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Article

A Study on the Impact of Capitalization on the Profitability of Banks in Emerging Markets: A Case of Pakistan

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Abstract: A strong capitalized position of financial institutions is essential to ensure their solvency. Because of their unique nature, banks must always keep an optimum level of capital to ensure smooth banking earnings. Consequently, it is mandatory for all types of banks operating in Pakistan to keep a minimum amount of required capital along with capital adequacy to remain solvent and profitable. Therefore, using three measures of capitalization, i.e., the Capital Ratio (CR), Capital Adequacy Ratio (CAR), and Minimum Capital Requirement (MCR), and four measures of profitability, i.e., Return on Avg. Assets (ROAA), Return on Avg. Equity (ROAE), Net Interest Margin (NIMAR), and Profit Margin (NMAR), this study contributes to the existing literature on the relationship between the capitalization and profitability of 29 Pakistani banks over the period of 2007–2018. The results, based on the Generalized Method of Moments (GMM) system estimator technique, reported an inverted U-shaped relationship between the two capitalization measures, i.e., CR and CAR, and the four profitability measures, i.e., ROAA, ROAE, NIMAR, and NMAR. This indicates that profitability increases with an increase in capitalization up to a certain level, while beyond that level, a further increase in capitalization decreases profitability. The results also indicate that banks who maintain their MCR have higher profitability than those who do not.

Keywords: capital ratio; minimum capital requirement; capital adequacy ratio; bank profitability

1. Introduction

Capital management is critical to the functioning of modern banks. There are stringent international and national requirements in this regard, which banks are required to conform. The State Bank of Pakistan (SBP) is the sole authority that sets and monitors the requirements of capital for banks in Pakistan and aims to ensure the strengthened profitability and solvency of financial institutions (banks and other financial intermediaries) in the country. The SBP varies the capital requirements from time to time in accordance with changing economic conditions and adjusts capital adequacy based on the risk profile by implementing different Basel Accords¹. Capital adequacy provides protection

¹ The Basel Committee on Banking Supervision (BCBS) established, in 1974, as a banking headquarters for international settlements (BIS) in Basel. The BCBS issued the Basel I, Basel II, and Basel III accords to establish an international

against adverse shocks and increases the likelihood of higher earnings. Consequently, it is important to evaluate the impact of regulatory capital requirements on bank profitability. Similarly, [Ahokpossi \(2013\)](#) argued that the regulatory requirements of capital might have a positive impact on the profitability of banks due to a lower cost of borrowing. On the one hand, other researchers argued that equity is an expensive source of funds that reduces profitability due to the higher returns required by shareholders ([García-Herrero et al. 2009](#)). While on the other hand, [Admati et al. \(2010\)](#) concluded that equity is not expensive and that well-capitalized banks perform better. However, the impact of maintaining higher equity on profitability is still debatable. The literature provides conflicting evidence on this factor, which further necessitates research in this area (see [Haris et al. 2019a](#); [Yao et al. 2018](#); [Tan et al. 2017](#); [Saona 2016](#); [Tan 2016](#); [Ahokpossi 2013](#); [Trujillo-Ponce 2013](#); [Admati et al. 2010](#); [García-Herrero et al. 2009](#); [Goddard et al. 2004a](#); [Goddard et al. 2004b](#); [Molyneux and Thornton 1992](#); among others).

This research area is well explored in both developed and developing economies. The significance and originality of this study lies in its methodology. In Pakistan, it is mandatory for each bank to maintain the required minimum capital along with the required capital adequacy ratio to ensure their sound capitalized position. Unlike the empirical literature, this is the first study that employs three different measures of capitalization, namely the Capital Ratio (CR), Minimum Capital Requirement (MCR), and Capital Adequacy Ratio (CAR). The use of CR is common in some studies (e.g., [Haris et al. 2019a](#); [Yao et al. 2018](#); [Tan et al. 2017](#); [Saona 2016](#); [Tan 2016](#); [Trujillo-Ponce 2013](#); [Athanasoglou et al. 2008](#); [García-Herrero et al. 2009](#); [Goddard et al. 2004a](#), [2004b](#); [Molyneux and Thornton 1992](#), among others). The performance of CR depends on the market value of assets and equity (i.e., capital, reserves, and profits/losses). If the market is inefficient (i.e., either undervalued or overvalued), this might unduly affect the true measure of capitalization and the empirical results. Some studies, such as [Al-Homaidi et al. \(2018\)](#); [Al-Homaidi et al. \(2018\)](#); and [Dietrich and Wanzenried \(2011\)](#), used the equity to asset ratio (CR) as capital adequacy; however, the measurement of CAR is different than that for CR (See Table 2). Therefore, our study used the capital adequacy ratio, a regulatory measure that depends on risk-weighted assets and the absolute value of regulatory capital invested by shareholders. The use of CAR as a measure of capitalization was very rare and limited in previous studies (e.g., [Tan and Anchor 2017](#); [Belaid et al. 2017](#); [Konara et al. 2019](#); [Jouida 2018](#)). Additionally, no available studies used MCR as a measure of capitalization to examine the relationship between regulatory capital and bank profitability. MCR also provides the absolute capitalized position of banks, as it does not include the effect of reserves and profits/losses and is also not linked with asset value. The use of MCR in this study is intended to provide the most accurate results regarding the impact of capitalization on bank profitability, which can be applied to other banking studies in related topics. We also used four profitability measures, namely Return on Avg. Assets (ROAA), Return on Avg. Equity (ROAE), Net Interest Margin (NIMAR), and Profit Margin (PMAR), to offer robust findings with regard to capitalization and bank profitability. Unlike [Tan \(2016\)](#), who use Return on Assets and Return on Equity as profitability indicators, the ROAA and ROAE consider the starting period and the ending period of the total assets, which we argue can measure profitability in a more accurate way. Further, from a geographical perspective, this study is the first attempt to evaluate the trends in the capitalization performance among all domestic banks in Pakistan. This study also provides a trend and mean comparison of the capitalization performance among all commercial banks (ACBs), specialized banks (SBs), private commercial banks (PCBs), and government commercial banks (GCBs). The empirical results of this study are based on the more acceptable methodology of the Generalized Method of Moments (GMM), which produces consistent and robust results. This study uses the largest

standard regarding capital requirements, risk management, supervision, and governance for the soundness of the banking system across the globe (visit <https://www.bis.org/bcbs/index.htm?m=3%7C14>). In August 2013, SBP revised the Basel II framework in accordance with the Basel III capital reforms, with full implementation intended by 2019 (available at <http://www.sbp.org.pk/bprd/2013/C6.htm>).

and latest dataset of 29 Pakistani banks over the period of 2007–2018. This is the period for which a complete data set is available for all banks. This sample succinctly covers 98 percent of the Pakistani banking industry on the basis of total assets (Yao et al. 2018). Further, this study controls the impact of additional variables (i.e., bank-specific, industry-specific, and country-specific variables) to ensure robust results.

The findings indicate that the GCBs in Pakistan maintain a higher average CR and CAR than PCBs, while the ratio of PCBs who maintained their MCR is higher than the ratio of GCBs. The SBs have a higher average of CR and CAR than ACBs, while the ratio of ACBs who achieved MCR during the period under analysis is higher than the ratio of SBs who achieved MCR. This study also reports a downward trend in the CR and CAR of the banking industry and an increasing trend in the ratio of banks who achieved MCR during the period under analysis (see Figures 1–3). The empirical findings indicate an inverted U-shaped relationship between CR, CAR, and profitability when measured by ROAA, ROAE, NIMAR, and PMAR. The results also show that the banks in Pakistan that maintain a minimum amount of equity according to MCR specifications by SBP earn higher profitability, when measured by ROAA, ROAE, NIMAR, and PMAR, than those who do not maintain MCR.

