IMPACT OF BANK REGULATION ON BANKS' PROFITABILITY: CROSS-COUNTRY EVIDENCE

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ABSTRACT

The clarion call for reform in bank regulation that ensures sound financial system and better performance following the financial melt-down of 2007–2009 across the globe has made it necessary to identify reforms that ensure these objectives are achieved. Using the most recent Banking Regulation and Supervision Survey of the World Bank and showing through empirical evidence, this paper adds to recent literature on the assessment of the impact of bank regulation on the profitability of banks across the globe. An Orbis financial database for 7535 banks observations in 114 countries over the period 2011–2018 is used for this study. The study shows that stringent capital requirement has positive and very significant impact on bank profitability. Same result is reported for Accounting/Information disclosure implying that regulations that strictly enforce information disclosure by banks to stakeholders eventually impacts positively on profitability. However, regulation on discipline/Problem institutions/exit has very significant and negative impact on bank profitability. Finally, the study again shows through the results that restriction on banking activities has positive impact on bank profitability though not significant just as expected.

KEY WORDS

banks, regulation, supervision, financial meltdown

JEL CODES

E5, G38, L51

1 INTRODUCTION

The global financial melt-down of 2007–2009 generated so much debate among academicians, policy makers and industry players with regards to how best the whole industry should be regulated to ensure sound and efficient financial system across the globe to prevent future

occurrence of that magnitude. The financial crisis was generally attributable to structural problems in the industry as well as the subprime mortgage crisis in the US and other major financial hubs around the globe.

Post-financial crisis led to several reforms across the globe mainly spearheaded by the Basel Committee on Banking Supervision from which it came out with sweeping reforms in the global financial sector to forestall and address any future financial meltdown. To prevent financial stress at the individual bank level, the Basel III accord was implemented and subsequently some aspects of Basel IV. It is also important to mention some other reforms in the banking sector which includes but not limited to; The G20 Accord (Over the Counter Derivatives), The Frank Dodd's Act and the European Market Infrastructure Regulation (EMIR).

In the wake of financial crisis of 2007–2009, many governments, central banks and financial institutions like the World Bank and the IMF were spurred to provide financial reforms and regulations that ensure sound and efficient banking system across the globe. The United States' Congressional Report on what led to the global financial meltdown of 2007–2009 as reported by Jickling (2010) provides as much as 26 major causes and provides strong arguments as to why they were the cause. But it is good to note that the debate as to the cause of the crisis will rage on for decades due to varying opinion on the matter.

This study seeks to contribute to literature on bank regulation and supervision for the countries understudy between the periods of 2011–2018. This research is interesting from both the perspective of theory and policy making. Worth mentioning are the myriad of contradictory predictions made by various scholars on the impact of bank regulations on bank performance even though the topic has received greater attention following the global financial crisis of 2007/2009. Also, there is no strong evidence that suggests one system of bank regulation that is effective universally. For instance Barth et al. (2013) used 4050 banks observations in 72 countries mostly from developed and emerging economies to examine whether bank regulation and supervision impacts positively or negatively on bank efficiency. Bank efficiency was used as the dependent variable, this current research however employs over 7500 banks in 114 countries from across the globe where return on asset is used as a dependent variable to show how bank regulations and supervision impacts on bank profitability for the banks sampled. Furthermore, Ozili (2017) and Yang et al. (2019) empirically researched on the regulatory impact of bank regulations on profitability of banks in Africa and Asia Pacific regions respectively. These however, do not provide a broader perspective of understanding of the phenomenon due to the limitation in scope. The novelty of this research is that it provides broader understanding of the findings since more banks are involved leading to enhancement of policy making and future theory formulation.

This paper again contributes to existing literature in several ways. It first shows that regulation on stringent capital requirement has very significant positive impact on bank profitability. Second, this research also shows that Accounting/Information disclosure has very significant and positive impact on bank profitability where vital information disclosure to stakeholders in the banking industry eventually impacts positively in banks performance. The paper again shows that restriction on banking activities increase bank profitability though not significant. Finally, this paper shows that regulation on discipline/Problem institutions/exit however has very significant and negative impact on bank profitability.

This paper is organised as follows; the review of literature on how bank regulation impacts bank profitability is provided in section two (2), in section three (3) also, methodology of data and estimation techniques are discussed. The main results and findings are analysed in section four (4). Robustness and sensitivity analysis are also provided in section five (5). Finally, section six (6) deals with conclusion of the entire research.

2 LITERATURE REVIEW

Relevant literature pertaining to the impact of bank regulation and supervision on bank profitability is analyzed in this section by looking into the theoretical and empirical perspectives. The empirical literature specifically reviews regulations on capital requirement, restrictions on banking activities, accounting/information disclosure and discipline/Problem institutions/exit.

In order to protect the banking sector from excessive risk-taking and reduce moral hazards to the barest minimum, the combination of banking regulations, supervisions and policy restrictions ensure all these goals are ultimately achieved (Ayadi et al., 2016). Other research by Casu et al. (2017) posit that the complexity and turbulence of the whole banking industry in the past decades has led to changes in banking regulation that focuses more on internal management promotion than on supervisory and monitoring activities. Furthermore, in the wake of financial and regulatory reforms comes the tightening of capital requirement for banks (Djalilov and Piesse, 2019).

