**CAPITAL UNIVERSITY OF SCIENCE AND TECHNOLOGY, ISLAMABAD**

# Interrelationship Between Basel Accords Regulations, Efficiency and Risk. An Empirical Analysis of Pakistani Banking Industry

by

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# Interrelationship Between Basel Accords Regulations, Efficiency and Risk. An Empirical Analysis of Pakistani Banking Industry

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*Dedicated to my dear father (LATE), praiseworthy mother, brother, sisters, wife, adorable children and beautiful nieces*

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This is to certify that the research work presented in the thesis, entitled "**Interrelationship Between Basel Accords Regulations, Efficiency and Risk. An Empirical Analysis of Pakistani Banking Industry**" was conducted under the supervision of  **Dr. Arshad Hassan**. No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the **Department of Management Sciences, Capital University of Science and Technology** in partial fulfillment of the requirements for the degree of Doctor in Philosophy in the field of **Management Sciences**. The open defence of the thesis was conducted on **May 02, 2018.**

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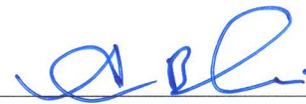
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# *List of Publications*

Bashir, A & Hassan, A. (2017). Interrelationship Among Basel Capital Regulation, Risk, and Efficiency in Pakistani Commercial Banks. *Business & Economic Review*, 9(2), 165-186.

# *Abstract*

This study examines the effectiveness of Basel Accord regulations on the banking sector of Pakistan. Pakistani banking sector has undergone a lot of changes and it has witnessed a remarkable growth from 1998 to 2015. Incidentally this is the time period when Pakistan started implementing Basel regulations. Since one objective of these Basel regulations was to reduce risk of the banks and enhance the efficiency of banks so the purpose of this study is to find the impact of Basel capital regulations on the risk taking and efficiency of Pakistani banks. The fact that banks are obligated to implement Basel also raises questions on how regulation affects efficiency and risk taking behavior of the banks, and how this effect has changed over time. By taking various proxies and using secondary data collected from balance sheet and income statements of banks listed in Pakistan Stock Exchange during 1998 to 2015 the present study empirically investigates the impact of bank capital regulation on bank risk and bank efficiency from beginning of Basel regulation in 1998 to 2015 in Pakistan. Moreover this study also quantifies the effect of different Basel accords on the banking sector of Pakistan. By employing the Generalized Method of Moments (GMM), results of this study highlights that Basel capital regulations have reduced the bank risks taking, however the effect of capital regulation of Basel I and II on bank risk taken is not same. Though capital adequacy ratio for Basel I and II is same, however Basel II is more successful than Basel I in curbing the risk taking behavior of banks, thus highlighting the effectiveness of Basel II in reducing risks than Basel I. As far as the impact of capital regulation on the bank efficiency is concerned, it reduces the bank efficiency. However banks have seen their efficiency reduced more in Basel II, while Basel I impact on the cost efficiency of banks is negligible. Furthermore this study also analyzes the effect of other regulatory, firm specific and macroeconomic factors on the relationship between capital, risk and efficiency in the commercial banks of Pakistan. The findings of this study are beneficial for policy maker like State Bank of Pakistan (SBP) and management of banks to assess the consequences of implementation of Basel regulations in terms of risk reduction and efficiency enhancement. The results of this study are significant as they facilitate (SBP) to

assess whether banks in Pakistan are following Basel regulation in its true Letter and Spirit. The findings of this study are helpful to SBP in formulating and enforcing suitable policies and strategies regarding risk management and improvement of the efficiency of Pakistani banks for the betterment of the banking industry in particular and stability of financial system in general.