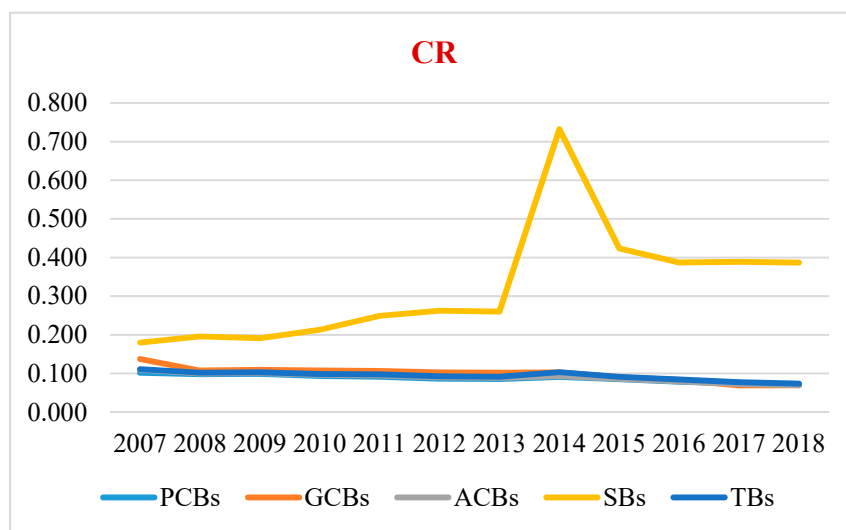


Figure 1. Comparative trends of the Capital Ratio (CR) (during the study period of 2007–2018).

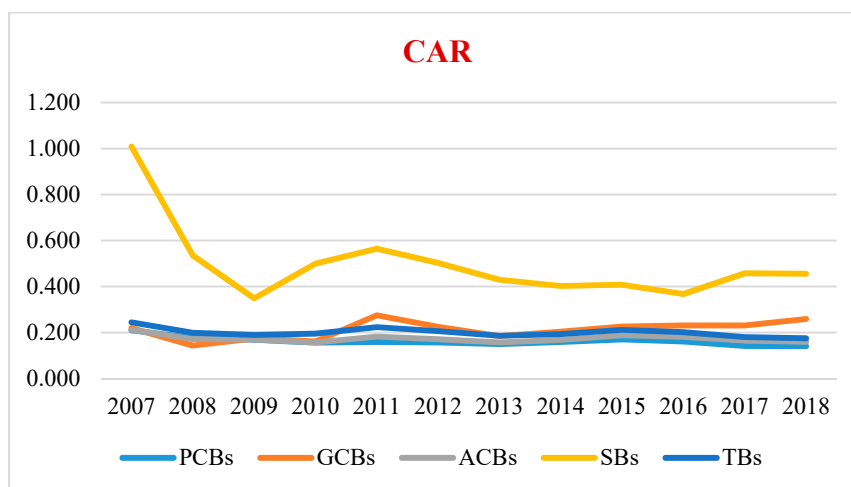


Figure 2. Comparative trends of the Capital Adequacy Ratio (CAR) (during the study period of 2007–2018).

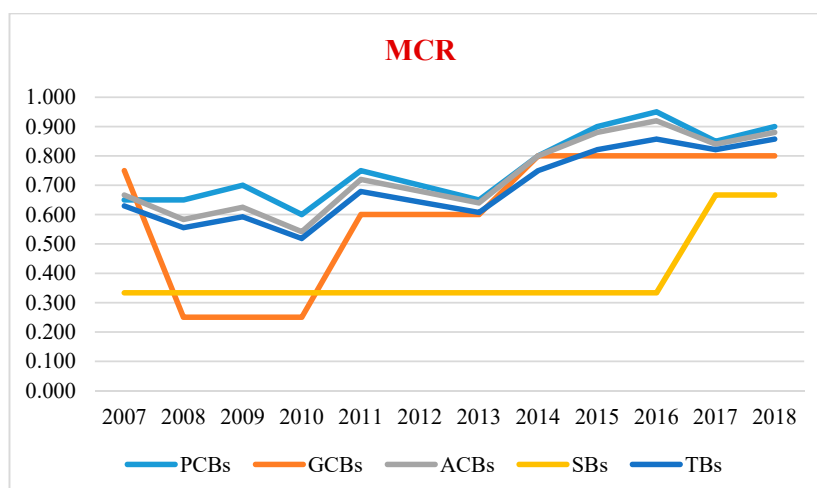


Figure 3. Comparative trends of Minimum capital requirement (MCR) (during the study period of 2007–2018).

The remaining part of this study is organized as follows. Section 2 briefly discusses the banking industry of Pakistan. A brief review of relevant literature and the development of the hypotheses are included in Section 3. Section 4 provides the data and methodology employed and defines all the variables. Section 5 reports and discusses the findings of this study. Finally, Section 6 provides the conclusions of this paper and highlights its implications.

2. The Pakistani Banking Industry

Pakistan has a dual banking system that facilitates both Islamic and conventional ideologies. The industry includes both government-owned and privately-owned banks, as well as some foreign banks. The structure of the Pakistani banking system includes commercial and specialized banks. As of December 2019, there were 20 domestic privately-owned banks, four foreign banks, and nine government-owned banks operating in Pakistan². Pakistan inherited a banking sector dominated by foreign banks when it gained independence in August 1947. There were only five domestic banks operating with 97 branches until 1951. The major share of the banking industry initially remained held by foreign banks. However, the market share of local banks subsequently started growing gradually (Haris et al. 2019a). In 2018–2019, domestic private banks held almost 98% of the total bank assets (Haris et al. 2019b). In 1974, the industry suffered a massive setback when the Government of Pakistan (GOP) nationalized all the domestic privately-owned banks, and government-owned banks held almost 90 percent of the share in the banking industry until 1980. After realizing the adversity of nationalization, the GOP initiated reforms and started issuing licenses to privately-owned banks to operate alongside the nationalized banks. These reforms were necessary to overcome the adverse effects of nationalization, remove operational inefficiencies, and steer the banking sector toward becoming more competitive (Patti and Hardy 2005). Although inevitable, the impact of these reforms was slower than anticipated on the growth of the domestic sector. This is because the performance of Pakistani banks remained under criticism due to challenges related to credit rationing, credit restrictions, credit risk exposure, higher non-performing loans, higher service costs, and higher financial costs caused by the limited availability of equity (Haris et al. 2019a; Haris et al. 2019b). Most relevant studies, including those conducted to study the aftereffects of these reforms, arrived at the common conclusion that the performance of the Pakistani banking sector was still a question mark. However, a significant improvement has recently been noted, largely due to the adoption of the BASEL regulations.

² This information was accessed from http://sbp.org.pk/publications/q_reviews/qpr.htm.

What also justifies a fresh look at the performance of the Pakistani banking sector is the fact that the industry experienced tremendous growth over the study period of 2007–2018. The asset size increased to 19,372 billion rupees from 3716 billion rupees (421% growth), loans and advances increased to 7088 billion rupees from 2099 billion rupees (238% growth), investments increased to 8391 billion rupees from 739 billion rupees (1081% growth), and deposits increased to 14,102 billion rupees from 2919 billion rupees (383% growth). For the capitalization of the Pakistani banking industry, equity increased to 1425 billion rupees from 410 billion rupees (248% growth) and paid-up capital increased to 388 billion rupees from 185 billion rupees (180% growth). Moreover, the capital adequacy ratio required by SBP increased to 11.90 from 8 percent (a 33% increase), and the minimum capital requirement increased to 10 from 4 billion rupees (a 150% increase). Despite the improvements in the industry's capitalization position, the profitability of the Pakistani banking sector declined. The ROAA of Pakistani banks decreased from 1.69 percent to 0.81 percent (109% decline), the ROAE decreased from 15.21 percent to 10.73 percent (42% decline), the NIMAR decreased from 7.16 percent to 3.40 percent (111% decline), and the PMAR decreased from 2.54 percent to 1.31 percent (94% decline). This is a considerable development in the banking sector of a country that ranks 23rd in the world on the basis of its purchasing power parity (PPP) and 42nd on the basis of its gross domestic product (GDP). It is thus likely to be of wide interest to examine the impact of improvements in equity and the regulatory requirements of capitalization on the profitability of the Pakistani banking sector.

