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Regulatory capital and its effect on credit growth, non-performing loans and bank efficiency

Regulatory capital

Evidence from Ghana

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Abstract

Purpose – This paper aims to investigate the influence of the central bank's regulatory capital on commercial banks specific performance outcomes such as credit supply, interest rate spread (as a measure of efficiency) and non-performing loans (NPLs).

Design/methodology/approach – Using specific commercial bank-level panel data from 2002-2012, a system of equations was modeled that allows us to apply the system generalized methods of moment approach and estimate the equations, while controlling for specific bank level, industry and macroeconomic variables.

Findings – The study finds a positive relationship between a net minimum capital ratio and the net interest margin. Although this is in contrast with the study expectations, the result suggests that a high net minimum capital requirement would widen the spread between the lending and saving rates. The study further finds evidence to support the fact that high minimum capital requirement and excess capital above the minimum required drive credit growth in the banking sector of Ghana. However, high excess capital increases risk-taking activities of the banks, as excess capital is found to be associated with high NPL ratios.

Practical implications – Given the economic benefits and costs of sharply increasing bank regulatory capital, our results speak to the ongoing debates on the right level of capital, the effectiveness of the Bank of Ghana policy rate (PR) and the high lending rates that appear to respond only slowly to macroeconomic indicators such as the PR and the inflation rate. The finding also has practical implications for the adoption of the Basel III accord.

Originality/value – The empirical literature has not paid enough attention to the impact of regulatory capital on the three specific bank-level outcomes – NPLs, interest rate spread and the nature of interrelationships among these variables, particularly in the African context.

Keywords Banks, Regulatory change, Capital

Paper type Research paper

1. Background

There has been a growing wealth of literature on the importance of regulatory capital for bank stability and soundness in recent times. This has even been reinvigorated by the introduction of the global charter that regulates banks' capital requirements – the Basel

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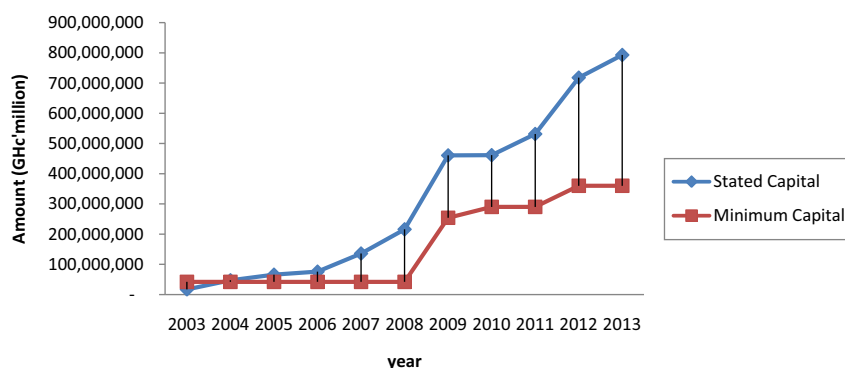


III Accord – which aims to make each bank’s capital holdings proportional or sensitive to its potential credit losses (The [Basel Committee on Banking Supervision, 2006](#))[1]. This is because capital has long been recognized as one of the key factors to be considered when the safety and soundness of a particular bank is being assessed. [Greuning and Bratanovic \(2000\)](#), analysing banking risk, observed that an adequate capital base serves as a safety net for a variety of risks to which an institution is exposed in the course of its business. Furthermore, while capital absorbs possible losses and thus provides a basis for maintaining depositor confidence in a bank, it also serves as the ultimate determinant of a bank’s lending capacity and risk-taking activities. Moreover, according to these studies, capital availability determines not only the maximum level of assets a bank holds but also the amount and cost of capital impact on a bank’s efficiency and its competitive position.

At the same time, high risk-based capital adequacy requirements, serving as a buffer against risk, can accentuate the procyclicality of bank lending, which is damaging to all economies – but particularly so for fragile developing ones, which are more vulnerable to strong cyclical fluctuations of financing ([Griffith-Jones and Persaud, 2008](#)). This is because as raising equity capital is costly or very difficult in developing countries, like those in Africa, and the cost of holding capital comes over to loan prices ([Jokivuolle *et al.*, 2007](#)), banks may be forced to scale back their lending activities, particularly, to the agricultural and high-risk informal sectors, to maintain a minimum capital buffer on less risky assets. Thus, while minimum capital regulations are certainly necessary, overly strict or high capital adequacy regulations can also become a disincentive to credit expansion, particularly, to the perceived highly risked agricultural and informal sectors which are the bedrock of most African economies.

In this regards, several theoretical studies assessing and comparing the flat-rate capital requirement under the previous Basel I regime and the Basel II regime, which has a risk-based capital requirement and their respective impacts on some banking sector outcomes and on the macroeconomic indicators, have emerged ([Jokivuolle and Vesala, 2007](#); [Griffith-Jones and Persaud, 2008](#); [Pasiouras *et al.*, 2009](#); [Pennacchi, 2005](#); and [Kopecky and VanHoose, 2006](#)). The findings of the regulatory capital adjustments have however been somewhat contradictory on varying indicators, such as banking efficiency, credit risk and lending.

Ghana is an interesting case study in Africa because of the recent regulatory capital adjustments that have occurred in its banking sector and the various risk concerns that have been expressed by regulators and researchers alike. The minimum capital requirement or the regulatory capital has been increased substantially on three separate occasions since 2003. These developments made the banking industry fairly well-capitalized with stated capital increasing from GH¢16.2 million (US \$22.5 million) in 2001 to about GH¢1,700 million (US \$1,016 million) in February 2012. By the end of 2013, the stated capital of the banks had increased to GH¢2,345.4 million (US \$1,172.7 million). In each of the years, the growth rate was exponential. These high increases were also due to the fact that banks had continually kept their capital well in excess of the minimum required on their balance sheets. [Figure 1](#) compares the deviation of the actual stated capital of the top six banks to the total minimum required by the BOG. The six banks, which are also known as the first quartile banks, account for 51 per cent of the total industry assets. The deviation of the stated capital from the minimum



Source: Bank of Ghana Annual Reports and Banks' Financial Statements (2003-2013)

Figure 1.
Stated capital of some selected banks and the minimum capital requirement

required capital has been increasing over the years, as depicted by the height of the vertical bars.

These massive injections of capital in the banking industry was expected to stimulate competition in the banking sector, promote efficiency and drive down lending rates in particular, which have remained high over a long period of time. While credit supply to the private sector has increased substantially, lending rates and the non-performing loan (NPL) ratios remained high raising concerns about the quality of bank assets and the macroeconomic implications. Even though the central bank constantly adjusts its policy rate (PR) as a nominal anchor to inflation, banks lending rates have remained largely unresponsive to these adjustments.

To the best of our knowledge, no study has explicitly studied the impact of minimum capital adjustments and other central bank policy instruments on banks' specific performance outcomes (interest rate spread, NPLs and credit allocation) and macroeconomic variables, as well as the nature of interrelationships among these variables, particularly in the African context. This study therefore extends the frontiers of literature by filling this void and contributes to the on-going debate by seeking answers to the following specific questions: to what extent, do net minimum capital requirements (the difference between stated capital and the minimum capital requirement) with mainstream banks risk-taking incentives, efficiency and supply of credit? In other words, does high stated capital of banks influence excessive risk-taking activities, supply of credit and interest rate spread? How do banks of different ownership structure respond to regulatory capital and policy instruments (such as the PR) adjustments? What is the nature of relationship between the supply of credit, NPL, regulatory capital and interest rate spread as a measure of efficiency?

