when total regulatory capital (TRC) is at least 20% and zero otherwise, reflecting periods when African banks have sufficient regulatory capital ratio; such that banks with at least 20% regulatory capital ratio have sufficient regulatory capital ratio. The RC dummy variable is interacted with the profitability determinants, and then estimated separately for listed banks and non-listed banks using both static and dynamic estimation. The expanded model for the full sample is given as:

$$ROA_{i,t} = \beta_1 + \beta_2 LOTA_{i,t} + \beta_3 TRC_{i,t} + \beta_4 NPL_{i,t} + \beta_5 LLP_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 \Delta GDP_{j,t} + \beta_8 RC + \beta_9 RC*TRC_{i,t} + \beta_{10} LISTED*RC*TRCi,t \ \beta_{11} RC*LOTA_{i,t} + \beta_{12} RC*SIZE_{i,t} + \beta_{13} RC*LLP_{i,t} + e_{i,t}. \quad (3a)$$

$$ROA_{i,t} = \beta_1 ROA_{i,t-1} \ \beta_2 LOTA_{i,t} + \beta_3 TRC_{i,t} + \beta_4 NPL_{i,t} + \beta_5 LLP_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 \Delta GDP_{j,t} + \beta_8 RC + \beta_9 RC*TRC_{i,t} + \beta_{10} LISTED*RC*TRCi,t \ \beta_{11} RC*LOTA_{i,t} + \beta_{12} RC*SIZE_{i,t} + \beta_{13} RC*LLP_{i,t} + e_{i,t}. \quad (3b)$$

Finally, the static models are estimated using bank and year fixed effect regression estimation while the dynamic model is estimated using first-difference bank and year fixed effects based on Arellano and Bond (1991) Generalized Method of Moments (GMM) first-difference estimator. The GMM estimator takes into account the dynamic adjustment to bank return on assets, that is, the need to use lagged dependent variable in the model to capture the dynamic behavior of ROA; and to control for the endogeneity of the explanatory variable(s) arising from first differencing. For the dynamic estimation, we use simple first-difference GMM based on Arellano and Bond (1991). The first-differenced lagged dependent variable is instrumented with its past levels (lagged values) whereas the other variables are considered as strictly exogenous.5 AR(1) and AR(2) statistics are reported to test for lack of first- and second-order serial correlation in the first differenced residuals. The Sargan test is also reported to test for the absence of correlation between the instruments and the error term.

4. Empirical Results

4.1 Descriptive Statistics

Table 1b provides the summary of the descriptive statistics for the full sample, listed banks and non-listed banks sample for the 2004 to 2013 period. The mean ratio of ROA is 2.4, 2.9 and 2.2% for the full sample, listed banks and non-listed banks, respectively. The higher ROA observed for listed banks indicate that they are more profitable than non-listed banks. On average, the loan to asset ratio (LOTA) for the full sample is 52.73%, and is higher at 56.12%, for listed banks and lower at 50.21% for non-listed banks. This indicates that listed banks in general have higher loan to asset ratios in their balance sheet than non-listed banks. Non-performing loans capture the quality of bank loan portfolio. NPLs are, on average, 7.03% of gross loans, and are lower for listed banks at 7.97% than for non-listed African banks, at 8.53%. The lower NPLs for listed banks suggest that listed banks tend to have better credit quality than non-listed banks. TRC is lower for listed banks and higher for non-listed banks. SIZE is, on average, 14.51 for listed banks and 13.66 for non-listed banks, and indicates that listed banks in Africa are, on average, larger than non-listed banks

[Insert Table 1b here].

4.2. Regression Results

This section presents the results on (i) the determinants of bank profitability (ii) the influence of capital market listing on the determinants of bank and (iii) whether having sufficient capital ratios influence the profitability determinants of banks. Table 2 reports the estimates of models (1) and (2) for the full sample, listed banks sample and non-listed banks sample. For model (1a), the estimated coefficient for LOTA is positive and statistically significant across all three samples. This suggests that loan to asset ratio is a significant determinant of the profitability of listed and non-listed African banks, and implies that African banks with higher loan to asset ratios are more profitable. This is consistent with the findings of Abreu and Mendes (2001) who argue that banks with higher loan banks with higher loan to asset ratio are more profitable if they have a well-diversified loan portfolio. The estimated coefficient for LLP is negative and statistically significant, and indicates that higher loan loss provisions lower the profitability of listed and non-listed African banks. The findings is consistent with Vong and Chan (2009), Dietrich and Wanzenried (2011) and Ozili (2015), implying that higher loan loss provisions lower bank net interest income and lead to decrease in bank profitability. The estimated coefficient for TRC is positive and statistically significant for listed banks, and implies that higher total regulatory capital ratios are associated with higher profitability. However, the estimated coefficient of TRC coefficient is not statistically significant for non-listed banks. The estimated coefficient for SIZE is negative and statistically significant at the 10% level for listed banks but is insignificant for non-listed banks. The estimated coefficient for ΔGDP is positive and statistically significant at the 10% level for non-listed banks but is insignificant for listed banks, and implies that the state of the economy has some impact on the profitability of non-listed banks. Amuakwa-Mensah and Marbuah (2015) finds similar evidence for the relation between ΔGDP and profitability (i.e. net interest margin). One reason for this could be because the profitability and performance of non-listed banks is significantly affected, to a greater extent, by fundamental factors that are correlated with economic fluctuations compared to listed banks whose profitability is more

influenced by capital market incentives. NPL has an estimated coefficient that suggests it does not have a statistically significant effect on bank profitability, regardless of the listed status.