3. Literature Review and Hypothesis Development

There is much literature on the relationship between capitalization and bank profitability. However, there is no conclusive evidence or academic consensus on the impact of capitalization on profitability. Previous studies have reported both positive and negative impacts of maintaining higher equity on profitability. Berger (1995), for instance, suggested the signaling hypothesis and bankruptcy cost hypothesis as the two main reasons for the positive impact of capitalization on bank profitability. Berger (1995) elaborated by arguing that higher equity of a bank signals positive information to the market regarding the future prospects and profitability of the bank. On the other hand, the bankruptcy cost hypothesis asserts that a well-capitalized bank is less dependent on debts and, as a result, has a lower cost of funding. This not only reduces the bankruptcy cost but also increases profitability. Dietrich and Wanzenried (2011) argued that well-capitalized banks are safe, remain profitable, and can become resilient, even during economic difficulties, and rely less on external funding. Almaqtari et al. (2019) recently reported that by increasing their equity, the banks can absorb the negative results of a higher volume of non-performing loans arising as a result of excessive lending during economic boom periods. They further suggested that a high amount of regulatory capital indicates creditworthiness, which help reduces the cost of borrowing. Higher equity requires higher returns, so banks engage in more prudent lending to avoid defaults. Belaid et al. (2017) supported this by providing evidence suggesting that the likelihood of loan defaults reduces if the regulatory capital ratio is increased.

Existing studies have reported a linear relationship between bank capitalization and bank profitability in various countries using static regression and or GMM methodologies. Molyneux and Thornton (1992) used the static regression approach and reported a positive relationship between the capitalization and profitability of banks in eighteen European countries. Goddard et al. (2004a) applied both static regression and GMM and used the Capital to Asset Ratio as a measure of capitalization and reported its positive impact on the profitability of 665 banks in six European countries. Pasiouras and Kosmidou (2007) applied static regression and found a positive impact of the equity to assets ratio on the profitability of 284 commercial banks operating in 15 European countries. Demirgüç-Kunt and Huizinga (1999) applied static regression and found a positive association between the equity to assets ratio and the profitability of banks in 80 countries. Athanasoglou et al. (2008) linked a higher capital to asset ratio to financial soundness and reported that higher capital enables banks to deal with unexpected losses and pursue business opportunities more effectively. The authors reported the

positive impact of a higher capital to assets ratio on the profitability of Greek banks. [Lee et al. \(2015b\)](#) applied GMM and found a positive impact of the equity to asset ratio on the Net Interest Margin (NIM) of 418 U.S. regional banks during the pre-crisis period. [Berger \(1995\)](#) also provided empirical evidence of the positive relationship between the capitalization and profitability of U.S. banks. [Ben Khediri and Ben-Khedhiri \(2011\)](#) and [Bougatef \(2017\)](#) applied GMM and found a positive impact of the equity to asset ratio on the profitability of Tunisian banks. Bougatef argued the higher capitalization enables banks to convert their funds into higher earnings. [Ben Khediri and Ben-Khedhiri \(2011\)](#) argued that banks with higher capitalization require higher margins to cover the costs of their equity financing. [Sufian and Habibullah \(2009\)](#) argued that a sound capital position is important for banks in emerging economies, as it increases the safety for depositors under undesirable macroeconomic conditions by providing additional strength to endure financial crises. The authors applied static regression and found a positive impact of the equity to assets ratio on the profitability of Chinese banks. In addition, [García-Herrero et al. \(2009\)](#) and [Tan and Floros \(2012\)](#) applied GMM and found a positive relationship between the equity to asset ratio and profitability for Chinese banks. [Sun et al. \(2017\)](#) applied GMM and found a positive impact of a higher equity to assets ratio on the profitability of 66 conventional banks in OIC countries. [Zarrouk et al. \(2016\)](#) applied GMM and found a positive impact of the equity to assets ratio on the profitability of 51 banks in the Middle Eastern and North Africa (MENA) region. [Sinha and Sharma \(2016\)](#) applied GMM and found a positive impact of the equity to assets ratio on the profitability of 42 Indian banks. [Sharma and Anand \(2018\)](#) applied both GMM and static regressions and reported a positive relationship between the capitalization and profitability of 169 BRICKS banks. Lastly, another recent study by [Haris et al. \(2019a\)](#) applied static regression and found a positive impact of the equity to asset ratio on the profitability of nine government-owned Pakistani banks.

On the other hand, it is argued that banks with higher equity are expected to face low risk ([Molyneux et al. 2014](#); [Yin 2019](#)). Therefore, as per the conventional risk–return hypothesis, a lower level of risk leads to lower profitability ([Dietrich and Wanzenried 2011](#); [Goddard et al. 2013](#)). Further, the agency theory suggests that a higher capital ratio increases the agency cost, thus negatively affecting profitability ([Jensen and Meckling 1976](#)). Moreover, a bank with a higher amount of equity tends to operate over-cautiously and thus misses potential growth opportunities ([Goddard et al. 2004b](#); [Maudos 2017](#)). [Martins et al. \(2019\)](#) applied static regression and found both a positive and negative impact of the equity to asset ratio on the profitability of 108 banks from the U.K., Germany, and the U.S. [Masood and Ashraf \(2012\)](#) applied static regressions and found a negative impact of the equity to asset ratio on the profitability of 25 banks in 12 countries. [Tan and Floros \(2012\)](#) applied GMM and reported a negative relationship between a higher equity to assets ratio and profitability among 101 Chinese banks. The authors argued that higher capitalization of the Chinese banking industry precedes lower interest margins. The literature is rich in this area, and a number of studies have reported a negative relationship between capitalization and bank profitability in different parts of the world (see, for example, [Modigliani and Miller \(1963\)](#); [Altunbas et al. \(2007\)](#); [Goddard et al. \(2004b\)](#); [Saunders and Schumacher \(2000\)](#)).

Some studies have reported both positive and negative relationships between capitalization and profitability. [Tan et al. \(2017\)](#) and [Tan \(2016\)](#) applied GMM and found both positive and negative impacts of the equity to assets ratio on the profitability of 101 Chinese banks. [Al-Homaidi et al. \(2018\)](#) also observed both positive and negative impacts of a higher capital ratio on profitability. [Dietrich and Wanzenried \(2011\)](#) applied GMM and found both positive and negative impacts of the equity to assets ratio on the profitability of 372 Swiss banks.

The literature review suggests that previous studies have tested the monotonic relationship between the capitalization and profitability of banks. However, based on the theoretical background, we hypothesize that the relationship between capitalization and profitability could also be non-linear (inverted U-shaped) because increasing equity can yield benefits to a certain level, after which banks might operate over-cautiously, thus leading them towards lower profitability. The agency theory suggests that banks with large equity may not be able to finance their future growth opportunities with

debts because the required rate of return will be higher. [Alhassan et al. \(2016\)](#) found both a linear and non-linear (inverted U-shaped) relationship between the capitalization and profitability of 156 banks in seven Latin American countries. He argued that the profitability of banks increases up to a certain level as capitalization increases. Our study is also unique and different from [Alhassan et al. \(2016\)](#) work because Saona only used the equity to assets ratio and NIMAR to determine the inverted U-shaped relationship between capitalization and bank profitability, while our study, by using the equity to assets ratio and regulatory capital to risk weighted assets ratio as capitalization measures and ROAA, ROAE, NIMAR, and PMAR as profitability measures, offers more reliable and robust findings for the inverted U-shaped relationship between capitalization and bank profitability. Table 1 summarizes other notable studies reporting various relationships between capitalization and bank profitability.

Table 1. Summary of the literature review on the relationship between capitalization and bank profitability in different countries.

