Regulatory Capital Requirements and Risk Taking Behaviour: Evidence from the Malawi Banking System

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Abstract

Proponents of stringent regulation argue in favour of higher capital requirements as it issaid to promote financial stability. Opponents of higher capital requirements argue that capital adequacy rules may not enhance stability but may in fact increase a bank's riskiness. The paper tests this hypothesis with a dynamic panel data model for eight Malawian commercial banks. Results reveal that there is high persistency in risk-taking behaviour of Malawian banks. Further, the study finds that high capital ratios reduce bank risk-taking behaviour of Malawian banks through reduction in Non-Performing Loans (NPLs) ratio and investment in high risky assets. Based on these results, imposition of stringent penalties on banks that fail to meet minimum capital requirements and strict enforcement of regulation is key to ensuring that all banks sustain sufficient capital buffers and hence safeguard stability of the banking system.

JEL Classification: *G21, G28*

Key Words: *Capital requirements, Banks, Malawi, Risk-taking behaviour*

1. Introduction

The increased emphasis on risk-based micro prudential regulation has reignited the long-standing debate on the effect of capital requirements on banks' behaviour. Despite the debate and recent progress in research on the issue, literature is inconclusive. In Malawi, despite the regulatory authorities implementing various measures of risk-based capital regulation, it is not certain whether these measures have restricted bank managers in taking excessive risks. Proponents of stringent regulation argue in favour of higher capital based on two arguments: firstly, capital limits promote financial stability since they are a buffer that absorbs losses and hence reduce the risk of insolvency and therefore mitigate systemic risk factors (Perrotti and Vlahu, 2011). Secondly, the argument is premised on the option-pricing model in that capital requirements restrict bank shareholders (who are provided with limited liability) to take excessive risk (Meckling and Jensen,1976; Kahane, 1977; Kareken and Wallace, 1978; and Admati and Hellwig, 201 3).

Opponents of higher capital requirements argue that capital adequacy rules may not enhance stability but may in fact increase a bank's riskiness. The intuition behind this is that flat capital requirements would restrict a bank to maximize utility, forcing it to reduce leverage and restructure its portfolio of risky assets, thereby increasing the probability of failure (Blum, 1999; Kahane, 1977; Koehn and Santomero, 1980). Further, risk-based capital regulation may not necessarily reduce bank risk-taking as systemically important banks exploit the implicit public guarantee by taking higher risk even with stringent capital regulation, knowing they would be bailed out in case of financial turmoil (Stolz, 2002). It is also argued that high capital requirements may push intermediation out of the banking system into unregulated entities, possibly increasing systemic risk (Dagher et al, 2016). Furthermore, Perrotti and Vlahu (2011) argue that higher capital may have an unintended effect of enabling banks to take more tail risk without the fear of breaching the minimum capital ratio in non-tail risky project realization. Meanwhile, another strand of literature demonstrates that banks often hold capital ratios well above the minimum requirements and, as such, they are not constrained by capital regulation and have their own target capital and risk taking levels (Rime, 2001; Calem and Rob. 1996; Floquet and Biekpe, 2008).

Notwithstanding the above divergent views, contemporary banking literature has stressed the role of corporate governance in risk-taking behaviour of banks. It is argued that independent boards are likely to exercise effective control over managers and hence would promote corporate performance, including limiting managers

to take excessive risk. In a similar line of thinking, Minton, Taillard and Williamson (2010) argue that larger and more independent boards are associated with lower levels of risk-taking. This view is also shared by Kirkpatrick (2009), who argues that weak boards may lead to insufficient monitoring of managers' actions, which may eventually lead to excessive risk-taking behaviour. Further, another strand of corporate governance literature that capitalizes on agency paradigm argues that while alignment of management incentives with bank owners may ameliorate the shareholders-manager agency problem, this may not necessarily limit bank managers to take excessive risk. Kose and Yiming (2003) and Anginer et al (2018) argue that in fact this may create strong incentives to undertake high-risk investments even when they are not realizing positive net present value investments. From the foregoing theories and mixed empirical evidence, the effect of capital requirements and corporate governance on risk taking behaviour of banks, therefore, becomes an empirical question.

In Malawi, through the Reserve Bank of Malawi (RBM), the Registrar of financial institutions as a supervisory and regulatory authority has been imposing minimum capital requirements for banks to ensure that the banking sector is sound and stable. These regulations have evolved over time, in line with the requirements in the Basel Accord by the Basel Committee on Banking Supervision (BCBS). For example, in June 1993, the capital adequacy requirement directive came into effect in line with the Basel I under which all banks were expected to maintain core capital and total capital ratios of 4.0% and 8.0% or more, respectively. Later, in line with the Risk-Based Approach (RBA) to supervision, and to ensure that banks evaluate, monitor and control all material[1] risks, the RBM adopted risk management guidelines in 2010. Thereafter in 2013, credit and market risk-based capital regulations were adopted. Later in January 2014, the RBM fully migrated to Basel II standards, where banks were required to maintain minimum core capital and total capital ratios of 10.0% and 15.0%, respectively. These directives were therefore, expected to enhance risk management by bank managers, which would in turn limit excessive risk-taking.

However, despite implementing various measures of risk-based capital regulation and hence revision of capital requirements, credit risk was increasing. In particular, risk weighted assets were persistently high, above 50%, more particularly for the two domestic systemically important banks, though slightly declining in the later years. Further, in the latter years, asset quality was deteriorating significantly as evidenced by increase in the ratio of Non-Performing Loans (NPLs) in the banking system. NPL ratio in Malawian banking system was mostly above the prudential maximum of 5% for the past decade or so. In very few years was the ratio below the regulatory maximum requirement. This, therefore, puts an empirical question as to whether adoption of risk-based capital regulation has really helped Malawian banks in their risk exposures. In particular, what has been the impact of stringent capital regulation on Malawian banks? What about bank governance-related factors; do they matter in terms of risk-taking behaviour of Malawian banks? What are the other factors that influence the risk-taking behaviour of Malawian banks?

Against this background, the paper aims to investigate the impact of capital requirements on Malawi's banks risk-taking behaviour for the period 2010-2017. In particular, the study investigates the relationship between regulatory capital and risk-taking behaviour of Malawian banks. Further, the study examines the effect of banks' governance-related factors on the risk appetite of Malawian banks. The study is restricted to this period due to unavailability of granular data in the earlier period. While there is a lot of work on the subject for developed economies, emerging markets and Asian countries, very little work has been done for developing countries. To the best of our knowledge, no empirical work of a similar nature has been done for Malawi. As such, the results from the study are expected to inform policy and regulation of the Malawian banking system and thus enhance the stability of the Malawian financial system.