The remainder of the paper is organised as follows: Section 2 presents the macroeconomic context and an overview of the banking regulatory environment. Section 3 comprehensively reviews the literature while Section 4 presents the conceptual framework and empirical model specification. Section 5 reports the model estimation procedure and discusses the estimation results. Section 6 concludes with the summary of the main findings and the policy implications of the findings.

2. Regulatory environment and recent developments in the banking sector

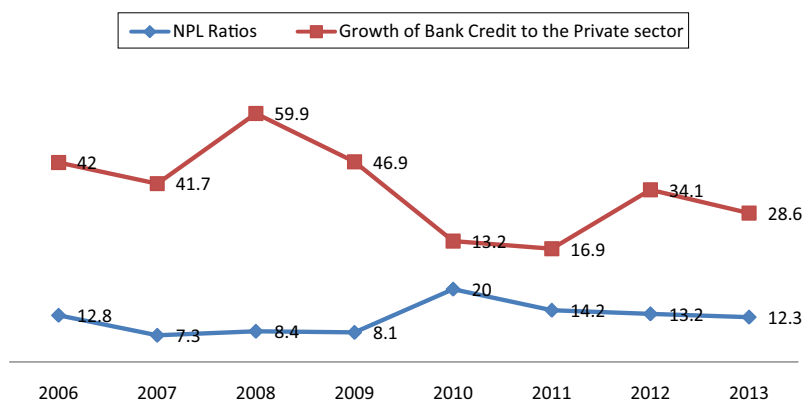
As the banking industry across Africa began bracing itself to adopting the new risk-based supervision and a more complex capital adequacy framework, known as the Basel III[2], the BOG responded by repealing the existing Banking Act (Banking Law, 1989 [PNDCL 225]) and replaced it with the Banking Act, 2004 (Act 673). This Act incorporates the requirements of the core principles of Basel II. Therefore, the main purpose of the Act was to amend and consolidate the laws relating to banking, to regulate institutions which carry on banking business and to provide for other related matters. Further, under this Act, to ensure that the local banking industry meets the more rigorous requirements of Basel III and to make the banking sector well capitalized, the minimum capital requirement and the CAR were adjusted upward and continue to be reviewed.

As mentioned previously, the [Bank of Ghana since 2013](#) had reviewed upwards the minimum capital requirement for the country commercial banks on a number of occasions. For example, the bank increased the minimum capital to GH¢7 million (US \$7.8) by the end of 2006 and further raised in 2009 to GH¢60 million (US \$50m) all foreign-owned banks and GH¢25 million (US \$21m) for the Ghanaian-owned banks. The latest was the announcement made in 2013 that new commercial banks are required to have a minimum stated capital of GH¢120 million (US \$ 55.5 million). Existing banks are only required to maintain a stated capital of GH¢60 million it set previously. However, the understanding was that existing banks would voluntarily grow their capital to the GH¢120 million in line with their business. Since then four existing banks have moved their capital voluntarily to over GH¢120 million, according to the 2014 Ghana Banking Survey report.

However, the knock-on effects of these massive capital injection changes have been mixed for the country. On the positive side, for example, the total operating assets of the industry had increased from GH¢2.3 billion in 2003 to about GH¢12.42 billion in 2009, representing an annual growth rate of well over 66 per cent per cent over the period. This had further increased to GH¢42.5 billion in 2013[3]. [A Ghana Banking Survey Report \(2008\)](#) observes that a key result of compliance with the recapitalization directive in 2007 was that bank lending increasing from GH¢1,055 million (US \$1,2126 million) in 2003 to GH¢2,464 million (US \$2,6213 million) in 2007, representing a 133 per cent increase. Thereafter, the growth of credit had been kept above 40 per cent until a dramatic downturn in 2010 when there was a sharp decline to 13.2 per cent [Figure 2](#)). Credit to the private sector picked up thereafter but declined by 28.6 per cent to a nominal amount of GH¢14,757.2 million in 2013, compared with 34.1 per cent in 2012. The sharp downturn in credit growth (Cr) in 2010 was believed to be a result of a tightening response to a sharp upturn in impairment allowances for NPL, as shown in [Figure 2](#). The NPL ratio increased to 20 per cent in 2010 from 8.1 per cent in the corresponding period in 2009.

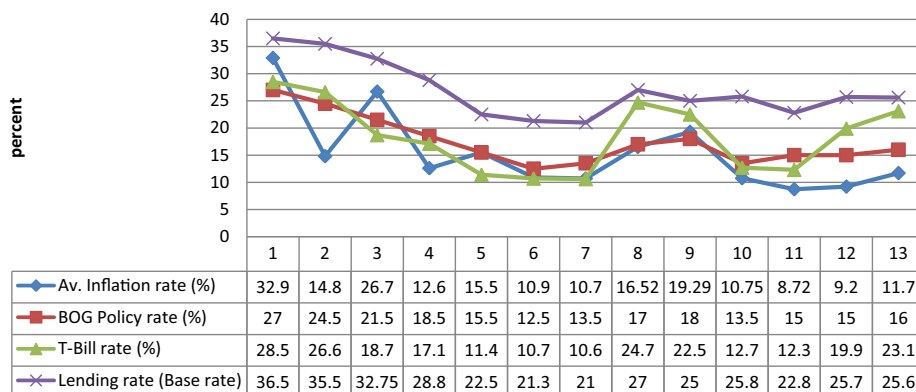
There is a concern of banks being tempted to engage in bad lending, as they have capital on their books in volumes unprecedented in Ghana's banking history, for which they need to find profitable business to generate returns for providers of capital ([Ghana Banking Survey Report, 2008](#)).

However, as [Figure 3](#) shows, the country's lending rates have remained high (averaging about 27 per cent) over a long period of time. A wide spread between the lending and deposit rates has been a key feature of the banking industry over the past



Source: BOG Annual Reports (2006-2013)

Figure 2. Non-performing loan ratios and rate of growth of credit to the private sector



Source: BOG, 2013

Figure 3. Trends in inflation rate, T-bill rate, PR and lending rate, 2001-2013

decade with the net interest spread recording over 12 per cent in December 2013. Banks' lending rates have largely remained unresponsive to the BOG PR, which is supposed to be an indicative rate around which all the other rates revolve. This development raises macroeconomic stability concerns as even when both inflation rate and the PR were consistently declining over 2009-2011, the lending rates by banks did not follow suit.

3. Theoretical literature

The controversy on the exact impact regulatory capital has on banking outcomes remains despite the theoretical and empirical interests it has generated for several decades now. The strand of empirical literature linking these variables is mixed and even more in conflict than in the theory.

For example, while many studies find that higher or stricter capital requirements reduce the profitability of future lending and/or banking efficiency (Repullo and Suarez, 2008), others find that stricter capital requirements improve cost efficiency and have a

significant effect on bank allocative efficiency (Pasiouras *et al.*, 2009; Fare *et al.*, 2004 and Barth *et al.*, 2004). In a more detailed study but with somewhat mixed outcomes, Pasiouras *et al.* (2009) used the Stochastic frontier analysis (SFA) model to provide international evidence on the impact of regulatory and supervisory framework on bank efficiency. They investigated the impact of regulations related to the three pillars of Basel II (namely, capital adequacy requirements, supervisory power and market discipline) on the cost and profit efficiency of banks. Their findings suggest that stricter capital requirements improve cost efficiency but reduce profit efficiency, while restrictions on bank activities have the opposite effect, reducing cost efficiency but improving profit efficiency. Their findings support Fare *et al.* (2004)'s conclusion that the effect of risk-based capital requirements on the profit efficiency performance of US banks indicates that allocative inefficiency is a larger source of profit loss than technical inefficiency and that the risk-based capital standards have a significant effect on bank allocative efficiency.