References	Banking Sector	Data	Methodology	Findings
Lee et al. (2015a)	Chinese banking sector	1997–2011	Generalized Method of Moments (GMM)	Positive impact of equity to assets on ROA and a negative impact on ROE, NIM, and NIR
Pasiouras and Kosmidou (2007)	European banking sector	1995–2001	Static regression	Positive impact of equity to asset ratio on profitability
Staikouras and Wood (2003)	European banking sector	1994–1998	Static regression	Positive impact of equity to asset ratio on profitability
Bourke (1989)	Banking sectors of 12 countries	1972–1981	Static regression	Positive between capitalization and profitability
Altunbas et al. (2007)	European banking sector	1999–2004	Static regression	Positive relationship between equity to asset ratio and profitability
Trujillo-Ponce (2013)	Spanish banking sector	1999–2009	GMM	Positive impact of the equity to assets ratio on ROA and a negative impact on ROE.
Yao et al. (2018)	Pakistani banking sector	2010–2016	GMM	Positive impact of equity to asset ratio on profitability
Haris et al. (2019b)	Pakistani banking sector	2010–2016	GMM	Positive impact of equity to asset ratio on NIM and PM
Almaqtari et al. (2019)	Indian banking sector	2008–2017	Static regressions	Found a positive but insignificant impact of the equity to assets ratio on profitability
Ahamed (2017)	Indian banking sector	1998–2014	GMM	Positive impact of equity to asset ratio on profitability
Al-Homaidi et al. (2018)	Indian banking sector	2008–2017	Static regressions and GMM	Found an insignificant impact of equity to asset ratio on profitability
Jouida et al. (2017)	French financial sector	2002–2012	GMM	Positive impact on ROA but a negative impact on ROE
Ben Salah Mahdi and Abbes (2018)	Banks in MENA region	2005–2012	Static regression	Positive relationship between ROA and equity to assets ratio
Siew Peng and Mansor (2017)	Malaysian banking sector	2008–2014	GMM	Positive relationship between capitalization and profitability
Alhassan et al. (2016)	Ghanaian banking sector	2003–2011	GMM	Positive between equity to assets ratio and profitability

Further, a vast majority of the studies reviewed used the equity to assets ratio as a measure of capitalization and ignored the relationship between the profitability of banks and their regulatory capital ratios, i.e., their capital to risk-weighted assets ratio and minimum capital requirements. Some studies, however, did use the capital to risk-weighted assets ratio as a measure of capitalization but in a different context (see for example [Tan and Anchor 2017](#); [Belaid et al. 2017](#); [Konara et al. 2019](#);

Jouida 2018). This study is the first to employ the equity to assets ratio, capital to risk-weighted assets ratio, and minimum capital requirements as measures of capitalization to provide better insight and offer more profound implications. In the vein of previous studies, this study examines both the linear and non-linear (i.e., the inverted U-shaped) relationship between capitalization and profitability among Pakistani banks. We used the CR and CAR to measure the impact of the linear relationship between capitalization and profitability. However, to test the inverted U-shaped relationship, we applied a squared term (CR-SQ and CAR-SQ) of the proxies (CR and CAR) used to measure capitalization. The squared terms of CR and CAR will help understand the optimal level of capital that enables banks to operate in a financially and economically unstable environment more efficiently. Because an excessive level of capital not only increases the opportunity but also the agency cost and, it restricts the ability of managers to put more effort into increasing shareholder value, which ultimately leads to a lower profitability of the banks (Berger 1995; Jensen and Meckling 1976; Saona 2016). Thus, the following hypotheses are proposed:

Hypothesis 1. *There is an inverted U-shaped relationship between the capital ratio and profitability.*

Hypothesis 2. *There is an inverted U-shaped relationship between the capital adequacy ratio and profitability.*

Hypothesis 3. *The minimum capital requirement has a significant impact on profitability.*

4. Data and Methodology

4.1. Samples and Data

The sample of this study is based on 29 domestic banks out of the 34 total banks operating in Pakistan. These banks consist of commercial (private and government-owned) and specialized banks (government-owned). The required data for the five foreign banks were not available and were thus excluded from the sample.

The data related to capitalization and the variables for banks and industry were obtained from consolidated and unconsolidated financial statements (audited) and notes on audited financial statements over the period of 2007–2018. All reports and notes were accessed using the websites for each bank and the SBP database. The World Bank database was also used to obtain data on the macroeconomic indicators. We obtained 12 years of reports for each bank, except for Sindh bank limited (SBL) and MCB Islamic bank limited (MCBIL). MCB and MCBIL were incorporated in 2011 and 2015, so we could only obtain the data on SBL bank for eight years (2011–2018) and the data on MCBIL for four years (2015–2018). Further, we could only obtain reports on NIB bank limited for 10 years (2007–2016) because of its acquisition by another bank. Overall, we obtained 334 bank-year observations of 29 banks over a period of 12 years (2007–2018).

4.2. Variable Description

4.2.1. Dependent Variables

This study analyzed the impact of capitalization on the profitability of Pakistani banks. To do so, we used the four profitability indicators from Tan (2016), Haris et al. (2019b), Haris et al. (2019c), and Yao et al. (2018). These indicators are the Return on Avg. Assets (ROAA), Return on Avg. Equity (ROAE), Net Interest Margin (NIMAR), and Profit Margin (PMAR). The ROAA is the ratio of net profits to average assets and measures the efficient utilization of assets to generate earnings. The ROAE is the ratio between the net profits to the average shareholder equity and measures the efficient utilization of shareholders' funds to produce profits. The NIMAR is the ratio between interest income to the average earning assets after providing for interest costs. It determines the revenue generating capacity of interest-bearing assets, as well as the efficacy of the investment decisions of

the bank management. The PMAR is the ratio between profits before taxes to the average assets, which provides the actual income generated from a bank’s core operations before corporate taxes.

4.2.2. Independent Variables

This study employs three measure of capitalization: the Capital Ratio (CR), as a measure of total equity to total assets (Haris et al. 2019c; Athanoglou et al. 2008; Saona 2016; Tan 2016; Yao et al. 2018); the Capital Adequacy Ratio (CAR), as a measure of regulatory capital to total risk-weighted assets (Belaid et al. 2017; Jouda 2018; Konara et al. 2019; Tan and Anchor 2017); and the Minimum Capital Requirement (MCR). The CR has been extensively studied in the vast body of literature, while the CAR and MCR are regulatory concerns³ based on the BASEL guidelines developed to measure and strengthen the capital position of banks and other financial institutions. Further, we used the squared term (CR-SQ) of CR and the squared term (CAR-SQ) of CAR to examine the inverted U-shaped relationship between capitalization and profitability.

In addition, some studies reported the significant impact of several other factors on the profitability of banks. Therefore, apart from capitalization, we controlled for the impact of all the important factors that were highlighted in previous studies (Athanoglou et al. 2008; Dalla Pellegrina 2012; Demirgüç-Kunt and Huizinga 1999; Dietrich and Wanzenried 2011; García-Herrero et al. 2009; Haris et al. 2019a, 2019b; Ho and Saunders 1981; Iannotta et al. 2007; Molyneux and Thornton 1992; Pasiouras and Kosmidou 2007; Saona 2016; Shawtari 2018; Staikouras and Wood 2004; Sufian and Habibullah 2009; Sun et al. 2017; Yao et al. 2018). The control variables are categorized into bank-specific variables (BSVs), industry-specific variables (ISVs), and country-specific variables (CSVs). The BSVs include bank size (BKSIZE), credit quality (CRQ), liquidity (LIQT), operational efficiency (OEFF), financial structure (FINS), diversification (DIVE), funding costs (FCOST), operating costs (OPRC), employee productivity (EMPPR), and bank type (BANKT). The ISVs include industry concentration (INDC₅) and banking sector development (BSD). The CSVs include economic growth (ECGR), inflation (INFLT), and government transitions within the country (GOVTCH). The details of all variables used in the study are presented in Table 2, along with their definitions and expected impacts.

Table 2. Variables of the study with their hypotheses.

Type of Variables	Symbols	Definitions	Hypotheses
DEPENDENT			
Return on Avg. assets	ROAA	(Profit minus tax)/average assets	
Return on Avg. equity	ROAE	(Profit minus tax)/average equity	
Net interest margin	NIMAR	(Interest received minus interest paid)/average earning assets	
Profit margin	PMAR	Earning assets calculated as advances, lending to financial institutions, investments (Profit plus tax)/average assets	
INDEPENDENT			
<i>Capitalization</i>			
Capital Ratio	CR	Total shareholder equity to total assets	+/-
Capital Adequacy Ratio	CAR	Regulatory capital to total risk-weighted assets	+/-
Minimum Capital Requirement	MCR	Dummy equals to 1 if a bank meets the capital regulatory requirements and 0 otherwise Capital regulatory requirements defined as the minimum capital requirements and minimum capital adequacy ratio as per SBP	+/-

³ The SBP specifies the CAR and MCR from time to time and is mandatory for each bank operating in Pakistan to achieve (for detail please visit <http://www.sbp.org.pk/circulars/cir.asp>).