For the estimates from the dynamic model in (1b), presented in Table 2, the estimated coefficient for SIZE is negative and statistically significant for the full sample as well as for listed and non-listed banks. The estimated coefficient for LLP is negative and statistically significant for the full sample and for non-listed banks while the estimated LOTA coefficient is positive and statistically significant for non-listed banks. The remaining variables for the subset of listed banks all have statistically insignificant effects. The insignificant effects for listed banks might be due to the reduced sample size and reduced degrees of freedom. The Sargan test (J-statistic) is low for the listed bank sub-sample and suggests that the static model is more appropriate (Kao & Chiang, 1999). Also, the F-statistic is higher for listed for listed banks than non-listed banks. To summarize, the static and dynamic estimation show that loan to asset ratio (LOTA) and loan loss provisions (LLP) are significant determinants of return on asset (ROA) for non-listed banks while bank size (SIZE) is a main determinant of profitability for listed banks

[Insert Table 2 here]

4.2.1. Interaction Result: listed and non-listed banks

Table 3 reports the estimates for profitability determinants of listed banks compared to non-listed banks. The estimated coefficient for LISTED*SIZE is negative and statistically significant at the 1% level in Column 1, indicating that bank size is a more significant determinant of the profitability for listed banks than for non-listed banks. The estimated coefficient for LISTED*LOTA is positive and insignificant in Column 2. The estimated coefficient for LISTED*TRC is positive and statistically significant at the 1% level in Column 3, indicating that bank regulatory capital ratio is a more significant determinant of the profitability of listed banks compared to non-listed banks. The finding is consistent with Beltratti and Stulz (2009) who posit that banks with sufficient regulatory capital ratios should perform better because they have sufficient capital to absorb adverse shocks and/or unexpected losses that would otherwise lower bank profitability. The estimated coefficient for

LISTED*NPL is positive and insignificant in Column 4. The estimated coefficient for LISTED*LLP is positive and significant at the 1% level in Column 5, indicating that bank loan loss provisions is a significant determinant of the profitability of listed African banks compared to non-listed banks. Overall, the findings show that regulatory capital, bank size and loan loss provisions significantly influence the profitability of listed banks than for non-listed banks.

[Insert Table 3 here]

4.2.2. Impact of Regulatory Capital on ROA

Next, we use model (3) to test the impact of regulatory capital on the profitability of listed banks relative to non-listed banks. To do this, we use two-way interaction terms: 'LISTED and RC', and interact 'LISTED and RC' with each profitability determinant based on the full sample. The two-way interactions test the determinants of profitability for listed banks (relative to non-listed banks) when they have sufficient regulatory capital (Tier 1 + Tier 2). The results are reported in Table 4. The estimated coefficient for LISTED*RC*TRC is positive and statistically significant in the static and dynamic models. This implies that regulatory capital is positively associated with ROA when listed banks have sufficient regulatory capital, compared to non-listed banks. Other estimated coefficient for other interaction terms: LISTED*RC*LLP, LISTED*RC*SIZE and LISTED*LOTA*TRC report conflicting signs in the static and dynamic models. Overall, the findings show that regulatory capital has a statistically significant and larger impact on the return on assets of listed banks than non-listed banks.

[Insert Table 4 here]

4.3. Sensitivity Analysis

4.3.1. Sub-sample Result: Impact of Regulatory Capital on ROA

Next, we divide the full sample into listed and non-listed subsamples using model (4) to test whether the determinants of profitability significantly differ for listed and non-listed banks when they have

sufficient total regulatory capital (Tier 1 + Tier 2). The expanded model for the listed and non-listed sub-sample is given as:

$$ROA_{i,t} = \beta_1 + \beta_2 LOTA_{i,t} + \beta_3 TRC_{i,t} + \beta_4 NPL_{i,t} + \beta_5 LLP_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 \Delta GDP_{j,t} + \beta_8 RC + \beta_9 RC*TRC_{i,t} + \beta_{10} RC*LOTA_{i,t} + \beta_{11} RC*SIZE_{i,t} + \beta_{12} RC*LLP_{i,t} + e_{i,t}. \quad (4a)$$

$$ROA_{i,t} = \beta_1 ROA_{i,t-1} + \beta_2 LOTA_{i,t} + \beta_3 TRC_{i,t} + \beta_4 NPL_{i,t} + \beta_5 LLP_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 \Delta GDP_{j,t} + \beta_8 RC + \beta_9 RC*TRC_{i,t} + \beta_{10} RC*LOTA_{i,t} + \beta_{11} RC*SIZE_{i,t} + \beta_{12} RC*LLP_{i,t} + e_{i,t}. \quad (4b)$$

First, the analysis is done by adding variables individually, and the results are reported in Tables 5 and 6. In Table 5, the estimated coefficient of RC*TRC is insignificant in Column 1 while the estimated coefficients for the other interaction variables are not significant for listed African banks in Columns 1 to 4 in the static and dynamic models. However, the estimated coefficient of RC*TRC is positive and statistically significant, after incorporating all variables together in Column 5, and confirms the earlier result in Section 4.2.2. In Table 6, the estimated coefficient of RC*TRC is negative and statistically significant in Column 2 and 5, and implies that a 20% total regulatory capital has a negative impact on the return on assets of non-listed banks. However, the estimated coefficient of RC*TRC is negative but insignificant in the dynamic model in Column 6 and 10. Moreover, the estimated coefficients for RC*LOTA and RC*LLP are statistically significant for non-listed banks the static and dynamic models, and implies that loan to asset ratio and loan loss provisions are significant drivers of the profitability of non-listed banks when they have sufficient regulatory capital ratios.

[Table 5 and 6]

4.3.2. Stress-testing Regulatory Capital Thresholds

We check whether the sub-sample results in Tables 5 and 6 are sensitive to alternative regulatory capital thresholds. First, we use at least 15% total regulatory capital threshold in Appendix A3. We find that the estimated coefficient for RC*TRC coefficient is insignificant for both listed and non-listed banks, implying that a 15% regulatory capital threshold do not have a significant impact on the ROA of listed and non-listed banks. Next, we use at least 25% regulatory capital threshold in Appendix A4. We also find that RC*TRC coefficient is insignificant for both listed and non-listed

banks. Lastly, we use at least 30% regulatory capital threshold in Appendix A5, and find that RC*TRC coefficient is negative and statistically significant for non-listed banks and insignificant for listed banks, implying that higher regulatory capital thresholds have a negative impact on the return on assets for non-listed banks. Overall, the sensitivity analysis above shows that a 15% regulatory capital threshold is too low and will have an insignificant impact on profitability while a 30% regulatory capital threshold is high and will negatively affect bank profitability, and confirms the negative trade-off between profitability and bank capital which suggests that keeping high capital levels ties down funds that could otherwise be used to generate more profit for banks; implying higher capital levels hinders bank profitability (Jackson et al., 1999).