Closely related to this present study is that of Kwan and Eisenbeis (1997), which provides evidence on the links between bank risk, capitalization and operating efficiency. Using data from 176 banks from the USA and applying a simultaneous equation framework, the study tests hypotheses about the interrelationships among bank interest rate and credit risk taking, capitalization and operating efficiency. A positive effect of inefficiency on risk taking was found and supports the moral hazard hypothesis that poor performers are more vulnerable to risk taking than high performance banking organizations. The study attributed the positive effect of inefficiency on the level of capital to regulatory pressure on underperforming institutions. The study further finds firms with more capital to operate more efficiently than less well-capitalized banking organizations. Moreover, a U-shaped relationship is detected between inefficiency and loan growth, indicating that operating efficiency improves at a decreasing rate as loan growth rate increases.

In another respect, Berger and Bouwman (2011) investigated how bank capital affect the survival, profitability and market shares of banks during crises and normal times using a logit panel regression. The results of the study show that higher capital increases the survival, market shares and profitability of banks during both normal and crises times. These results were achieved in separate panel regressions. It is important to note that this study recognized the existence of potential endogeneity between profit and market shares and this was addressed using their lagged values. More recently, Berger *et al.* (2014) examined how regulatory intervention and capital support influence banks' risk-taking predispositions in a panel using IV and the two-stage regression approach. The study uses data on all banks operating in Germany from 1999 to 2009. The results of the study show that banks significantly reduce their risk taking after regulatory intervention and capital support. The study results further indicate that liquidity creation reduces after taking regulatory interventions, but this is not affected by capital support.

In another study, Boudriga *et al.* (2009) empirically analyse the determinants of NPLs and the potential impact of regulatory capital on credit risk exposure in a cross-country study. They use aggregate banking, financial, economic and legal environment data for a panel of 59 countries over the period 2002-2006. Empirical results indicate that higher capital adequacy ratio and prudent provisioning policy seem to reduce the level of problem loans. They also report a desirable impact of private ownership, foreign

participation and bank concentration. Another study (Osei-Assibey and Baimba, 2013) investigates the factors that influence banks' credit supply in Sierra Leone. Using annual bank-level data on an unbalanced panel of 13 banks in the market for the study period, and using a time and bank-specific fixed effects model, the study confirms the principal hypothesis that the level of risk premium influences the share of loans to the private sector in interest earning asset of banks. Additionally, the study finds that NPLs, Tier 1 capital ratio and local currency deposit levels positively and significantly affect banks' loan supply to the private sector, while a ratio of a bank's gross loans and advances to local currency deposits, as a measure of liquidity and bank size have significant negative effect on the dependent variable.

In the Ghanaian context, literature on regulatory capital and bank-level outcomes is scanty. To the best of our knowledge, no study has explicitly controlled for minimum capital requirements – although there have been several attempts to gauge the efficiency of the banking sector either by using the SFA model or interest rate spread. Although several studies (Amidu, 2006; and 2007; Abor, 2008; Osei-Assibey et al. 2012) have focused on the determinants of capital structure of banks and enterprises in Ghana, not much attention has been given to the impact of regulatory capital on bank-specific performance. In a quite related study, however, Bawumia et al. (2005), examining the determination of interest rate spreads in Ghana in a single equation model, conclude that the existence of major structural impediments such as market concentration and the degree of contestability among banking institutions, among others, prevent the financial system from reaching its full level of efficiency. However, even though the study controlled for NPLs and the existence of liquidity reserves, as well as high operating costs, regulatory capital changes were not a subject in their model. A closely related study by Aboagye et al. (2008) investigates the determinants of interest rate spreads in Ghana. Although they did not explicitly control for the stringency of capital requirements, they alluded to the importance of capital adequacy in reducing interest rate spread. Similar conclusion was also reached by Barnor and Odonkor (2012). Specifically, the studies recommend that to help reduce interest rate margins, the central bank should consider lowering the capital adequacy ratio and banks should be required to pass the full extent of reductions or increases in the central bank's prime rate onto borrowers.

As so far reviewed, the existing literature on the impact of regulatory capital on banking performance has mostly centred on the advanced economies, while the findings have been somewhat contradictory on varying indicators such as banking efficiency, credit risk and lending. Furthermore, the empirical literature has not paid enough attention to regulatory capital and the three specific bank-level outcomes – NPLs, interest rate spread and credit supply. Besides, their counterfactual effects or the possible interrelationships among these variables have not been discussed in much detail. Most of the studies have been done in isolation of the other performance indicators. Yet, Barth et al. (2004) write that while recognizing the advantages of tightly focused studies, there is a growing evidence stressing that the salient issues in bank regulation, supervision and specific bank level outcomes are inextricably interrelated. Thus, there are advantages to examining an array of regulatory indicators and regulatory policies simultaneously to identify those that enjoy a strong, independent relationship with banks' outcomes such as efficiency, risk taking and credit supply. Apart from these shortfalls, studies on regulatory capital have paid little attention to

how different ownership structures of banks respond to regulatory capital and instruments by the central bank.

4. Theoretical framework and econometric model specification

Within the framework of the role of capital in financial institutions, [Berger et al. \(1995\)](#) noted that regulatory capital requirements can have unintended consequences. This is because, in response to an increase in its required equity-to-asset ratio, a bank might increase its portfolio risk and raise its probability of failure. For example, changes in regulatory capital requirements elicit interest rate and Cr adjustments and result in changes in risk-taking tendencies by banks to stay competitive. However, the theory further hypothesize that risk-based capital requirements that penalize increases in portfolio risk can reduce such unintended consequences of capital requirements, but these standards are imprecise, leaving open the possibility that some banks may increase portfolio risks when capital standards are raised ([Berger et al., 1995](#)). Similarly, [Koehn and Santomero \(1980\)](#) argue that banks will respond to regulatory actions to increase their capital and reduce their leverage by increasing asset risk. However, the theory further indicates that banks with more capital are found to operate more efficiently than banks with less capital, indicating that the level of capitalization is a good proxy for performance ([Kwan and Eisenbeis, 1997](#)). On the other hand, efficiency could, in turn, be also affected by the level of bank risk ([Berger and De Young, 1995](#)) [Figure 4](#).

With regards to the supply and allocation of loans, it is argued that imperfections in setting the level of required capital and the relative risk weights may lead to allocative inefficiencies if capital requirements distort relative prices both among banks and between banks and non-bank competitors, and divert financial resources from their most productive uses ([Berger et al., 1995](#)). Moreover, [Kopecky and VanHoose \(2006\)](#) hypothesize that the imposition of binding capital requirements on a previously unregulated banking system unambiguously increases the market loan rate and reduces aggregate lending. For instance, high credit risks which require high capital buffer



Figure 4.
Regulatory capital
and its relationship
with bank-level
outcomes

could lead to credit apprehension – and reduce credit expansion, particularly to the perceived high risk sectors (like agriculture and households) – which eventually puts an upward pressure on net interest margins (NIMs) (due to high risk premium). However, wide interest rate margins can lead to adverse selection and moral hazards which could exacerbate default rates (Stiglitz and Weiss, 1981).