Table 2. Cont.

Type of Variables	Symbols	Definitions	Hypotheses
<i>Bank Specific</i>			
Size	BKSIZE	Logarithm of total assets	+/-
Quality of Credit	CRQ	Provisions of loan loss/net advances	-
Liquidity Position	LIQT	Total advances divided by total assets	+/-
Operating Efficiency	OEFF	Operating expenses divided by gross income	-
Financial Structure	FINS	Bank deposits/bank equity	+/-
Diversification of Income	DIVF	Non-interest income divided by gross income	+/-
Cost of Funding	FCOST	Interest expenses divided by average deposits	-
Operational Cost	OPRC	Operating expenses divided by average assets	+
Employee Productivity	EMPPR	Gross income divided by average employees	+
Type of Bank	BANKT	Assigned 1 if a bank is privately-owned and otherwise 0.	+/-
<i>Industry Specific</i>			
Concentrated Industry by Five Banks	INDC ₅	Largest five banks' assets divided by industry assets	-
Development of Banking Sector	BSD	Total assets of the banking sector divided by gross domestic product	+/-
<i>Country Specific</i>			
Growth in Economy	ECGR	Annual growth rate of the gross domestic product	+
Inflation in Country	INFLT	Change in the rate of the annual consumer price index	+/-
Change of Government	GOVTCH	Assigned 1 if there is change of government (2008 and 2009; 2013 and 2014) and 0 otherwise.	-

4.2.3. Methodology

This study employed *t*-test, tabulation, and graphical methods to analyze the data. To empirically examine the impact of capitalization on profitability, this study used the efficient two-step GMM system estimator of [Arellano and Bover \(1995\)](#) and [Blundell and Bond \(1998\)](#). This estimator is justified as the profitability of banks tends to persist due to difficulties in the identification and measurement of some characteristics of banks, which create a problem of unobserved heterogeneity. For instance, the profitability of Pakistani banks may be affected by differences in the ownership structure, corporate governance, political interference, and attitudes of bank managers towards internal policies and risk. Further, the presence of endogenous variables in an equation makes the results biased and inconsistent. For example, more profitable banks could be more strongly capitalized due to retaining additional reserves ([Yao et al. 2018](#); [Athanasoglou et al. 2008](#)). Therefore, this study uses GMM, which deals with profitability persistence, unobserved heterogeneity, and endogeneity and produces unbiased and consistent results ([Roodman 2009](#)), while Ordinary Least Square (OLS) does not ([Baltagi 2001](#)).

This study follows [Athanasoglou et al. \(2008\)](#); [Haris et al. \(2019c\)](#); [Yao et al. \(2018\)](#), and [Tan \(2016\)](#) and treats capitalization (as measured by CR, CAR, and MCR) and credit quality (CQ) as endogenous and predetermined with a two and one-year lag, respectively. The GMM allows one to use additional exogenous variables. Therefore, the GMM calculates, by default, the Hansen-J statistic and uses the difference-in-Hansen test (known as C-statistic) to ensure the valid use of the instruments and the instruments' subsets, respectively. To deal with the problems of serial correlations, the GMM calculates the first-order autocorrelation (AR1) and second-order (AR2) autocorrelation of [Arellano and Bond \(1991\)](#) under a null hypothesis of no autocorrelation. To validate the use of GMM, the absence of AR2 is essential. Furthermore, [Windmeijer \(2005\)](#) introduced some corrections to the estimated asymptotic

standard errors to increase the consistency of GMM under a small sample size. Consequently, we applied robust standard errors to obtain consistent results.

4.2.4. Econometric Specification

Following Athanasoglou et al. (2008); Yao et al. (2018); Yao et al. (2018), and Tan (2016), among others, the addition of a one-year lag of the dependent variable (profitability) on the left side of the equation makes our model dynamic. We used the following model to evaluate the impact of capitalization on profitability:

$$P_{it} = \alpha_0 + \delta P_{it-1} + \beta_i CAP_{it} + \sum_{j=1}^J \beta_j CVs_{it}^j + Year_t + v_{it} + \mu_{it} \tag{1}$$

where i is the bank, and t is the time in years. P_{it} is the profitability (dependent variable) of bank i at t time, expressed as the ROAA, ROAE, NIMAR, and PMAR. δP_{it-1} is the one-year lag of the dependent variable to solve the issue of time persistence, δ indicates the adjustment speed, and $\beta_i CAP_{it}$ is the capitalization expressed as the CR and two regulatory indicators, i.e., CAR and MCR. CVs_{it}^j indicates the control variables categorized into BSVs, ISVs, and CSVs (for detail see Table 2); α is a constant; β is the coefficient, fixed-year effect, and unobserved bank-individual effect indicated by $Year_t$ and v_{it} , respectively; μ_{it} is an idiosyncratic error.

5. Findings

5.1. The Capitalization Performance of the Banking Industry

Table 3 compares the capitalization performance of private commercial banks (PCBs) with government commercial banks (GCBs) and that of all commercial banks (ACBs) with specialized banks (SBs). It also provides the trend analysis of total banks (TBs) used in this study to gauge the overall capitalization performance of the industry. Figure 1 provides a graphical representation of Table 3. Table 4 reports the results of the t -test used to compare the average capitalization performance of the PCBs with the GCBs and the ACBs with the SBs.

Table 3. Comparative trend analysis of capitalization.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
CR												
PCBs	0.102	0.098	0.099	0.093	0.091	0.086	0.085	0.091	0.085	0.079	0.074	0.070
GCBs	0.137	0.107	0.109	0.108	0.106	0.103	0.102	0.103	0.090	0.083	0.069	0.069
ACBs	0.110	0.100	0.101	0.096	0.095	0.090	0.089	0.093	0.086	0.079	0.073	0.069
SBs	0.180	0.196	0.191	0.213	0.249	0.263	0.260	0.732	0.424	0.387	0.389	0.387
TBs	0.111	0.102	0.103	0.099	0.097	0.092	0.092	0.103	0.091	0.084	0.077	0.074
CAR												
PCBs	0.210	0.177	0.168	0.156	0.159	0.157	0.150	0.159	0.155	0.149	0.141	0.140
GCBs	0.219	0.143	0.174	0.161	0.275	0.225	0.185	0.204	0.226	0.230	0.230	0.259
ACBs	0.211	0.171	0.169	0.157	0.182	0.170	0.157	0.168	0.169	0.165	0.165	0.159
SBs	1.009	0.536	0.349	0.500	0.565	0.503	0.429	0.402	0.408	0.367	0.458	0.455
TBs	0.245	0.199	0.189	0.195	0.223	0.206	0.186	0.193	0.195	0.187	0.180	0.175
MCR												
PCBs	0.650	0.650	0.700	0.600	0.750	0.700	0.650	0.800	0.850	0.900	0.850	0.900
GCBs	0.750	0.250	0.250	0.250	0.600	0.600	0.600	0.800	0.800	0.800	0.800	0.800
ACBs	0.667	0.583	0.625	0.542	0.720	0.680	0.640	0.800	0.840	0.880	0.840	0.880
SBs	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.667	0.667
TBs	0.630	0.556	0.593	0.519	0.679	0.643	0.607	0.750	0.786	0.821	0.821	0.857

Table 4. Mean comparison.

	Obs.	CR	CAR	MCR
Mean of PCBs	242	0.101	0.163	0.752
Mean of GCBs	56	0.104	0.209	0.625
Diff.		-0.003	-0.046 ***	0.127 **
<i>p-value</i>		0.378	0.001	0.027
Mean of ACBs	298	0.101	0.172	0.728
Mean of SBs	36	0.339	0.439	0.389
Diff.		-0.238 ***	-0.267 ***	0.339 ***
<i>p-value</i>		0.000	0.000	0.000

Note: **, and ***, show the level of significance at 5%, and 1%, respectively.

