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Financial Regulations, Profit Efficiency, and Financial Soundness: Empirical Evidence from Commercial Banks of Pakistan

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The purpose of this paper is threefold. First, it measures profit efficiency and financial stability of commercial banks of Pakistan. Second, it empirically estimates the effect of the already implemented financial regulations on the profit efficiency and financial stability of banks. Third, it examines the differential effect of financial regulations on profitability and financial soundness across bank size. To carry out the empirical analysis, a balanced bank-level panel data covering the period 2008-2014 is used. To gauge the profit efficiency of commercial banks, Data Envelopment Analysis (DEA) is utilised, while, to proxy the financial soundness, the Z-score is calculated for each bank. The panel regression approach is used to examine the effects of financial regulations on the profit efficiency and financial soundness of banks. We find that the financial regulations enforced by State Bank of Pakistan (SBP) have significant impacts on the profit efficiency and financial stability of banks. The results indicate that the non-performance loans to assets ratio (NPLL) and the reserve ratio (RR) impact positively, whereas, the liquidity ratio (LIQR) and the loans to deposits ratio (LODEPOSIT), significantly and negatively affect the profit efficiency of banks. However, only LR and RR are positively and significant related to the financial stability. The results also suggest that the financial regulations have significant differential effects on the profit efficiency and financial soundness of banks across bank size.

JEL Classification: C23, E44, G21, G28

Keywords: Profit Efficiency, Financial Soundness, Financial Regulations, Data Envelopment Analysis, Z-Score, Differential Effects

1. INTRODUCTION

The recent global financial crisis has stimulated interest to recognise and improve financial regulations that would work best in the development, performance, and stabilisation of commercial banks. An efficient banking sector plays an important role in financial and economic stability of a country. The overall activities of banks are significantly influenced by financial regulations imposed by the central banks. Principally, financial regulations are directly related to the behaviour of commercial banks. Specifically, financial regulations mainly aim at enabling banks to improve their profitability and stability. However, whether their implementation enhances the efficiency or impedes it is an empirical question. Yet, when we look at empirical

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literature we find that there is very little evidence on the issue whether financial regulations really enhance or indeed slow down the profit efficiency of commercial banks.

Like many other developing countries, the banking sector of Pakistan contributes significantly to economic growth.[1] The banking sector functions within a certain regulatory framework laid down by the State Bank of Pakistan (SBP). The regulatory framework of SBP incorporates Basel Accords as well. These accords definitely help banks to improve their stability and risk management capabilities. Further, commercial banks cannot work in isolation. The banks need to integrate with international financial markets to expand their businesses. Therefore, the compliance with Basel Accords helps them to integrate into international financial markets more quickly. The Basel Accords also help banks to improve their capital requirement and strengthen their interconnectedness with foreign banks operating across the globe. The commercial banks of Pakistan are already following Basel II. The SBP is on its way to move to Basel III, which is an unimproved version of Basel II. The Basel III has more strict capital requirements for banks. As per SBP instructions, banks have to maintain a capital adequacy ratio (CAR) of 10 percent and Tier 1 capital of at least 6.0 percent of the total risk weighted assets (RWA). There is also additional capital conservation buffer (CCB) of 2.5 percent of total RWA. The SBP is giving ample time to the banks to prepare themselves for meeting the requirements of Basel III.

Comment [T1]: Is Basel III an improved or an unimproved version of Basel II?

Reviewing the existing empirical literature, we observe that researchers have paid less attention to the efficacy of these implemented financial regulations with respect to profit efficiency and financial stability of banks operating in Pakistan. Yet, these financial regulations are definitely regulated and imposed not only to protect but also to improve the confidence level of both the consumers and the investors. The financial regulations are expected to directly affect the behaviour of commercial banks. The financial regulations are imposed with the aim of improving profitability and stability of commercial banks, which, in turn, increase the financial stability of the whole system. However, the question between the lines is that whether the implementation of these financial rules and regulations really improve profitability of banks. It would also be worth exploring whether the bank size matters in the effectiveness of financial regulations with regards to profitability and risk management. This study is an attempt to find the answer to these questions.

In particular, the study investigated how financial regulations affect profit efficiency and financial strength of commercial banks of Pakistan. The main purpose of this study is threefold. First, the study aims to calculate profit efficiency of commercial banks using DEA and the financial stability based on Z-score. Second, the study aims to explore the impact of financial regulations on the profit efficiency and risk taking behaviour of commercial banks of Pakistan. Third, it examines the differential effect of financial regulations on the profit efficiency and financial soundness across the bank size. To do this, we classify banks into three subgroups (large, medium, and small banks) as per their total assets. The main rationale behind this division is to see whether financial regulations have different effects for different size of banks. Examination of differential

[1]As a component of services sector, financial sector contributes 6.6 percent into gross domestic product [Pakistan Economic Survey (2012-13)].

effects of financial regulations is also rationalised, based on very a well-know Finance theory, namely "Too Big to Fail".

Our empirical investigation consists of two phases. In the first phase, we calculate profit efficiency by using Data Envelopment Analysis (DEA) and financial stability based on the Z-score. In the second phase, we empirically examine the impact of financial regulations on the profit efficiency and risk taking behaviour of banks. The study uses quarterly data covering the period 2008-2014 for all commercial banks operating in Pakistan during the examined period. The empirical models of profit efficiency and financial stability are estimated using the fixed effects estimator in a panel framework. The ratios that we use to proxy financial regulations are reserve ratio, provision coverage ratio, liquidity ratio, loan to deposit ratio, capital adequacy ratio, and leverage ratio. The leverage ratio is also being investigated because it is one of the requirements of Basel III. The choice of these ratios is based on prior literature and availability of data.