Nevertheless, the effectiveness of banking regulation following the financial crisis of 2007–2009 continue to be questioned by policymakers as well as researchers who see the weakness of this regulation as a key determinant of the crisis (Čihák et al., 2013).

The theoretical perspective on the exact impact of bank regulation and supervision is not clear due to some general views held in the industry (Barth et al., 2013). The two views as elaborated in Barth et al. (2008) discusses about the "public interest view" where governments are expected to provide a regulatory framework that seeks to promote efficient banking and avoid market failures. The other view which is "private interest view" as explained, mainly make regulations to seek the interest of the minority group which eventually does not lead to bank efficiency. Due to these conflicting views which may affect predictions on theoretical studies, it is imperative that an empirical perspective should be looked at to help make an informed policy decisions.

Early empirical studies have emphasized on how regulatory as well as supervisory frameworks have impacted the performance of the banking sector amongst which include but not limited to (Dewatripont and Tirole, 2018; Hovakimian and Kane, 2000; Rochet, 1992). In evaluating the regulatory impact on banks profit, Barth et al. (2013) raises a cautionary flag with regards to the use of policies by governments in supervising and regulating bank activities which they posit will affect the banks' performance. The study was based on the sample of banks in 107 countries. Similar findings was reported by Demirgüç-Kunt and Huizinga (1999) where they shows that tighter regulation on banking activities tends to increase the cost of financial intermediation which eventually affects banks profitability.

Based on the analysis of 4050 banking institutions across 72 countries, Barth et al. (2013) found that bank efficiency and restrictions on bank activities had negative relationship. Positive relationship was however found between bank profitability and bank efficiency and same results for strengthening of supervisory power. Financial transparency based on market monitoring of banks also impacts positively on bank efficiency. Same results was reported by Agoraki and Tsamis (2017) in their research of emerging European banks in 2000–2016. They find that banks in countries with high capital requirement, restrictions on banking activities and market activities perform better with regards to efficiency and profitability. However, Other research by Ahamed et al. (2021) find that limited restrictions on banking activities as well as stringent high capital regulation leads to greater flow of low-cost fund hence good return on investment. This research was based on international sample of 1740 in 2004–2015.

Other recent empirical study in the Eurozone area by Asteriou et al. (2021) find strong positive relationship between regulation and bank profitability but the relationship according to the study depends on the type of regulation. In their study on the "Role of Bank Regulation on Bank Performance" in the Asia-Pacific region,

Yang et al. (2019) also find that Australian and Indonesian banks exhibit highest and lowest level of technical efficiency respectively. They further find evidence of tighter bank regulation and supervision resulting in high efficiency for both small and large size banks. In the Africa region, some other research finds evidence of impact of bank regulation on profitability and efficiency. Ozili (2017) and Triki et al. (2017) all find divergent impact of bank regulation on profitability. Ozili (2017) for instance show evidence that capital regulation having both significant and positive impact on the profitability of listed banks in the stock exchange than the unlisted banks. The study further finds negative impact on the profitability of non-listed banks with high regulatory capital. Triki et al. (2017) also show that the effect of some bank regulation depends on bank size as well as the risk level of the bank. Their findings further show that more stringent restrictions on entry increase large banks' efficiency. Restrictions on exit for small banks however affect the efficiency of the banks.

In a nutshell, two important points stand out from the above regarding previous studies on the impact of bank regulation on bank performance. First and foremost, there is no empirical evidence that show the best universal application of one bank regulation. Also, the efficiency of various bank regulations and supervision measures significantly changes depending on the regulatory framework as well as the type of the banking sector in question.

3 EMPIRICAL STRATEGY AND DATA

3.1 Sample

Financial data from 114 countries across the globe was used for the purpose of this study and the period covered is 2011–2018. The study uses an unbalanced panel financial data from Orbis and it involves a little over 7500 banks sampled from six continents. The variables used in this paper follow many others used in recent literature like Barth et al. (2013), Bitar et al. (2018), Borio et al. (2017), Chortareas et al. (2012) and many others.

3.2 Return on Asset (Dependent Variable)

To account for and measure profitability in the banking industry, Return on asset, Return on Equity and Net interest margin are widely used by many scholars. The return on asset shows how much profit is earned by a bank after tax as it deploys all its total assets (expressed in %). Return on equity indicates profit earned after tax per each equity capital invested by equity shareholders.

3.3 Control Variables

In order to ensure that the heterogeneity of banks are accounted for in cross-country data, bank performance variables used in many literatures are used as in Athanasoglou et al. (2008), Demirgüç-Kunt and Huizinga (1999), Dietrich and Wanzenried (2014) and Goddard et al. (2004). The net interest margin shows the net of interest earned as a result of loans granted to banks customers and what it pays for loans taken to finance its activities, which is measured per total assets of the bank. The ROA explains how efficient the banks' management are in utilising the assets of the bank. It shows the profits earned per USD of assets and indicates how effectively the bank's assets have been managed to generate revenues (Dietrich and Wanzenried, 2014). As Goddard et al. (2004) point out, Return on asset is mostly considered as the main ratio so far as the evaluation of bank profitability is concerned and has become the yardstick for bank profitability measurement in many literatures.