**Key words: Bank-risk taking, Bank efficiency, Capital regulation, Market Discipline, Basel Accords, Financial Crisis, Islamic banks, Conventional banks, Political regimes, Inflation, Pakistan.**

# Contents

# List of Tables

# Abbreviations

| | |
|---|---|
| **3SLS** | Three Stage Least Square |
| **BC** | Bank Capital |
| **BCBS** | Basel Committee on Bank Supervision |
| **BE** | Bank Efficiency |
| **BR** | Bank Risk |
| **CAR** | Capital Adequacy ratio |
| **CDR** | Credit Deposit Ratio |
| **CE** | Cost Efficiency |
| **CIR** | Cost to Income Ratio |
| **DEA** | Data Envelopment Analysis |
| **GMM** | Generalized Method of Moments |
| **GRD** | Growth in Deposits |
| **IEAEL** | Interest Expense to Average Earning Liabilities |
| **INF** | Inflation |
| **PSX** | Pakistan Stock Exchange |
| **LASTF** | Liquid Asset to Short Term Funding |
| **LLPNIR** | Loans Loss Provision to Net Interest Revenue |
| **NIENI** | Non-Interest Expense to Net Income Ratio |
| **NIM** | Net Interest Margin |
| **NLTA** | Net loans to Total asset |
| **NPL** | Non-Performing Loans |
| **NPLGL** | Non-Performing Loans to Gross Loans |
| **OECD** | Organization for Economic Development |
| **OLS** | Ordinary Least Squares |

**RMSE**    Root Mean Square Error

**ROAA**    Return on Average Assets

**S.D**    Standard Deviation

**SBP**    State Bank of Pakistan

**SFA**    Stochastic Frontier Analysis

**SUR**    Seemingly Unrelated Regression

**TCTR**    Total Capital to Total Risk Weighted Assets

**VIF**    Variance Inflation Factor

# Chapter 1

# Introduction

## 1.1 Background of the Study

Impact of capital regulation on the bank risk taking is a fundamental question in bank capital regulation literature. According to (Mitchell, 1986), magnitude of involvement in risky activities by banks on one hand increases the likelihood of bank failure on the micro-level, and on the other hand it casts doubts on the sustainability of banking system on macro level. Regulators, therefore, have tried to offset the possible incentives of banks excessive risk-taking mainly by giving capital adequacy a more important role in the prudential regulatory process. Specially, the introduction of the 1988 Basel Accord on international bank capital standards and subsequent amendments reignited interest on the effectiveness of bank capital regulations. Literature presents mixed evidence on the effect of capital on risk. One school of thought advocates the positive connection of capital and risk. They support the notion of regulatory hypothesis. (Koehn and Santomero, 1980) and (Kim and Santomero, 1988) with the help of utility-maximizing theory, argue that with the introduction of higher capital ratios, banks had incentive to move their portfolios towards riskier assets due to presence of deposit insurance mechanism. According to (Van, 2005) this happened because flat requirements restricted the bank's risk-return frontier, thus leading them to compensate losses in utility from the upper-limit on leverage with, perhaps, the optimal option of

increasing the riskiness of the portfolio. However another group of scholars question the notion of forcing banks to maintain specific levels of capital. The authors support the moral hazard hypothesis, that banks have advantages to make use of presented flat deposit insurance schemes. Besides, under capitalized banks could meet the risk-based requirement by increasing capital and/or reducing portfolio risks, while well capitalized banks may choose to reduce capital or to increase risk levels. There is another group of researchers who are of the view that bank hold above required capital ratio also called capital buffer and capital regulations do not affect risk taking behavior of the banks. They argue that banks are not forced by the capital requirements and they have their own chosen capital ratios and risk taken behavior.

As far as the impact of capital regulation on the performance of banks is concerned, there is mixed evidence on the impact of bank capital on bank efficiency. Those advocating a positive relationship, are of the view that high efficiency allows banks extra income for maintaining high capital ratios to overcome the possibility of bankruptcy. Those in favor of negative relationship are of the view that increased efficiency is also a signal of low bankruptcy. As a result, this low default probability allows a bank to lower its capital as it has low default risk due to high efficiency.

Initial part of this section provided the basic ground for conducting the study including the impact of bank capital on bank risk-taking and bank efficiency. Subsequent parts of this section discuss the rationale for financial intermediation, theories of banking, justification of bank regulation and an overview of the Basel Accords. Then an overview of Pakistani banking industry and its reforms is provided. In the last parts of this section research questions along with objectives and significance of the study are given. The organization of the thesis is also described at the end of this chapter.