[Insert Appendix AA3, A4 & A5 here]

5. Conclusion

This study investigates the determinants of bank profitability while controlling for bank capital regulation. Using a sample of 200 African banks, the findings show that bank size, total regulatory capital, and loan loss provisions are significant determinants of the return on assets of listed banks compared to non-listed banks. Also, we find that regulatory capital has a more significant (and positive) impact on the return on assets of listed banks than non-listed banks particularly when listed banks have at least 20% regulatory capital threshold. Finally, we find that high regulatory thresholds (say, 30%) have a negative impact on the return on asset of non-listed banks.

Bank supervisors in Africa may consider the need to strengthen bank capital requirements to improve the profitability of banks. For the purpose of policy making, we propose a regulatory capital threshold that African banks need to stay profitable. This paper demonstrates that if bank total regulatory capital ratio is set at a minimum of 20% of bank risk-weighted assets, such threshold will have a positive impact on the return on asset for listed banks while higher regulatory capital thresholds have a negative impact on the return on asset for non-listed banks.

The main message of this paper is that although total regulatory capital improves the profitability of listed African banks compared to non-listed African banks, there is a regulatory capital threshold that listed banks need to remain profitable beyond which higher regulatory capital ratios could have a negative impact on bank profitability. Any attempt to design a capital threshold for banks in several African countries should take into account the impact of such regulatory capital threshold for listed and non-listed banks. Going forward, a natural direction for future research is the need to determine what the optimal regulatory capital ratio should be as well as the maximum and minimum limits for total regulatory capital ratio among African banks. Also, there is the need for future research to investigate the impact of capital regulation on bank profitability for individual countries in Africa..

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Tables

Table 1a: Sample Distribution				
S/N	Country	# Banks	Listed	Non-Listed
1	South Africa	29	9	20
2	Ghana	15	4	11
3	Egypt	16	10	6
4	Tunisia	17	11	6
5	Morocco	9	5	4
6	Kenya	24	8	16
7	Angola	8	0	8
8	Uganda	9	2	7
9	Togo	4	1	3
10	Tanzania	16	0	16
11	Ethiopia	4	0	4
12	Cameroun	5	0	5
13	Algeria	11	1	10
14	Mauritius	7	0	7
15	Zambia	5	2	3
16	Namibia	9	2	7
17	Botswana	6	2	4
18	Senegal	6	1	5
	Total	200	58	142

Table 1b. Descriptive Statistics									
Bank	Statistics	ROA	NPL	LOTA	SIZE	TRC	LLP	ΔGDP	# Banks
Full Sample	Mean	0.024	7.03	52.73	13.62	21.43	0.009	5.32	200
Listed	Mean (i)	0.029	7.97	56.12	14.51	19.36	0.013	4.84	58
Non-listed	Mean (ii)	0.022	8.53	50.21	13.66	22.62	0.009	5.61	142
	(iii)=(i)-(ii)	0.07	-0.56	5.91	0.85	-3.26	0.004	1.23	
Full Sample	Median	0.021	4.94	52.83	13.39	17.01	0.005	5.14	
	Maximum	0.437	94.19	98.46	19.12	127.01	0.222	22.59	
	Minimum	-0.122	-20.00	1.17	8.67	-17.81	-0.305	-1.54	
	Standard Deviation	0.029	33.59	19.11	1.87	13.04	0.020	3.20	
	Observation	1877	1250	1880	1883	1003	1828	2000	

Table 2: Sub-Sample Regression							
Variable	Exp. Sign	Full Sample		Listed Banks		Non-Listed Banks	
		OLS	GMM	OLS	GMM	OLS	GMM
c		0.049 (0.60)		0.168* (1.66)		-0.035 (-0.37)	
ROA_{t-1}	?		0.192*** (3.31)		-0.071 (-0.23)		0.113*** (3.35)
LOTA	+	0.0004*** (3.08)	0.0006 (1.55)	0.0006** (2.09)	0.001 (1.19)	0.0004** (2.56)	0.0008*** (4.51)
TRC	+	0.0003* (1.65)	0.0003 (1.14)	0.0007** (2.05)	-0.001 (-0.82)	0.0001 (0.66)	-0.0002 (-0.93)
NPL	-	0.0004 (1.43)	-0.001 (-1.44)	-0.0002 (-0.05)	-0.001 (-0.43)	0.0003 (0.84)	0.0004 (0.93)
LLP	-	-0.977*** (-5.16)	-1.112*** (-6.43)	-1.318*** (-5.64)	-1.060 (-0.93)	-0.995*** (-6.85)	-1.157*** (-11.34)
SIZE	+	-0.004 (-0.59)	-0.037*** (-2.76)	-0.012* (-1.83)	- 0.050** (-2.03)	0.003 (0.43)	-0.010** (-2.03)
ΔGDP	+	0.0007** (2.02)	0.0007 (0.88)	0.002 (1.49)	0.005 (1.37)	0.0007* (1.67)	0.001 (1.57)
Adjusted R^2		66.74		75.63		66.84	
F-statistic		12.15		14.73		11.03	
Sarjan (J-statistic)			28.68		1.37		34.77
P-value (J-statistic)			0.48		0.85		0.21
AR(1)			0.004		0.898		0.008
AR(2)			0.015		0.976		0.222
Observation			670	147	119	474	372

***, ** and * denotes significant difference at the 0.01, 0.05 and 0.10 levels, respectively. OLS estimation include bank and year fixed effects. GMM regression is based on Arellano and Bond (1991) first difference estimator. Standard errors are clustered by year. ROA = ratio of pre-tax earnings to total assets. SIZE = natural logarithm of total assets. LLP = ratio of loan loss provisions to total assets. LOTA = ratio of net loans to total assets; NPL = the ratio of impaired loans to gross loans; ΔGDP = change in gross domestic product. TRC = total regulatory capital ratio. ROA_{t-1} = lagged dependent variable.