The cost-to-income ratio as an independent variable is the cost associated with running the banks' operation which comes in the form of (emoluments to staff; maintenance cost of

properties; administration running cost, discounting non-performing and bad loans losses as against total generated revenue (Dietrich and Wanzenried, 2014). Accordingly in this research, it is expected that a high cost-income ratio will exhibit a negative relationship with bank profitability. Loan loss reserves over gross loans represent credit risk in this paper and extant literature indicates that much exposure to credit risk impacts negatively on bank profitability and by implication a negative effect of this variable on bank profitability should be expected. Another important variable in our model (Net Loans over Total Assets) looks at the liquidity risk of the bank with the expectation of low liquidity resulting in positive impact on profitability.

As in Athanasoglou et al. (2008), Demirgüç-Kunt and Huizinga (1999), this paper uses the logarithm of Total Assets to represent bank size which is also an important determinant of bank profitability. It is worthy of note that total assets may not be the best measure for bank size of big banks for the simple reason of some having important off-balance sheet activities (Dietrich and Wanzenried, 2014). For the purpose of having a uniformity to fit the sample in this research, the log of total asset is used. Due to divergent definitions of what represents large, medium and small banks in different countries, this paper uses of dummy variables for three different bank size categories generated on country level (Dietrich and Wanzenried, 2014). Naturally, the expectation is that large and medium sized banks impacts positively on bank profitability as compared to small sized banks due to economies of scale they enjoy in the short term. However, economies of scale may be impacted negatively for heavy capitalised banks in the long run.

This paper also uses equity to total assets as capital adequacy which is the measure of risk of insolvency of the bank as well as the assets' market value as in Maudos and de Guevara (2004). According to Agoraki and Tsamis (2017), equity represents the resources (funds) owned by the bank available for its operations and provides a cushion when markets condition is not favourable and negatively affects banks' development. As posited by Martínez-Peria and Mody (2004) and Saunders and Schumacher (2000) the relative expensive nature of equity being source of funding may lead to rise in capital cost. Depositors in developing countries have strong conception that banks with sufficient capital provide safety net and a marginal bankruptcy cost (Agoraki and Tsamis, 2017).

This research uses real GDP Per Capita to capture the impact of macroeconomic environment on bank profitability as a means of measuring economic activity shocks and the policy-rate to capture monetary policy decisions. Again consumer price indexes (inflation) as well as nominal exchange rate are included in the model. Brock and Rojas-Suárez (2000) and Claeys and Vennet (2008) all posit that a rise in GDP Per Capita could lead to increase in profitability mainly on the account of more lending and lower default rates.

The swift and timely manner in which banks adjust interest rates to cope with rising inflation increases profitability which results in income rising faster than cost (Pasiouras and Kosmidou, 2007). The reverse happens if banks fail to anticipate inflation. Most studies find that inflation positively influences profit (Bourke, 1989; Molyneux and Thornton, 1992) and even net interest margins (Demirgüç-Kunt and Huizinga, 1999). On the other hand, Abreu and Mendes (2001) researched on banks from four European countries (Germany, France, Portugal and Spain) between the period 1986–1999 and find that return on asset and inflation have a negative relationship.

With regards to the nominal exchange rates, Hardy and Pazarbasioglu (1999) and Sahminan (2007) confirm that exchange rate depreciation significantly leads to banking distress. They strongly argue that exchange rate depreciation significantly reduces the profitability on lending in foreign currency. Thus, it is expected from this research that sharp decline in real effective exchange will impact negatively on bank profitability.

Monetary policy rates as another important determinant of bank profitability impacts profitability in a couple of ways; firstly, reduction in policy rates impacts positively on

the macroeconomic conditions that eventually helps the banks in reducing their associated cost of funding and increasing the creditworthiness of borrowers. Again, it is also argued that accommodating policy rates may result in the contraction in the net interest income of banks in the long-run.

3.4 Regulation Indices

To account for the regulation and supervision of banks in the model of this research, four regulatory indices are used as in Agoraki and Tsamis (2017), Anginer et al. (2021) and Barth et al. (2008). The study uses four dummy variables that the researcher thinks are a good representatives (proxies) for regulations and supervision.

The first dummy variable represents the area on regulation for capital requirement and the survey question as used by the World Bank is: *"What items and in what percentage do they constitute Tier 1 capital?"* An answer "capital instruments" represents 1 and otherwise represents 0. This research uses the World Banks' Banking Regulation and Supervision Survey of 2016 as a guide for this study.

The second dummy variable represents restrictions on banking activities and the survey question is: *"Under which conditions are banks allowed to engage in securities activity?"* An answer "Banks could engage in full range of these activities." is scored 1 and 0 for otherwise.

The third dummy variable also represents accounting/information disclosure and the survey question is: *"Are financial statements submission to the banking supervisor required before public disclosure?"* An answer "yes" is scored 1 and 0 for "no".