The rest of the paper is organized as follows: section 2 gives some stylized facts, section 3 summarizes selected literature, section 4 outlines the methodology used, section 5 analyses and discusses results and section 6 concludes.

2. Stylized facts

Capital regulation in the Malawi banking system

As alluded to earlier, the Reserve Bank of Malawi (RBM) as a supervisory and regulatory authority imposes minimum capital requirements on banks to ensure that the banking sector is sound and stable. These requirements have evolved over time in line with the standardized requirements by the Basel Committee on Banking Supervision. The Malawian banking system has, For example, this far adopted Basel I and Basel II, which entailed adoption of various banking rules.

For example, in line with the Basel I Accord, the capital adequacy directive came into effect in June 1993 and, under this directive, all banks were required to maintain core (Tier 1)[2] and total capital (Tier II) ratios of 4% and 8% or more, respectively. At that time, assessment of banks' compliance to prudential requirements was based on CAMEL[3], with risk-based assessment running in parallel with CAMEL.

Further, with the advent of globalization and increased innovation of financial services, new risks emerged requiring attention of both bank management and supervisory authorities. In response to this, the RBM adopted a Risk-Based Approach to Supervision of Financial Institutions in 2007 in line with Basel II Accord. The aim was to foster sound risk management systems among banks in Malawi. The new rules meant that financial institutions were to use the standardized approach for calculating the capital requirement for credit, market and operational risks. In view of the complexity and costs involved under Pillar I of the Basel II, the RBM strategy was to implement Basel II in a phased manner.

In March 2013, the RBM adopted credit risk-based capital regulation for all banks. The objective was to assist banks to appropriately incorporate credit risk in measuring capital under the standardized approach under Pillar I of Basel II. Banks were required to measure their capital position through a risk-based capital ratio, which was calculated by dividing its capital base by total risk-weighted assets. In calculating risk-weighted assets, banks had to use three categories of risks and apply weights ranging from 0% to 100% depending on institution and type of exposure. In April 2013, the risk-based capital regulation was amended further to incorporate market risk of banks into the regulatory capital and risk weighted assets calculations.

In January 2014, Malawi fully migrated to Basel II standards to strengthen financial sector stability. Under the Basel II regime, banks were required to maintain minimum

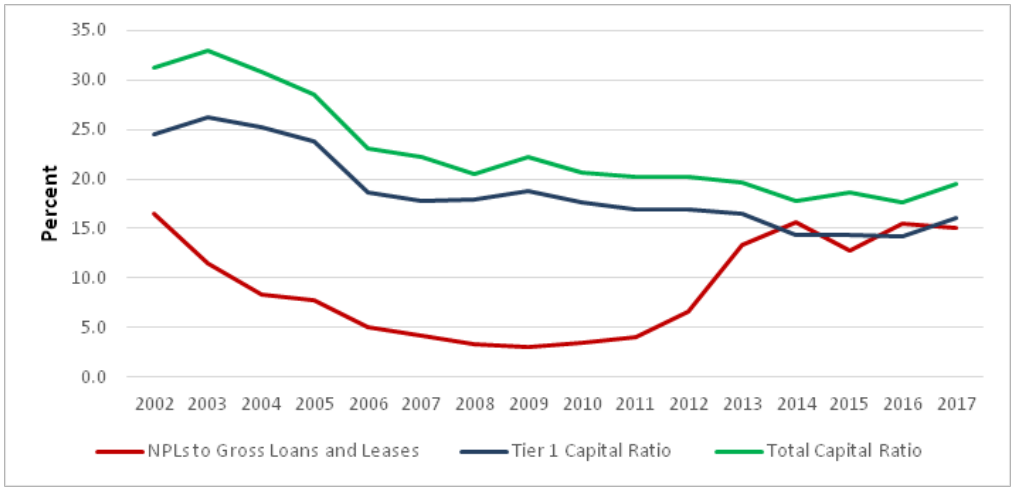
core capital and total capital ratios of 6.0% and 10.0%, respectively. However, Malawi opted for higher minimum capital adequacy ratios of 10% for core capital and 15% for total capital than under Basel II standards, considering the banking business environment and factoring in the possible errors in capital calculation that could result from inadequate or poor quality data and inadequate risk management systems. The RBM further took additional steps to strengthen the soundness of the financial sector, which in a way would affect their capital positions. For example, to enhance the provisioning for NPLs, an asset classification directive was enacted in May 2014 based on the Estimated Recoverable Amount Method (ERAM). The directive imposed a provisioning rate that increased by 16.7 percentage points per quarter on loans past due after 90 days, up to 100 percentage points after 18 months. The new directive was expected to increase the provisions to NPLs to minimize capital loss in the event of borrowers' loan default. Meanwhile, a Prompt Corrective Action (PCA) framework was enacted in May 2014 to strengthen the legal framework for early intervention and bank resolution. The PCA directive clarified and enhanced existing triggers for early remedial actions for banks in financial distress. Under Basel II Pillar II, banks were required to conduct stress tests and internal capital adequacy processes (ICAAP) in relation to their strategy, business and financial projections and all material risks (RBM, 2015).

Apart from the risk-based capital requirements, there were also a number of directives put in place to ensure that banks manage their risks well. For example, in 2008, a directive on large exposures was put in place. Under this directive, large exposures were not to exceed 25% of a licensed institution's capital base. Further, the aggregate of a licensed institution's large exposures was not to exceed 800% of its capital base.

Despite the RBM undertaking an oversight role over banks through periodic off-site and on-site inspections, a few banks failed to meet the minimum capital requirements over the years. Consequently, they were either re-capitalized by shareholders, merged with other banks or even taken over. For example, in 2006, one private-owned bank that for some time had both its Tier 1 and total capital ratios below the minimum requirement went into voluntary liquidation following regulatory pressure. In 2016, two public-owned banks with regulatory capital challenges were acquired by existing domestic private-owned banks. Similarly, in 2017, one foreign-owned private bank was merged with another domestic-owned private bank due to failure by its shareholders to inject additional capital to bring the capital ratios above the regulatory benchmarks. However, other two domestic-owned private banks that were experiencing capital challenges were fully re-capitalized by the shareholders at the end of 2017 as directed by RBM.