We find that the financial regulations enforced by SBP have significant impacts on the profit efficiency and financial stability of banks. Our results reveal that the non-performance loans to assets ratio (lNPLL) and the reserve ratio (RR) positively, whereas, the liquidity ratio (LIQR) and the loans to deposits ratio (LODEPOSIT), significantly and negatively affect the profit efficiency of the banks. The results also suggest that the financial regulations have significant differential effects across bank size. For instance, although the capital adequacy ratio (CAR) has a positive and significant effect on the profit efficiency of medium and small banks, it does not significantly affect the profit efficiency of large banks. Likewise, large banks' profit efficiency increases with the leverage ratio (LR), whereas, the LR has a negative impact on the profit efficiency in case of both the small and medium size banks. The RR has also differential effect across bank size, positively (negatively) affecting the profit efficiency of medium (small and large banks) banks.

The findings regarding the effects of financial regulations on financial soundness of banks suggest that in case of full sample, only LR and RR are positively and significant related to the financial stability. Estimating the differential effects of the financial regulations across bank size we show that the negative impact of CAR on the financial health of banks is statistically significant only in case of medium banks. However, LIQR, LODEPOSIT, NPLL deteriorate the financial soundness of all size of banks. In contrast, the financial stability of large banks decreases with LR, whereas, the financial stability of small and medium banks strengthens with LR.

The empirical findings of the paper are useful for policy-makers, regulators, and management of commercial banks. Specifically, the results help policy-makers and regulators to understand the impact of already implemented financial regulations on the profit efficiency and financial stability of commercial banks of Pakistan. Therefore, the policy-makers should design such policies that help the commercial banks to increase their profit efficiency and mitigate the excessive risk taken by them.

The rest of the paper is structured as follows. Section 2 reviews the existing literature. The methodology, data description, and variable construction are given in Section 3. Section 4 presents the empirical findings. Finally, Section 5 presents the conclusions of this study.

2. LITERATURE REVIEW

Depending upon the structure and functions of concerned economy, the efficiency of banking sector is of vital importance both in the developed and the developing economies. The SBP has imposed financial regulations on the commercial banks of Pakistan to improve the performance of commercial banks. These financial regulations relate to compliance with Basel Accords. This study is an attempt to empirically examine the impact of financial regulations on the profit efficiency and risk taking behaviour of commercial banks of Pakistan. Therefore, it would be useful to present a brief explanation of the banking regulations imposed by SBP and Basel III. Next, we review the studies that have focused on examining the efficiency of commercial banks. Finally, we present the summary of the literature on the influence of financial regulations on profit efficiency and bank risk.

2.1. Financial Regulations: A Brief History

The development of banking sector of any economy is closely linked with the development and growth of economy. No economy can increase its growth and well-being of its population without having a strong financial sector. The banks in Pakistan constitute 95 percent of the financial sector. All the financial regulations imposed by the SBP completely follow the Basel Accords. Currently Pakistan is following Basel II. The SBP has given clear instructions to the banks to start preparing themselves for Basel III. The risk management practices are being customised by the SBP in order to increase reliance on Basel II with an aim of moving towards Basel III.

The capital requirements have been made stringent for the banks in order to prepare banks for Basel III. As per the SBP instructions, all the commercial banks have to maintain a Carob 10 percent. In addition leverage ratio is also being introduced in Basel III. The required Leverage ratio as per Basel III is 3 percent. There is also additional capital conservation buffer (CCB) of 2.5 percent of total RWA. The SBP wants banks to comply with Basel III in phases, with an aim of full implementation by December 2019.

The provision coverage ratio requirement reflects how the regulators want the banks to set aside a certain portion of their assets as a preventive measure to be used in case of any emergency. The required ratio set by SBP is 14.3 percent. The required reserve ratio for the banks of Pakistan is 5 percent. This ratio is basically to secure the solvency of banks and drain out the excess money from the banks. This ratio helps to control money supply.

The SBP regulates the liquidity ratio to enable the banks to improve the short-term obligations of the banks. The SBP revised it from 15 percent to 18 percent since 2006 to enable the bank to advance more loans. Loans to deposit ratio declined to 60 percent in April 2012 from about 67 percent in April 2011. Banks invest about 44 percent more funds mostly in government treasury bills and bonds and also in stocks and other approved securities.

2.2. Efficiency and Financial Regulations

Depending upon the structure and functions of the concerned economy, the efficiency of the banking sector is quite important, both in the developed and the developing economies. The efficiency of the banking sector has emerged as a

multidimensional perception and is widely being explored in the literature, either being measured through data envelopment analysis (DEA) and stochastic frontier analysis (SFA) around the globe. The financial sector's efficiency and the strategies being followed can be noticed in their financial statements. However, there are differences between variable selections being used for analysing the relationship for banking efficiency at all levels.

When we review the literature on Pakistan, we find that there are several studies that examine the efficacy of commercial banks. Rizvi and Khan (2001) using the DEA method for analysing the efficiency of commercial banks of Pakistan found that the banks in the field of productivity and efficiency make no major improvements. The foreign banks are found to consume resources in a more effective and efficient manner [Burki and Niazi (2003)]. Yet, the empirical evidence suggests that the efficiency of commercial banks of Pakistan has improved since 2000. The foreign banks are found to be more efficient than the local commercial banks.

There is another study conducted by Ahmed (2008) using data on 37 commercial banks of Pakistan for the period 2001-2004. The findings of the study indicated that the banks included in the sample needs to improve asset structure and interest earnings to improve their efficiency. Further, the author argued that the government should not promote mergers of commercial banks. Rather, they should take steps to increase their profit efficiency.

Akhtar (2010) examined the efficiency of commercial banks in Pakistan. He used annual data covering the period 2001-2006 and employed the DEA to measure efficiency. The results indicated that the average efficiency scores of the banking sector of Pakistan have been very low. The study further explored that foreign banks operating in Pakistan perform better than the local banks.