## 1.2 Rationale for Financial Intermediation

Most advantageous investment, lack of arbitrage and stability in financial markets are the three cornerstones of the modern financial theory. In the perfect world

of (Arrow and Debreu, 1954), financial assets are reasonably priced and due to presence of symmetric information, lenders and borrower can contact with each other with no intermediation fee. His perfect world is centered on the notion of complete markets. He suggests that market facilitates efficient allocation of resources. The persons or organizations with excess capital can easily find the one which are deficit or shortage of capital without incurring any cost. (Fama, 1980) also suggest that households itself can eliminate the existence of intermediary by constructing their own portfolios. However, in reality information asymmetries exist, thus defying the important condition of perfect market. This presence of information asymmetries justifies the presence of financial intermediaries. Moreover, imperfections and limitations of the real world also justify the existence of financial intermediaries.

According to (Scholtens et al., 2003), the rationale for the presence of financial intermediaries can be grouped into three major headlines. These are theory of asymmetric information, transaction costs and regulatory factors. According to information problems or asymmetric information approach before investing in business, initially intermediaries gather and scrutinize information. On the basis of this gathered information, they take the decision of investing. If they decide to continue, then they must choose the amount and conditions of investment. Then intermediaries must keep an eye on firms to safeguard the interests of lenders. Lenders of funds are mainly households and firms. The process of provision of funds to users is accomplished in either through the financial markets, which composed of short term i.e. money markets and long term i.e. bond and equity markets or through banks and other financial intermediaries. (Levine, 1997) supports role of intermediaries through optimal allocation of resources. He is of the view that economic growth accelerates through efficient allocation of capital in an economy. (Leland and Pyle, 1977) suggest that financial institution be able to take advantage of its knowledgeable position by putting capital in the assets regarding whom it have particular information. (Diamond, 1984) has advocated that role of the intermediaries as "delegated monitors" allow them to triumph over asymmetric information.

The second argument for the existence of financial intermediaries is the presence of transaction cost or the fee of financial services. The work of (Scholes et al., 1976) and (Fama, 1980) is considered pioneer in this regard. By acting for savers and borrowers the financial institutions may make use of economies of scale and scope. (Tobin, 1963) describes it as financial costs. While according to (Scholes et al., 1976), it may also include monitoring and audit costs. Therefore, with task of intermediation, savers and investors are likely to work together with each other at relatively less cost and at low probability of default due to increased screening and monitoring. The financial intermediary function to regulate money creation and provision of money to economy is the third reason for its existence as described by (Fama, 1980). There is school of thought that disagrees to notion of regulations especially for financial industry. However, intermediaries carry out some activities that inherently "ask for regulation". The asset transformation function of financial intermediary is one such example. In it financial intermediaries convert the risk characteristics of assets. By asset transforming they carry the risk of illiquidity and insolvency. So regulation is necessary to keep a check on the activities of financial institutions. However there is no consensus on financial sector regulations.

## 1.3 Theories of Banking

Banks are one of the important intermediary and according to (Werner, 2016) there are three main theories of banking and their accounting. These are financial intermediary theory, fractional reserve theory of banking and credit creation theory of banking. The financial intermediation theory finds its roots in the theory of informational asymmetry and the agency theory. The work of (Gurley and Shaw, 1960) is considered to be the pioneer in developing the theory of intermediation. The work of (Santos, 2001) is important in dividing the intermediation theories into earlier and contemporary theories. Another important contributor in this theory is (Diamond, 1984), who introduced the concept of moral hazard and delegate monitors. (Bolton and Freixas, 2000) introduce the relationship facet of the intermediation. They are of the view that firms favor banks to markets due

