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

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Abstract

Proponents of stringent regulation argue in favor of higher capital requirements that it promotes financial stability, while opponents argue that capital requirements might not enhance stability but might in fact increase a bank's riskiness. In this paper, we test this hypothesis with a dynamic panel data model for eight Malawian commercial banks using GMM estimation technique. Our results reveal that there is high persistency in risk-taking behavior of Malawian banks. Further, the study finds that high capital ratios reduce risk-taking behavior of Malawian banks through reduction in 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 banking system. However, contrary to corporate governance propositions, the study finds that the structure of board of directors does not significantly influence the impact of capital regulation on bank risk taking in Malawi.

Keywords: Banks, capital requirements, Malawi, risk-taking behavior, risk-weighted assets, non-performing loans

JEL Classification: G21, G28.

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' behavior. 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 favor of higher capital, based on two arguments; firstly, capital limits promote financial stability since they are a buffer that absorb losses and hence reduce the risk of insolvency and therefore mitigates systemic risk factors (Perotti, Ratnovski, & 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 & Jensen, 1976; Kahane, 1977; Admati & Hellwig, 2013).

On the other hand, opponents of higher capital requirements argue that capital adequacy rules might not enhance stability but might 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). Further, risk-based capital regulation might 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). Meanwhile, another strand of literature demonstrate 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; Floquet & Biekpe, 2008).

Notwithstanding the above divergent views, contemporary banking literature has stressed the role of corporate governance in risk taking behavior 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) argued that larger and more independent boards are associated with lower levels of risk taking. Kirkpatrick (2009) also shared the same view, arguing that weak boards might lead to insufficient monitoring of managers' actions, which might eventually lead to excessive risk taking behaviour. Further, another strand of corporate governance literature that capitalizes on agency paradigm argue that while alignment of management incentives with bank owners may ameliorate the shareholders-manager agency problem, this might not necessarily limit bank managers to take excessive risk (see Kose & Qian, 2003; Anginer, Demirguc-Kunt, Huizinga, & Ma, 2018).

In Malawi, through the Reserve Bank of Malawi (RBM), the Registrar of financial institutions as a supervisory and regulatory authority imposes 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). In particular, capital adequacy requirement regulations and guidelines in Malawi have broadly evolved from less stringent Basel I accord to more stringent Basel II accord. However, despite implementing various measures of risk based capital regulation and adoption of stringent capital requirements, credit risk was high. In particular, risk weighted assets particularly for two domestic systemically important banks were persistently high, above 50%, though slightly declined in later years. Further, in the later years, asset quality deteriorated significantly as evidenced by high non-performing loans (NPLs) ratio in Malawian banking system that was persistently above the prudential maximum of 5% in some years in the past decade. This therefore puts an empirical question on whether the 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? Do bank governance related factors matter in terms of risk taking behavior of Malawian banks? What are the other factors that influence the risk taking behavior of Malawian banks?

Against this background, the paper aims to investigate the impact of capital requirements on Malawi's banks risk taking behavior, for the period of 2010 to 2017. In particular, the study investigates the relationship between regulatory capital and risk taking behavior of Malawian banks. Further, the study examines the effect of banks' governance related factors on risk appetite of Malawian banks. While there is a lot of work on the subject for developed economies, emerging markets as well as Asian countries, there is very little work for developing countries. In particular, to the best of our knowledge, no empirical work of a similar nature is available for Malawi. As such, the results from the study would inform policy and regulation of the banking system, thus enhance financial system stability.

The rest of the paper is organized as follows; section two presents some stylized facts, section three summarizes selected literature, section four outlines the methodology used, section five analyses and discusses results and section six concludes and provides policy recommendations.

2. Stylized Facts

2.1 Capital Regulation in the Malawi Banking System

As alluded to earlier, capital requirements in Malawian banking system have evolved over time, in line with Basel Accord, in order to foster sound risk management systems among banks in Malawi. This far, Malawian banking system has adopted Basel I and Basel II, which entailed adoption of various banking rules. For instance, in line with the Basel I accord, the capital adequacy directive came into effect in June 1993, under which all banks were required to maintain minimum core (tier 1) (Note 1) and total capital ratios of 4% and 8%, respectively. At that time, assessment of banks' compliance to prudential requirements was based on CAMEL (Note 2), running in parallel with risk-based assessment.