Finally, the last dummy variable is a proxy for regulation on discipline/Problem institutions/exit and the survey question for this variable is: *"Are formal enforcement actions by bank regulators supposed to be made public especially in the areas of cease and desist orders and mutual agreements between the regulator and the banking organisation?"*. An answer for "yes" is scored 1 and "no" 0.

See details in Tab. 5 in the Annex.

3.5 Model Specification

To achieve the objective of this paper, the following mathematical model was used and applied and the model is a modified version of Cross-sectional model used by Barth et al. (2013), Demirgüç-Kunt and Huizinga (1999) and Pasiouras and Kosmidou (2007). However, there is a slight variation of the above model as this research specifically uses a pooled regression time series as in Goddard et al. (2004), Staikouras and Wood (2011) and Neely and Wheelock (1997). The pooled regression model as used here assumes the same effect for profit and so therefore cross sectional variation (among banks) in any of the independent variables as well as variation overtime in that variable for an individual bank (Goddard et al., 2004). Yearly dummy is included in the model to make up for time impact.

$$\begin{aligned} \mathrm{ROA}_i = &\sum_{b=1}^{B} \beta_k \, \mathrm{BankSpec}_i^b + \\ &+ \sum_{s=1}^{s} \gamma_s \, \mathrm{Macro}_j^s + \\ &+ \sum_{r=1}^{R} \rho_\eta \mathrm{BankReg}_j^r + \\ &+ \theta_t + \mu_i, \end{aligned}$$

where the model relate the profitability of a Bank i in time t, denoted by ROA and selected back control variables (BankSpec) that are associated with bank profitability, liquidity risk, capital adequacy and leverage (net interest margin, cost to income, equity over total assets, net loans over total assets, loan loss reserves over gross loans, total assets). Included in the model are macroeconomic variables in country j at time t; Macro GDP per capita, inflation, and exchange rate and policy rate. BankReg from the model represents dummy variables for bank regulation and supervision survey (Bank Regulation Survey 1, Bank Regulation Survey 2, Bank Regulation Survey 3 and Bank Regulation Survey 4). Time dummy in model is θ_t with an error term μ_i.

4 MODEL ESTIMATION RESULTS

In this section, the researcher dissects how bank regulation and supervision impacts on the profitability of banks under study. Before examining the main model, the paper in Tab. 4 in the Annex shows the descriptive statistics of the main variables used in the research.

4.1 Descriptive Statistics

The mean average return on asset is approximately 1% for over 7500 banks sampled across 114 countries. It shows how much profit the banks earn per asset. This corresponds with the same as mean value obtained by Staikouras and Wood (2011). Banks generally make an average net interest margin of 4.3%, relatively close to 6.4% in Adelopo et al. (2018). The cost to income ratio which signals how efficient management are in managing cost has mean value of 75.6 for the sampled banks as obtained in Pasiouras and Kosmidou (2007) for Spanish banks 70.3. The financial leverage ratio which measures the use of debt by the banks to finance assets has mean value of 19.50.

With regards to macroeconomic statistics, the GDP Per Capita which measures the economic health of an economy for countries under study has a mean value of 1.03 and this is close to results obtained by Pasiouras and Kosmidou (2007) for the United Kingdom. The policy rate for the central banks used in the determination of commercial banks' interest rates as well as inflation have mean of 1.6 and 1.0 respectively.

The correlation matrix among these variables enables to identify that using some of the variables at the same time is not prudent, since the same phenomenon would probably have been explained. A closer look at the table below shows no correlation amongst all the variables, thus good selection of variables for the model. This research test for multicollinearity by studying whether the correlation coefficients absolute values between the explanatory variables exceed 0.80 (Studenmund, 2014). The details in Tab. 6 in the Annex suggest that all correlation coefficients are below 0.80. Hence, this research does not have a multicollinearity problem.

To ensure the absence of multicollinearity among explanatory variables the study uses OLS regression of the model to estimate Variance Inflation Factor (VIF) and as stated in Robinson and Schumacker (2009) the value should not exceed the value of 10. In Tab. 7 in the Annex, we show that none of the explanatory variables have a VIF value more than 10.

4.2 Pooled Regression Results

The study presents the findings on the impact of bank regulation on banks profitability and the model introduces the bank regulation variables gradually until all the variables are included simultaneously and the details are available in Tab. 1. The results for the control variables show that cost to income ratio, net interest margin, Equity to total assets, bank size, loan loss reserves over gross loans are significant. Except for cost to income and loan loss reserves over gross loans that have negative signs, all the other control variables have positive signs. This result indicates that competitive banks in the countries understudy earn enough profit from deployed resources. From the macro-economic environment, GDP Per capita, inflation, exchange rate are positive and significant except for policy rate that has negative sign. Somewhat surprisingly, this study finds a hike in policy rate leading to decline in bank profit. Perhaps the use of inter-bank rates could confirm this results or otherwise.

Three bank regulation and supervision measures (bank regulations supervision 1, 3 and 4) have very significant and positive impact on bank profitability. It is clear from the results that Bank regulation and supervision survey 1 which represents regulation on capital requirement is associated with an increase in bank profitability as the coefficient is positive and significant (at the 1% level) and this is consistent with Fethi and Pasiouras (2010), Barth et al. (2013), Agoraki et al. (2017) and Yang et al. (2019). Overall Accounting/Information disclosure which is bank regulation survey 3 is significant and positive (at 1% level).