to this special relationship of banks with companies. The supporters of financial intermediary theory treat banks and non-bank financial institution alike: they take deposits from customers and lend these in the form of loans. (Dewatripont et al., 2010) claim that bank take deposits from depositors in the form of short term maturities and lend to debtors in the form of long term maturities. (Sealey and Lindley, 1977) propose a production theory for depository Institutions and state that "The transformation process for a financial firm involves the borrowing of funds from surplus spending units and lending those funds to deficit spending units, i.e. financial intermediation". The proponents of fractional reserve theory of banking like agree with financial intermediary theory by considering each bank as intermediary; however they disagree with financial intermediary theory about the overall macroeconomic role of banks. They are of the view that multiple deposit expansion allows the banking system to create money. (Crick, 1927) argues that money is created by the system as a whole instead of individual bank. The credit creation theory of banking disagrees from both financial intermediary theory and fractional reserve theory. It does not treat bank as financial intermediary neither alone nor together. It disagrees with the notion of first getting deposits or reserves to lend. By executing loan contracts or purchasing assets bank creates credit. (Davenport, 1919) states that instead of lending their deposits, bank create deposits by extensions of credit. According to (Werner, 2014), among the three theories of banks, financial intermediary theory is most dominated theory and it is advocated by prestigious journals, and authors.

## 1.4 Justification of Bank Regulation

Due to the specialness of banks in the economy a high degree of regulation and supervision is required. The economic role of banks is chiefly cited as reason for banking regulation. According to (Ping, 2014) banks are special because banks through its deposits are major source of the national credit supply. The interruption of credit supply is major hurdle to economic growth and it can cause major crisis such as American banking crisis 1933. (Ping, 2014) says that linkage of banks

through interbank markets and their supremacy on the payment systems also can be the origin of severe monetary disturbance and it can even start a banking panic. According to (Santos, 2001), banking sector has great deal of regulations to contend with in the whole world. Koch and Macdonald (2006) cited five reasons for bank regulation. These are

1. To make sure the security and security of banks and its products

2. To provide an proficient and reliable financial system

3. To provide financial strength

4. To maintain the integrity of nation's payment system

5. To protect consumers from abuses by credit granting institutions

(Saidenberg et al., 2003) identify the avoidance of systemic risk as the major motive for financial regulation. Banks are considered to be a root cause of systemic risk due to their involvement in certain activities e.g. their vital role in the payments system, allotment of financial resources etc. Moreover banks are highly leveraged due to deposits, and comparatively less liquid assets, typically loans to firms or households. (Sahajwala and Van Den Bergh, 2000) cited Innovation, deregulation and globalization as the main reason for complexity and riskiness of banking industry of the world.

Due to this banks are considered "special" and therefore special supervision is needed. In order to ensure safety in financial systems and structures, laws and regulations are applied which are abide by whole world. The financial supervision of banks has existed as long as the banking history, but most important and significant revolutions in the regulation of financial supervision were started in the 1970s. According to (Valencia and Laeven, 2008) the importance of financial supervision regulation grew with the increasing number of banking crises since the 1970s.

## 1.5 Overview of the Basel Accords

In order to understand and overcome challenges, banking supervisory authorities have developed new mechanisms and processes for monitoring and assessing banks on an ongoing basis. Until the 1970s there was no international consistency among banks operated in different countries. Individual countries were responsible for the regulation of banks operated within their borders. The failure of Herstatt Bank in Germany in 1974 underlined the major risks that go with international banking, and uncovered the requirement for sound international cooperation between nations to minimize future risks connected with international banking. In response to the Herstatt incident, the member nations of the G-10 (a group of countries with the ten largest economies in the world) established the Basel Committee on Bank Supervision (BCBS) in 1974. Its primary objective was to recommend rules for working of banking sector. The major objective of the Basel Accord was enhancement of security and soundness of the international banking organizations and to obtain "a high degree of consistency in its application to banks in different countries with a view to diminishing an existing source of competitive inequality among international banks". The committee came up with three recommendations known as Basel Accords i.e. known as Basel I in 1988, Basel II in 2004 and Basel III in 2010.