From the foregoing analysis, therefore, it can be deduced that type of bank ownership matters in light of adherence to bank capital regulation in Malawi. The above notwithstanding, overall core and total capital ratios remained above the minimum regulatory requirement, even though exhibiting a downward trajectory (Figure 1).

Figure 1: Trends in capital ratio and non-performing loans ratio



Source Reserve Bank of Malawi (nd)

Risk-taking behaviour of Malawian banks

Asset structure of Malawian banks

Prior to the adoption of more stringent capital regulation, thus Basel II, total loans constituted about 50.0% of total banking sector assets between 2010 and 2014 (Table 1). However, the share of total loans and leases to total assets dropped when the country adopted Basel II, reaching a low of 26.8% in 2017. Investments in securities were progressively increasing to a proportion higher than loans in total assets. Trend in the data, therefore, suggests that the adoption of more stringent capital requirement led to unintended results as intermediation evidently dropped.

Table 1: Classification of assets for Malawi banking system (% of total assets)

Type of assets	2010	2011	2012	2013	2014	2015	2016	2017
Loans and Leases (%)	51.9	53.3	50.1	39.3	38.2	38.4	33.7	26.8
Securities and Investments (%)	18.4	19.4	12.2	18.6	17.9	28.6	31.1	39.2
Other assets (%)	29.8	27.3	37.7	42.1	43.8	33	35.2	34

Source: Reserve Bank of Malawi (2017)

Lending structure of Malawian banks

In almost all the nine banks in Malawi, over 80.0% of loans were channeled to private entities, and the rest to the government, statutory bodies, and Non-Governmental Organizations (NGOs). In terms of loan allocation to clients, seven (7) banks channeled over 70.0% of the private sector loans to private corporations (such as Small and

Medium Enterprises - SMEs and large enterprises) over the sample period. These loans comprised loans for financing agricultural production, commercial and industrial loans, and foreign exchange loans. Individual and household loans accounted for an average of only 15.0% of total loan book in these seven (7) banks. Meanwhile, the remaining two banks allocated a large part of their loan book (about 50.0%) to individuals and households in line with their lending business models that focus on small clients. Nevertheless, type of ownership or management did not influence individual bank's business lending models as the seven banks that focused on lending to SMEs and large enterprises consisted of both private-owned and foreign-owned banks, similarly for the two banks that mostly lent to individuals and households.

In terms of the sectoral allocation, the loans were mainly concentrated in a few sectors, with over 70.0% of banking sector total loans and leases channeled to five sectors between 2012 and 2017 (Table 2). Lending to the wholesale and retail constituted the highest proportion of total loans and leases, followed by agriculture and manufacturing holding the second and third largest proportion of total banking sector loans and leases to the private sector, respectively.

Table 2: Distribution of loans by sector

Sectors	2012	2013	2014	2015	2016	2017
Wholesale and retail trade	21.7	21.9	24.1	22.2	24.4	24.0
Agriculture	17.8	21.5	19.6	23.6	19.6	23.2
Manufacturing	10.1	15.1	15.5	21.1	18.0	16.5
Community, social and personal	11.8	10.3	11.8	10.5	14.0	10.5
Transport and communications	11.6	11.7	9.9	5.2	6.9	4.0
Other sectors	7.0	4.8	5.3	6.7	5.7	7.7

Source: RBM annual reports 2017

This notwithstanding, individual bank data reveals that the sectoral composition of the loans differed between domestically owned banks and foreign-owned banks. Domestically owned banks largely diversified across all sectors while foreign-owned banks concentrated in agricultural, manufacturing, and community and personal services sectors.

Trends and sectoral composition of NPLs in the Malawian banking system

Asset quality as measured by the ratio of NPLs in the Malawi banking system exhibited a mixed trend but persistently deteriorated in the later years. Asset quality was improving tremendously from 2002 to 2004 (Figure 1), as evidenced by sharp decline in the NPLs ratios, which stood below the maximum regulatory benchmark of 5.0% until mid-2012. This was mainly due to favourable macroeconomic environment

coupled with prudent loan administration by banks (RBM, 2003). During this period, the macroeconomic environment was characterized by declining lending rates, stable inflation and exchange rate coupled with increased economic activity. However, after September 2012, quality of the assets started deteriorating rapidly and the NPLs ratio reached a peak of 17.0% by December 2016 but later improved to 15.7% in 2017. Nonetheless, in December 2017, all banks except one had high NPLs ratio above the maximum regulatory requirement.

In terms of sectoral disaggregation, these NPLs were mostly in the wholesale and retail sectors, followed by agricultural, transport and manufacturing sectors (Annex Table 1). The high default rate in these sectors was due to reduced performance in these key sectors of the economy following an adverse macroeconomic environment as evidenced by high levels of interest rates, inflation rates, exchange rates and slowdown in economic growth.

3. Selected review of literature

Theoretical literature

Banks operate with the objective of maximizing the expected value of their profits. Thus, at each point in time, a bank has to make a decision on how it would allocate its assets between risky and safe assets to maximize the expected profits. The option-pricing model postulates that unregulated banks would take excessive portfolio and leverage risk to maximize shareholders returns (Furlong and Keeley, 1989). Meanwhile, to mitigate the risk of bank failure and associated contagion effects, capital regulation has been the focus of banking regulation. The increased focus on capital regulation follows concerns that banks may not hold adequate capital relative to their risk appetite, and that would increase the risk of bank failure. The importance of capital regulation was further emphasized in the aftermath of the 2008 global financial crisis that led to the failure of a number of financial institutions, internationally. Subsequently, more stringent capital requirements came into force under Basel III accord to cushion banks from financial distress and hence prevent future financial crises.

Notwithstanding the above, both theoretical and empirical literature regarding banking capital requirements and risk-taking behaviour of banks is inconclusive. Proponents of stringent regulation argue in favour of higher capital based on two arguments. The first argument is that capital promotes financial stability since it can be used as a buffer that absorbs losses and hence reduces the risk of insolvency. The risk absorption role also mitigates systemic risk factors such as collective uncertainty over counterparty risk (Perrotti and Vlahu, 2011). Consistent with this view, Calem and Rob (1996) argue that risk-based capital standards may have favourable effects if the requirements are stringent enough. They, however, further postulate that the amount of risk a bank undertakes depends on the bank's current capital position, with the relationship being roughly U-shaped.