Tab. 1: Impact of Bank Regulation and Supervision on Bank Profitability: All benchmark models

	(Model 1)	(Model 2)	(Model 3)	(Model 4)	(Model 5)
Dependent variable: Return on asset	**Panel Data (pooled)**	**Panel Data (pooled)**	**Panel Data (pooled)**	**Panel Data (pooled)**	**Panel Data (pooled)**
Cost to income	−0.0219***	−0.0219***	−0.0219***	−0.0218***	−0.0218***
	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0023)
Net interest margin	0.0190***	0.0187***	0.0186***	0.0175***	0.0175***
	(0.0046)	(0.0045)	(0.0045)	(0.0044)	(0.0043)
Log of total assets	0.0685***	0.0504***	0.0422**	0.0462***	0.0659***
	(0.0144)	(0.0130)	(0.0139)	(0.0136)	(0.0145)
Loan loss reserves	−0.0139*	−0.0142*	−0.0143*	−0.0143*	−0.0140*
over gross loans	(0.0059)	(0.0060)	(0.0060)	(0.0060)	(0.0059)
Net loans over total assets	0.0146	0.0151	0.0139	0.0117	0.00791
	(0.0148)	(0.0148)	(0.0149)	(0.0152)	(0.0152)
Equity over total assets	0.0318***	0.0313***	0.0306***	0.0299***	0.0297***
	(0.0068)	(0.0068)	(0.0069)	(0.0069)	(0.0070)
GDP per capita	1.147*	1.123*	1.058*	1.129*	1.129*
	(0.625)	(0.654)	(0.622)	(0.639)	(0.661)
Policy rate	−0.0365**	−0.0387**	−0.0407**	−0.0375**	−0.0345*
	(0.0134)	(0.0135)	(0.0132)	(0.0134)	(0.0135)
Inflation	0.0291**	0.0316**	0.0277*	0.0285**	0.0189
	(0.0102)	(0.0103)	(0.0109)	(0.0110)	(0.0116)
Exchange rate	0.00845**	0.0104***	0.0105***	0.0115***	0.0085**
	(0.0029)	(0.0027)	(0.0026)	(0.0026)	(0.0029)
Bank regulation and	0.178*				0.296***
supervision survey 1	(0.0808)				(0.0737)
Bank regulation and		−0.0318			0.0662
supervision survey 2		(0.0877)			(0.0868)
Bank regulation and			0.184*		0.216**
supervision survey 3			(0.0804)		(0.0791)
Bank regulation and				−0.198*	−0.250**
supervision survey 4				(0.0925)	(0.0863)
_cons	−1.185*	−1.016	−0.857	−0.864	−0.934
	(0.712)	(0.737)	(0.720)	(0.727)	(0.708)
Time dummies	Yes	Yes	Yes	Yes	Yes
Number of observations	33632	33632	33632	33439	33439
Number of countries	114	114	114	114	114
Number of banks	7535	7535	7535	7535	7535
R^2	0.159	0.159	0.159	0.159	0.161

Note: The estimation is based on pooled regression time series. The pooled regression model as used here assumes the same effect for profit and so therefore cross sectional variation (among banks) in any of the independent variables as well as variation overtime in that variable for an individual bank (Goddard et al., 2004). The sample is 8 period panels with yearly dummy included in the model to make up for time impact. The parenthesis covers the standard errors in the table. * = statistically significant at 10%; ** = statistically significant at 5%; *** = statistically significant at 1%

The result implies that a very stringent requirement for banks to provide vital accounting information leads to strong confidence in the banking industry which eventually leads to positive investor decisions and favorable market performance. Bank regulation survey 4 which is a proxy for regulation on discipline/Problem institutions/exit however is associated with less

bank profitability as indicated by its negative coefficient (at 1% level) has very significant and negative impact on bank profitability in sharp contrast to the findings of Yang et al. (2019). Restriction on banking activities (Bank regulation and supervision survey 2) has positive impact on bank profitability at 7% though not significant just as found in Barth et al. (2013) and Yang et al. (2019).

5 ROBUSTNESS CHECK

We conduct sensitivity analysis of our research findings above to reinforce strongly that the results obtained are valid in some other situations. To achieve this objective the study asks two important questions; whether bank size and income level of the bank present a significantly different outcome from the main research results or will further support it?

Tab. 2 details of the estimates of the model are provided by using the banks' size (log of total assets), where bank sizes are categorised as large, medium and small. Like the main results in Tab. 1, many of the bank-specific variables have very significant and positive impact bank profitability irrespective of the bank size. Cost to income ratio has a very significant negative coefficient at 1% impact on profit for all bank sizes. The results show an average reduction in bank profit for all bank sizes by 2.2%. The net interest margin has very significant positive coefficient (1.7%) on average for all bank sizes same as the main model in Tab. 1. The leverage as well as total assets both has very strong and positive coefficients for all bank sizes, same results in main model. Net loans to total assets however has positive even though significant coefficient same as the main model.