Table 3: Full Sample - OLS Regression (Main Result)						
	(1)	(2)	(3)	(4)	(5)	(6)
c	-0.016 (-0.89)	0.012 (0.73)	0.006 (0.36)	0.011 (0.68)	0.014 (0.89)	-0.009 (-0.50)
LOTA	-0.00003 (-0.35)	-0.0001 (-0.52)	0.00001 (0.09)	-0.00002 (-0.22)	-0.0001 (-0.61)	-0.001 (-0.82)
TRC	0.0006*** (4.73)	0.0006*** (3.30)	0.0004*** (4.03)	0.0006*** (4.28)	0.0005*** (4.37)	0.001*** (4.65)
NPL	-0.0004** (-2.49)	-0.0004** (-2.49)	-0.0004** (-2.29)	-0.0006** (-2.49)	- 0.0005*** (-2.83)	-0.0005** (-2.23)
LLP	0.008 (0.08)	0.021 (0.22)	-0.040 (-0.48)	0.020 (0.21)	-0.132 (-1.11)	-0.134 (-1.05)
SIZE	0.002** (2.25)	-0.0001 (-0.18)	0.0003 (0.40)	-0.0001 (-0.19)	-0.0001 (-0.13)	0.002** (2.19)
ΔGDP	0.0009** (1.98)	0.001** (2.15)	0.001*** (2.41)	0.001** (2.25)	0.001** (2.23)	0.001** (2.09)
LISTED	0.109*** (5.91)	0.011 (1.03)	-0.010 (-1.18)	0.012*** (3.03)	0.010*** (3.09)	0.076** (2.24)
LISTED*SIZE	-0.006*** (-5.47)					-0.006*** (-4.26)
LISTED*LOTA		0.0001 (0.57)				0.0002 (0.78)
LISTED*TRC			0.001*** (2.94)			0.0004 (0.83)
LISTED*NPL				0.0005 (1.13)		0.0001 (0.35)
LISTED*LLP					0.634*** (4.91)	0.471** (2.49)
Adjusted R^2	23.24	18.15	22.52	19.03	22.87	27.79
F-statistic	16.14	12.09	15.53	12.75	15.82	16.58
Observation	851	851	851	851	851	851

***, ** and * denote significant difference at the 0.01, 0.05 and 0.10 levels, respectively. All OLS regressions include year fixed effects. Standard errors are clustered by year. ROA = ratio of pre-tax earnings to total assets. SIZE = natural logarithm of total assets. LLP = ratio of loan loss provisions to total assets. LOTA = ratio of net loans to total assets; NPL = the ratio of impaired loans to gross loans; ΔGDP is change in gross domestic product. TRC = total regulatory capital. LISTED = dummy variable that take the value 1 if the African bank is listed, and 0 if the African bank is non-listed.

Table 4: Impact of Regulatory Capital on ROA (Full Sample)										
	OLS					GMM				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
C	-0.029*** (-2.73)	0.006 (0.84)	0.007 (0.97)	0.007 (0.92)	0.011 (1.49)					
ROAt-1						0.187*** (4.21)	0.155*** (-2.99)	0.183*** (3.84)	0.193*** (4.06)	0.189*** (4.20)
LOTA	-0.0002 (-0.50)	-0.00004 (-0.09)	-0.0004 (-0.80)	-0.0001 (-0.26)	-0.00003 (-0.69)	0.001** (2.29)	0.0006** (2.22)	0.0008*** (2.74)	0.001** (2.36)	0.001*** (2.79)
TRC	0.002*** (4.05)	0.0004*** (5.01)	0.0005*** (5.55)	0.0005*** (5.36)	0.0004*** (4.77)	0.001 (0.73)	0.0002 (0.77)	0.002 (0.94)	0.0002 (0.88)	0.0002 (0.84)
NPL	-0.0004*** (-4.25)	-0.0004*** (-5.01)	-0.0004*** (-5.22)	-0.0004*** (-5.20)	-0.0004*** (-5.23)	-0.001 (-1.53)	-0.001 (-1.61)	-0.0007 (-0.99)	-0.001 (-1.39)	-0.0006 (-0.84)
LLP	0.006 (0.14)	-0.027 (-0.63)	-0.020 (-0.47)	-0.0004 (-0.09)	-0.137*** (-2.95)	-1.229*** (-8.10)	-1.211*** (-9.11)	-1.139*** (-7.27)	-1.218*** (-7.95)	-0.975*** (-5.75)
SIZE	0.002*** (4.05)	0.0003 (0.58)	0.0003 (0.59)	0.0002 (0.38)	0.0001 (0.17)	-0.035*** (-4.37)	-0.040*** (-3.66)	-0.035*** (-4.79)	-0.036*** (-5.12)	-0.034*** (-4.91)
ΔGDP	0.001*** (3.28)	0.001*** (4.04)	0.001*** (3.94)	0.001*** (3.87)	0.001*** (3.98)	0.001* (1.71)	0.001** (2.19)	0.001** (2.22)	0.001** (2.10)	0.001** (2.37)
LISTED		0.010*** (4.73)								
RC	0.027*** (3.92)	0.001 (0.65)	0.001 (0.42)	0.002 (0.83)	0.004** (2.01)	-0.027 (1.24)	0.010* (-1.77)	0.018** (2.50)	0.015*** (2.78)	-0.019*** (-3.10)
RC*TRC	-0.001*** (-3.09)					-0.001 (-0.55)				
LISTED*RC*TRC		0.001*** (5.44)					0.001** (2.17)			
LISTED*RC*LOTA			0.0003*** (5.02)					-0.0003 (-0.99)		
LISTED*RC*SIZE				0.012*** (5.39)					0.0004 (0.65)	
LISTED*RC*LLP					0.629*** (7.36)					-0.976*** (-4.31)
Adjusted R^2	12.43	21.50	21.10	19.96	23.68					
F-statistic	8.09	13.94	13.63	12.78	15.65					
Sarjan (J-statistic)						24.15	22.46	25.48	22.33	22.84
P-value (J-statistic)						0.62	0.714	0.548	0.72	0.69
AR(1)						0.012	0.005	0.005	0.006	0.001
AR(2)						0.016	0.017	0.039	0.027	0.041
Observation	851	851	851	851	851	670	670	670	670	670