However, 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, the RBM in 2007 embarked on adopting Basel II accord in a phased manner in view of the complexity and costs involved. In the year, the RBM adopted Risk Based Approach to Supervision of Financial Institutions, under pillar I of Basel II Accord. In March 2013, the RBM adopted a credit risk-based capital regulation for all banks. The objective was to assist banks to incorporate credit risk in measuring capital under the standardized approach, calculated by dividing capital base by total risk-weighted assets. Market risk was later incorporated into the risk weighted assets calculations. Risk-weighted assets is calculated using three categories of risk (credit, operational and market risk) and apply weights ranging from 0% to 100% depending on institution and type of exposure.

In January 2014, Malawi fully migrated to Basel II standards in an effort to strengthen financial sector soundness and stability. Under the Basel II regime, banks are required to maintain minimum tier 1 and total capital ratios of 6% and 10%, respectively. However, the RBM opted for higher minimum capital adequacy ratios of 10% for tier

1 capital and 15% for total capital, considering the banking business environment and factoring in possible errors in capital calculation that could result from poor quality data and inadequate risk management systems. Under Basel 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). The RBM further took additional steps to strengthen the soundness of the financial sector, which in a way would affect capital positions. These included enactment of an asset classification directive in May 2014 to enhance the provisioning for NPLs based on the Estimated Recoverable Amount Method (ERAM), and a Prompt Corrective Action (PCA) framework in May 2014 that strengthen the Legal framework for early intervention and bank resolution and enhanced existing triggers for early remedial actions for banks in financial distress.

Despite these regulations and periodic inspections by the regulator, some banks failed to meet the minimum capital requirements over the years. Consequently, some banks were recapitalized, while those that failed to recapitalize were either merged with other banks or taken over. For instance, in 2006, one private-owned bank that consistently 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 challenge were acquired. Similarly, in 2017, one foreign-owned private bank that failed to recapitalize merged with another bank. Nonetheless, two domestic-owned private banks were recapitalized by shareholders at the end of 2017.

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

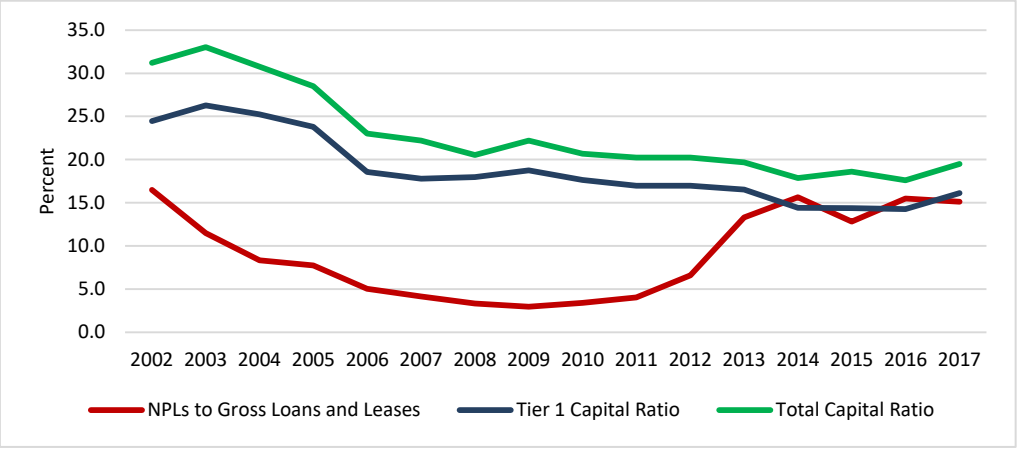

Figure 1. Trends in Capital ratios and Non-Performing Loans ratio

Source: RBM, nd.