The macroeconomic and bank regulation and supervision variables largely show significant and positive results for all bank sizes. This reaffirms the results of our main model in Tab. 1. The exchange rate at nominal value has positive 5% significance on profitability for all bank sizes as obtained in model 1. Inflation has positive coefficient though not significant, thus confirming the results in model 1. GDP Per Capita is also significant at 10%.

Three bank regulation measures (thus, regulations 1, 3 and 4) show very significant coefficients though bank regulation and supervision survey 4 is negative. The coefficients for regulation on capital requirement suggest that stringent capital requirement is very significant and positive (at 1%) for all bank sizes. Bank regulation and supervision survey 4 which is a proxy for regulation on discipline/Problem institutions/exit however has very significant and negative impact on bank profitability at all bank levels. Bank regulation and supervision survey 2 which proxy restrictions on banking activities have positive and insignificant coefficients for all bank sizes.

To further support the results of the researcher's main findings, the model is estimated by classifying and categorising countries by income levels. Countries are therefore categorised as high, middle and low incomes and the model estimation is in Tab. 3. Irrespective of the countries income level, cost to income coefficient is negative and very significant at 1% as in the main model. Thus high cost to income ratio is reflected in low bank profitability for high, medium and low income countries. One percent increase in net interest margin increase bank profit by an average of 1.8% for both high and middle income countries whilst same applies to low income countries but 5% significance and same result is reported for leverage. Net loans over total assets for all countries income level are positive though not significant further proving the sensitivity of the first model.

The macro environment further confirms the coefficients of the first model to be robust; the exchange rate regime is significant and positive at all countries income levels. Policy rate is positive and insignificant for both high and low income countries except for middle income which is negative and significant at 10%. This tells us that decision to raise policy rate by central banks in the middle level income countries only decreases bank profitability by 3.5%. Inflation largely is positive and insignificant

Tab. 2: Impact of bank regulation and supervision on bank profitability: Bank size

	(Large banks)	(Medium banks)	(Small banks)
Dependent variable: Return on asset	**Panel Data (pooled)**	**Panel Data (pooled)**	**Panel Data (pooled)**
Cost to income	−0.0218***	−0.0218***	−0.0225***
	(0.0023)	(0.0023)	(0.0024)
Net interest margin	0.0175***	0.0175***	0.0173***
	(0.0043)	(0.0044)	(0.0043)
Log of total assets	0.0659***	0.0659***	0.0860***
	(0.0145)	(0.0145)	(0.0157)
Loan loss reserves over gross loans	−0.0140*	−0.0140*	−0.0139*
	(0.00594)	(0.00594)	(0.00598)
Net loans over total assets	0.0079	0.0079	0.0029
	(0.0152)	(0.0152)	(0.0163)
Equity over total assets	0.0297***	0.0297***	0.0296***
	(0.0070)	(0.0070)	(0.0071)
GDP per capita	1.129*	1.129*	1.918*
	(0.661)	(0.661)	(0.793)
Policy rate	−0.0345*	−0.0345*	−0.0471**
	(0.0135)	(0.0135)	(0.0157)
Inflation	0.0189	0.0189	0.0204*
	(0.0116)	(0.0116)	(0.0118)
Exchange rate	0.0085**	0.0085**	0.0104**
	(0.0030)	(0.0029)	(0.0033)
Bank regulation and supervision survey 1	0.296***	0.296***	0.316***
	(0.0737)	(0.0737)	(0.0752)
Bank regulation and supervision survey 2	0.0662	0.0662	0.113
	(0.0868)	(0.0868)	(0.0938)
Bank regulation and supervision survey 3	0.216**	0.216**	0.244**
	(0.0791)	(0.0791)	(0.0884)
Bank regulation and supervision survey 4	−0.250**	−0.250**	−0.254**
	(0.0863)	(0.0863)	(0.0902)
_cons	−0.934	−0.934	−2.003*
	(0.708)	(0.708)	(0.833)
Time dummies	Yes	Yes	Yes
Number of observations	33439	33439	31898
Number of countries	114	114	114
Number of banks	7535	7535	7535
R^2	0.161	0.161	0.166

Note: The estimation is based on pooled regression time series. The pooled regression model as used here assumes the same effect for profit and so therefore cross sectional variation (among banks) in any of the independent variables as well as variation overtime in that variable for an individual bank (Goddard et al., 2004). The sample is 8 period panels with yearly dummy included in the model to make up for time impact. The parenthesis covers the standard errors in the table. * = statistically significant at 10%; ** = statistically significant at 5%; *** = statistically significant at 1%

for all income levels except for low income countries.