***, ** and * denotes significant difference at the 0.01, 0.05 and 0.10 levels, respectively. OLS estimation includes year fixed effects. GMM regression is based on Arellano and Bond (1991) first difference estimator with first-difference and year fixed effects. ROA = ratio of pre-tax earnings to total assets. ROA_{t-1} = lagged dependent variable. SIZE = natural logarithm of total assets. LLP = ratio of loan loss provisions to total assets. LOTA = ratio of net loans to total assets; NPL = the ratio of impaired loans to gross loans; ΔGDP = change in gross domestic product. TRC = total regulatory capital. RC = dummy variable that take the value of 1 when total regulatory capital (TRC) is at least 20%, reflecting periods when African banks have sufficient regulatory capital.

Table 5: Listed Banks (Impact of Regulatory Capital on ROA)										
	OLS					GMM				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
c	0.160 (1.59)	0.166 (1.62)	0.165 (1.61)	0.166 (1.59)	0.151 (1.43)					
ROAt-1						0.003 (0.01)	-0.028 (-0.08)	-0.049 (-0.17)	-0.298 (-0.66)	0.415*** (4.32)
LOTA	0.0006** (2.01)	0.0006* (1.91)	0.0006* (1.87)	0.0006* (1.87)	0.001** (1.97)	0.0008 (0.71)	0.0009 (0.77)	0.0004 (0.31)	0.001 (0.63)	0.0004 (0.51)
TRC	0.000 (1.16)	0.0005 (1.48)	0.0006 (1.57)	0.0006 (1.49)	0.0004 (1.17)	-0.0009 (-0.35)	-0.001 (-0.39)	-0.001 (-0.60)	- 0.0007 (-0.19)	0.003 (1.05)
NPL	0.0002 (0.54)	0.0001 (0.28)	-0.0001 (-0.12)	0.00004 (0.11)	0.0001 (0.09)	-0.001 (-0.45)	-0.0007 (-0.22)	-0.001 (-0.63)	-0.002 (-0.93)	-0.005** (-2.09)
LLP	-1.338*** (-5.52)	-1.315*** (-5.48)	-1.306*** (-5.36)	-1.284*** (-4.58)	-1.278*** (-4.29)	-1.249 (-1.18)	-1.120 (-1.08)	-0.517 (-0.33)	-2.202 (-0.73)	-0.978 (-1.85)
SIZE	-0.012* (-1.72)	-0.012* (-1.75)	-0.012* (-1.74)	-0.012* (-1.74)	-0.011 (-1.57)	-0.059* (-1.71)	-0.057 (-1.57)	-0.045 (-0.95)	-0.076 (-1.52)	-0.008 (-1.48)
ΔGDP	0.002 (1.50)	0.002 (1.48)	0.002 (1.37)	0.002* (1.49)	0.002 (1.42)	0.004 (1.01)	0.004 (1.06)	0.003 (0.63)	0.005 (0.81)	0.0003 (0.55)
RC	-0.021 (-1.33)	0.018 (0.96)	-0.062 (-0.70)	0.007 (1.26)	-0.315*** (-3.38)	-0.062 (-0.35)	0.021 (-0.11)	-0.952 (-0.58)	-0.045 (-0.25)	-1.302*** (-2.94)
RC*TRC	0.001 (1.59)				0.003* (1.90)	0.001 (0.38)				0.0004 (0.09)
RC*LOTA		-0.0002 (-0.63)			-0.001 (-0.86)		-0.0009 (-0.26)			-0.004 (-1.62)
RC*SIZE			0.005 (0.78)		0.023** (2.04)			0.071 (0.58)		0.109*** (2.98)
RC*LLP				-0.238 (-0.87)	-0.452 (-1.35)				1.699 (0.53)	-0.099 (-0.09)
Adjusted R^2	75.67	75.40	75.45	75.46	76.50					
F-statistic	13.97	13.79	13.82	13.83	13.19					
Sarjan (J-statistic)						1.09	1.12	1.05	0.81	2.59
P-value (J-statistic)						0.58	0.57	0.59	0.67	0.86
AR(1)						-	-	0.937	0.899	-
AR(2)						-	0.973	0.955	0.983	-
Observation	147	147	147	147	147	119	119	119	119	119

***, ** and * denotes significant difference at the 0.01, 0.05 and 0.10 levels, respectively. OLS estimation include bank and year fixed effects. GMM regression is based on Arellano and Bond (1991) first difference estimator with first-difference and year fixed effects. Standard errors are clustered by year. ROA = ratio of pre-tax earnings to total assets. ROA_{t-1} = lagged dependent variable. SIZE = natural logarithm of total assets. LLP = ratio of loan loss provisions to total assets. LOTA = ratio of net loans to total assets; NPL = the ratio of impaired loans to gross loans; ΔGDP = change in gross domestic product. TRC = total regulatory capital. RC = dummy variable that take the value of 1 when total regulatory capital (TRC) is at least 20%, reflecting periods when African banks have sufficient regulatory capital.