2.2 Risk Taking Behaviour of Malawian Banks

2.2.1 Asset Structure of Malawian Banks

Prior to the adoption of more stringent capital regulation, thus Basel II, total loans constituted about 50.0 percent of total banking sector assets between 2010 and 2014 (Table 1). However, the share of total loans and leases to total assets dropped after Basel II adoption, reaching the low of 26.8 percent in 2017. On the other hand, investments in securities was 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 might have led to unintended results as intermediation evidently dropped.

Table 1. Classification of assets for Malawi banking system (%age 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	33.0	35.2	34.0

Source: RBM 2017.

2.2.2 Lending Structure of the Malawian banks

Overall, over 80.0 percent of the loans in Malawian banking system are channeled to the private entities, while the rest to the government; statutory bodies; and Non-Governmental Organizations (NGOs). In terms of loan allocation to clients, seven banks channeled over 70.0 of the private sector loans to private corporations (thus Small and Medium Enterprises (SMEs) and large enterprises) over the sample period. While two banks allocated the large part of their loan book (about 50%) to individual and households, in line with their lending business strategy focusing on small clients. Nevertheless, type of ownership or management did not influence individual bank's business lending models.

In terms of the sectoral allocation, over 70.0 percent of banking sector total loans and leases is concentrated to five sectors (Table 2). Lending to the wholesale and retail constituted the highest proportion of total loans and leases during the sample period, followed by agriculture and manufacturing sectors.

Table 2. Distribution of loans by sector (percent)

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.

2.2.3 Trends and Sectoral Composition of NPLs

Asset quality as measured by the ratio of NPLs in the Malawi banking system has exhibited a mixed trend over the years, improving tremendously from 2002 to 2004 (Figure 1), as evidenced by sharp decline in the NPLs ratios, to below the recommended limit of 5% until mid-2012. This was partly due to favorable 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 rates coupled with increased economic activity. However, asset quality started deteriorating rapidly, with NPLs ratio reaching a peak of 17% by December 2016, but later improved to 15.7% in 2017. Nonetheless, it remained above the recommended limit.

3. Selected Review of Literature

3.1 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 decide on how it would allocate its assets between risky and safe assets, in order 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 & Keeley, 1989). Meanwhile, to mitigate against the risk of bank failure and associated contagion effects, capital regulation became the focus of banking regulation. The increased focus on capital regulation follows concerns that banks might 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 financial institutions. Subsequently, more stringent capital requirements came into force under Basel III accord in order to cushion the banks from financial distress and hence prevent future occurrence of financial crises.

Notwithstanding the above, both theoretical and empirical literature regarding banking capital requirements and risk taking behavior 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 acts 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 (Perotti et al., 2011). Consistent with this view, Calem and Rob (1996) argued that risk-based capital standards may have favorable effects if the requirements are stringent enough. They, however, further postulates 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 &

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 & 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, 2001).

On the other hand, models based on mean-variance (Note 3) 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 the bank, thus forcing it to reduce leverage and hence adjust their portfolios by adding more risky assets in order to increase expected return. The increase in bank's risk might outweigh the capital requirement, thereby leading to an increased probability of default. Dagher, Giovanni, Laeven, Ratnovski, and Tong (2016) also argued that this might push intermediation out of the banking system into unregulated entities, and possibly increase systemic risk. Furthermore, Perotti et al. (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 is also used to argue that risk-based capital regulation might not necessarily 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 might exploit this implicit public guarantee by taking higher risk even with stringent capital regulation, thereby increase the risk of default (Stolz, 2002).

Further, theory also suggests that other factors like corporate governance structure matter for bank risk taking, in light of capital regulation. For instance, 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 & 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 et al. (2010) who argued that larger and more independent boards are associated with lower levels of risk taking.