In this regards, any research on the impact of banks' regulatory capital should take into account the inter-relationships among the various outcomes such as credit risk, the volume of loans, allocation effects, efficiency and actual capitalization as encapsulated in the foregoing theoretical literature. It is clear that regulatory capital requirements influence bank-level outcomes which, in turn, trigger certain counter responses from banks, suggesting that all these variables are endogenously dependent and jointly determined. Thus, in the same spirit with studies by Kwan and Eisenbeis (1997), Altunbas et al. (2007) and Barth et al. (2004), we model three separate equations using the system generalised method of moments (GMMs). This approach has been adopted due to the perceived endogeneity between some of the variables in our specified model while controlling for specific bank level, industry and country characteristics. This leads to the specification of the model below.

The three models to be estimated are specified as follows:

$$NIM_{it} = \varphi_{10} + \varphi_{12}MCR_{it} + \varphi_{13}PR_{it} + \varphi_{14}CR_{it} + \varphi_{15}PBD_{it} + \varphi_{16}FBD_{it} + \varphi_{17}Fees_{it} + \varphi_{18}NPL_{it} + \varepsilon_{1t} \quad (1)$$

$$Cr_{it} = \varphi_{20} + \varphi_{21}MCR_{it} + \varphi_{22}PR_{it} + \varphi_{23}GDPG_{it} + \varphi_{24}PBD_{it} + \varphi_{25}FBD_{it} + \varphi_{26}NIM_{it} + \varepsilon_{2t} \quad (2)$$

$$NPL_{it} = \varphi_{30} + \varphi_{31}MCR_{it} + \varphi_{32}PR_{it} + \varphi_{33}Cr_{it} + \varphi_{34}PBD_{it} + \varphi_{35}FBD_{it} + \varphi_{36}Fees_{it} + \varphi_{37}Cr_{it} + \varepsilon_{3t} \quad (3)$$

where NIM_{it} is net interest margin, Cr_{it} is credit growth, PR_{it} is PR, NPL_{it} is non-performing loans, $GDPG_{it}$ is GDP growth, $Fees_{it}$ is fees charged by banks for the delivery of a service, PBD_{it} is public bank dummy (i.e. 1, if public, 0 if private), FBD_{it} is foreign bank dummy (1, if foreign, 0 if domestic) and MCR_{it} is net minimum capital requirement. The residual terms are represented by the ε 's and are assumed to be serially uncorrelated but could be contemporaneously correlated across equations, while the φ s are the impact coefficients of all the variables on the right hand side.

4.1 Measuring regulatory capital

MCR_{it} , as used in this study, is defined as the ratio of the difference between the minimum capital required and a bank's stated capital position to its assets. This ratio is intended to measure whether minimum capital requirements set by regulators are proportional or optimal not only with the actual risks banks take but also with the very growth and development of the banking industry and its intermediation efficiency. It assesses the degree to which banks' stated capital deviates/differs from the minimum required – if it converges, or diverges widely, what would be the effect on a bank's outcome? Are banks that keep their stated capital way above the minimum more likely to be associated with higher level performance outcomes or vice versa? The capital in question, which the Basel II accord refers to as Tier 1 capital, comprises equity shares,

retained earnings, non-redeemable and cumulative preference shares. According to Greuning and Bratanovic (2000), the level of this capital has a crucial bearing on profit margins, efficiency and banks' ability to bear risk and stay competitive. Thus, too little or too much of such capital in relation to the minimum required can have implication for a bank's performance outcomes. Banks with low MCRit will be risk averse and will either invest in safe assets or charge above market rates when making loans.

The following paragraphs explain how regulatory capital affects each of the dependent variables specified in the model. The first equation represents banks' efficiency, the second explains credit outlay and the third – credit risk.

4.2.1 The effect of regulatory capital on efficiency, credit and NPL. Based on the specified equations above, we estimate the impact of regulatory capital on efficiency, credit and credit risk as discussed below:

4.2.2 Regulatory capital and efficiency (NIMit). NIMit is measured as the ratio of the difference between interest income and interest expenditure to total earning assets (or interest rate spread). Although there are other indicators of efficiency such as intermediation costs (as a percentage of total assets) and the SFA model, this efficiency indicator was chosen because apart from it being a much simpler procedure and the relative ease of getting data, it is a current policy relevant indicator. This is because interest rate spreads sometimes remain high despite efficiency gains owing to the need to build loan-loss provisions or charge a risk premium in lending to high-risk borrowers. We also expect a positive relationship between MCR and NIMit, as high minimum capital requirement may lead to high cost of equity funds which will intend lead to high lending rates.

4.2.3 Regulatory capital and credit (Crit) allocation. Crit, which represents the growth of credit, is measured as the natural log-difference of credit outlay.

MCRit is expected to have a positive relationship with credit, as banks are likely to make loans when they have more excess reserves. Regarding Crit and NPL, as stated earlier, high NPL levels will create credit trepidation, thus leading to few loans being made. We therefore expect a negative relationship between the two variables. On the contrary, as banks profit from high interest rate spreads, they are likely to make more loans at wide interest rate margins and vice versa. This will establish a positive relationship between NIMit and Crit.

4.2.4 Regulatory capital and NPLit. NPLit is the ratio of NPLs to total gross loans by banks. It indicates the credit quality of bank loans, thereby serving as a measure of risk taking incentives of banks.

We expect a positive relationship between MCRit and NPLit, as low excess capital, for example, will push banks to make less risky loans, while excessive capital holdings could tempt them to make "bad loans", as they will feel pressure to make profit to generate returns for providers of capital. With regards to the other dependent variables, we expect NIMit to be positively related to NPLit, as wide interest rate margins or higher lending rates can exacerbate incentive problems such as adverse selection and moral hazards, thereby increasing the default risk probabilities among borrowers. In the case of credit, large volumes of loans may bear greater risks and unbridled advances in loans without the accompanying effective risk mitigation strategies. This will most likely result in high NPL levels. If the growth rate is excessively high, it could be that best practices are compromised which could lead to more bad loans being made. Thus, we expect a positive relationship between Crit and NPLit.

5. Controlling for other bank-specific characteristics, industry and macroeconomic indicators

5.1 Bank characteristics

The bank characteristics include fees and commissions charged for rendering services (feesit). In addition to this, bank ownership structure type, which is a dummy made up of public and private banks (PBD) or foreign and domestic banks (FBD), is included to assess how the ownership structure affects bank level outcomes.

5.2 Industry and macroeconomic variables

This category is made up of policy rate (PRit) and GDP growth rate (GDPGIt). GDPGIt is expected to have a positive impact on credit through, as per capita income would have increased alongside it, all other things being equal. We also expect a feedback effect that higher Cr can lead to GDPG. However, a test results for endogeneity shows it was not severe.