The second argument is premised on the fact that capital regulation has a role in ameliorating moral hazard induced by deposit insurance. Insurance providers and even regulators do not have full information regarding the portfolio risk of a particular bank, which makes setting actuarially fair risk-based premiums difficult (Daripa and Varotto, 2006). As such, insurance providers charge banks a flat premium, and this gives an incentive for banks to increase risk. In this regard, capital regulation would

limit incentives of bank shareholders (who are provided with limited liability) to take excessive risk (Meckling and Jensen, 1976). Capital requirements also curtail risk-taking by banks as it reduces moral hazard incentives by forcing bank shareholders to absorb a larger part of the losses in case of distress (Bertrand, 2000).

Models based on mean-variance[4] framework have challenged the ability of capital requirement to reduce bank failure and enhance banking system stability. The opponents of higher capital requirements argue that more stringent capital standards could lead to an increase in the bank's risk of failure. Koehn and Santomero (1980), modeling the bank as a portfolio of assets, assume that bankers are risk averse and therefore maximize a utility function of their financial net wealth. However, the introduction of a flat capital requirement restricts the risk return frontier of banks, thus forcing them to reduce leverage and hence adjust their portfolios by adding more risky assets to increase the expected returns. The increase in bank's risk may outweigh the capital requirement, thereby leading to an increased probability of default. Dagher et al (2016) have also argued that this may push intermediation out of the banking system into unregulated entities, possibly increasing systemic risk. Furthermore, Perrotti and Vlahu (2011) argues that higher capital may have unintended effect of enabling banks to take more tail risk without the fear of breaching the minimum capital ratio in non-tail risky project realization. Avery and Berger (1991) argued that if there are imperfections in risk weightings, then risk-based capital regulation may induce bank failure as banks constrained by capital regulation would improve their regulatory capital ratios by reducing risk in terms of official figures while actual business risk could be increasing. The concept of too-big-to-fail has also been used to argue that risk-based capital regulation may not reduce bank risk taking. Large banks that are systemically important know that they can be bailed out by public funds in case of financial distress. As such, they may exploit this implicit public guarantee by taking higher risk even with stringent capital regulation, thereby increasing the risk of default (Stolz, 2002).

Further, theory also suggests that other factors such as corporate governance structure matter for bank risk taking, in light of capital regulation. For example, based on corporate governance theory, Meckling and Jensen (1976) postulated that corporate risk taking is also influenced by the type of ownership within the corporate governance structure. Thus, more powerful shareholders advocate for more bank risk taking than debt holders and non-shareholder managers (Galai and Masulis, 1976). Further, it is also argued that an independent board may exercise effective control over managers and hence would promote corporate performance. This view is also shared by Minton, Taillard, and Williamson (2010) who argue that larger and more independent boards are associated with lower levels of risk-taking. As such, the impact of stringent capital regulation on risk taking by individual banks may vary depending on whether ownership is concentrated or not; involvement of shareholders in the management of the institution; and the structure of board of directors for the institution, thus board size and the number of outside directorship.

In addition, recent literature that capitalizes on agency paradigm argue that the impact of capital regulations on bank risk-taking in principle depends on the outcome of principal-agent relations involving bank owners, managers and regulators. They argue that the shareholders-manager agency problem can be ameliorated if management incentives are aligned with bank owners (John et al, 2008). In such cases, concentrating bank regulation on bank capital ratios may be ineffective in controlling risk-taking. While the bank shareholders-manager agency problem can be ameliorated, the bank shareholders-regulator and depositors-managers agency problems remain. Boyd et al (1998) postulated that bank shareholders (owners) may side with managers against depositors to extend high-risk loans, which may lead to high level of impaired loans. Some researchers have argued that in fact if top management is very closely aligned with equity interests in banks, which are highly leveraged institutions, it will have strong incentives to undertake high-risk investments even when they are not positive net-present value investments (Kose and Yiming, 2003, Anginer et al, 2018). In this case, despite the presence of independent boards, bank managers may still have an excessive risk appetite.

Empirical studies

Empirical work on the relationship between capital requirements and bank risk-taking behaviour supports the theoretical literature as it is also inconclusive. While some have found a negative relationship, others have found a positive relationship and yet there are other researchers that have found that capital requirements have no impact at all on bank risk-taking behaviour. A selected number of studies found a negative relationship despite using different measures of bank risk behaviour. For example, Abou-El-Sood (2017) using three measures of bank risk (risk weighted of assets, loans, or off-balance sheet items) and similarly Klomp and De Haan (2015) using banks' Z-scores as a measure of banking risk found that capital requirements and supervisory control are negatively-related to the risk of almost every kind of bank. However, they found that the effectiveness of other types of regulation and supervision depended on bank structure. Similarly, Ashraf et al (2016) using two measures of risk (the risk-weighted assets to total assets ratio and non-performing loans to gross loans ratio) also found that commercial banks have reduced assets portfolio risk in response to stringent risk-based capital requirements.

Others, For example Shrieves and Dahl (1992), found a positive association between changes in risk and capital. However, the finding was only holding for banks with capital ratios in excess of regulatory minimum levels. The results for banks that were undercapitalized by regulatory standards indicate that regulation was at least partially effective during the period covered. Lee and Hsieh (2013) and Deelchand and Padgett (2009) used loan loss reserves as a measure of bank risk-taking and found that equity to total assets ratios was inversely correlated with risk. Bichsel and Blum (2004) used the volatility per unit of market value of assets as a measure of risk and found that in a dynamic framework, capital adequacy rules may increase a bank's riskiness.

Meanwhile, a number of other researchers found mixed results. For example, Haq et al (2014) examined a sample of listed commercial banks in 15 Asia-Pacific countries and found mixed results. Specifically, they observed a negative association between bank capital and bank idiosyncratic and credit risks, and a positive association between bank capital and bank total and systemic risks. Similarly, the findings by Laeven and Levine (2009) suggest that regulation has different effects on bank risk-taking depending on the bank's corporate governance structure. Calem and Rob (1996) also found mixed evidence regarding the effect of stringent regulation on risk-taking behaviour of banks.

Yet, still others have found that capital requirements have no impact on bank risk-taking behaviour. For example, Floquet and Biekpe (2008) and Rime (2001) using ratio of non-performing loans to total loans as a measure of risk and partial adjustment model found no significant relationship between changes in capital and changes in risk.