One of the major contributions of the first Basel Accord also known as Basel I was to arrive at common definition of bank capital. (Makwiramiti, 2009) described the recognition of the definition and minimum criteria for capital requirement for banks major triumph of this Accord. Basel I divided total capital in two parts: Core capital and Supplementary capital. Core capital also known as Tier I capital was used to measure the financial strength of a bank and consisted of equity, disclosed reserves and retained earnings whereas Supplementary capital was given name of Tier II capital consisted of subordinated debt and undisclosed reserves etc. Tier II capital was considered less reliable than the Tier I Capital. Basel I also assigned the weighted risks to different types of assets and classified four risk buckets for this purpose. They were

- 0% for Cash and central bank and OECD government bank debt

- 20% for development bank debt, OECD bank debt

- 50% for Uninsured residential mortgages

- 100% for private sector debt, non-OECD bank debt, real estate

It also assigned a standard ratio of capital to weighted risk assets. According to Basel accord I the banks of developed countries i.e.G10 countries were required to hold a least level of total capital to risk-weighted assets equal to 8%. At least 50% of the banks total capital base had to be of core capital. The Basel I accord initially focused on credit risk. Credit risk is the risk of loss due to a debtors failure to pay a loan. According to (Ong, 2007) in spite of providing steadiness to financial sector the Basel Accord had few substantial weaknesses that forced the Basel Committee to present a recommendation for a new and improved capital adequacy regulation framework in 1999.

The deficiencies of Basel I were

- "One size fit all" solution to risk managing (Ong, 2007).

- Insensitiveness to other types of risks (Hai et al., 2007)

- The deficiency in risk weightiness of different assets with actual banking risks. For example, a corporate loan to a small company with high leverage requires the same regulatory capital as a loan to an AAA-rated large corporate company–8% because they are both risk weighted at 100%.

- No encouragement for banks to increase risk managing procedures (Makwiramiti, 2009) .

- Lack of accounting for the new complicated financial products which are becoming more common in the present age (Makwiramiti, 2009).

The Problems faced in assignment of risk weightiness of different assets by the international banks and together with the developments in the financial world,

forced the Basel Committee to present a recommendation for a new and improved capital adequacy regulation framework in 1999. Basel II retained the definition of capital and hold total capital to risk-weighted assets equal to 8%, however made some adjustment in calculation of capital. The other main features of Basel II were

- Three pillars

- Pillar 1 called the minimum capital requirements and covered the definition and calculation of bank capital and quantified the risks which capital must cover.

- Pillar 2 was given the name Supervisory Review Process. This entailed the banks to maintain their own inner systems to review their overall capital adequacy with respect to their risk portfolio. The purpose of Pillar 2 was to develop and use superior risk management techniques to look after and manage risks.

- Pillar 3 was called Market Discipline and intended to encourage banks to reveal information on their risk exposures, capital ratios and risk management. Pillar 3 focused on the transparency requirements for banks. Banks were required to reveal their inner and procedural processes and rules regarding risks, risk exposures, risk assessment capital adequacy and bank capital resources. The sharing of information to investors, depositors, customers and analysts etc. allowed them to assess the bank position and act accordingly.

- Inclusion of other risks e.g. operational and market risk.

- Increase of risk weighted buckets to five and adjustment of their treatment.

- More rely on internal risk assessment by banks to calculate of bank capital

- Encouragement of the banks with sound risk managing systems in the form of capital

The life of Basel II Accord was very short as compare to Basel Accord I as it was unable to meet the expectations of the regulators and participating banks

with respect to its working and results. Moreover, since it was introduced in the cultivating season of financial crisis, so according to (Daniela and Raluca-Dorina, 2009) and (Ali Shah, 2011), it had to be amended for the following reasons.

- Implementation of Basel II brings the large amount of costs regarding staff training and installation of information technology for less developing countries banks.

- It does discriminate between banks on the basis of size. The big banks are in better position to take advantage of it.

- It does punish banks and organization with low rating in the form of less loans

- Discrepancy exists regarding the significance and worth of capital in case of modest and compound trading book exposures

- Leverage is paid less attention in Basel II.

- It does not address the tricky aspect of overall impact the banks on the financial system

- It does not talk about the issue of systemic risks of the financial institution that occur due to interbank and common exposures

So, all these weaknesses in Basel II paved the way for the third accord called Basel III. Basel III started implementing in 2010.

According to the BCBS, the Basel III proposals have two main objectives:

- To strengthen international capital and liquidity principles with the objective of promoting a more strong banking sector; and

- To enhance the banking sectors capability to absorb shocks arising from financial and economic stress.