The BOG policy rate (PRit) is another instrument the monetary authority uses to regulate money supply. This is the rate at which the central bank lends to commercial banks. As the main operational target, the PR also influences short- and medium-term money market rates for open market operations, deposit money banks' holdings of excess reserves and, indeed, their own lending and deposit rates. However, the degree of banks' responsiveness to this instrument in recent times has been a matter of great concern. We expect a positive relationship between PRit and NIMit, as banks use PRit as a reference point when setting their base rates. A higher PRit will drive banks to increase the cost of borrowing to consumers. Again, PRit is expected to have a negative relationship with Crit because of the fact that the former is a borrowing cost to banks. A high PRit restricts the availability of loanable funds and, subsequently, credit. We expect PRit to also have negative a relationship with NPLit for the same reasons as above.

5.3 Data sources

The study uses secondary banking sector data that spans 2003-2012, mainly due to data availability and the need to include as many banks as possible for the study results to reflect the situation on the ground. The number of banks used for the study was based on data availability from all sources. Those banks that had data gaps were eliminated to avoid "near single matrix" errors. Furthermore, some prominent existing banks did not exist in 2003 or had just started operations. Bank-specific data were sourced from the Ghana Banking Survey by Price Water House Coopers and the annual financial statements of the banks, while Treasury bill rates (T-bill rates), PRs, reserve requirements and bank categories were drawn from the BOG annual reports.

6. Estimation procedure and results discussions

We identify the system GMMs estimation technique as the appropriate parameter estimation technique for the estimations due to the characteristics of the model. The likelihood of endogeneity issues, individual time-invariant fixed effects heterogeneity, autocorrelation and the fact that the cross-sections are greater than the time periods for the available data makes the GMM technique a more appropriate and robust technique ahead of other available techniques such as the seemingly unrelated regression, panel-corrected standard error estimates and instrumental variable and the two-stage least square.

Essentially, the system GMM procedure is preferred to the other estimation techniques for this study because:

- it overcomes the problem of endogeneity through the use of lagged values of explanatory variables as instruments;
- it eliminates the problem of information loss in cross-sectional regressions, as it allows for multiple observations for each bank across time;
- it allows for the use of level and lagged values of the variables in the estimation equation; and
- it is able to give consistent estimates even when T (time periods in years) is small and N (number of banks) is large.

Additionally, using system GMM is appropriate for at least two reasons. First of all, the variables used to describe a banks' business model are potentially endogenous. Second, differencing the regression equation to eliminate the bank-specific effects could lead to a correlation between the lagged dependent variable and the error term. The system GMM estimation procedure resolves these problems by instrumenting the predetermined and endogenous variables with their own lags. As the estimates produced are biased in the presence of too many instruments, we instrument the lagged endogenous variable with its first lags and the bank-specific variables with their second lag, as remote lags are unlikely to be informative instruments (Bond and Megshir, 1994). Because lagged levels provide only weak instruments for first differences when the time series are persistent, the system GMM is used instead of the Arellano Bond (AR) GMM estimator, also known as the differenced GMM (Blundell and Bond, 1998). The model is estimated with two-step system GMM, as proposed by Arellano and Bover (1995) and Blundell and Bond (1998) with Windmeijer's (2005) finite sample correction. This estimation technique is particularly suitable for small T and large N samples, as it applies to this study.

The validity of the instruments is tested using the Sargan test for over-identifying restrictions. In all cases, the test statistic accepts the null hypothesis that the instruments are indeed exogenous. We further use the AR test to control for serial correlation in the residuals. The null hypothesis is not rejected in all cases, indicating that there is no second-order autocorrelation in the first difference regression. All test results are reported at the bottom of the results in each regression in Table II.

6.1 Diagnostic tests

6.1.1 Endogeneity test. The study used the Durbin–Wu–Hausman (DWH) test to verify the presence of endogeneity among some of the variables. This is an augmented regression test which is applied to the residuals of each of the endogenous explanatory variables as a function of all other exogenous variables (Yokoyama and Alemu, 2009). If the null hypothesis holds, then basic regression techniques such as the pooled ordinary least squares (OLS), and the panel fixed and random effects would be appropriate in the sense that the variables are not correlated with the error term. Otherwise, the rejection of the null hypothesis indicates that the variables are endogenous; hence, OLS estimators would be inconsistent. The significant results of the DWH test provided in the table below indicates that variables such as credit supply (Cr), net interest rate ratio (NIM), NPLs, net minimum capital ratio (MCR) and the PR are endogenous in the model, while

GDPG and fees are not. Again, as indicated earlier, the lagged values of the endogenous variables are used as instruments, and the appropriateness of instruments are tested using the AR test for autocorrelation and the Sargan test for over-identifying restrictions.

6.2 Fixed versus random effects

The DWH test was performed to determine which of fixed or random effects models fit the data for estimation. If the test favours fixed effects, it implies the existence of heterogeneity across banks and therefore gives the indication that the unobserved bank-specific effects indeed vary across banks. The DWH test results in Table I reject the null hypothesis of random effects for all the three regression models, indicating that the system GMM estimates are therefore consistent, as the system GMM procedure requires that the data fits the fixed effects model to yield consistent results. The DWH test results reject the null hypothesis of random effects for all the three regression models, indicating that the system GMM estimates are therefore consistent.

6.3 Estimation results and discussions

The study applies the system GMM estimation approach, an approach that ensures unbiased and consistent estimates of regression parameters in the presence of endogeneity and dynamic panel bias. The model controls for specific bank level, industry and country characteristics. Three regression equations are estimated for each one of the dependent variables: interest rate margin (NIM), supply of credit (Cr) and NPLs. The results for all the three models are shown in Table II and subsequently discussed as follows:

6.4 NIM as dependent variable

The study results with the NIM (or interest spread), which proxy banking efficiency, as a dependent variable are generally consistent with behavioural expectations of the independent variables. The results, however, establish a positive relationship between MCR and the NIM, albeit at the 10 per cent significance level. Although this is in contrast with the study expectations, the result suggests that a high net minimum capital requirement could widen the spread between the lending rate and the saving rates. A

Variables	Test for Residuals	χ^2 (1) statistic	p -value ($p > \chi^2$)
Credit growth (Cr)	res_cr = 0	12.02	0.001
NIM	res_nim = 0	4.31	0.038
NPL	res_npl = 0	4.27	0.039
MCR	res_MCR = 0	2.79	0.095
GDPG	res_gdp = 0	0.23	0.634
TBILL	res_tbill = 0	2.07	0.150
Bank fees	res_fees = 1	0.89	0.345
PR	res_pr = 2	3.91	0.048

Notes: The residuals of the variables are obtained after regressing the variables on their instruments, including the exogenous variables. The residuals are then tested for significance

Source: Authors' estimation

Table I.
Durbin–Wu–Hausman (DWH) test for endogeneity

Variables	NIM	Cr	NPL
MCR	0.336* (2.15)	6.136** (2.31)	2.319* (1.88)
PR	-0.004* (-1.86)	-0.170*** (-5.15)	0.063** (2.30)
GDPG	0.003 (1.69)	0.065** (2.88)	-0.030* (-1.89)
PBD	0.094* (2.20)	-0.628 (-1.48)	-0.787 (-1.58)
FBD	0.061 (1.07)	-0.627*** (5.69)	-1.367** (-3.04)
Bank fees	-0.043 (-1.02)		1.411*** (8.14)
Credit supply (Cr)			-0.044 (-0.30)
NPLs	0.030 (1.31)		
NIM		-17.295*** (-3.98)	
Constant	0.18 (1.01)	4.506*** (5.81)	-3.198* (-2.09)
Number of banks	11	11	11
Number of observations	78	78	78
<i>F</i> -test (<i>p</i> -value)	0.000	0.000	0.000
AR (2) test (<i>p</i> -value)	0.504	0.166	0.693
Sargan test (<i>p</i> -value)	0.868	0.186	0.264
Hausman test (<i>p</i> -value)	0.062	0.012	0.046

Notes: The dependent variables in the three regression models are NIM, Credit Supply (Cr) and NPL, respectively. Figures in parentheses are *t*-statistics, and *, ** and *** indicates statistical significance at the 10, 5 and 1% levels, respectively

Source: Authors' estimation

Table II.
System GMM
regression results

plausible reason could be that as the cost of raising capital is high the country, banks are compelled to charge high lending rates to make high enough returns for their common equity holders, thereby widening the NIM. This is consistent with the findings by Elliott (2009) who finds that higher minimum capital requirement will lead to high equity or total funding costs which would then be passed on to borrowers in whole or part.