Comment [T2]: Rather than using the phrase 'of Pakistan', my preference would be to use 'in Pakistan'
- Multiple occurances of this use!

Turning to the impact of financial regulations on profit efficiency, we find that relatively less work has been done to examine the impact of financial regulations on the efficiency of commercial banks around the globe. Hermes and Meesters (2015) investigated how financial liberalisation and regulations effect bank efficiency. The efficiency of public listed banks of 61 countries was calculated using SFA. They found that the profit efficiency of commercial banks was conditional on the extent of financial regulation and financial liberalisation. Similarly, Gaganis and Pasiouras (2013) investigated the relationship between profit efficiency of commercial banks and financial supervision of central banks. They found that the profit efficiency of the banks decreases with increases in a number of the financial institutions supervised by the central bank. The independence of central bank was found to be negatively and significantly related to the profit efficiency of banks.

Lee and Chih (2013) investigated the impact of already implemented financial regulations on Chinese banking efficiency and risk. Using bank total assets they categorised banks as large and small banks. Their findings suggested that the cost to income ratio and provision coverage ratio both were found to be more important for large banks, while the loans to deposits ratio, the capital adequacy ratio, and the leverage ratio are found to be more important for small banks. Their findings further suggested that the liquidity ratio did not affect commercial banks of China.

Barth, Lin, Seade, and Song (2013) investigated the relationship between bank regulations, supervision, and efficiency of banks. They used an unbalanced panel of 72 countries covering the period 1999–2007. They found that strict restrictions on bank activities had a negative and significant relationship with the efficiency of the bank. They further found that there is a positive and significant relationship between capital regulation and the bank efficiency. Moreover, they found a significant relationship between 'efficiency' and 'experienced supervisory and market based monitoring'.

Pasiouras, Tanna, and Zopounidis (2009) used SFA approach to analyse the impact of regulatory and supervision framework on bank efficiency. They included 615 commercial banks operating in 74 countries in their sample for the period 2000-2004. The results suggested that there is a positive and significant relationship between supervisory power and profit efficiency. The strict capital requirements were found to have a positive and significant relationship with the cost efficiency, but a negative relationship with the profit efficiency. Furthermore, they found that high restrictions have negative and significant effects on the cost efficiency, whereas, positive and significant impacts on the profit efficiency.

Barth, Caprio, and Levine (2008) provided mixed results about the impact of financial regulations on the performance of commercial banks of 150 countries. They first highlighted the data insufficiency in order to calculate the impact of financial regulations on performance of the banks. Their empirical findings revealed that restricting banking activities can reduce the bank efficiency but it could also increase the probability of the bank default. They also found that stringent regulations are not significant for profit efficiency of the banks.

Naceur and Omran (2008) explored the influence of financial regulations, financial and institutional development on commercial bank profitability across Middle East and North Africa (MENA) countries. He used the panel data covering the period 1989–2005. He found that bank-specific characteristics positively and significantly impact banks' net interest margin, cost efficiency, and profitability. The regulatory variables found to have a significant and positive impact on banks' performance. His empirical results also demonstrated that the corruption increases the cost efficiency and net interest margins. Finally, he suggested that improvements in law and order cause variable decreases in the cost of efficiency without affecting the overall performance of the banks. Barth, Caprio, and Levine (2008) provided mixed results in the relationship between financial regulations and efficiency of commercial banks. They found that restricting banking activities can reduce bank efficiency, but it could also increase the probability of default of the bank. They also found that stringent regulations are not statistically significant for the profit efficiency.

2.2. Financial Regulations and Insolvency

In general, it is evident that various regulations and capital requirements positively affect performance and risk taking behaviour of the banking sector. In this subsection, we review the studies that have focused on analysing the effects of financial regulations on the financial soundness of banks.

Recently, Rashid and Yousaf (2016) examined the empirical determinants of financial strength of Islamic and conventional banks of Pakistan. They also investigated

how the competitive conduct of banking affects the banking system stability. They used quarterly data of 10 conventional banks, 4 full fledged Islamic banks, and 6 standalone Islamic branches of conventional banks of Pakistan. Their analysis covered the period 2006–2012. They found that Islamic banks are relatively more financially stable as they have a higher mean value of Z-score. Doing regression analysis, they found that several bank-specific variables, namely income diversity, loans to assets ratio, bank size, and market concentration ratio, are significant in determining the stability of banks of Pakistan. Finally, they have shown that, as compared with conventional banks, Islamic banks contributed more profoundly in the stability of financial sector during the examined period.

Fu, Lin, and Molyneux (2014) investigated 14 Asia Pacific economies for the time period 2003 to 2010 to explore the impact of national institutions, bank competition, regulation concentration, and on individual bank fragility. The bank's fragility was measured by probability of bankruptcy and the bank's Z-score. They found that the risk could be reduced for the commercial banks by controlling certain macroeconomic, bank-specific, and regulatory parameters. They also found that tougher entry restrictions are good for the stability of banks, but strong deposit insurance schemes are significantly related with fragility of the bank.

Alam (2013) investigated whether banking regulations, supervision, and monitoring enhance or impede the technical efficiency and risk taking behaviour of Islamic banks across the globe. He found that financial regulations, strict monitoring of operations, and advanced supervisory power of authorities help to increase the technical efficiency of Islamic banks. More strict financial regulations and supervision can affect banking efficiency. He also found that a powerful supervisory body can also increase inefficiency of banks.

Zhang, Wang, and Qu (2013) examined how law enforcement affects a bank's risk taking ability and efficiency. They used a sample of 133 commercial banks across 31 regions for the period from 1999 to 2008. They found that strong law enforcement leads to encourage larger bank risk taking behaviour in the region. Their findings suggested that Chinese commercial banks performance is greatly affected by law enforcement efficacy within the region. They concluded that regions having a better legal environment and protection of intellectual property rights have positive and significant impact on the efficiency of banks.