Table 6: Non-Listed Banks (Impact of Regulatory Capital on ROA)										
	OLS					GMM				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
C	-0.059 (-0.61)	-0.048 (-0.52)	-0.038 (-0.42)	-0.029 (-0.30)						
ROA_{t-1}					0.161** (2.22)	0.107** (2.30)	0.219*** (3.12)	0.117* (1.67)	0.141** (2.46)	-0.001 (-0.01)
LOTA	0.0004*** (2.79)	0.0003* (1.84)	0.0004*** (2.78)	0.0004*** (2.63)	0.0003** (2.25)	0.001*** (5.53)	0.0001 (0.02)	0.0009** (2.16)	0.0009*** (3.63)	0.002 (0.58)
TRC	0.001** (2.13)	0.0001 (0.52)	0.00004 (0.18)	0.0001 (0.28)	0.001*** (2.62)	0.002 (1.38)	0.0001 (0.45)	-0.0001 (-0.30)	0.00003 (0.22)	0.001 (0.57)
NPL	0.0003 (1.04)	0.0003 (0.87)	0.0003 (0.89)	0.0003 (0.86)	0.0002 (0.70	0.0009 (1.52)	0.0008 (1.27)	0.0002 (0.27)	0.0002 (0.39)	-0.001 (-0.54)
LLP	-0.989*** (-7.35)	- 0.996*** (-8.34)	-0.997*** (-7.66)	-1.115*** (-11.07)	-1.079*** (-11.24)	-1.186*** (-10.26)	-0.979*** (-6.48)	-1.049*** (-4.89)	-1.313*** (-6.73)	-0.790*** (-2.01)
SIZE	0.003 (0.45)	0.004 (0.66)	0.003 (0.46)	0.003 (0.37)	-0.002 (-0.39)	-0.009* (-1.64)	-0.002 (-0.27)	0.018 (1.15)	0.0006 (0.09)	-0.006 (-0.44)
ΔGDP	0.0008* (1.75)	0.0007 (1.44)	0.0007 (1.60)	0.0007* (1.69)	0.001 (1.53)	0.001* (1.88)	0.001* (1.76)	0.002** (2.16)	0.002** (2.14)	0.001*** (2.78)
RC	0.030** (2.36)	-0.018 (-1.28)	-0.0001 (-0.003)	0.0001 (0.03)	0.011 (0.36)	0.047** (1.98)	-0.043** (-2.35)	0.245*** (2.65)	0.005 (1.02)	0.104 (0.50)
RC*TRC	-0.002** (-2.23)				-0.001** (-2.53)	-0.002 (-1.48)				-0.001 (-0.61)
RC*LOTA		0.0005* (1.81)			0.0003 (1.30)		0.001*** (2.94)			-0.001 (-1.11)
RC*SIZE			0.0004 (0.13)		-0.0002 (-0.09)			-0.018*** (-2.64)		-0.006 (-0.43)
RC*LLP				0.359*** (4.04)	0.242** (2.15)				0.555** (2.57)	0.167 (0.76)
Adjusted R^2	68.06	67.96	66.95	68.03	74.14					
F-statistic	11.39	11.34	10.88	11.38	13.83					
Sarjan (J-statistic)						26.24	26.44	22.21	24.55	18.49
P-value (J-statistic)						0.51	0.49	0.726	0.59	0.730
AR(1)						0.044	0.011			0.034
AR(2)						0.177	0.077	0.109	0.000	0.383
Observation						372	372	-	0.478	372

***, ** and * denotes significant difference at the 0.01, 0.05 and 0.10 levels, respectively. OLS estimation include bank and year fixed effects. GMM regression is based on Arellano and Bond (1991) first difference estimator with first-difference and year fixed effects. Standard errors are clustered by year. ROA = ratio of pre-tax earnings to total assets. ROA_{t-1} = lagged dependent variable. SIZE = natural logarithm of total assets. LLP = ratio of loan loss provisions to total assets. LOTA = ratio of net loans to total assets; NPL = the ratio of impaired loans to gross loans; ΔGDP = change in gross domestic product. TRC = total regulatory capital. RC = dummy variable that take the value of 1 when total regulatory capital (TRC) is above 20%, reflecting periods when African banks have sufficient regulatory capital.

Appendix

Table A1. Determination of bank regulatory capital threshold

To choose the regulatory capital threshold, we base our choice on the average of 'bank regulatory capital to risk-weighted assets' for each randomly selected African country. Data for 'bank regulatory capital to risk-weighted assets' for each country is obtained from 'Global Financial Development indicators' available from World Bank database. Some African countries do not have data for this ratio. We consider this ratio to be more appropriate because it reflects the average regulatory capital to risk-weighted assets for banks in a country in a given period, and also take into account differences in national accounting, taxation, capital regulation and supervisory regimes in each African country and may not be comparable across countries. We randomly select 10 African countries that have full country-level data for bank regulatory capital to risk-weighted assets ratio from 2004 to 2014 and take the average of the ratios for each country, and thereafter take the average ratio for all countries together. This gives us a mean of 20.14% which we round up to 20%.

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Mean
Uganda	20.5	18.3	17.9	19.3	20.7	20.9	20.2	20.3	21.9	22.9	22.2	20.46
Swaziland	15.5	17.3	26.3	23.6	33.8	28.4	29.8	28	31	22.2	24.9	25.53
Sierra Leone	38.1	35.7	33.3	35	43.4	34	30.7	27	27.7	30.1	30.2	33.20
Rwanda	14	14	13.7	17.8	15.9	19	21.6	23.8	21.4	23	24.2	18.95
Seychelle			19.6	15.4	12	21.6	21.5	24.2	26.3	26.1	21.6	20.92
Mozambique	18	13.4	12.5	14.2	13.9	15.1	14.4	17.1	17.9	16.9	15.1	15.32
Namibia	15.4	14.6	14.2	15.8	15.5	15	15.3	14	14.2	14.4	14.7	14.83
Lesotho	22	22	19	14.2	13.7	16.6	14.1	15.2	14	12.1	..	16.29
Kenya	16.6	16.3	17	18	18.9	19.6	20.8	19.4	21	23.2	19.2	19.09
Ghana	13.9	16.2	15.8	15.7	13.8	18.2	19.1	17.4	18.6	18.5	17.9	16.83
											Mean	20.14

Table A2: Full Sample Pearson correlation analysis (p-values in parentheses)

Variables	ROA	NPL	LOTA	SIZE	TRC	ΔGDP	LLP
ROA	1.000						
NPL	-0.127***	1.000					
	(0.000)						
LOTA	-0.032	-0.151***	1.000				
	(0.349)	(0.000)					
SIZE	-0.017	-0.064*	0.143***	1.000			
	(0.623)	(0.064)	(0.000)				
TRC	0.223***	0.172***	-0.074**	-0.315***	1.000		
	(0.000)	(0.000)	(0.032)	(0.000)			
ΔGDP	0.134***	-0.089***	-0.169***	-0.276***	0.012	1.000	
	(0.000)	(0.009)	(0.000)	(0.000)	(0.724)		
LLP	-0.001	0.311***	0.098***	0.003	0.199***	-0.119***	1.000
	(0.967)	(0.000)	(0.004)	(0.936)	(0.000)	(0.000)	