In model 3, bank regulations on capital requirement (Bank regulation and supervision survey 1) increases bank profitability for both higher income and middle income countries but reduce profitability for countries with low income. Restriction on banking activities

Tab. 3: Bank regulation and profitabilty: Country income level

	(High income)	(Middle income)	(Low income)
Dependent variable: Return on asset	**Panel Data (pooled)**	**Panel Data (pooled)**	**Panel Data (pooled)**
Cost to income	−0.0136***	−0.0218***	−0.0460***
	(0.0017)	(0.0023)	(0.0064)
Net interest margin	0.0182***	0.0175***	0.0182**
	(0.0041)	(0.0044)	(0.0059)
Log of total assets	0.0862***	0.0659***	0.111*
	(0.0127)	(0.0145)	(0.0563)
Loan loss reserves over gross loans	−0.0191*	−0.0140*	−0.0100
	(0.0097)	(0.0059)	(0.0073)
Net loans over total assets	0.0132	0.00791	0.0503
	(0.0133)	(0.0152)	(0.0539)
Equity over total assets	0.0357***	0.0297***	0.0320**
	(0.0083)	(0.0070)	(0.0110)
GDP per capita	0.979	1.129*	0.519
	(0.802)	(0.661)	(0.830)
Policy rate	0.000150	−0.0345*	0.124
	(0.0113)	(0.0135)	(0.184)
Inflation	0.0381*	0.0189	0.0350**
	(0.0213)	(0.0116)	(0.0109)
Exchange rate	−0.00491*	0.00852**	0.0150**
	(0.00224)	(0.00296)	(0.00462)
Bank regulation and supervision survey 1	0.379***	0.296***	−0.162
	(0.0657)	(0.0737)	(0.190)
Bank regulation and supervision survey 2	−0.0557	0.0662	0.533**
	(0.104)	(0.0868)	(0.198)
Bank regulation and supervision survey 3	0.0321	0.216**	0.148
	(0.0672)	(0.0791)	(0.182)
Bank regulation and supervision survey 4	−0.0863	−0.250**	−0.945***
	(0.0723)	(0.0863)	(0.219)
_cons	−0.807	−0.934	−0.0407
	(0.717)	(0.708)	(1.743)
Time dummies	Yes	Yes	Yes
Number of observations	27594	33439	5845
Number of countries	114	114	114
Number of banks	7535	7535	7535
R^2	0.154	0.161	0.244

Note: The estimation is based on pooled regression time series The pooled regression model as used here assumes the same effect for profit and so therefore cross sectional variation (among banks) in any of the independent variables as well as variation overtime in that variable for an individual bank (Goddard et al., 2004). The sample is 8 period panels with yearly dummy included in the model to make up for time impact. The parenthesis covers the standard errors in the table * = statistically significant at 10%; ** = statistically significant at 5%; *** = statistically significant at 1%

(Bank regulation and supervision survey 2) has mixed results for all three income levels; it is significant at 5% and increase bank profit for low income countries. However it reduces bank profitability but the coefficient is insignificant for high income countries and the results largely confirm the results in model 1. Accounting/Information disclosure represents

bank regulation and supervision survey 3 and it increase bank profitability for all countries income level but only significant for middle income economies. And regulation on discipline/Problem institutions/exit is largely significant and decreases bank profitability across board.

6 CONCLUSION

This research examines the impact of bank regulation and supervision on bank profitability and provides further check through sensitivity analysis whether bank size and countries income level impacts differently from main model estimation. Based on the analysis of the impact of bank regulation on bank profitability, the results show through our main model and robustness check that bank regulation and supervision has very much significance on the profitability of banks. This research confirms in particular that stringent capital requirement has significant impact on bank profitability. Accounting/Information disclosure from this research, confirms that it has some significant level of impact on bank profitability. The results also show regulation on discipline/Problem institutions/exit having some marginal impact and reduction on bank profitability. Finally, the only bank regulation and supervision variable from the results that increase bank profitability though not significant is restrictions on banking activities. This result explains to large extent an important trade-offs between sound financial systems and bank profitability.

This study contributes by way of complementing other existing studies where we have mixed evidence of the impact of bank regulation on the profitability of banks across the globe (Agoraki and Tsamis, 2017; Ahamed et al., 2021; Barth et al., 2013; Mashamba, 2018; Ozili, 2017; Triki et al., 2017). In particular, this study extend the current literature by examining how bank regulation impacts bank profitability using cross country evidence since most of the current studies are based on individual countries, regional economic blocs and continents based. Investigating from the global perspective of such a phenomenon gives us more insight into the understanding of the impact of bank regulation on profitability. The researcher recommends the use of other banking regulation and supervision surveys measures like external auditing requirements; bank governance; consumer protection and many others as these would prove or otherwise the impact on bank profitability.

By way of policy implication of this research, the researcher believes that the results as obtained, point to the fact that actions taken by governments and central banks on regulations impacts the profitability of commercial banks and therefore new regulations must be aimed and targeted at important trade-offs to ensure banks run efficiently and profitably. Thus, policy makers and supervisors in the industry need to identify the shortcomings and weaknesses in the current banking regulations and work towards improving their effectiveness in the long run.