Murari (2012) examined insolvency risk for 80 public, private, and foreign Indian banks. He constructed the Z index for the period 2005-2009. He found that the probability of bankruptcy of Indian banks has declined over the years. Das (2012) examined insolvency risk of commercial banks in India for the period 1998–2007. He found that Indian private banks are most risky, whereas, the foreign banks are found to be least risky for their fat capital cushion.

Beck, Demirgüç-Kunt, and Maksimovic (2008) argued that countries that require banks to regularly report their financial data to regulators and market participants are financially stable. They emphasised the significance of transparency in making supervisory processes effective and strengthening market discipline. Lepetit, Nys, Rous, and Tarazi (2008) explored the impact of non-interest revenue on risk structure of banks. They used sample of 734 listed and non-listed banks in 14 European countries. The

insolvency risk was quantified by Z-score. They found that small banks were less risky while larger banks were less exposed to risk.

Comment [T3]: Please check this sentence for accuracy!

Laeven and Levine (2007) found that the financial regulations that encourage diversification help in reducing risk of the banks. Specifically, they showed that financial regulations encourage banks to be more diversified either by requiring them to expand their loan portfolios or by allowing them to engage in more lending and non-lending activities. They also found that banks' supervisory activities and regulatory restrictions increase bank risk. Their findings suggested that diversifying income reduces bank risk.

Altunbas, Carbo, Gardener, and Molyneux (2007) examined the relationship between capital, risk, and efficiency for European banks for the period 1992–2000. They found that inefficient European banks hold more capital and undertake less risk. However, they further noted that there exists a significant relationship between risk and capital for commercial banks. They also found that for cooperative banks, capital is inversely related to risk and that inefficient banks hold less capital.

Fell and Schinasi (2005) found that financial regulations, which restrict financial activity, can avert systemic problems and help banks in attaining financial stability. Barth, Caprio and Levine (2004) empirically examined bank regulation and supervision for 107 countries. They concluded that large banks with less supervisory activities tend to involve in more high risk taking activities. Banks would take benefit of great freedom to raise bank asset portfolio risk.

3. EMPIRICAL FRAMEWORK AND METHODOLOGY

3.1. Measuring Profit Efficiency

The three main approaches extensively used in the literature for the examining the profit efficiency of financial institutions are 'financial indicators analysis', 'stochastic frontier approach (SFA)' and 'data envelopment analysis (DEA)'. In this study, we employed the DEA method. The DEA approach is comparatively simple and provides more information regarding profit efficiency of banks as compared to other methods.

The DEA method needs banks' inputs and outputs, the choice of which is always arbitrary. Out of a vast range of the ways for defining and categorising input and output variables in banking literatures, we prefer the intermediation approach.[2] The previous studies have also applied this approach to gauge the profit efficiency [Das and Ghosh (2009) and Arif, Badar, Mohammad, and Hassan (2008)]. The intermediation approach is considered relatively better for the evaluation of frontier efficiency for the profitability of commercial banks [Iqbal and Molyneux (2005)]. In this study, funds and fixed assets with their respective prices are used as inputs while loans and investment with their respective prices are used as output. Table 1 lists the variables used in the DEA.

[2]The intermediation approach was suggested by Sealey and Lindley (1977). It views banks as an intermediator of financial services and assumes that banks collect funds (deposits) and transform them into loans and other assets. The intermediation approach is preferred over production approach, first proposed by Benston (1965) because it suits the nature of banking industry more than the production approach.

Table 1

Input and Output Variables for Calcuating Efficiency

Variable Type	Variable Name	Description
Input	Fixed assets	Capital
	Funds	Total deposits plus total funds
Input Price	Price of fixed assets	Operating expenses to fixed assets
	Price of funds	Interest expenses to total funds
Output	Total loans	Total of short term and long term loans
	Investment	Total Investments
Output Price	Price of loans	Interest income on loans to total loans
	Price of investment	Operating income to investments

3.1.1. *The Profit Efficiency Model*

As in Lee and Chih (2013), consider a bank which produces m outputs using n inputs. If the bank can produce output bundle y by using input bundle x, then the input-output bundle (x, y) would be considered feasible. We can explain the technology used by the bank in production possibility framework.

$T = \{(x, y)$: y bundle of output can be produced using x bundle of inputs$\}$

In case of single output, the production function can be expressed as follows:

$f(x) = \max y: (x, y) \in T$

However, in case of multiple output, the production possibility frontier set would be the production correspondence $F(x,y) = 1$.

The data envelopment analysis (DEA) was first introduced by Charnes, Cooper, and Rhodes in 1978 by assuming the constant return to scale. After that, Banker, Charnes, and Cooper (1984) extended the DEA by considering variable returns to scale. In the DEA framework, the production possibility set can be constructed based on observed input-output bundles, which does not require assuming a functional form of the production technology. Specifically, we assume that (x^j, y^j) is input output bundle which is observed for bank j (j = 1, 2, . . ., N). Obviously, all these input-output bundles are considered to be feasible. Then the smallest production possibility set that meets the assumptions of convexity and free disposability and includes all these observed bundles is defined as follows:

$$S = \{(x, y): x \geq \sum_{j=1}^{N} \lambda_j x^j; y \leq \sum_{j=1}^{N} \lambda_j y^j; \sum_{j=1}^{N} \lambda_j = 1; \lambda_j \geq 0 \quad \ldots \quad \ldots \quad (1)$$

where $j = 1, 2, \ldots, N$

For a commercial bank/firm, both inputs and outputs are choice variables, the feasibility of input output bundle chosen would be the only constraint. In this scenario, the criterion of efficiency is profit maximisation. Given w and p input and output prices, respectively, the actual profit of the firm producing the output bundle y^0 from input bundle x^0 is

$$\Pi^0 = p'y^0 - w'x^0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Therefore, the maximum feasible profit for the firm is

$$\Pi(w,p) = maxp'y - w'x : (x,y) \in T \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