A downward trend is observed in the CRs of all banks except for SBs (see Table 3 and Figure 1). The CRs of PCBs and GCBs decreased to 7.0% and 6.9% in 2018 from 10.2% and 13.7% in 2007, respectively. On the other hand, the CRs of ACBs decreased to 6.9% in 2018 from 11% in 2007, while the CRs of SBs increased to 38.7% in 2018 from 18% in 2007. Overall, the CRs of the banking industry (TBs) also decreased to 7.4% in 2018 from 11.1% in 2007. The downward trend in the CR indicates that the Pakistani banking industry was either changing its patterns towards relying more on deposits or facing decreasing profitability ratios during the study period, as reported by Yao et al. (2018). The *t*-test comparison indicates that the GCBs have comparatively higher average CRs (0.104) than the average CRs (0.101) of the PCBs, although the difference is insignificant. The SBs have a higher average CR (0.349) than the overall average CR (0.101), which represents a significant difference at a 1 percent level (see Table 4). Overall, we find that the capitalized position, when measured by CR, of government-owned banks (GCBs and SBs) is stronger than that of privately-owned banks (PCBs).

Each bank operating in Pakistan must maintain a minimum CAR as specified by the SBP. Table 5 reports the CAR requirements of the SBP⁴ for the period from 2007 to 2018. Although the analysis indicates fluctuations in CAR, it shows that all types of banks have maintained their CARs higher than the regulatory requirements (see Table 3 and Figure 1). On the other hand, Table 4 reports that the average CARs (0.209) of GCBs is higher than the average CARs (0.163) of PCBs, which is significant at a 1 percent level. The average CARs (0.439) of SBs are higher than the average CARs (0.172) of ACBs, which is also significant at a 1 percent level.

Table 5. The regulatory requirements of CARs and MCRs.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
CR	8	9	10	10	10	10	10	10	10.25	10.65	11.275	11.90
MCR	4	5	5	7	8	9	10	10	10	10	10	10

Note: The CR is required to maintain its percentage. The MCR is required to maintain a value of one billion rupees.

The SBP also specifies the MCR, which must be adhered by banks operating in Pakistan. The MCR specified by SBP⁵ over the study period is reported in Table 5. However, Table 3 reports that 75% of GCBs and only 65% of PCBs achieved the necessary MCR in 2007, which increased to 80% and 90%, respectively, in 2018. On the other hand, 66.67% of ACBs and only 33.3% of SBs achieved the MCR in 2007; however, the ratio of ACBs and SBs increased to 88% and 66.7%, respectively, in 2018. Overall, out of the 29 banks used in the study, only 63% banks achieved the necessary MCR in 2007, which increased to 82.7% in 2018. The *t*-test (see Table 4) indicates that the higher average ratio of PCBs

⁴ The SBP also revises the ratio of the capital to risk weighted assets from time to time based on the Basel capital adequacy guidelines (visit <http://www.sbp.org.pk/bpd/index.htm>).

⁵ The SBP raises the minimum capital requirements through different circulars from time to time. All circulars are maintained in the database of SBP at <http://www.sbp.org.pk/bsrvd/index.htm>.

compared to GCBs is statistically significant at a 5 percent level. The higher ratio for ACBs compared to SBs is also significant at a 1 percent level. This analysis suggests that some Pakistani banks are still not fully complying with the regulatory requirements based on the BASEL recommendations for maintaining sound solvency.

5.2. Descriptive Statistics

The reported results suggest that the Pakistani banking industry remained profitable during the period under analysis (2007–2018). The results further suggest that the differences in CRs among banks is high, varying from -0.040 to 0.811 . The differences in CARs are also high among banks, varying from -0.137 to 1.009 . Overall, the average CAR (0.199) of the banking industry is higher than the regulatory requirements. The MCR result suggests that some banks in Pakistan failed to maintain the minimum capital requirements required by SBP. The results of the descriptive statistics are not reported due to space requirements but are available on request.

5.3. Unit Root and Multicollinearity

This study applied important pre-estimation tests to validate the model; these results are not reported due to limited space but are available if requested. An Augmented Dickey Fuller (ADF) unit root test and a Variance Inflation Test (VIF) were performed to assess the unit root and multicollinearity issues, respectively. The variables were found to be stationary due to the significant p -values of ADF test. The VIF values, as reported in Table 6, show that the variable have no multicollinearity at the cut-off VIF value of 4. Third, we also performed a correlation analysis (see Table 6) that rejected the problem of multicollinearity at a cut-off correlation coefficient of <0.8 . Although the correlation coefficient between CR and CAR is 0.815 , this is not a case of multicollinearity because both CR and CAR are applied in separate regression equations.

5.4. Capitalization and Profitability

The GMM results of this study are reported in Tables 7–9. In all tables, the dynamic nature of our all models was proven by obtaining the significant positive coefficients of the dependent variables. The reported insignificant p -values of AR2 confirm the absence of autocorrelation. The validity of the instruments and instruments' subset was confirmed by obtaining insignificant p -values for the Hansen-J and C-statistics.

Table 6. Correlation Matrix.

	CR	CAR	MCR	BKSIZE	CRQ	LIQT	FINS	OEFF	FCOST	DIVF	OPRC	EMPPR	BANKT	INDC ₅	BSDEV	ECGR	INFLT	GOVTCH	VIF	
CR	1.000																			2.03
CAR	0.815 ***	1.000																		2.26
MCR	-0.091 *	-0.078	1.000																	1.62
BKSIZE	-0.473 ***	-0.509 ***	0.550 ***	1.000																2.82
CRQ	0.119 **	0.296 ***	-0.296 ***	-0.407 ***	1.000															1.87
LIQT	0.100 *	-0.101 *	-0.103 **	-0.088	-0.205 ***	1.000														1.62
FINS	-0.301 ***	-0.286 ***	-0.110 **	0.077	0.127 **	-0.036 **	1.000													1.13
OEFF	0.016	0.044	-0.356 ***	-0.411 ***	0.505 ***	-0.072	0.137 ***	1.000												2.13
FCOST	0.173 ***	0.119 **	-0.090 *	-0.278 ***	0.209 ***	0.254 ***	-0.111 **	-0.032	1.000											1.58
DIVF	-0.070	-0.181 ***	0.318 ***	0.304 ***	-0.254 ***	0.174 ***	-0.074	-0.295 ***	0.282 ***	1.000										1.46
OPRC	0.435 ***	0.456 ***	-0.346 ***	-0.589 ***	0.476 ***	0.103*	-0.064	0.623 ***	0.202 ***	-0.179 ***	1.000									2.51
EMPPR	-0.396 **	-0.322 ***	0.478 ***	0.675 ***	-0.268 ***	-0.373 ***	-0.230	-0.306 ***	-0.248 ***	0.185 ***	-0.519 ***	1.000								2.44
BANKT	-0.354 ***	-0.371 ***	-0.212 ***	0.339 ***	-0.359 ***	-0.018	-0.017	-0.063	-0.329 ***	0.018	-0.196 ***	0.255 ***	1.000							1.35
INDC ₅	0.018	0.011	-0.078	-0.103 **	0.019	0.108 **	-0.090 *	0.021	0.099 *	0.006	0.015	-0.151 ***	0.005	1.000						1.34
BSDEV	-0.045	-0.029	0.165 ***	0.165 ***	-0.005 ***	-0.039	0.046	-0.007	-0.192 ***	0.187 ***	-0.135 **	0.129	-0.002	0.113**	1.000					4.61
ECGR	-0.062	-0.026	0.207 ***	0.241 ***	-0.009	-0.221 ***	0.071	-0.054	-0.239 ***	0.167 ***	-0.191 ***	0.245 ***	-0.014	-0.041	0.602 ***	1.000				4.61
INFLT	0.033	-0.013	-0.037	-0.078	-0.009	0.247 ***	0.032	0.029	0.016	0.049	0.025	-0.128 **	0.009	-0.158 ***	0.207 ***	-0.262 ***	1.000			2.59
GOVTCH	-0.001	-0.056	-0.032	-0.019	-0.002	0.166 ***	-0.040	-0.018	0.035	-0.106 **	0.033	-0.027	0.000	0.054 ***	-0.131 **	-0.063	0.286 ***	1.000		1.57

Note: *, **, and ***, show the level of significance at 10%, 5%, and 1%, respectively.