Table A3: Impact of Regulatory Capital on ROA (15% capital threshold)										
	Listed					Non-Listed				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ROA_{t-1}	-0.006 (-0.02)	-0.189 (-0.32)	-0.297 (-0.49)	1.277 (0.49)	-0.115 (-0.23)	0.143** (2.22)	0.147*** (2.75)	0.164** (2.46)	0.112** (2.39)	0.129** (2.58)
LOTA	0.001 (0.71)	0.0003 (0.12)	-0.001 (-0.14)	0.0001 (0.04)	0.002 (0.86)	0.001*** (2.88)	-0.0009 (-0.48)	0.0009*** (3.08)	0.001*** (3.67)	0.0009*** (4.27)
TRC	0.001 (-0.03)	0.0001 (0.44)	0.001 (0.34)	-0.0007 (-0.12)	0.001 (0.25)	-0.002 (-0.62)	-0.0002 (-0.59)	-0.0001 (-0.50)	-0.0001 (-0.41)	-0.0001 (-0.65)
NPL	-0.002 (-0.46)	-0.003 (-0.70)	-0.002 (-0.58)	0.0006 (0.08)	-0.004 (-0.72)	0.0002 (0.33)	0.0009 (1.13)	0.0005 (0.88)	0.0004 (0.55)	-0.0001 (-0.19)
LLP	-0.766 (-0.35)	-0.752 (-0.23)	0.637 (0.18)	-3.197 (-0.50)	-0.144 (-0.07)	-1.097*** (-6.17)	-1.006*** (-5.81)	-1.185*** (-8.33)	-1.227*** (-7.96)	-1.104*** (-8.47)
SIZE	-0.048 (-0.81)	-0.018 (-0.27)	0.001 (0.02)	-0.054 (-0.84)	-0.030 (-0.54)	-0.008* (-1.02)	-0.003 (-0.38)	-0.007 (-0.63)	-0.008 (-1.44)	-0.007 (-1.25)
ΔGDP	0.003 (0.30)	-0.004 (-0.38)	-0.007 (-0.66)	0.004 (0.25)	-0.001 (-0.09)	0.001* (1.87)	0.003* (1.73)	0.001* (1.69)	0.001** (2.30)	0.001 (1.57)
RC	-0.02 (-0.05)	-0.095 (-0.76)	0.359 (0.48)	-0.069 (-1.51)	-0.040 (-0.56)	0.013 (0.39)	-0.077*** (-2.86)	0.083 (1.17)	0.004 (0.77)	0.003 (0.40)
RC*TRC	0.005 (0.46)					-0.013 (-0.59)				
RC*LOTA		0.009 (0.59)					0.002*** (3.36)			
RC*SIZE			-0.359 (-0.55)					-0.006 (-1.17)		
RC*LLP				1.903 (0.55)					0.297** (2.48)	
RC*NPL					0.002 (0.38)					0.0006 (1.26)
Sarjan (J-statistic)	1.37	0.67	0.40	0.36	0.99	27.22	20.43	21.29	28.76	30.42
P-value (J-statistic)	0.51	0.715	0.817	0.836	0.607	0.45	0.81	0.773	0.373	0.295
Observation	119	119	119	119	119	372	372	372	372	372

***, ** and * denotes significant difference at the 0.01, 0.05 and 0.10 levels, respectively. OLS estimation include bank and year fixed effects. GMM regression is based on Arellano and Bond (1991) first difference estimator with first-difference and year fixed effects. Standard errors are clustered by year. ROA = ratio of pre-tax earnings to total assets. ROA_{t-1} = lagged dependent variable. SIZE = natural logarithm of total assets. LLP = ratio of loan loss provisions to total assets. LOTA = ratio of net loans to total assets; NPL = the ratio of impaired loans to gross loans; ΔGDP = change in gross domestic product. TRC = total regulatory capital. RC = dummy variable that take the value of 1 when total regulatory capital (TRC) is above 15%, reflecting periods when African banks have sufficient regulatory capital.

Table A4: Impact of Regulatory Capital on ROA (25% capital threshold)										
	Listed					Non-Listed				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ROA_{t-1}	0.110 (0.36)	0.037 (0.08)	-0.175 (-0.68)	-0.529 (-0.48)	-0.115 (-0.23)	0.151** (3.02)	0.130** (2.53)	0.111* (1.78)	0.154*** (2.72)	0.197*** (2.92)
LOTA	0.002 (0.77)	0.0003 (0.90)	0.001 (1.18)	0.003 (0.06)	0.002 (0.86)	0.001*** (4.47)	-0.0004 (-1.36)	0.0006** (2.24)	0.0007*** (3.10)	0.0007** (2.35)
TRC	-0.004 (-0.44)	0.0001 (0.38)	-0.0007 (-0.49)	0.0004 (0.09)	0.001 (0.25)	0.0009 (1.33)	-0.0002 (-0.89)	-0.0003 (-1.61)	0.0001 (0.02)	-0.0002 (-1.00)
NPL	0.0009 (0.13)	-0.003 (-0.70)	-0.001 (-0.17)	-0.0004 (-0.09)	-0.004 (-0.72)	0.0006 (0.92)	0.0004 (0.65)	0.0007 (1.22)	0.0002 (0.34)	-0.0002 (-0.43)
LLP	-1.689 (-0.73)	-1.250 (-0.59)	-0.979 (-0.97)	-4.164 (-0.58)	-0.144 (-0.07)	-1.098*** (-8.25)	-1.071*** (-8.25)	-1.209*** (-8.19)	-1.268*** (-8.65)	-1.150*** (-8.92)
SIZE	-0.059 (-0.77)	-0.019 (-0.27)	-0.039 (-1.06)	-0.055* (-1.64)	-0.030 (-0.54)	-0.007 (-0.97)	-0.012 (-1.52)	-0.007 (-1.11)	-0.004 (-0.66)	-0.007 (-1.25)
ΔGDP	0.002 (0.18)	0.002 (0.17)	0.004 (0.82)	0.001 (0.09)	-0.001 (-0.09)	0.001** (1.96)	0.001* (1.87)	0.001** (2.03)	0.002** (2.34)	0.001* (1.75)
RC	-0.002 (-0.03)	-0.032 (-0.61)	0.459 (0.46)	0.069 (0.36)	-0.040 (-0.56)	0.025 (1.43)	-0.013 (-0.87)	0.157*** (2.63)	-0.006 (-0.99)	-0.0009 (-0.40)
RC*TRC	0.005 (0.46)					-0.001 (-1.59)				
RC*LOTA		0.003 (0.62)					0.004 (1.12)			
RC*SIZE			-0.035 (-0.46)					-0.012** (-2.50)		
RC*LLP				3.269 (0.44)					0.413*** (3.24)	
RC*NPL					-0.004 (-0.11)					0.001* (1.87)
Sarjan (J-statistic)	0.635	0.67	0.40	0.55	1.52	28.38	28.55	24.73	26.78	28.91
P-value (J-statistic)	0.73	0.715	0.817	0.758	0.467	0.392	0.383	0.589	0.476	0.365
Observation	119	119	119	119	119	372	372	372	372	372