3.2 Empirical Studies

Empirical work on the relationship between capital requirements and bank risk taking behavior is also inconclusive. Whilst some studies found a negative relationship, others found a positive relationship and yet other studies established that capital requirements have no impact at all on bank risk taking behavior. A selected number of studies found a negative relationship despite using different measures of bank risk behavior. Ding and Sickles (2019) in their study on US banks established that stringent capital requirement causes banks to reduce investments in risk-weighted assets, thus evidence of negative association. Rahmana, Zheng, Badar Ashraf, and Rahman (2018) who employed two-step Generalized Methods of Moments (GMM) and used net interest margin and Z-sore as measures of risk also found that capital adequacy reduces the risk seeking behavior of commercial banks in Bangladesh. Abou-El-Sood (2017) using three measures of bank risk (risk weighted assets, loans, or off-balance sheet items); and 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 type of bank. However, they found that the effectiveness of other types of regulation and supervision depended on bank structure. Similarly, Ashraf, Nadeem and Yuancheng (2016) using two measures of risk (the risk weighted assets to total assets ratio and NPLs ratio) also established that commercial banks have reduced assets portfolio risk in response to stringent risk-based capital requirements.

On the other hand, others found a positive relationship. For instance, 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. Results for banks which were undercapitalized by regulatory standards indicate that regulation was at least partially effective during the period covered. Bichsel and Blum (2004) also found that in a dynamic framework capital adequacy rules might increase a bank's riskiness.

Meanwhile, a number of other researchers found mixed results. Haq, Faff, Seth, and Mohanty (2014) examined

a sample of listed commercial banks in 15 Asia-Pacific countries and they observed a negative association between bank capital and bank idiosyncratic and credit risks, while found a positive association between bank capital and bank total and systemic risks. Similarly, Laeven and Levine (2009) findings suggest that regulation has different effects on bank risk taking depending on the bank's corporate governance structure.

Yet still others have found that capital requirements have no impact on bank risk taking behavior. For instance, 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 coupled with scanty literature in the Sub-Saharan African (SSA) economies calls for more empirical studies on the subject.

4. Methodology and Data

4.1 Empirical Model and Variables

To assess the impact of capital requirements on risk taking behavior of Malawian banks, we adopt the partial adjustment framework, following existing literature (Bertrand, 2001; Floquet & Biekpe, 2008; Ashraf et al., 2016) and estimate the following equation:

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

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:

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

Literature has an array of proxy measures for risk and this study uses 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. For robustness check, the study also uses ex-post measure of risk, thus NPLs, following Floquet and Biekpe (2008). The study also uses the measure of overall bank risk, thus the Z_score (Note 4), which is computed as the sum of Return on Asset (ROA) and tier 1 capital ratio divided by the standard deviation of ROA. The higher value of Z_score indicates low bank risk, while the lower value of the Z-score indicates higher risk of a bank.

To examine the effect of regulatory capital requirements on bank risk taking behavior, the study measures Capital adequacy ratio (CAR) using the ratio of total capital to Risk Weighted Assets and the ratio of tier 1 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, low regulatory pressure (LREG) dummy is instead used as a measure of capital requirement since tier 1 is also used in the calculation of the dependent variable Z_score. The LREG 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. Apriori, the sign for the coefficient of capital requirement variable is ambiguous as banks may react differently to increases in capital requirements. Specifically, some banks may react 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 different impact on individual bank's risk taking behavior depending on different corporate governance factors including; whether ownership is concentrated or not; size of board of directors; and number of outside or independent directors on the board of the institution. In this study, we incorporate a bank's corporate governance factor by using a measure of the board structure. In particular, we use the number of outside directors on the board of individual banks at time t ($OUTSIDE_{i,t}$). 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 behavior is expected to be negative because the more the independent 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 by 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 instances, smaller banks may take riskier positions in order to increase their

market share in line with findings by Hakimi, Dkhili, and Khlaifia (2012) for the Tunisian banking system. The expected sign of the coefficient therefore is unknown a priori. The study also includes ROA as a measure of bank profitability, computed as the ratio of net income to average total assets. Theoretically, an increase in ROA 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 take risky positions in order to meet their objective. The expected sign therefore is negative.

The study also includes the variable, loan to asset ratio (LASSET), to proxy the evolution of the credit risk taken when creating bank assets (Floquet & 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 mixed macroeconomic performance, banks' risk appetite in Malawi might also be influenced by macroeconomic variables. In addition, other studies have found macro-economic variables to be important drivers of bank risk taking behaviour. For example, Laeven and Majnoni (2003), Davis and Zhu (2009) and Barrel, Davis, Liadze, and Karim (2010) found provisioning decisions to be associated with economic growth. As such, following this literature, we include GDP growth in order to control for macroeconomic variables and apriori we expect a negative sign.