For any empirical analysis, the maximum profit can be obtained as

$$\Pi^* = maxp'y - w'x \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

$$s.t. \sum_{j=1}^{N} \lambda_j y^j \geq y; \ \sum_{j=1}^{N} \lambda_j x^j \leq x \ ; \ \sum_{j=1}^{N} \lambda_j = 1 \ ; \ \lambda_j \geq 0 \quad \ldots \quad \ldots \quad (5)$$

where j= 1, 2, … , N

Finally, the profit efficiency of the bank is defined as $\delta = \Pi^0/\Pi^*$. The DEA score ranges between 0 and 1 except when the actual profit is negative while maximum profit is positive. In that case, δ is less than 0. However, the δ will exceed unity in the case when the maximum profit is negative.

3.2. Calculating Z-Score

The Z-score measures the stability of banks by indicating the distance from insolvency. The Z-score indicates the number of standard deviations that a bank's return on assets that drop below to its expected value before equity is depleted and the bank is insolvent [Roy (1952) and Boyd and De Nicolo (2005)].

The Z-score uses probability of default being extracted by Roy (1952) and developed by Goyeau and Tarazi (1992), which can be written as:

$$Probability\ of\ default = Prob\ (\pi < -E) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

We divide it by total assets and obtain returns on assets as follows:

$$Prob\left(\frac{\pi}{A} \leq -\frac{E}{A}\right) = Prob\left(ROA < -\frac{E}{A}\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

Where *ROA* is return on assets and *A* is total assets of bank. The above expression can be written as follows:

$$\text{Prob}\left[\frac{(ROA-\mu_{ROA})}{\sigma_{\text{ROA}}} \leq \frac{(-\lambda-\mu_{\text{ROA}})}{\sigma_{\text{ROA}}}\right] = \text{Prob}\left[\frac{(ROA-\mu_{ROA})}{\sigma_{\text{ROA}}} < -Z\right] \quad \ldots \quad \ldots \quad (8)$$

where μ_{ROA} and σ_{ROA} are mean and standard deviations of returns on assets, respectively.Thus, the Z-score can be defined as follows:

$$Z - score = (\frac{E}{A} + \mu_{ROA})/\sigma_{ROA} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

3.3. Data Description and Sample Selection

To carry out the empirical analysis, we use quarterly data covering the period 2008–2014. The data are collected from bank financial statements, various issues of International Financial Statistics (IFS), World Development Indictors (WDI), and State Bank of Pakistan (SBP). Islamic banks were excluded from the study because of the differences in their operations.

Since the main objective of the study is to examine the effect of financial regulations on the profit efficiency and financial stability of banks, we consider all those

financial regulations that have already been implemented by SBP. Moreover, we also investigated the effect of leverage ratio, which is introduced in Basel III. The explanatory variables used in the study are the provision coverage ratio, the reserve ratio, the liquidity ratio, the loans to deposits ratio, the capital adequacy ratio, and the leverage ratio. Further, the establishment year of the bank is taken as a control variable. The detailed description of variables used in the study is given in Table 2.

Table 2

Definition of Variables for Profit Efficiency and Financial Soundeness

Variables	Variable Name	Description	Required Ratio
1. Asset Quality			
NPLL	Provision coverage ratio	Non-performing loans to loans outstanding	14.3%
RR	Reserve ratio	Cash to deposits	5%
2. Liquidity			
LIQR	Liquidity ratio	Current assets to current liabilities	18%
LODEPOSIT	Loan to deposit ratio	Total loans to deposits	18%
3. Capital Adequacy			
CAR	Capital adequacy ratio	Capital to risk weighted assets	10%
LR	Leverage ratio	Tier 1 capital to asset ratio	3%
4. Control Variable			
TIME	Established time of bank	Cumulative year of establishment of individual bank	

Source: SBP and WDI.

As one of the objectives of the study is to examine the differential effect of financial regulations on profit efficiency and financial stability of banks across the bank size, we classify banks into three groups according to their size. Specifically, the sample banks are classified as per their assets structure. Using KPMG Banking Survey 2013, we divide the sample banks into three main categories: large, medium, and small banks. Banks with total assets in excess of Rs 400 billion are categorised as “large banks”, banks with total assets from Rs 101 billion to Rs 400 billion are categorised as “medium size banks”, and banks with total assets up to Rs 100 billion are categorised as “small banks”. According to this classification scheme, we identify 6 banks as large banks, 8 banks as medium size banks, and remaining 7 banks as small banks. The list of banks according to their size is given in Table 3.

Table 3

List of Banks

Large Banks	Medium Banks	Small Banks
National Bank of Pakistan	National Investment Bank	Silk Bank
Muslim Commercial Bank	Askari Bank	Samba
Habib Bank	Habib Metropolitan Bank	Bank of Khyber
United Bank	Soneri Bank	JS Bank
Bank Alfalah	Bank of Punjab	Barclays
Allied Bank	Bank Al-Habib	First Women Bank
	Summit	KASB
	Standard Chartered Bank	

Note: Classifications of banks is based on existing assets of banks.