The result for the BOG PR is counter-intuitive but is in line with the experience in Ghana. Under normal circumstances, the relationship between PR and NIM is positive, as banks would be expected to respond to PR adjustments by adjusting their own lending rates. However, the study results establish a negative relationship between PR and NIM. This could be due to a number of factors. Firstly, NIM is defined as a ratio of the difference between interest income (interest on lending) and interest expenditure (interest on deposits) to total earning assets. What this means is that even if PR is reduced by the monetary authority and the banks follow with a lower lending rate, banks could still make profit by making more loans, which would in turn earn them more interest income, particularly if the interbank interest rates do not change with the PR, as has been the case in many instances in Ghana. Alternatively, banks could cut interest expenditure, leading to much higher net interest incomes than used to be the case. Furthermore, banks could reduce lending rates but also reduce savings rates even more to create a higher interest rate spread and net interest incomes, all other things being equal. Thus, the reduced PR would have been matched by a positive NIM. Secondly, the negative relationship between PR and NIM could be justified by the fact that Ghanaian banks respond to PR changes with a lag at best, especially if it is a downward review. There have been many instances where PR was reviewed downwards and banks have been reluctant to follow by reducing their lending rates.

There have even been a few cases where banks have increased lending rates in the face of downward PR reviews. This finding corroborates the earlier observation from the overview of developments in the banking system, which suggests that bank lending rates are unresponsive or weakly responsive to the BOG PR.

The results also established a positive relationship between the public banks dummy and NIM. This suggests that public banks are associated more with a higher NIM and thus less efficient than private banks. Thus, public banks are more likely to charge higher lending rates on loans while offering lower deposit rates to customers, resulting in high NIMs.

6.5 Credit as dependent variable

The estimation with the growth of credit as the dependent variable has most of the coefficients being significant, as shown in [Table II](#). In concord with theoretical expectations, MCR has a positive relationship with Cr. In general, as banks create excess capital over the minimum capital, they are able to take on additional risks by mainly advancing more credits to businesses and households. The findings further suggest that a higher PR appears to have a depressing effect on the supply of credit to the private sector, as the previous result also suggests. [Table II](#) indicates that an increase in the BOG PR reduces credit advancement to the private sector. This is because PR is a cost to banks, and as it increases, banks will be averse to borrow from the central bank or among themselves, leading to low credit supply. The result is consistent with theory, as a high PR could mean a high lending rate and less credit due to the fact that the cost of borrowing would have increased.

Growth in GDP positively impacts Cr, as the borrowing public would feel at ease to contract loans when they are assured of high income flows both now and in the future. The study finds a negative relationship between the foreign banks dummy on Cr. This means that the growth of credit by foreign banks is lower than that of their domestic counterparts. This could be attributed to the cautious approach which they attach to credit supply. The NIM has a negative effect on Cr. This could mean that banks are unable to make more loans, even though they might want to, due to the high borrowing cost to customers.

6.6 NPLs as dependent variable

The results with NPL as dependent variable, as shown in [Table II](#), are mixed. In line with expectations, the BOG PR shows a positive and statistically significant effect on NPLs. This means that as the PR rises, lending rates generally increase which induces banks to lend more at an increased cost to borrowers, which subsequently increases the chances of loans going bad. The coefficient for MCR is positive in relation to NPL, suggesting that banks create more loans when they have excess capital over the requirement, leading to high loan impairment. Although the recent increases in banks' NPL ratios have been partly attributed to government's inability to pay contractors on time, the banks might have been pushed to give "toxic loans" (loans which have high risk of default) or sub-optimal credit decisions made by banks, as they have too much capital on their books as a result of minimum capital upward adjustments. [Elliott \(2009\)](#) argues that bank managers in such situations are likely to take bad risks in an attempt to keep profits up in the face of the cost pressures as previously mentioned.

The same observation holds for bank fees, which suggests that the NPL level of banks increases when the fees charged by banks on services in the intermediation process are higher. It is expected that a rise in fees would raise the incentive for banks to lend more to clients with the hope of increasing income, all other things being equal. Such practice could lead to very little due diligence being done thereby, culminating in loan impairment. GDPG has a negative effect on NPLs. This could be the case, as higher income levels in the country would enable borrowers to meet their loan commitments to the banks. The FBD shows a negative and statistically significant effect on NPL, implying that the effect of the other explanatory variables on NPL is lower for foreign-owned banks than for domestic-owned banks.

7. Concluding remarks

In this paper, we investigate the influence of regulatory capital and the central bank policy instruments on bank-specific outcomes such as credit supply, interest rate spread (as a measure of efficiency) and NPLs (as a measure of risk-taking behaviour of the commercial banks). We model a system of equations that allows us to apply the system GMM approach and estimate the equations, while controlling for specific bank level, industry and macroeconomic variables.

We find a positive relationship between MCR and the NIM. Although this is in contrast with the study expectations, the result suggests that a high net minimum capital requirement would widen the spread between the lending rate and the saving rates. A plausible reason could be that as the cost of raising capital is high the country, banks are compelled to charge high lending rates to make high enough returns for their common equity holders. Furthermore, increased excess capital over the required levels may not have the expected impact on NIM if the intention is towards meeting higher capital requirements. Banks would, thus, discourage lending by increasing the cost of borrowing to the client. The study also finds a negative relationship between interest rate spread (proxy by net interest income) and the BOG PR. This negative relationship could largely be justified by the fact that Ghanaian banks respond to the BOG policy changes with a lag at best, especially if it is a downward review. We also find that the effect of factors affecting the NIM in the model is more pronounced for public banks than private banks.

Further, increasing BOG, PR appears to have a depressing effect on supply of credit to the private sector. This is because as the PR rises the interest rate on government securities such as the T-bill rates often rises faster than the lending rates and being less risky, these government securities are preferred.

We find evidence to support the fact that high minimum capital requirement and excess capital above the minimum required drive higher Cr in the banking sector of Ghana. However, high excess capital increases risk-taking activities of the banks, as excess capital is found to be associated with high NPL ratios. The positive coefficient suggests that banks create more loans when they have excess capital over the requirement, leading to high loan impairment. As banks minimum capital is raised as a buffer against risk, they may be able to find avenues to take on additional risks by mainly advancing more credits to businesses and households. However, because of the equity cost pressures, they are tempted to make more profits by giving out bad loans or bad credit decisions.

Once one accepts that there will be significant economic costs to sharply higher capital requirements, then a useful debate can take place about the right level of capital, given the trade-offs and how best to achieve it. In fact, this is the debate that much of the policymaking and academic community has been involved in for some years.