4.2 Data and Estimation Technique

The study uses quarterly data from eight commercial banks in Malawi for the period 2010 to 2017. The study was restricted to this period due to unavailability of granular data in the earlier period. Further, data was limited to eight banks as one bank had a very short span of data being fairly new on the market. The data was obtained from commercial banks' balance sheets, annual financial statements and augmented by data from RBM. Since our model takes the form of the dynamic panel with the lagged dependent variable as one of the explanatory variables and some of the regressors might be endogenous, we adopt a System GMM for dynamic panel model in estimating the model. We use one-period lag of the endogenous regressors as instruments. Further, we conduct Arellano-Bond test for autocorrelation as well as Sargan test of over-identifying restrictions in order to test the overall validity of instruments.

5. Discussion of Results

5.1 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. This notwithstanding, there was high variation in NPLs ratio with a standard deviation of 15.3, with one bank having almost zero NPLs whilst some banks having high level of NPLs to the tune of 69.0% of 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.

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.

Estimates for pair-wise correlations between variables (Appendix, Table 1) 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. On the other hand, 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.

5.2 Empirical Results

Table 4 below present 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)
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

Note. *** p<0.01, ** p<0.05, * p<0.1

Figures in parenthesis are standard errors.

However, for the risk-weighted assets specification, the instruments are fairly 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 percent level, similar to the findings by Ashraf et al. (2016). Similar results are obtained for the lag of NPLs, thus when NPLs is used as a dependent variable. The significance of the results suggest that risky borrowers would

have a lasting effect or would be persistent in the bank risk-taking behavior 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 percent 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 measure, 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 percent level of significance. Similarly, when the Z_score (Note 5) is used, the study finds a positive and significant relationship between Z_score and low regulatory pressure (Appendix, Table 2). 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. Results are shown in Appendix, Table 3. 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 percent 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 shareholder 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 shareholder. Further, the results could mean other factors do matter in influencing Malawi commercial banks risk taking behavior. 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.

With regard to other factors, the study finds that the coefficient for market share (SIZE) is found to be 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 in order 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 might stem from increase in loans, which might render the bank highly exposed. The study, however, finds insignificant relationship between foreign OWNERSHIP Dummy and ROA with both measures of bank risk.

6. Conclusion and Policy Recommendations

The study investigated the impact of regulatory capital requirements on risk taking behavior of Malawi's commercial banks. The study used quarterly panel dataset for eight commercial banks in Malawi covering the period 2010 to 2017. Adopting system GMM estimation technique, our results reveal that there is high persistence in bank risk taking behavior. Further, the results show that high capital ratios reduce risk taking behavior of banks in Malawi through reduction in NPLs ratio and investment in high risky assets. Although the debate on whether bank capital requirements influence risk taking behavior of banks is still inconclusive, results for the Malawi banking system reaffirm the propositions that argue in favor of higher capital regulation in controlling risk taking behavior 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 could in turn reduce overall risk in Malawian banks. This said, there is need to closely monitor activities of the banking sector to ensure that capital regulation does not encourage banks to shift away from intermediation into investment of risk-free assets like government bonds.

Contrary to expectations, the study finds that the structure of board of directors does not significantly influence risk-taking behavior 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 suggest that other factors do matter in influencing Malawi commercial banks risk taking behavior.

6.1 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.

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Notes

Note 1. 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.

Note 2. Is a supervisory ratings system of banks condition and stands for Capital adequacy; Assets; Management Capability; Earnings; Liquidity (also called asset liability management).

Note 3. A framework for combining a portfolio of assets in order to maximize expected return for a given level of risk,

Note 4. 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.

Note 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.

Appendix

Table 1. 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 2. 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

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

Table 3. 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 Chi2	42.51	0.77
p-value	(0.000)	(0.679)
No. of Instruments	11	11
Observations	232	231
Banks	8	8

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