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8 ANNEX

Tab. 4: Descriptive Statistics on bank specific, macroeconomy and bank regulation variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Return on asset	51084	0.989	5.057	−99.27	99.34
Net interest margin	46791	4.324	15.504	−383	933.37
Cost to income	46569	75.555	45.123	−947.56	990.81
Total assets	51239	11.996	2.51	0	22.328
Net loans over total assets	48392	5.149	2.449	−0.925	10.473
Loan loss reserves over gross lons	39236	4.127	13.301	−14.28	807.94
Equity over total assets	49844	19.501	23.4	−516.35	100
GDP per capita	60186	1.013	0.075	0.008	4.958
Policy rate	56414	1.596	1.454	−1	35
Exchange rate	55144	98.998	15.062	3.5	141.875
Inflation	60034	1.038519	4.767895	−126.9265	134.4944
Bank regulation survey 1	58354	0.437	0.496	0	1
Bank regulation survey 2	58354	0.207	0.405	0	1
Bank regulation survey 3	58250	0.205	0.403	0	1
Bank regulation survey 4	57346	0.63	0.483	0	1

Tab. 5: Model explanatory variables

Variable name	Definition	Source
Bank Specific Variables		
Dependent:		
Return on Asset	It represents Return on Asset, thus the net income to total assets ratio.	Orbis
Independent:		
Net Interest Margin	It represents net interest margin expressed as a percentage of earnings asset. A higher margin indicates high profitability for the bank if only asset quality is maintained.	Orbis
Equity over Total Assets	It measures equity to total assets and looks at the equity funding in the balance sheet as well as capital adequacy.	Orbis
Cost to Income	Cost to income ratio is the ratio of operational expenses and gross revenue. It measures management's efficiency in managing cost.	Orbis
Loan Loss Reserves over Gross Loans	It is a proxy for credit risk.	Orbis
Net Loans over Total Assets	A net loan over total assets represents the liquidity risk of the bank with high liquidity impacting negatively on profitability.	Orbis
Log of Total Assets	Total assets proxies bank size.	Orbis
Macroeconomic Variables		
GDP per Capita	It captures fluctuations in economic activity.	IMF/IFS
Inflation	It captures fluctuations in economic activity.	IMF/IFS
Exchange rate at nominal rate	Nominal exchange rate captures fluctuations in the economy.	IMF/IFS
Policy rate	The rate at central banks lend to commercial banks.	IMF/IFS
Bank Regulation and Supervision		
BRSS1	Dummy variable on regulation for capital requirement and the survey question is: *"What items and in what percentage do they constitute Tier 1 capital?"* An answer "capital instruments" represents 1 and otherwise represents 0.	World Bank BRSS 2016
BRSS2	Dummy variable on restrictions on banking activities and the survey question is: *"Under which conditions are banks allowed to engage in securities activity?"* An Answer "yes" is scored 1 and 0 for "no".	World Bank BRSS 2016
BRSS3	Dummy variable for accounting/information disclosure and the survey question is: *"Are financial statements submission to the banking supervisor required before public disclosure?"* An answer "yes" is scored 1 and 0 for "no".	World Bank BRSS 2016
BRSS4	It is a proxy for regulation on discipline/Problem institutions/exit and the survey question for this variable is: *"Are formal enforcement actions by bank regulators supposed to be made public especially in the areas of cease and desist orders and mutual agreements between the regulator and the banking organisation?"* An answer for "yes" is scored 1 and "No" 0.	World Bank BRSS 2016

Tab. 6: Correlation matrix for bank specific, macroeconomic and bank regulation variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Net interest margin	1.000													
(2) Cost to income	−0.017	1.000												
(3) Loan loss reserves	0.075	0.016	1.000											
(4) Equity to total assets	0.194	0.040	0.212	1.000										
(5) Total assets	−0.083	−0.329	−0.009	−0.271	1.000									
(6) Net loans over total assets	0.054	−0.189	−0.144	−0.123	0.166	1.000								
(7) Exchange rate	−0.109	0.115	−0.125	−0.114	−0.221	−0.042	1.000							
(8) Inflation	0.189	−0.046	0.111	0.200	−0.038	0.044	−0.364	1.000						
(9) GDP per capita	−0.007	−0.050	−0.014	0.026	0.096	0.054	0.108	−0.034	1.000					
(10) Policy rate	−0.004	0.021	−0.014	−0.005	−0.115	0.051	0.277	−0.003	0.257	1.000				
(11) Bank regulation 1	−0.036	0.228	−0.105	0.022	−0.609	−0.081	0.433	−0.016	−0.102	0.130	1.000			
(12) Bank regulation 2	0.124	−0.122	0.135	0.122	0.184	0.025	−0.269	0.084	0.162	0.049	−0.423	1.000		
(13) Bank regulation 3	0.060	−0.100	0.051	0.081	0.257	0.089	−0.150	0.266	0.037	−0.042	−0.272	−0.037	1.000	
(14) Bank regulation 4	−0.225	0.125	−0.142	−0.226	−0.145	−0.140	0.302	−0.307	−0.024	0.099	0.367	−0.203	−0.253	1.000

Tab. 7: Variance inflation factor for bank specific, macroeconomic and bank regulation variables

	VIF	**1/VIF**
BRSS1	2.446	0.409
Total assets	1.979	0.505
Exchange rate	1.632	0.613
Inflation	1.412	0.708
BRSS4	1.402	0.713
BRSS2	1.368	0.731
Equity over total assets	1.279	0.782
BRSS3	1.274	0.785
Policy rate	1.193	0.838
Cost to income	1.158	0.864
GDP per capita	1.132	0.883
Net loans over total assets	1.116	0.896
Loan loss reserves over gross loans	1.099	0.91
Mean VIF	1.422	.

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