The above mixed findings on the relationship between capital regulation and bank risk-taking calls for more empirical studies on the subject and more especially that literature is scanty in the sub-Saharan African (SSA) economies.

4. Methodology and data

Empirical model and variables

To analyse the impact of capital requirements on risk-taking behaviour of Malawian banks, we adopt the partial adjustment framework, following existing literature (Bertrand, 2000; Floquet and Biekpe, 2008 ; Ashraf et al, 2016). This framework is adopted based on the argument that banks may not adjust their risk instantaneously in response to a change in capital regulation or other relevant factors. Instead, banks adjust their risk levels over time. Further, since risky investments provide higher returns than risk-free investments, banks tolerate a certain level of risk to achieve their objective of profit maximization.

In view of this, the study estimates the following equation to assess the impact of capital regulation on risk-taking behaviour by banks in Malawi.

$$\boldsymbol{RISK_{i,t} = \beta_{it} + \delta RISK_{i,t-1} + \alpha CAR_{i,t} + \gamma X_{i,t} + \theta Y_t + u_{jt}} \quad (1)$$

Where; $RISK_{i,t}$ is risk for bank i at time *t*, Capital adequacy ratio (CAR), While $X_{i,t}$ is institutional quality variables and Y_t is a vector of control variables (bank level characteristics and a macroeconomic variable).

Therefore, the empirical model to be estimated is as follows:

$$\boldsymbol{RISK_{i,t} = \beta_0 + \delta_1 RISK_{i,t-1} + \alpha CAR_{i,t} + \gamma OUTSIDE_{i,t} + \theta_1 SIZE_{i,t} + \theta_2 ROA_{i,t} + \theta_3 LASSET_{i,t} + \theta_4 OWNERSHIP_t + \theta_5 GDP_t + u_{it}} \quad (2)$$

Where; $RISK_{i,t}$ is risk for bank *i* at time t. Literature has an array of proxy measures for risk and in this study, we use two alternative proxies for risk. Firstly, considering that credit risk is the main source of risk for Malawian banks, the paper first uses the ex-ante proxy measure of risk, thus the risk weighted assets to total assets. The risk-weighted assets comprise all exposures to the bank thus both on-

balance sheet and off-balance sheet exposures. The assets are weighted taking into account all types of risk (credit, operational and market risk). The weighting scheme is based on Basel II requirements under the Standardized Approach. For robustness check, the study also uses ex-post measure of risk, thus non-performing loans (NPLs), following Floquet and Biekpe (2008). Further, the study also uses the measure of overall bank risk, thus the Z_score,[5] which is computed as the sum of Return on Assets (ROA) and Tier 1 capital ratio divided by the standard deviation of ROA. A high value of Z-score indicates low bank risk while a low value of the Z-score indicates higher risk of a bank.

To examine the effect of regulatory capital requirements on bank risk-taking behaviour, the study uses Capital adequacy ratio (CAR) using two measures, thus the ratio of total capital to Risk Weighted Assets and the ratio of Tier1 capital to Risk Weighted Assets. In the Malawian banking system, Tier 1 comprises paid-up capital, retained earnings, current year profits and share premiums. However, in the specification where Z-score is the dependent variable, regulatory pressure (LREG) dummy is instead used as a measure of capital requirement since Tier 1 is also used in the calculation of the Z-score (the dependent variable). The low regulatory dummy takes a value of 1 for banks whose Tier 1 ratio falls above the regulatory minimum, otherwise 0 for banks whose Tier 1 ratio falls below the regulatory minimum. *A priori*, the sign for the coefficient of capital requirement variable is ambiguous as banks may react differently to increases in capital requirements. Some banks may react to increased requirements of capital by taking more risk to compensate for the loss while others may decide to reduce leverage.

With regard to banks' corporate governance, literature suggests that capital regulation has a different impact on individual bank's risk-taking behaviour depending on their corporate governance structure. More powerful shareholders advocate for more bank risk-taking than debt holders and non-shareholder managers (Galai and Masulis, 1976; Meckling and Jensen, 1976; Laeven and Levine, 2009; Abou-El-Sood, 2017). Further, it is also argued that an independent board may exercise effective control over managers and hence would promote corporate performance. This view is also shared by Minton, Taillard, and Williamson (2010), who found that larger and more independent boards are associated with lower levels of risk taking. As such, the impact of stringent capital regulation on risk-taking of individual banks may vary depending on a number of corporate governance factors, including: whether ownership is concentrated or not, thus involvement of shareholders in the management of the institution; size of board of directors; and number of outside or independent directors on the board for the institution.

In this study, we incorporate a bank's corporate governance factor by using a measure of the board structure. We did not use ownership structure (involvement of shareholders in the management of the institution) as data revealed that ownership is highly concentrated in all the nine banks in Malawi, such that there is no variation in the variable. We therefore use the number of outside directors in the board for

individual banks at time t (to capture the corporate governance factor). Following Abou-El-Sood (2017), outside directorship is measured by the ratio of number of outside directors on the board to board size, where board size is measured as the total number of board directors. *A priori*, the relationship between the ratio of outside directorship and risk-taking behaviour is expected to be negative as the more independent the directors, the more the board is able to carry out its oversight function effectively.

In terms of bank level control variables, we include bank size *(SIZE)* measured as market share, which is the ratio of an individual bank's assets to total assets for the banking system. Common wisdom suggests that bigger banks are more likely to take risky positions, like the results by Teresa and Dolores (2008) for the Spanish banking system. However, in other cases, smaller banks may take more risky positions to increase their market share in line with results by Hakimi et al (2012) for the Tunisian banking system. The expected sign of the coefficient, therefore, is unknown *a priori*. The study also includes Return on Assets *(ROA)* as a measure of bank profitability, computed as the ratio of net income to average total assets. Theoretically, an increase in *ROA*, which could either be due to an increase in net interest income or non-interest income puts a bank at a competitive position, hence more likely to reduce the risk appetite of banks. Conversely, a reduction in profits could lead managers to take risky positions to meet their objective. The conventional view is that higher risk is associated with greater probability of higher return. This therefore implies that there is a natural two-way causality between *RISK* and *ROA*. A broad measure of profitability is used as most Malawian banks' non-interest income is significantly high. The expected, sign therefore, is negative.