In sum, our results speak to the ongoing debates on the right level of capital, effectiveness of the BOG PR and the high lending rates that appear to respond only slowly to macroeconomic indicators such as the PR and the inflation rate. More specifically, the findings raise issues about excessive minimum capital regulations/requirements, high cost of borrowing and high NPLs in the economy. While risk-based minimum capital requirement improves stability and is associated with increased lending, the evidence suggests that if it is too high or if banks keep capital high in excess of the minimum required, it can increase the cost of borrowing as the cost of acquiring this capital is high. Besides, high and strict capital requirement can increase risk-taking incentives of banks and increase the NPL ratios, as the evidence above suggests. This finding has practical implications for the adoption of the Basel III accord, as some studies (Slovik and Cournède, 2011), studying the macroeconomic impacts of the Basel III, have found a negative impact on output growth. According to the study, economic output would be mainly affected by an increase in bank lending spreads, as banks pass a rise in bank funding costs, due to higher capital requirements, to their customers[4].

Another plausible explanation is also that although increase in NPL ratios in recent times has been partly attributed to government inability to settle contractors in time and the difficult economic conditions, banks are being pushed to give “toxic loans” (loans which has a high risk of default) or not-so-good credit decisions in recent times because of excessive capital in their books. The industry watchers believed that there is a temptation of bad lending, as banks have capital on their books in volumes unprecedented in Ghana’s economic history, for which they need to find profitable business to generate returns for providers of capital without enough risk mitigation tools (Ghana Banking Survey Report, 2008) – thus leading to a further deterioration of asset quality and increase in non-performing ratios.

Notes

1. The First Basel accord (Basel I accord) was published in 1988 and was revised to the Basel II in 2004 to overcome some of the problems associated with the Basel I accord, which required that all corporate debts having 100 percent risk be changed to a regulatory capital based on credit rates. The Bank of Ghana, which is the primary regulator of banks in Ghana, has currently adopted the Basel II accord in determining capital requirement. Basel III, which implementation spans from 2013 to 2019, was supposed to strengthen bank capital requirements by increasing bank liquidity and decreasing bank leverage.
2. Unlike Basel I and Basel II, which focus primarily on the level of bank loss reserves that banks are required to hold, Basel III focuses primarily on the risk of a run on the bank by requiring differing levels of reserves for different forms of bank deposits and other borrowings.
3. At the same time, the number of banks and branches had increased substantially largely due to the influx of foreign banks. For example, as of 2000, there were only 17 banks with about 300 branches, but by the end of 2013, the number of banks had increased to 27 with 904 branches. Out of this, 15 were foreign owned (or majority shareholders) and 12 had local ownership (with government having majority shares in only three of these banks).

4. To meet the capital requirements under Basel III originally effective in 2015, banks were estimated to increase their lending spreads on average by about 15 basis points. Capital requirements effective as of 2019 (7 per cent for the common equity ratio, 8.5 per cent for the Tier 1 capital ratio) could increase bank lending spreads by about 50 basis points.

References

- A World Bank. (1995), *World Development Report 1989: Financial Systems and Development*, Oxford University Press, New York.
- Aboagye, A.Q.Q., Akoena, S.K., Antwi-Asare, T.O. and Gockel, A.F. (2008), "Explaining interest rate spreads in Ghana", *African Development Bank Journal*, Vol. 20 No. 3, pp. 378-399.
- Abor, J. (2008), "Determinants of the capital structure of Ghanaian firms", African Economic Research Consortium, Research Paper RP_176, Nairobi, Kenya.
- Amidu, M. (2006), "Credit risk, capital structure and lending decisions of banks in Ghana", *Banks and Bank Systems*, Vol. 1 No. 1, pp. 93-101.
- Amidu, M. (2007), "Determinants of capital structure of banks in Ghana: an empirical approach", *Baltic Journal of Management*, Vol. 2 No. 1, pp. 67-79.
- Altunbas, Y., Carbo, S., Gardener, P.M.E and Molyneux, P. (2007), "Examining the relationships between capital, risk and efficiency in European banking", *European Financial Management*, Vol. 13 No. 1, pp. 49-70.
- Arellano, M. and Bover, S. (1995), "Another look at the instrumental variable estimation of error-components models", *Journal of Econometrics*, Vol. 68, pp. 29-51.
- Bank of Ghana (BOG) (2013), "2013 BOG annual report", available at: www.bog.gov.gh/index.php?option=com_content&view=article&id=1734%3Aannual-report-2013&catid=102%.
- Barnor, C. and Odonkor, T.A. (2012), "Capital adequacy and the performance of Ghanaian banks", *Journal of Business Research*, Vol. 6 Nos 1/2.
- Barth, J.R., Caprio, G. and Levine, R. (2004), "Bank regulation and supervision: what works best?", *Journal of Financial Intermediation*, Vol. 13, pp. 205-248.
- Basel Committee on Banking Supervision. (2006), "International convergence of capital measurement and capital standards: a revised framework", *Bank for International Settlements*, June.
- Bawumia, M., Belnye, F. and Ofori, M. (2005), "The determination of bank interest spreads in Ghana: an empirical analysis of panel data", Bank of Ghana Working Paper Series, WP/BOG-2005/09.
- Berger, A.N. and Bouwman, C.H.S. (2011), "How does capital affect bank performance during financial crises?", *Journal of Financial Economics*, available at SSRN: <http://ssrn.com/abstract=1739089> or <http://dx.doi.org/10.2139/ssrn.1739089>.
- Berger, A.N., Bouwman, C.H.S., Kick, T.K. and Schaeck, K. (2014), "Bank Risk taking and Liquidity creation following regulatory interventions and capital support", available at: <http://ssrn.com/abstract=1908102>
- Berger, A.N. and De Young, R. (1995), "Problem loans and cost efficiency in commercial banks," Working Paper, Office of the Comptroller of the Currency.
- Berger, A.N., Herring, R.J. and Szego, P.G. (1995), "The role of capital in financial institutions", *Journal of Banking and Finance*, Vol. 19 Nos 3/4, pp. 393-430.
- Blundell, R. and Bond, S. (1998), "Initial conditions and moment restrictions in dynamic panel data models", *Journal of Econometrics*, Vol. 87, pp. 115-143.