3.4. The Estimation Method

Following the previous study of [Lee ad Chin (2013)], we estimate the following models to achieve the objectives of the study.

$$EFFCY_{it} = \beta_i + \beta_1 CAR_{it} + \beta_2 LR_{it} + \beta_3 LIQR_{it} + \beta_4 LODEPOSIT_{it} + \beta_5 NPLL_{it} + \beta_6 RR_{it} + \beta_7 TIME_{it} + \varepsilon_{it} \quad \ldots \quad \ldots \quad \ldots \quad (10)$$

$$Z-score_{it} = \beta_i + \beta_1 CAR_{it} + \beta_2 LR_{it} + \beta_3 LIQR_{it} + \beta_4 LODEPOSIT_{it} + \beta_5 NPLL_{it} + \beta_6 RR_{it} + \beta_7 TIME_{it} + \varepsilon_{it} \quad \ldots \quad \ldots \quad \ldots \quad (11)$$

where *EFFCY* and Z-score are dependent variables calculated from the *DEA* and Z-score, respectively for i^{th} bank in quarter *t*. *CAR* is the capital adequacy ratio, *LR* is the leverage ratio, *LIQR* denotes the liquidity ratio, *LODEPOSIT* is the loans to deposits ratio, *NPLL* denotes the provision coverage ratio, *RR* represents the reserve ratio, and *TIME* is the year of establishment. β_i is bank-specific fixed effects and ε_{it} is error term having zero mean and constant variance.

We applied fixed effects (*FE*) estimator to estimate Equations (10) and (11). To overcome the problem of heteroskedasticity of errors, we estimate robust standard errors. We prefer the use of fixed effects estimator as it helps in controlling for surreptitiously heterogeneity, particularly, when it is constant over time. The fixed effects model is based on the assumption that there is no correlation between the individual-specific effects and the independent variables included in the model. In contrast, for random effects (*RF*) model, it is assumed that the explanatory variables are totally uncorrelated with the individual fixed effects. However, one should note that the assumption of no interaction between the explanatory variables and the individual specific effects does not hold, the random effects model does not yield consistent estimates, whereas, the fixed effects model produces consistent results. In general, it is very likely that bank-specific fixed effects vary with the characteristics of banks. Hence, the fixed effects estimator seems more appropriate to examine the effects of financial regulations on profit efficiency and financial stability of banks. A brief description of the fixed effects model is given as follows. Suppose the following general form of the linear unobserved effect model for *N* observation and *T* time periods.

$$y_{it} = \alpha_i + X_{it}\beta + \omega_{it} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (12)$$

where y_{it} is the dependent variable, which is observed at time t for individual i. X_{it} is the $1 \times K$ vector of the time-variant independent variables. α_i is the unobserved time-invariant individual-specific fixed effect and ω_{it} is the error term. Under the fixed effects model, α_i are allowed to be correlated with X_{it}. Yet, the assumption of strict exogeneity is required for consistent estimates. Unlike X_{it}, the economists cannot directly observe α_i, the time-invariant individual specific fixed effects cannot directly be controlled. Therefore, implementing the fixed effects model one can eliminate them by demeaning the variables included in the model, using within the transformation.

Comment [mud4]: What does it mean?

Comment [T5]: This sentence needs revision!

4. EMPIRICAL RESULTS

4.1. Descriptive Statistics

We start our empirical analysis by presenting summary statistics in Table 4. It can be observed from the table that the mean of profit efficiency is higher for large banks as compared to both small and medium banks. This implies that the profit efficiency of banks increases with their size. The standard deviation value, however, indicates that the profit efficiency of large banks is slightly more volatile than the profit efficiency of both small and medium banks. The mean value of Z-score suggests that large banks are relatively more financially stable. In terms of financial soundness, small banks stand at second number. This implies that medium banks are financially less sound as compared to both large and small banks. Yet, variations in Z-score are higher for small banks as compared to their large and medium counterparts.

Table 4

Descriptive Statistics

Variable	Bank Type	Mean	Median	Max	Min	SD
EFFCY	Large Banks	0.921	1.00	1.001	0.942	0.071
	Medium Banks	0.731	0.750	0.872	0.451	0.052
	Small Banks	0.451	0.451	0.700	0.452	0.061
Z-score	Large Banks	62.70	19.20	182.00	6.70	89.01
	Medium Banks	80.23	24.13	200.2	5.31	98.01
	Small Banks	70.14	28.12	370.00	0.73	113.00
CAR	Large Banks	0.195	0.152	0.973	0.019	0.140
	Medium Banks	0.494	0.134	12.02	0.001	1.123
	Small Banks	0.160	0.131	1.535	0.017	0.150
LR	Large Banks	0.096	0.095	0.161	0.044	0.029
	Medium Banks	0.177	0.070	2.281	0.001	0.324
	Small Banks	0.145	0.131	0.853	0.025	0.093
LIQR	Large Banks	8.202	7.872	19.30	3.755	2.637
	Medium Banks	9.540	4.990	3.940	0.060	31.98
	Small Banks	6.700	6.377	18.86	0.106	3.409
LODEPOSIT	Large Banks	0.953	0.619	35.53	0.001	3.057
	Medium Banks	2.070	0.620	99.10	0.003	8.122
	Small Banks	11.5	0.5	831	0.001	12.1
NPLL	Large Banks	0.521	0.097	59.95	0.008	4.987
	Medium Banks	2.771	0.177	94.92	0.003	11.04
	Small Banks	4.820	0.176	220.75	0.011	28.54
RR	Large Banks	0.195	0.109	7.923	0.065	0.6915
	Medium Banks	4.070	0.080	712.68	0.007	51.425
	Small Banks	1.842	0.078	167.87	0.034	14.636

The mean value of CAR is larger for medium size banks as compared to large and small banks. This implies that the capital adequacy ratio for medium banks is higher. The standard deviation indicates that CAR is more volatile in case of large banks compared with small and medium banks. Similarly, the mean value of LR suggests that medium bank have, on average, more Tier 1 capital compared with large and small banks operating in Pakistan. The standard deviation of LR indicates that this ratio is more volatile for small banks compared with other banks.

Medium banks are also likely to keep more liquid assets, on average. The mean of NPLL indicates that small banks are more likely to issue non-performing loans compared with both medium and large banks. However, summary statistics suggests that medium size banks have higher reserve ratio than small and large banks during the examined period.