The study also includes the variable, loan to asset ratio *(LASSET)*, proxying the evolution of the credit risk taken when creating bank assets (Floquet and Biekpe, 2008). Further, the paper includes a variable to capture ownership of the bank *(OWNERSHIP)* that is whether a bank is domestically- or foreign-owned. The dummy variable takes the value of one where there is dominant foreign shareholding, otherwise zero.

Further, considering that the study period corresponds to a period of macroeconomic instability, banks' risk appetite in Malawi may also be influenced by macroeconomic variables. In addition, other studies have found macroeconomic variables to be important drivers of bank risk-taking behaviour. For example, Laeven and Majnoni (2003) and Bikker and Metzemakers (2005) found provisioning decisions to be associated with economic growth, apart from banks' lending behaviour and capital strength. Similarly, Davis and Zhu (2009) and Barrel et al (2010) found provisioning to be correlated with GDP growth. As such, following this literature, we include GDP growth to control for macroeconomic variables and, *apriori*, we expect a negative sign. Details of definition of variables are contained in Annex Table 2.

Data and estimation technique

The study uses quarterly data from eight commercial banks in Malawi for the period 2010.1 to 2017.4. Data was limited to eight and not nine banks as one bank had a very short span of data since it was fairly new in the market. Further, data was obtained from various sources, including commercial banks' balance sheets, annual financial statements and augmented by data from the Reserve Bank of Malawi. Since our model takes the form of the dynamic panel with the lagged dependent variable as one of the explanatory variables, and considering that our data has a small N but relatively large T, the most appropriate estimation technique would have been the bias-corrected least squares dummy variable (LSDVC) technique proposed by Kiviet (1995) for dynamic panel data models. It is argued that LSDVC technique is more superior since it performs better in terms of bias and root mean squared error (RMSE) than Instrumental Variables (IV) and Generalized Method of Moments (GMM) estimators when N is small. However, one drawback with LSDVC technique is the assumption that all regressors must be exogenous. In our model, we have some unique characteristics of the bank, which we are interested to estimate their impact on the risk behaviour of banks and may be endogenous. Further, as alluded to earlier, we adopt a partial adjustment model that includes lagged dependent variable as one of the regressors. In addition, Floquet and Biekpe (2008) argue that decisions regarding the levels of capital and risk may be dependent on each other, such that there may be reverse causality between RISK and CAR, and between RISK and ROA. As such, there is potential endogeneity in the model. In view of this, we adopt a System Generalized Method of Moments (GMM) for dynamic panel model. We use one-period lag of the endogenous regressors as instruments. Further, we conduct Arellano-Bond test for autocorrelation, and Sargan test of over-identifying restrictions to test the overall validity of instruments.

5. Discussion of results

Summary statistics

The mean value for the ratio of risk-weighted assets is 58.8% (Table 3) and indicates that banks in Malawi, on average, allocated a considerable share of their total assets in risky assets. In addition, a standard deviation of 14.8% shows that there is high volatility in banks' risk-weighted assets. Similarly, the mean value of NPLs ratio indicates that, on average, 12.2% of total loans in the Malawi banking sector were not performing during the sample period. This signifies high level of default by borrowers in Malawi's banking system. This notwithstanding, there was high variation in NPLs ratio with a standard deviation of 15.3, with one bank having almost zero NPLs while some banks have quite high level of NPLs to the tune of 69.0% of the total loans during the study period. The mean for Tier 1 and total capital ratios of 16.6% and 20.9%, respectively, indicate that on average banks maintained high capital ratios that were above the regulatory minimum. Nevertheless, the minimum values of minus 7.2% and minus 14.4% for Tier 1 and total capital ratios, respectively, show that some banks failed to meet the regulatory minimum capital requirements during the sample period. It should be mentioned that during the sample period, some three failing banks were merged with other two banks; as such, this may to some extent bias the estimates. Nonetheless, the sample does not include those acquired banks.

Estimates for pair-wise correlations between variables (Annex Table 3) show that both Tier 1 and total capital ratios have fairly strong negative correlation with two key measures of bank risk-taking, thus NPLs and risk-weighted assets, while with Z-score the capital ratios have a strong positive correlation. The results generally show that there is low correlation among the regressors to be included in the models except for the size (proxied by market share) and ROA. This, therefore, implies that multicollinearity is not a potentially big problem in our empirical analysis.

Table 3: Descriptive statistics of main variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Z_score	240	10.242	6.427	-3.775	28.496
RWAs ratio	247	58.845	14.779	13.81	96.45
NPLsratio	247	12.17	15.273	0	68.95
Tier1ratio	240	16.569	6.418	-7.19	39.43
totalcapitalratio	247	20.862	8.381	-14.38	59.92
ROA	247	3.246	3.208	-6.3	16.12
LASSET	247	38.458	24.343	5.02	244.18
Size	247	11.652	9.115	1.61	32.59
GDP	256	4.522	2.585	-2.741	10.339
Outside	256	78.87	7.264	66.667	91.667
Foreign	256	.5	.501	0	1
baselchange	256	.5	.501	0	1

Source: Author's compilation

Empirical results

Table 4 presents the results estimated using one-step system GMM. Model 1 uses risk-weighted assets as a measure of bank risk-taking while Model 2 uses NPLs as bank risk measure. Diagnostic statistics for our system GMM are generally consistent with the assumptions for system GMM. In particular, the coefficient for Allerano-Bond test for second order autocorrelation AR(2) is insignificant in both model 1 and 2, implying absence of second order autocorrelation. The reported values for the Sargan test of over-identifying restrictions indicate that we fail to reject the null of over-identifying restrictions for the NPLs specification, implying that the instruments as a group are exogenous.

Table 4: Regression results estimated using System GMM

	Model 1: Dependent Variable LnRWAs	Model 2: Dependent Variable LnNPLs
Lag of RWAs	0.784***	
	(0.072)	-
Lag of NPLs	-	0.819***
		(0.071)
CAR (Tier 1)	-0.038***	-0.068***
	(0.006)	(0.022)
ROA	0.009	-0.014
	(0.013)	(0.025)
LOANTOASSET	0.000	0.005***
	(0.001)	(0.001)

continued next page

Table 4 Continued

	Model 1: Dependent Variable LnRWAs	Model 2: Dependent Variable LnNPLs
SIZE	0.022***	0.020*
	(0.007)	(0.011)
GDP	-0.007*	0.008
	(0.004)	(0.010)
OUTSIDE	0.002	0.014
	(0.006)	(0.015)
FOREIGN Dummy	0.117	0.168
	(0.104)	(0.247)
Constant	2.522***	0.967
	(0.573)	(0.967)
AR(1)	-2.13**	-2.43**
p-value	(-0.033)	(0.015)
AR(2) p-value	0.90	-0.87
p-value	(0.367)	(0.387)
No. of Instruments	11	11
Observations	234	233
Banks	8	8

*** p<0.01, ** p<0.05, * p<0.1

NB: Figures in parenthesis are standard errors

However, for the risk-weighted assets specification, the instruments are weak as we weakly reject the null of validity of the over-identifying restrictions. Nonetheless, the number of instruments in both specifications is not too high compared to the number of observations. Therefore, the problem of instruments proliferation would not undermine the validity of our results.