The results for the impact of CR on profitability are reported in Table 7. The significant positive coefficients of CR ($p < 1\%$) and the significant negative coefficients of CR-SQ ($p < 1\%$ & $p < 5\%$) confirm the inverted U-shaped relationship of capitalization with profitability (ROAA, ROAE, NIMAR, and PMAR). This finding only applies to CR and NIMAR, which is consistent with Alhassan et al. (2016), who only examined the inverted U-shaped relationship between CR and NIMAR. However, our study extends the evidence of the inverted U-shaped relationship of CR with three additional profitability measures, i.e., ROAA, ROAE, and PMAR. No matter what profitability indicators we used, our study reported consistent results. Previously, many studies observed the positive impacts of increases in capitalization on profitability (Athanasoglou et al. 2008; Bouzgarrou et al. 2018; Haris et al. 2019a; Molyneux and Thornton 1992; Siew Peng and Mansor 2017; Sun et al. 2017). However, our study indicates that profitability increases with an increase in capitalization but only up to a certain level; beyond that level, a further increase in capitalization decreases profitability (ROAA, ROAE, NIMAR, and PMAR). The relationship between CR and profitability is supported by the expected bankruptcy costs and signaling hypothesis—that bank managers signal positive future prospects by increasing the equity ratio to keep bankruptcy risk low, which ultimately reduces the cost of debts and thus raises profitability. On the other hand, relying more on equity prevents the bank management from using debts and deposits for financing their future investment opportunities. As they are cheaper than equity, deposits/debts are always a source of higher profitability. Further, higher equity and less reliance on deposits also reduces the customer base, which deteriorates the income generated from diversified sources (e.g., non-interest-bearing activities) and thus reduces profitability. Moreover, the non-linear relationship between CR and ROAA also suggests that higher capitalization also increases the net tax and prevents banks from gaining advantages from the tax subsidies provided by interest deductibility on debt (Saona 2016); hence, profitability reduces. Consequently, our study supports the optimal capital structure theorem. Finally, the control variables were found to be significantly related to profitability (see Table 7).

Table 7. Capital Ratio (CR) and profitability.

Variables	ROAA		ROAE		NIMAR		PMAR	
	Coeff.	ST.E	Coeff.	ST.E	Coeff.	ST.E	Coeff.	ST.E
DEP _{t-1}	0.291 ***	0.11	0.679 ***	0.225	1.093 ***	0.193	0.499 *	0.272
CR	0.321 ***	0.096	7.057 ***	2.649	0.206 ***	0.066	1.199 ***	0.421
CR-SQ	-0.212 ***	0.078	-7.391 **	3.025	-0.301 ***	0.107	-1.185 ***	0.418
BKSIZE	0.006	0.005	0.039	0.059	0.007 **	0.003	0.005	0.006
CRQ	-0.020 **	0.009	-0.400 **	0.195	-0.024 **	0.011	-0.015	0.017
LIQT	0.026	0.033	2.724 **	1.084	0.122 ***	0.031	0.137 *	0.073
FINS	0.001	0.001	-0.003 **	0.002	-0.000	0.000	0.003 ***	0.001
OEFF	0.024 ***	0.004	0.676 ***	0.165	0.022 ***	0.005	0.064	0.039
FCOST	-0.098 ***	0.032	-4.672 **	2.097	-0.123 **	0.060	-0.313 *	0.181
DIVF	0.117 ***	0.03	2.083	1.972	0.015	0.034	0.333 *	0.169
OPRC	-1.296 ***	0.457	-22.056 **	10.531	-0.959 ***	0.294	-4.360 **	2.138
EMPPR	-0.000	0.000	0.000	0.000	-0.000 *	0.000	-0.000 **	0.000
BANKT	0.002	0.012	-4.498	0.323	-0.001	0.011	-0.025	0.027
INDC ₅	-0.521 *	0.289	-31.042 ***	11.843	-0.853 **	0.392	-2.687 *	1.426
BSDEV	-0.144 ***	0.707	-10.250 ***	2.977	-0.314 *	0.181	0.001	0.165
ECGR	0.001	0.003	0.169**	0.069	0.008	0.007	-0.010	0.006
INFLT	0.007 **	0.003	.388*	0.205	0.002	0.008	0.026 *	0.014
GOVTCH	-0.011 **	0.005	-0.822 ***	0.310	-0.025 *	0.014	-0.038 *	0.021
CONST.	0.329 *	0.188	-14.409	5.14	0.406 *	0.229	-1.520 **	0.720
Banks	29		29		29		29	
Observ.	280		294		274		281	
Instruments	29		29		29		29	
F	16.70 ***		23.51 ***		143.59 ***		20.40 ***	
AR(1)	-1.67 (0.094)		-1.13 (0.258)		-2.40 (0.017)		-1.82 (0.096)	
AR(2)	-0.48 (0.631)		-1.41 (0.159)		1.40 (0.162)		-0.95 (0.343)	
Hansen-J	4.92 (0.896)		8.15 (0.614)		1.67 (0.998)		4.56 (0.919)	
C-statistics	0.19 (0.980)		3.14 (0.370)		0.61 (0.895)		0.85 (0.837)	

Note: The results are based on a two-step GMM system estimator. *, **, and ***, show the level of significance at 10%, 5%, and 1%, respectively. CR-SQ is the squared term of CR.

In Table 8, we replace the measurement of capitalization with CAR, which is the regulatory requirement for capitalization based on the BASEL recommendations. This indicator also proves the robustness of our study and ensures the effectiveness of the regulatory recommendations. Our study reports a positive impact of CAR ($p < 1\%$ and $p < 5\%$) on profitability when measured by ROAA, ROAE, NIMAR, and PMAR. These findings are consistent with the findings of Tan et al. (2017) and suggest that maintaining an adequate level of capital required by the regulator (i.e., that defined by the SBP from time to time) translates into higher profitability. On the other hand, to assess the inverted U-shaped relationship of CAR with profitability, we introduced CAR-SQ and found it to have a significant negative impact ($p < 1\%$ & $p < 5\%$) on each of the profitability indicators used in this study. Thus, our study indicates both a linear and non-linear relationship of CAR with profitability, which also affirms the inverted U-shaped relationship. This is the first evidence for the inverted U-shaped relationship of CAR and the four profitability measures. This result suggests that bank profitability increases with an increase in the required CAR but only up to a certain level, beyond which a further increase in the CAR does not favor profitability. This is significant for bank management and for SBP in its policy formulation and implementation. The inverted U-shaped relationship between capitalization and profitability suggests that there exists an optimal level of capitalization that bank management should operate close to. The wider implications of this fact could compel SBP to pay closer attention to the level of capitalization while considering changes to their capital adequacy and minimum capital requirements. In addition, the magnitude of the significant coefficient of the control variables was shown to change, but all variables maintained a consistent relationship, as depicted in Table 7.

Table 8. The Capital adequacy ratio (CAR) and profitability.

Variables	ROAA		ROAE		NIMAR		PMAR	
	Coeff.	ST.E	Coeff.	ST.E	Coeff.	ST.E	Coeff.	ST.E
DEP _{t-1}	0.395 **	0.160	0.702 ***	0.240	1.026 ***	0.129	0.684 ***	0.229
CR	0.550 ***	0.205	7.320 ***	2.845	0.271 ***	0.093	0.938 **	0.441
CR-SQ	-0.755 **	0.321	-12.205 ***	4.713	-0.325 **	0.102	-1.142 **	0.480
BKSIZE	0.012 **	0.006	0.431 ***	0.127	0.007 *	0.004	-0.003	0.015
CRQ	0.028	0.017	-0.155	0.317	0.013	0.008	-0.016	0.027
LIQT	0.065	0.069	-1.459 **	0.624	0.024	0.024	-0.183	0.187
FINS	-0.000	0.000	-0.010 ***	0.002	-0.000	0.000	0.001	0.000
OEFF	0.048 ***	0.018	0.860 **	0.384	0.024 ***	0.008	0.061 ***	0.023
FCOST	-0.055	0.072	1.810	1.814	0.008	0.057	0.032	0.081
DIVF	0.161 **	0.075	-0.393 **	2.421	-0.030	0.043	0.132	0.135
OPRC	-2.147 **	0.930	-6.470	8.437	-1.161 *	0.655	-4.080	2.762
EMPPR	-0.000 **	0.000	-0.000 ***	0.000	-0.000 **	0.000	-0.000	0.000
BANKT	0.007	0.012	-0.194	0.270	0.002	0.008	-0.016	0.032
INDC ₅	-0.876 **	0.369	-1.450	8.216	-2.376 **	1.178	-4.892 **	1.959
BSDEV	-0.599 *	0.309	-13.417 ***	8.826	0.323	0.191	0.620	0.807
ECGR	0.018 *	0.011	0.451 *	0.264	-0.007	0.005	-0.009	0.016
INFLT	-0.002	0.008	0.463	0.280	0.031 ***	0.010	-0.073	0.048
GOVTCH	-0.030 **	0.017	0.361	0.274	-0.041 **	0.018	-0.088 *	0.045
CONST	0.440	0.296	9.381	7.414	1.029 *	0.588	2.621 **	1.088
Banks	29		29		29		29	
Observ	275		275		275		288	
Instruments	29		29		29		29	
F-statistic	9.71 ***		12.82 ***		264.99 ***		18.62 ***	
AR(1)	-2.63 (0.009)		-2.01 (0.044)		-1.30 (0.194)		-1.40 (0.161)	
AR(2)	-0.25 (0.803)		-1.21 (0.227)		-0.36 (0.722)		-0.30 (0.764)	
Hansen-J	4.06 (0.945)		2.18 (0.995)		6.50 (0.772)		4.77 (0.906)	
C-statistics	1.49 (0.685)		0.70 (0.873)		0.92 (0.820)		2.34 (0.505)	