4.2. Regression Results

In this subsection, we present the fixed effects model estimation results for the effects of financial regulations on the profit efficiency. To examine the differential effect of financial regulations, we also estimate EFFCY regression for large, medium, and small banks, separately. The results are given in Table 5. The adjusted R-squared and calculated F-statistics indicate that all the estimated models are a good fit to the data and the estimated models explain a substantial variation in the dependent variable. Examining the estimated coefficient for a sample of all banks, we find that CAR, NPLL and RR are significantly and positively related to the profit efficiency of commercial banks operating in Pakistan. On the other hand, LIQR and LODEPOSIT are negatively and significantly related to the profit efficiency. Specifically, we find that the estimated of coefficient of CAR (coefficient = 0.13) suggests that the banks having higher capital adequacy ratio are more efficient in earning profits. Since the estimated coefficient of LIQR is negative (coefficient = 0.18) and statistically significant at the 5 percent level, we can say that banks with more liquid assets in their reserves have low profit efficiency.

Table 5

Fixed Effects Estimation for Financial Regulation Effects on Profit Efficiency

Dependent Variable: *EFFCY*

	All Banks		Large Banks		Medium Banks		Small Banks	
Variable	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
CAR	0.13*	1.67	0.13	0.90	0.10*	1.70	0.58**	2.94
LR	0.11	0.81	0.37	1.05	0.06	0.43	0.64**	2.40
LIQR	–0.18**	–1.98	–0.45**	–2.33	–0.22*	–1.32	0.42**	2.60
LODEPOSIT	–0.22*	–1.67	3.74	1.20	–0.50*	–1.83	0.09**	2.42
NPLL	0.23**	2.17	0.55**	2.80	0.20	0.80	–0.07	–1.14
RR	0.15*	1.18	–5.13**	–2.55	0.54**	2.67	–0.11**	–1.92
TIME	0.11	0.42	5.86	0.84	0.68*	1.38	0.80**	3.25
Adjusted R^2	0.71		0.76		0.69		0.74	
Hausman Stat.	5.07		4.15		4.05		6.07	
F-statistics	23.86		7.33		43.60		40.07	
Prob (F-stat.)	0.00		0.00		0.00		0.00	

*, **, and *** indicate significant at the 10 percent, 5 percent, 1 percent level significance, respectively.

The estimated coefficient of LODEPOSIT suggests that the profit efficiency of banks decreases with the loans to deposits ratio. The estimated coefficient of RR suggests that if other things remain fixed, a one-unit increase in the reserve ratio will increase the profit efficiency by 0.15 units, on average. The estimation results also reveal that both TIME and LR are not significantly related to the profit efficiency of all banks. These results are largely in agreement with our hypotheses.

Turning to the differential effects of financial regulations on the profit efficiency across bank size, we observe that CAR is positively and significantly related to the profit efficiency of medium and small banks. Yet, based on the magnitude of the estimated coefficient, we find that compared with medium banks, the profit efficiency of small banks is more affected by CAR. In contrast, CAR does not have any statistically significant effect on the profit efficiency of large banks. The LR does not significantly affect the profit efficiency of large and medium banks, whereas, it significantly and positively affects small banks' profitability, although it was insignificant when we estimate the model for whole sample.

The estimated coefficient of LIQR reveals that it negatively and significantly affects the profit efficiency of banks at all levels. However, the negative effects of LIQR are larger for small banks than that for medium and large banks. This implies that the profit efficiency of small banks is more sensitive to LIQR compared with the large and medium banks. Interestingly, LODEPOSIT positively and significantly affects the profit efficiency of small banks, whereas, it is negatively and significantly related to the profit efficiency in case of medium banks. The results also suggest that LODEPOSIT does not play any significant role in determining the profit efficiency of large banks.

The results given in the table suggest that both NPLL and RR have also differential effects on the profit efficiency. For instance, NPLL is significantly and positively related only to the profit efficiency of large banks, although estimated coefficient of NPLL for both medium and small banks appears statistically insignificant. The effect of RR is statistically significant for large, medium, and small banks. However, this effect is negative for large and small banks, whereas, it is positive in case of medium banks. Finally, we can see from the table that the variable TIME is significantly and positively related with the profit efficiency of medium and small banks. In summation, the results presented in Table 5 provide strong evidence of the differential effects of financial regulations on the profit efficiency of large, medium, and small commercial banks operating in Pakistan.

Comment [T6]: Table number ?

After establishing the effects of the financial regulations on the profit efficiency of banks, we turn to examine the effects of these regulations on financial stability of the banks. Similar to Table 6, we estimate four different models to examine the effects of financial regulations on banks' financial stability. The financial stability of banks is proxied by Z-score, which is calculated using Equation (9). The higher value of Z-score for a bank implies that the bank is financial sound and has less of a chance of default. The empirical model presented in Equation (11) is estimated by employing the fixed effects estimator. The results are given in Table 6. The adjusted R-squared and F-statistics suggest that all the estimated models are a good fit to the data and explain a significant proportion of total variation in the dependent variable.

Table 6

Fixed Effects Estimation for Financial Regulation Effects on Financial Soundness

Dependent Variable: Z-score								
	All Banks		Large Banks		Medium Banks		Small Banks	
Variable	Coefficient	t-stat.	Coefficient	t-stat.	Coefficient	t-stat.	Coefficient	t-stat.
CAR	–0.05	–0.80	0.52	0.71	–0.45***	–4.92	0.002	0.01
LR	0.25***	4.07	–7.82*	–1.67	0.70**	2.87	1.05***	4.85
LIQR	–0.14**	–1.98	–1.14***	–3.09	–0.60**	–2.01	–0.05	–0.59
LODEPOSIT	–0.23**	–2.58	–1.32***	–4.46	–1.30***	–3.48	–0.22	–1.54
NPLL	–0.38***	–5.51	–1.30***	–4.65	–1.04***	–3.04	–0.27**	–2.43
RR	0.18**	2.01	1.01***	3.23	0.70*	1.53	0.38**	2.55
TIME	1.22***	6.15	2.66*	1.60	4.50**	2.07	1.87***	8.30
Adjusted R^2	0.73		0.39		0.65		0.86	
Hausman Stat.	4.19		3.20		5.01		4.12	
F-statistics	52.43		8.34		7.03		82.10	
Prob. (F-stat.)	0.00		0.00		0.00		0.00	

*, ** and *** indicate significant at the 10 percent, 5 percent and 1 percent level, respectively.