The coefficient of the lag of the dependent risk variable (Lag of RWAs) is positive and highly significant at 1% level, similar to the findings by Ashraf et al (2016). Similar results are obtained for the lag of NPLs. Thus when NPLs are used as a dependent variable. The significance of the results suggests that risky borrowers would have a lasting effect or would be persistent in the bank risk-taking behaviour in Malawi. This, therefore, implies that high levels of risk weighted assets and non-performing loans that would cause NPL ratio to deviate from the acceptable maximum benchmark of 5% would persist if capital regulation is not well enforced. Manthos and Georgios (2011) argue that a similar mechanism would prevail given bank networks, or if the banking industry is opaque.

On capital regulation measures, the results reveal that there is negative and highly significant relationship between CAR (Tier 1) ratio and the two measures of risk, thus the risk-weighted assets and NPLs in Malawian banking system, at 1% level of significance. Similarly, when the Z-score is used, the study finds a positive and

significant relationship between Z-score and low regulatory pressure (Annex Table 4). This means that banks that have higher capital ratios above the regulatory minimum and essentially face low regulatory pressure have high Z-score, hence lower risk or low probability of becoming insolvent. This confirms our earlier finding that higher capital contributes to low bank risk. For robustness check, we further re-estimated the two models in Table 4 above after removing the outliers. The results are shown in Annex Table 5. In both risk-weighted assets and NPL models, the results are consistent with earlier findings as the coefficient on CAR ratio remains negative and highly significant at 1% level. In view of the foregoing, we therefore find evidence to support the hypothesis that stringent requirements help in reducing investment in high-risk assets and lowering NPLs. As such, strict enforcement of capital regulation is effective in minimizing risk-taking by Malawian banks, both ex-ante and ex-post.

Contrary to expectations, the study finds that the ratio of outside to total number of board of directors for banks (*OUTSIDE*) is insignificantly related to both measures of bank risk-taking. The results are suggestive that independent directors do not matter in limiting Malawi commercial bank managers' risk appetite. This could be because most banks have single controlling shareholders who are able to align their interests with managers' incentives. In this case, more outside directors may be less able to argue with the single controlling shareholders. Further, the results could be suggestive that other factors do matter in influencing Malawi commercial banks risk-taking behaviour. However, the results need to be interpreted with caution as due to lack of data, the study was unable to use a comprehensive measure of corporate governance factor.

Regarding other factors, the study finds that the coefficient for market share (*SIZE*) is positive and significant. That is, an increase in the size of banks in Malawi in terms of market share leads to an increase in both investments in risky portfolio and rise in NPLs. Bigger banks tend to extend loans even to risky customers to increase their return as their asset portfolio is well diversified, while smaller banks are often risk-averse. This is consistent with findings by Teresa and Dolores (2008) for the Spanish banking system, but in contrast to findings by Hakimi et al (2012) for the Tunisian banking system.

Further, the study finds a significant negative association between real GDP and risk-weighted assets, as expected. This means that during an economic boom, banks reduce investment in risky assets but instead accumulate their capital buffers. The study also finds a positive and significant association between loan-to-total assets ratio (LASSET) and NPLs. This provides evidence that as banks are growing their loan books relative to total assets, they are likely to increase their risk exposures as well. The above, therefore, suggests that supervisors need to closely monitor asset composition of banks that are growing in terms of total assets as the growth may stem from increase in loans, which may render the bank highly exposed. The study, however, finds insignificant relationship between foreign *OWNERSHIP* Dummy and return on asset *(ROA)* with both measures of bank risk.

6. Conclusion and policy recommendations

The study investigated the impact of regulatory capital requirements on risk-taking behaviour of Malawi's commercial banks. The study used panel dataset for eight commercial banks in Malawi covering the period 2010.1 to 2017.4. Using system GMM estimation techniques, our results reveal that there is high persistence in bank risk-taking behaviour. Further, the results of the study show that high capital ratios reduce bank risk-taking behaviour in Malawi through reduction in NPLs ratio and investment in high risk assets. Although the debate on whether bank capital requirements influence risk-taking behaviour of banks is still inconclusive, results for the Malawi banking system reaffirm the propositions that argue in favour of higher capital regulation in controlling risk-taking behaviour of banks. Based on the findings of this study and considering that the Malawi banking system had persistently very high NPLs ratio since early 2012, imposition of stringent penalties on banks that fail to meet minimum capital requirements is also key to ensuring that all banks sustain sufficient capital buffers while at the same time ensuring low risk exposure by banks. Thus, enhanced capital regulation coupled with close supervision can help in forcing banks to consistently maintain high capital ratio above the minimum regulatory risk-based capital requirement, which would in turn reduce overall risk in Malawian banks. That said, there is a need to closely monitor the activities of the banking sector to ensure that capital regulation does not encourage banks to shift from intermediation into investment of risk free assets such as government bonds.

Contrary to expectations, the study finds that the structure of board of directors does not significantly influence risk-taking behaviour of Malawian banks. This is contrary to the hypothesis that postulates that independent directors do matter in limiting commercial bank managers' risk appetite. This could be suggestive that other factors do matter in influencing the risk-taking behaviour of Malawi commercial banks.

Limitations of the study

There are quite a number of bank governance factors that, a posteriori, have an impact on risk-taking behaviour of Malawian banks, but were not included in the study due to limitation of data.

Notes

1. Material risks include strategy risk, credit risk, liquidity risk, interest rate risk, foreign exchange rate risk, price risk, operational risk, compliance risk, reputational risk.

2. In Malawi, core capital comprises paid up capital; retained profits; current year profits; and share premiums. While total capital includes core capital plus revaluation and other statutory reserves.