The changes in Basel III according to (Kubat et al., 2014) are as follows:

- Increase in capital to risk-weighted assets from to 8% to 10.5%

- Changes in calculation of capital. Some components of Basel II removed and new parts added

- Reduction in limit of bank leverage to 3%. Bank total assets cannot be more than 33 times of its capital.

- Special attention is paid to liquidity regulations by means of Liquidity Coverage Ratio and Net Stable Funding Ratio

- Risk coverage is given due attention by focusing on counterparty credit risk.

So from the above discussion it is quite clear that the major focus of all three Basel guidelines is on the regulation of bank capital as it facilitates the buffer against losses and bank failure.

## 1.6 Overview of the Banking Sector of Pakistan

According to state bank of Pakistan, the banking system covers more than 85% share of the total financial sector, while the share of non-bank financial institutions is roughly 15 percent. Moreover, banking sector in Pakistan comprises of commercial banks, microfinance banks and development finance institutions, while non-bank financial institutions include leasing companies, mudarabas, and insurance companies, investment banks, housing finance companies, venture capital companies and mutual funds. In 1947, territory where today Pakistan is situated only produced agricultural products and raw material was exported from these areas to industries which are situated in those areas which are part of India. Practically there was no industry in the Muslim majority areas. Since the announcement of independence plan June 1947, banks having their head offices in Pakistani areas moved to India. That resulted in reduction in number of banks (Siddiqi, 1998). At the time of independence due to lack of resources and trained staff it was advised that Reserve bank of India should serve Pakistan in monetary matters like

issuance of coins and currency etc. till 30<sup>th</sup> September 1948. Afterwards this date was amended to 30<sup>th</sup> June 1948.

### 1.6.1 Establishment of Commercial Banking System (1947-1973)

State Bank of Pakistan was established on 1<sup>st</sup> July 1948 because Imperial bank which was agent of Reserve Bank of India started closing its branches from Pakistan and Indian government did not pay Rs.750 Million to Pakistan which was his portion of cash balance in Reserve Bank of India. Government of Pakistan promulgated banking companys ordinance 1947 and banking companys act 1949 to cope the challenges. There were two Muslims banks at the time of partition i.e. Habib Bank Limited and Australasia Bank. SBP supported HBL for enhancing its network and also established National Bank of Pakistan in 1949 which took agency function from Imperial Bank of India in 1952. With the help of government of Pakistan and under the fostering care of the State Bank of Pakistan, development of the new institution in Pakistan saw a rapid growth. SBP established Industrial Development Finance Corporation and Agriculture development bank. Proper economic planning phase started in 1956. A new bank United Bank Limited was established in 1959. Separation of East Pakistan in 1971 had also effect on progress of banking sector. (Siddiqi, 1998) stated that up to 31<sup>st</sup> December 1973, there were 14 scheduled Pakistani banks having 3323 branches in Pakistan and 74 branches in foreign countries.

### 1.6.2 Nationalization of Banks (1974-1978)

In 1974 government decided to take control of everything in its custody from private sector and banks were no exception to it. In the light of Banks Nationalization Act 1974, all the banks were nationalized by the Govt. The ownership, management and control of these banks were taken from private sector and shifted to Federal Government. There were 14 Pakistani commercial existed at the time of Nationalization on December 31, 1973. As a result of this nationalization small

bank were merged and 5 major banks came into existence i.e. National Bank of Pakistan, Habib Bank Limited, United Bank Limited, Muslim Commercial Bank Limited and Allied bank Limited. According to (Abidi et al., 2014) nationalization process resulted in deterioration of the performance of these banks due to provision of substandard financial products and services. Moreover it also gave the private investors and foreign financial institutions a negative message.