Note: The results are based on the two-step GMM system estimator. *, **, and ***, show the level of significance at 10%, 5%, and 1%, respectively. CAR-SQ is the squared term of CAR.

In Table 9, we also studied another regulatory indicator: MCR. It is mandatory for every bank operating in Pakistan to maintain a minimum level of capital, as specified by the SBP. Our study cross-examined the impact of capitalization on profitability by introducing a dummy variable (MCR),

which equals 1 if a bank maintains its capital level at least according to MCR specifications and 0 otherwise. The significant positive coefficients ($p < 1\%$ and $p < 5\%$) of MCR confirm that the banks who strictly follow the necessary regulations and maintain their equity levels at least according to MCR specifications have higher profitability than those that do not. Moreover, the banks achieving the necessary MCR reported a comparatively higher ROAA, ROAE, NIMAR, and PMAR. This is new evidence extended by the current study indicating the positive impact of maintaining regulatory capital on bank profitability. On the other hand, the magnitude of the significant coefficients of the control variables was shown to change, but all variables maintained their relationships, which is consistent with Tables 7 and 8.

Table 9. Minimum capital requirement (MCR) and profitability.

Variables	ROAA		ROAE		NIMAR		PMAR	
	Coeff.	ST.E	Coeff.	ST.E	Coeff.	ST.E	Coeff.	ST.E
DEP _{t-1}	0.140	0.161	1.318 ***	0.325	0.301 *	0.173	0.227	0.221
MCR	0.029 **	0.010	0.406 ***	0.152	0.015 **	0.007	0.026 **	0.010
BKSIZE	0.001	0.005	0.089	0.083	0.006	0.005	0.008	0.007
CRQ	-0.021	0.013	-0.606	0.430	-0.016	0.018	-0.028	0.049
LIQT	0.272 ***	0.077	1.027	1.368	0.099 **	0.049	0.330 **	0.160
FINS	-0.000	0.000	-0.002	0.002	-0.000 ***	0.000	-0.001	0.002
OEFF	0.023 ***	0.006	0.804 ***	0.235	0.008 **	0.003	0.011	0.022
FCOST	-0.191	0.143	-3.324 *	1.829	-0.123 *	0.064	-0.562 ***	0.210
DIVF	0.306 *	0.173	-0.326 *	1.908	0.019	0.055	0.189 *	0.112
OPRC	-0.645 **	0.265	12.778	7.607	-0.959 *	0.505	-2.412 *	1.304
EMPPR	-0.000 ***	0.000	0.000	0.000	0.000	0.000	-0.000 ***	0.000
BANKT	-0.037 *	0.021	-0.399 **	0.179	0.016 ***	0.005	-0.051 **	0.024
INDC ₅	-2.287 **	1.141	-34.421 **	16.954	0.869	0.850	2.807	1.922
BSDEV	-0.662 ***	0.212	4.391	3.703	-0.454 *	0.265	-2.453	0.667
ECGR	0.012 ***	0.005	0.210 *	0.114	0.008	0.006	0.002	0.018
INFLT	0.022 *	0.013	0.697 **	0.320	0.039 *	0.022	-0.019	0.036
GOVTCH	-0.048 ***	0.019	-0.510 **	0.223	-0.039 *	0.021	-0.034	0.024
CONST.	-1.176 **	0.509	-22.561 **	9.506	0.427	0.364	-1.693 *	0.899
Banks	29		29		29		29	
Observ.	282		280		293		281	
Instruments	29		29		29		29	
F-statistic	172.64 ***		14.11 ***		48.24 ***		19.16 ***	
AR(1)	-1.62 (0.104)		-2.30 (0.021)		-1.53 (0.127)		-1.23 (0.220)	
AR(2)	-0.97 (0.331)		0.83 (0.409)		-1.08 (0.279)		-1.13 (0.260)	
Hansen-J	5.85 (0.883)		6.71 (0.822)		6.56 (0.834)		2.90 (0.968)	
C-statistics	0.17 (0.982)		0.47 (0.926)		0.38 (0.944)		0.30 (0.960)	

Note: These results are based on the two-step GMM system estimator. *, **, and ***, show the level of significance at 10%, 5%, and 1%, respectively.

6. Conclusions

This study reported a downward trend in the capitalization performance of Pakistani banks. We found an increasing tendency among Pakistani banks to achieve the MCR. Overall, the industry reported a consistently higher CAR than that required by the authorities. The *t*-test showed that GCBs have higher mean CRs and CARs than ACBs. SBs have a higher mean value of CRs and CARs than ACBs. The average ratio of banks who achieved their MCRs was shown to be higher for PCBs and ACBs than for GCBs and SBs. The empirical findings indicate an inverted U-shaped relationship between the CR and CAR and profitability ratios. This suggests that profitability increases with an increase in CR and CAR but only up to a certain level, after which a further increase in both CR and CAR decreases profitability. These results indicate that banks achieving the regulated MCR experience statistically significant higher profitability compared to banks who do not.

The findings of this paper will be of interest to academics, policy makers, investors, and bank management. This study also has several policy implications. First, the downward trend in CR and CAR indicates that banks are changing their financial structures from equity-oriented to debt-oriented.

Regulators should ensure the inclusion of adequate equity as a tool to control the stability of the banking system. Second, the SBP should strictly monitor the MCRs of all banks to boost their solvency and profitability aspects and should avoid any exemptions given to banks who failed to achieve the necessary MCR. Third, the banks in Pakistan have maintained CARs even higher than the required CAR, which highlights the effective implementation of the different Basel accords. Fourth, the SBs do not rely on deposits; consequently, there is a need to inject higher amounts of equity to remain solvent and profitable by achieving the MCR. Fifth, our study recommends that an optimum level of equity should be held to remain solvent and profitable. Before extending any specified regulatory requirements on capitalization, regulators should consider that an equity amount beyond a certain limit will impede the profitability of the banking industry. The capitalization limit in our case is 12.7% for CR and 19.9% for CAR.⁶ Currently, the CAR required by the SBP remains 11.9%, which means that the regulator (i.e., SBP) still has a significant margin to increase regulatory capital against risk-weighted assets without damaging the profitability of banks. However, any extension beyond these stipulated limits will harm profitability.

Although this study is based on a large fraction of time series and cross-sectional data, a comprehensive set of variables, and robust econometric techniques, it has some limitations. For instance, the study period of 2007–2018 was due to the lack of availability of all necessary data beyond 2018. Our study was based on the Pakistani banking sector, but future studies could provide similar evidence from non-banking financial institutions. Moreover, the same set of variables used in this study could be replicated in studies on other emerging and developed economies. Future studies may also examine capitalization and profitability with special reference to banking risk management.

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⁶ Based on the mean values of the CR and CAR of the data under analysis.

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