First we interpret the results of the model estimated for a sample of all banks. The estimates indicate that except CAR, all other variables included in the model are significantly related to Z-score. Specifically, the results indicate that both LR and RR are positively, whereas, LIQR, LODEPOSIT, and NPLL are negatively related to financial soundness of commercial banks. However, the results indicate that CAR does not have any significant influence on banks' financial soundness. The estimated coefficient of LR (coefficient = 0.25) suggests that if other things are unchanged, a one-unit increase in LR leads to an increase in Z-score by 0.25 units. Similarly, the RR coefficient is positive, suggesting that the financial soundness of banks increases with RR. On the other hand, the financial soundness of banks decreases by 0.23 and 0.38 units, respectively, due to a one-unit increase in LODEPOSIT and NPLL. Year of incorporation is also significantly and positively related with the financial soundness of banks.

The estimated results for the sub-sample indicate that the financial regulations have differential effects on the financial health of banks across the bank size. In case of large banks, all the variables are significantly and negatively related to Z-score, except the CAR and LR. The estimated coefficient of CAR and LR indicate that CAR is statistically insignificant, whereas, LR is significantly and positively related to the financial soundness of large banks.

The effects of financial regulations on medium banks' financial soundness are similar to those for the full sample except for CAR. The effect of CAR is negative and significant for medium banks, which was insignificant in case of full sample. In case of small banks, we find that both LR and RR are significantly and positively related to Z-score. We also find that NPLL is negatively and significantly related to Z-score, suggesting that small banks' financial soundness decreases when they issue more non-performing loans. Thus, the results suggest that issuance of non-performing loans has a negative effect on the financial soundness of large, medium, and small banks. Finally, we find that CAR, LIQR and DEPOSIT are not significantly related to financial soundness in case of small banks. As a summary, the results suggest that the financial regulations have considerable differential effects on the financial soundness of large, medium, and small banks.

5. CONCLUSION

In this study, we examined the effects of financial regulations enforced by SBP on the profit efficiency and financial soundness of commercial banks operating in Pakistan. We also examine whether the financial regulations' effects differ across large, medium, and small banks. Using quarterly data covering the period 2008–2014 for a sample of 21 banks, we carry out the empirical analysis. The profit efficiency for each bank included in the sample is measured by using the DEA approach. The financial soundness is proxied by Z-score. To examine the differential effects of financial regulations, the sample banks are classified into large, medium, and small banks based on their assets. We use fixed effects estimator to estimate the empirical models.

Estimating the regression for the whole sample, we find that the financial regulations play a significant role in determining the profit efficiency of banks operating in Pakistan. Specifically, our results indicate that the financial regulations indicators viz. NPLL and RR positively, whereas, LIQR and LODEPOSIT, significantly and negatively affect the profit efficiency of banks. We also find that the financial regulations have significant differential effects across bank size. In particular, we observe that although CAR does not significantly affect the profit efficiency of large banks, it is positively and significantly related to both medium and small banks. Likewise, small banks' profit efficiency increases with LR, whereas, LR does not have any statistically significant impact on the profit efficiency in case of both large and medium size banks. The RR has also a differential effect across the bank size, positively (negatively) affecting the profit efficiency of medium (small and large banks) banks. Finally, the effects of LODEPOSIT are also conditional on bank size. The profit efficiency of large and small banks is positively associated with the loans to deposits ratio, whereas, the profit efficiency of medium banks decreases when they issue more loans relative to deposits.

The findings regarding the effects of financial regulations on financial soundness of banks suggest that in case of the full sample, only LR and RR are positively and significantly related to the financial stability. Other three indicators of financial regulations, namely, LIQR, LODEPOSIT, and NPLL negatively and significantly affect the financial soundness of banks. We also find that the impact of financial regulations on the financial stability varies with bank size. In particular, our findings suggest that the negative impact of CAR on the financial health of banks is statistically significant only in case of medium banks. However, both LIQR and LODEPOSIT deteriorate the financial soundness of all sizes of banks. In contrast, the financial stability of large banks decreases with LR, whereas, the financial stability of small and medium banks strengthens with LR. Finally, we find that RR has adverse effects on the financial soundness of all three categories of banks.

Our findings are useful for policy-makers, regulators, and management of commercial banks as they help them to understand the impact of each already implemented financial regulation on the profit efficiency and financial stability of banks of Pakistan. In particular, the findings suggest that almost all of the obligations enforced by SBP are essential for improving banking sector's profit efficiency and financial stability. Therefore, we highly recommend that banks operating in Pakistan should prioritise implementing effectively the existing financial obligations but also design strong internal audit procedure to ensure that implantation occurs without any hesitation.

Recently, SBP enforced a number of financial regulations for improving the overall performance and stability of the banking sector. A few regulations have been implemented taking into consideration the Basel Accords as well. Indeed, ardent implementation of financial regulations is of great significance to enhancing the profit efficiency and financial soundness of banks. Thus, it is a need of the hour to further strengthen the regulatory framework for mitigating the likelihood of financial insolvency, and, in turn, paving the way for well-functioning, efficient, and sound banking in Pakistan.

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