### 1.6.3 Initiatives for Islamization of the Banking Sector (1979-1992)

The breeding seeds of this revolutionary concept of Islamic banking were sown in late 1940s & by 1960s & 1970s it started taking a meaningful shape. Traces of first Islamic bank are found in the area of Mit Ghamr in Egypt in 1963 when first interest free Islamic bank was formed & from that point onwards it has not looked back. The whole decade of 1970 saw the emergence of so many Islamic banks namely Nasser Social Bank Cairo (1972), Dubai Islamic Bank (1975), Kuwait Finance House (1977), Dar Al-Maal Al-Islamic (1980). The Govt. of Pakistan has employed a number of initiatives during 1979-1992 to introduce Islamic banking. In Pakistan during the period of 1981, concept of interest free Islamic banking was introduced. National Investment Trust (NIT), Investment Corporation of Pakistan (ICP) and House Building Finance Corporation (HBFC) abolished interest from its dealings. Other steps in this regards include establishment of Mudarbaha companies, launching of Participatory Term Certificates (PTC) and issuance of Zakat ordinance in 1980. Moreover, nationalized banks were bound to have interest-free counters for their customers in 1981. In 1983 usher ordinance was implemented along with amendment of came into force in 1983 throughout the Pakistan. 1984 saw the amendment in the Banking and Financial Services Ordinance by incorporating non-interest based systems.

## 1.6.4  Privatization Process of Banking (1992-2000)

Two decades after the nationalization of banks, it was realized that nationalization is not producing its objective. In fact it turned out that its results were stark contrast to the objectives of nationalization. According to (Husain et al., 2011) banks along with other public enterprises in Pakistan became a drain on the countrys funds due to overstaffing and non-problem loans. So the Nationalization scheme was reversed in January 1991. The first step in this regard was the formation of Privatization Commission (PC) on January 22, 1991. Though Privatization Commission was meant for industry initially, however by 1993 banks were included in privatization process. Banks were privatized in two phases. In the first phase (1992-96) banks were partially privatized and during the second phase (1997-2000), resulted in the total denationalization of the banking sector.

## 1.6.5  Implementation of Basel Regulation (1997-2013)

In order to align itself with international community the State Bank of Pakistan (SBP) has taken several steps for the implementation of Basel Accords. It has issued road maps and various directives to all banks regarding the implementation of Basel regulations in Pakistan banking sector. Moreover keeping in mind the ground realities and problems faced by the banks, SBP has revised its deadlines so that banks can implement Basel regulations accordingly. SBP issued BSD Circular No. 36 of November 4, 1997 to implement 2005 Basel I. While Basel II was implemented in 2008 vide BSD Circular # 8 of June 27, 2006. The implementation of Basel III started from December 31, 2013 through BSD Circular # 6 of August 15, 2013. In line with different directives stated above Pakistan started implementing Basel Accord I recommendation from Dec 1997. The implementation of the Basel II started in Pakistan 2008 and Basel III was implemented form December 2013.

## 1.6.6  Inception of Islamic Banking Practices (2002)

The Shariat Appellate Bench (SAB) of the Supreme Court of Pakistan instructed the government of Pakistan to bring its financial system in line with Shariah by

making necessary changes in current financial structure. To conform the decision of SAB, in December 2001 State Bank of Pakistan took several steps. One of this was issuance of comprehensive criteria for the establishing of full-fledged private Islamic commercial banks. Meezan Bank Limited (MBL) became the first Islamic commercial bank after the issuance of full-fledged Islamic bank license from SBP in January 2002. Different task forces were set up to eradicated interest from Government financial transactions and to change the legal frame work to Islamic principles. In January, 2003 the State Bank provided detail guidelines for setting up subsidiaries and stand-alone Islamic banking branches by existing commercial banks.

## 1.7 Pakistan Financial Sector Reforms

Pakistan started its financial sector reforms in 1990s to inculcate competition within the financial institutions and increase their monitoring and supervision. The purpose of these reforms was to increase the competitiveness and transparency of the financial sector by privatizing previously nationalized commercial banks, liberalizing interest rates and credit ceilings, strengthening the supervisory capacity of the central bank and standardized accounting and auditing systems. (Khan and Khan, 2007) divided the restructuring in the financial sector in three phases. According to them first Phase was from 1988 to 1996. The objective of these reforms was to create efficient, productive, and enabling atmosphere. Some initiatives in this regard are liberalization of the entry process for private and foreign banks. This was done to increase efficiency and competition in the financial sector. Partly privatization of banks also comes under these set of reforms. Branch and employee downsizing of major state-owned commercial banks and DFIs were also carried out under these reforms. One of the major developments during this phase was abolishment of Credit Deposit Ratio (CDR) and usage of open market operations as an instrument of monetary policy. Another milestone was achieved by making State Bank of Pakistan was fully autonomous. SBP was made autonomous in February 1994 by making amendments in the State Bank of Pakistan Act, 1956.