***, ** and * denotes significant difference at the 0.01, 0.05 and 0.10 levels, respectively. OLS estimation include bank and year fixed effects. GMM regression is based on Arellano and Bond (1991) first difference estimator with first-difference and year fixed effects. Standard errors are clustered by year. ROA = ratio of pre-tax earnings to total assets. ROA_{t-1} = lagged dependent variable. SIZE = natural logarithm of total assets. LLP = ratio of loan loss provisions to total assets. LOTA = ratio of net loans to total assets; NPL = the ratio of impaired loans to gross loans; ΔGDP = change in gross domestic product. TRC = total regulatory capital. RC = dummy variable that take the value of 1 when total regulatory capital (TRC) is above 25%, reflecting periods when African banks have sufficient regulatory capital.

Table A5: Impact of Regulatory Capital on ROA (30% capital threshold)										
	Listed					Non-Listed				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ROA_{t-1}	0.063 (0.23)	-0.066 (-0.13)	-0.123 (-0.54)	-0.445 (-0.38)	0.071 (0.22)	0.196*** (3.49)	0.210*** (2.88)	0.083 (1.02)	0.164*** (3.09)	0.157*** (2.74)
LOTA	0.001 (1.12)	0.0006 (0.57)	0.001 (0.99)	0.002 (0.06)	0.001 (1.35)	0.001*** (5.14)	0.0007* (1.84)	0.0006 (1.42)	0.0009*** (3.29)	0.001*** (4.43)
TRC	-0.004 (-0.97)	0.0007 (0.09)	-0.0008 (-0.57)	0.0002 (0.06)	-0.0002 (-0.07)	0.001* (1.96)	0.0002 (0.41)	-0.001*** (-3.39)	0.0001 (0.02)	0.00001 (0.08)
NPL	-0.001 (-0.33)	-0.0009 (-0.26)	-0.001 (-0.38)	-0.0006 (-0.14)	-0.0002 (-0.06)	0.0006 (1.23)	0.0002 (0.42)	0.0005 (0.78)	0.00001 (0.02)	0.0006 (1.13)
LLP	-1.373 (-1.27)	-1.266 (-0.77)	-1.002 (-1.81)	-4.342 (-0.80)	-1.038 (-1.19)	-1.087*** (-12.90)	-1.179*** (-10.25)	-1.279*** (-9.54)	-1.325*** (-8.37)	-1.150*** (-8.92)
SIZE	-0.052 (-1.62)	-0.046 (-1.20)	-0.035 (-0.99)	-0.057*** (-2.66)	-0.047** (-2.13)	-0.005 (-0.72)	-0.005 (-0.74)	-0.012 (-1.65)	-0.002 (-0.25)	-0.006 (-0.86)
ΔGDP	0.002 (0.37)	0.008 (0.69)	0.003 (0.65)	0.001 (0.08)	0.003 (0.50)	0.001* (1.75)	0.001 (1.43)	0.002* (1.92)	0.001** (2.17)	0.001* (1.75)
RC	-0.053 (-0.36)	-0.165 (-0.30)	0.529 (0.57)	0.041 (0.44)	0.085 (0.44)	0.011 (0.69)	-0.047* (-1.97)	0.512*** (4.03)	-0.013** (-2.13)	-0.009 (-1.24)
RC*TRC	0.004 (0.59)					-0.001* (-1.88)				
RC*LOTA		0.005 (0.36)					0.0007* (1.84)			
RC*SIZE			-0.040 (-0.57)					-0.012** (-2.50)		
RC*LLP				3.420 (0.57)					0.555*** (2.95)	
RC*NPL					-0.010 (-0.44)					-0.0009 (-1.52)
Sarjan (J-statistic)	0.563	0.797	0.706	0.254	1.519	25.03	24.09	22.11	25.24	27.52
P-value (J-statistic)	0.755	0.67	0.703	0.881	0.468	0.573	0.624	0.732	0.561	0.435
Observation	119	119	119	119	119	372	372	372	372	372

***, ** and * denotes significant difference at the 0.01, 0.05 and 0.10 levels, respectively. OLS estimation include bank and year fixed effects. GMM regression is based on Arellano and Bond (1991) first difference estimator with first-difference and year fixed effects. Standard errors are clustered by year. ROA = ratio of pre-tax earnings to total assets. ROA_{t-1} = lagged dependent variable. SIZE = natural logarithm of total assets. LLP = ratio of loan loss provisions to total assets. LOTA = ratio of net loans to total assets; NPL = the ratio of impaired loans to gross loans; ΔGDP = change in gross domestic product. TRC = total regulatory capital. RC = dummy variable that take the value of 1 when total regulatory capital (TRC) is above 30%, reflecting periods when African banks have sufficient regulatory capital.