3. CAMEL Is a supervisory ratings system of banks condition and stands for Capital adequacy; Assets; Management Capability; Earnings; Liquidity (also called asset liability management)

4. A framework for combining a portfolio of assets in order to maximize expected return for a given level of risk

5. It indicates the number of standard deviations that bank's ROA has to drop below its expected value before equity is depleted and the bank becomes insolvent.

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Annex

Table 1: Disaggregation of NPLs by sector for individual banks

	2014	2015	2016	2017
Agriculture, forestry, fishing and hunting	18.39	8.03	13.24	18.11
Mining and quarrying	0.1	0.38	0.26	0.49
Manufacturing	6.09	10.98	20.19	28.7
Electricity, gas, water and energy	0.34	1.84	0.96	0.85
Construction	6.63	4.11	5.55	4.28
Wholesale and retail trade	25.85	30.9	22.4	19.58
Restaurants and hotels	4.49	2.45	0.64	0.51
Transport, storage and communications	11.51	26.85	20.79	6.71
Financial services	2.86	0.91	1.08	2.43
Community, social and personal	16.15	9.2	6.68	9.56
Real estate	0.21	0.21	0.63	0.48
Other sectors	7.36	4.14	7.6	8.34

Source: Reserve Bank of Malawi (nd)

Table 2: Definition of variables

Variables	Definition
NPLs	Non-performing loans, proxy for bank risk
RWAs	Risk weighted assets, proxy for bank risk
Z-SCORE	Proxy for bank risk. It is computed as the sum of ROA and Tier 1 capital ratio divided by the standard deviation of ROA
CAR	Capital to risk weighted assets ratio (Tier 1 ratio)
ROA	Return on asset
LASSET	Loans to assets ratio
SIZE	Bank size measured by market share
OUTSIDE	Composition of outside directors in the board, measured by ratio of outside directors to total board size
FOREIGN	Dummy which takes value of 1 for foreign-owned banks, 0 for domestically-owned
BASELCHANGE	Dummy on change in Basel Accord, that takes value of 1 for Basel II era, 0 for Basel I era
GDP	Real GDP growth
LREG	Dummy that captures low regulatory pressure and takes value of 1 for banks whose Tier 1 ratio falls above the regulatory minimum, 0 otherwise for banks whose tier 1 ratio falls below the regulatory minimum

Table 3: Correlation matrix

Variables		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	Z_score	1.000											
(2)	RWAs	-0.142	1.000										
(3)	NPLs	-0.382	0.162	1.000									
(4)	tier1ratio	0.531	-0.302	-0.457	1.000								
(5)	totalcapitalra	0.622	-0.335	-0.396	0.673	1.000							
(6)	roa	0.524	0.127	-0.371	0.131	0.267	1.000						
(7)	lasset	0.127	0.355	0.007	-0.200	0.257	0.084	1.000					
(8)	size	0.443	0.181	-0.240	0.044	0.067	0.542	-0.020	1.000				
(9)	gdp	0.059	-0.080	-0.006	0.066	0.064	0.040	-0.089	0.015	1.000			
(10)	outside	-0.384	0.096	0.463	-0.029	-0.273	-0.306	-0.130	-0.128	-0.025	1.000		
(11)	foreign	-0.088	-0.388	-0.269	0.444	0.139	-0.237	-0.335	-0.227	-0.000	0.299	1.000	
(12)	baselchang	-0.240	0.121	0.280	-0.385	-0.348	-0.204	-0.305	-0.010	-0.049	0.162	0.036	1.000

Table 4: Alternative regression results estimated using system GMM

	Model 1: Dependent Variable LnRWAs	Model 2: Dependent Variable LnNPLs	Model 3: Dependent Variable LnZ_score
Lag of RWAs	0.675***	-	
	(0.095)		-
Lag of NPLs	-	0.764***	-
		(0.107)	
L.LnZ_score	-	-	0.395***
			(0.082
BASELCHANGE	0.441	0.334	
	(0.153)	(0.371)	
LREG	-	-	0.421***
			(0.133)
ROA	0.009	-0.024	-
	(0.010)	(0.033)	
LASSET	0.002***	0.008***	-0.001
	(0.001)	(0.002)	(0.001)
SIZE	0.028***	0.020**	0.017
	(0.010)	(0.008)	(0.011)
GDP	-0.012***	0.002	0.006
	(0.003)	(0.006)	(0.006)
OUTSIDE	0.006**	0.026***	-0.013*
	(0.003)	(0.008)	(0.007)
FOREIGN	-0.155**	-0.355*	0.175
	(0.077)	(0.208)	(0.153)
Constant	2.410***	-0.776*	1.655***
	(0.685)	(0.404)	(0.617)
AR(1)	-2.39**	-2.25**	-2.24**
p-value	(-0.017)	(0.024)	(0.025)
AR(2) p-value	1.78	-0.75	0.32
p-value	(0.0747)	(0.454)	(0.753)
Sargan Test Chi²	20.78	0.02	4.75
p-value	(0.000)	(0.992)	(0.093)
No. of Instruments	11	12	10
Observations	239	233	228

*** p<0.01, ** p<0.05, * p<0.1,Figures in parenthesis are standard errors

Table 5: Re-estimation results using System GMM after removing outliers

Lnrwas	**Model 1: Dependent Variable LnRWAs**	**Model 2: Dependent Variable LnNPLs**
Lag of RWAs	0.729***	-
	(0.062)	
Lag of NPLs	-	0.805***
		(0.088)
CAR (Tier 1)	-0.042***	-0.072***
	(0.005)	(0.019)
ROA	0.008	-0.018
	(0.013)	(0.026)
LASSET	-0.001	0.004***
	(0.001)	(0.002)
SIZE	0.027***	0.021*
	(0.006)	(0.011)
GDP	-0.009*	0.007
	(0.004)	(0.009)
OUTSIDE	0.004	0.016
	(0.006)	(0.016)
FOREIGN	0.087	0.131
	(0.109)	(0.239)
Constant	2.968***	1.003
	(0.509)	(1.004)
AR(1)	-2.09**	-2.39**
p-value	(-0.037)	(0.017)
AR(2) p-value	0.90	-0.85
p-value	(0.367)	(0.397)
Sargan Test Chi ^{2}	42.51	0.77
p-value	(0.000)	(0.679)
No. of Instruments	11	11
Observations	232	231
Banks	8	8

*** p<0.01, ** p<0.05, * p<0.1

NB: Figures in parenthesis are standard errors

Mission

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

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

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