- Bond, S. and Megshir, C. (1994), "Dynamic investment models and the firm's financial policy", *Review of Economic Studies*, Vol. 61, pp. 197-222.
- Boudriga, A., Boulila, N. and Jellouli, S. (2009), "Does bank supervision impact non-performing loans: cross-country determinants using aggregate data?", *MPRA Paper No. 18068*, available at: <http://mpra.ub.uni-muenchen.de/18068/>
- Dugan, J. and Jennifer, XI. (2011), *US Implementation of Basel II: Final Rules Issued by no Supervisory Approvals to Date*, Covington & Burling LLP, Washington, DC.
- Elliott, D. (2009), Quantifying the Effects of Lending Increased Capital Requirements, The Brookings Institution, Washington, September, available at: www.brookings.edu/papers/2009/0924_capital_elliott.aspx
- Fare, R., Grosskopf, S. and Weber, W. (2004), "The effect of risk-based capital requirements on profit efficiency in banking", *Applied Economics*, Vol. 36, pp. 1731-1743.
- Greuning, V.H. and Bratanovic, B.S. (2000), *Analyzing Banking Risk: A Framework for Assessing Corporate Governance and Financial Risk Management*, The World Bank, Washington, DC.
- Griffith-Jones, S. and Persaud, A. (2008), "The pro-cyclical impact of basel ii on emerging markets and its political economy", *Capital Market Liberalization and Development*, Vol. 27, pp. 262-288.
- Jokivuolle, E., Kiema, I. and Vesala, T. (2007), "Portfolio effects and efficiency of lending under Basel II", Bank of Finland Research Discussion Papers 13.
- Koehn, M. and Santomero, A.M. (1980), "Regulation of bank capital and portfolio risk", *Journal of Finance*, Vol. 35, pp. 1235-1244.
- Kopecky, K.J. and VanHoose, D. (2006), "Capital regulation, heterogeneous monitoring costs, and aggregate loan activity", *Journal of Banking and Finance*, Vol. 30, pp. 2235-2255.
- Kwan, S. and Eisenbeis, R.A. (1997), "Bank risk, capitalization, and operating efficiency", *Journal of Financial Services Research*, Vol. 12 Nos 2/3, pp. 117-131.
- Osei-Assibey, E. and Baimba, A. (2013), "Bank risks, capital and loan supply: evidence from sierra leone", *Journal of Financial Economic Policy*, Vol. 5 No. 3.
- Osei-Assibey, E., Bokpin, A.G. and Twerefou, D.K. (2012), "Microenterprise financing preference: testing POH within the context of Ghana's rural financial market", *Journal of Economic Studies*, Vol. 39 No. 1, pp. 84-105.
- Pasiouras, F., Tanna, T. and Zopounidis, C. (2009), "The impact of banking regulations on banks' cost and profit efficiency: cross-country evidence", *International Review of Financial Analysis*, Vol. 18, pp. 294-302.
- Pennacchi, G.G. (2005), "Risk-based capital standards, deposit insurance, and procyclicality", *Journal of Financial Intermediation*, Vol. 14, pp. 423-465.
- PWC, Ghana Banking Survey Report (2008), Raising the Bar: Increase in the Minimum Capital Requirements and Implications on The Industry, Pricewaterhouse Coopers and Ghana Association of Bankers, Ghana, available at: www.pwc.com/en_GH/gh/pdf/ghana-banking-survey-2008.pdf
- Repullo, R. and J. Suarez (2008), "The procyclical effects of Basel II", *CEPR Discussion Paper No. 6862*.
- Slovik, P. and Cournède, B. (2011), "Macroeconomic impact of Basel III", available at: www.oecd-ilibrary.org/economics/oecd-economics-department-working-papers_18151973;jsessionid=24qndegq4q31x.x-oecd-live-03 OECD Economics Department Working Papers No.: 844, Pages 16, February.

- Stiglitz, E.J. and Weiss, A. (1981), "Credit rationing in markets with imperfect information", *The American Economic Review*, Vol. 71 No. 3, pp. 393-410.
- Windmeijer, F. (2005), "A finite sample correction for the variance of linear efficient two-step GMM estimators", *Journal of Econometrics*, Vol. 126, pp. 25-51.
- Yokoyama, K. and Alemu, M.A. (2009), "The impacts of vertical and horizontal export diversification on growth: an empirical study on factors explaining the gap between Sub-Saharan Africa and East Asia's Performances", *Ritsumeikan International Affairs*, Vol. 17 No. 41.

Further reading

- Arellano, M. and Bond, S. (1991), "Some tests of specification for panel data: monte carlo evidence and an application to employment equations", *Review of Economic Studies*, Vol. 58, pp. 277-297.
- Bank of Ghana (B.O.G) (2009), "Annual report", available at: www.bog.gov.gh/privatecontent/Publications/Annual_Reports/2009.pdf
- Brownbridge, M. and Gockel, S.A.F. (1996), *The Impact of Financial Sector Policies on Banking in Ghana*, Research Department of Bank of Ghana, Ghana.
- Modigliani, F. and M. Miller (1958), "The cost of capital, corporation finance, and the theory of investment", *American Economic Review*, Vol. 48 No. 3, pp. 261-297.
- Osei-Assibey, E. and Baah-Boateng, W. (2012), "Interest rate deregulation and private investment: revisiting the mckinnon – shaw hypothesis in Ghana", *The IUP Journal of Applied Economics*, Vol. 11 No. 2, pp. 12-30.
- Santomero, A. and Watson, R. (1977), "Determining an optimal capital standard for the banking industry", *Journal of Finance*, Vol. 32, pp. 1267-1282.
- Schliephake, E. and Kirstein, R. (2010), "Strategic effects of regulatory capital requirements in imperfect competition", *FEMM Working Paper No. 12*, available at: www.wu.uni-magdeburg.de.
- VanHoose, D. (2007), "Theories of bank behavior under capital regulation", *Journal of Banking and Finance*, Vol. 31, pp. 3680-3697.
- Wooldridge, J.M. (2003), *Introductory Econometrics: A Modern Approach*, 2nd ed., Thomson Learning, South-Western.
- Zellner, A. (1962), "An efficient method of estimating seemingly unrelated regression and tests for aggregation bias", *Journal of the American Statistical Association*, Vol. 57 No. 298, pp. 348-368.

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2. TumwineSulait, Sulait Tumwine, SejjaakaSamuel, Samuel Sejjaaka, BbaaleEdward, Edward Bbaale, KamukamaNixon, Nixon Kamukama. 2018. Determinants of interest rate in emerging markets. *World Journal of Entrepreneurship, Management and Sustainable Development* **14**:3, 267-290. [[Abstract](#)] [[Full Text](#)] [[PDF](#)]
3. AdesinaKolade Sunday, Kolade Sunday Adesina, MwambaJohn Muteba, John Muteba Mwamba. 2018. Linking bank regulatory capital buffer to business cycle fluctuations. *Journal of Economic Studies* **45**:3, 565-585. [[Abstract](#)] [[Full Text](#)] [[PDF](#)]
4. RazArisyi Fariza, Arisyi Fariza Raz. 2018. Risk and capital in Indonesian large banks. *Journal of Financial Economic Policy* **10**:1, 165-184. [[Abstract](#)] [[Full Text](#)] [[PDF](#)]
5. Mohd IsaMohd Yaziz, Mohd Yaziz Mohd Isa, Voon ChoongYap, Yap Voon Choong, Yong Gun FieDavid, David Yong Gun Fie, Abdul RashidMd. Zabid Hj, Md. Zabid Hj Abdul Rashid. 2018. Determinants of loan loss provisions of commercial banks in Malaysia. *Journal of Financial Reporting and Accounting* **16**:1, 24-48. [[Abstract](#)] [[Full Text](#)] [[PDF](#)]
6. Mohd IsaMohd Yaziz, Mohd Yaziz Mohd Isa, Abdul RashidMd. Zabid Hj, Md. Zabid Hj Abdul Rashid. 2018. Regulatory capital funds and risk-sharing behavior in distressed financial conditions. *Journal of Financial Reporting and Accounting* **16**:1, 197-216. [[Abstract](#)] [[Full Text](#)] [[PDF](#)]
7. Changjun Zheng, Anupam Das Gupta, Syed Moudud-Ul-Huq. 2017. Do market competition and development indicators matter for banks' risk, capital, and efficiency relationship?. *International Journal of Financial Engineering* **04**:02n03, 1750027. [[Crossref](#)]