According to (Khan and Khan, 2007), financial sector was about to collapse due to increase in Non-Performing Loans (NPLs). Political interference, failure of governance, lack of financial discipline and ineffective judicial system had converted one-third of banking assets to Non-Performing Loans. All these problems were calling for further reforms. So the second phase of financial sector reforms was from 1997 to 2001. The first step of these reforms was the restructuring of cost structure of banks by virtue of capital. Banks were directed to maintain minimum capital. Secondly, partially privatized commercial banks were fully privatized completely. Another important step taken was banks branches made fully liberalized which permitted private banks to grow faster and increase their market share. Fourthly, loan collateral foreclosure was facilitated and strengthened to reduce default costs and to expand lending to lower tier markets, including consumer banking. Fifthly, national savings schemes were reformed so as to integrate with the financial market. Sixthly, the mandatory placement of foreign currency deposits was withdrawn. Lastly, the SBP was strengthened to play a more effective role as regulator and guardian of the banking sector and phase out the direct and concessional credit programs to promote market integration.

During the third Phase of financial sector reforms from 2002 to 2004, the focus was on consolidation. SBP started the consolidation process of the banking sector by increasing the minimum capital requirement for banks. Banks were encouraged to make independent subsidiaries to work as mutual funds, asset management companies, venture capital, foreign exchange companies, etc. Furthermore, banks were encouraged to increase their loaning to middle and lower income groups. Special focus was given to Automation and Prudential Regulations. Banking audit, monitoring and corporate governance is given due weightage and is taken great care of.

## 1.8 Research Problem

According to (Barth et al., 2006), a well-organized banking system is categorized by its regulatory practices, its risk taking and its governance mechanism. It endorses financial performance and economic stability. The banking sector in Pakistan has witnessed a remarkable growth. According to State Bank of Pakistan (2017) banking industry has grown from a very few branches in 1947 to total of 14,193 branches of 30 local and 4 foreign banks throughout the country at the end of Mar 2017. Moreover during last two decades banking is one of the most profitable industries in Pakistan. Incidentally this period of profitability and growth of banking coincides with the autonomy of State Bank of Pakistan and implementation of Basel regulations in Pakistan. The purpose of this study is to examine the link between Basel Accord capital regulations and Pakistani bank behavior in terms of efficiency and risk taking.

## 1.9 Research Question

The specific research questions of the study are:

1. What is the effect of capital regulations on the risk taking of commercial banks listed on Pakistan Stock Exchange (PSX) in Pakistan?

   (a) Do Basel I and Basel II capital regulations have similar impact on the risk taking of commercial banks of Pakistan?

   (b) Do capital regulations have same effect on the risk taking of commercial banks of Pakistan during different political regimes?

   (c) Do capital regulations have similar impact on the risk taking of commercial banks of Pakistan in big and small banks?

   (d) Do high and low capital have same effect on the risk taking of commercial banks of Pakistan?

   (e) Does capital has same effect on the risk taking of commercial banks of Pakistan in high and low inflation period?

(f) Do capital regulations have similar impact on the risk taking of convetional of and Islamic banks of Pakistan?

(g) What is the effect of capital on the risk taking of commercial banks of Pakistan during financial crisis 2008?

(h) What is the effect of market discipline on the risk taking of commercial banks of Pakistan?

2. What is the effect of capital regulations on the efficiency of commercial banks listed on Pakistan Stock Exchange (PSX) in Pakistan?

(a) What is the effect of Basel I and Basel II capital regulations on the efficiency of commercial banks of Pakistan?

(b) What is the effect of capital regulations on the efficiency of commercial banks of Pakistan in big and small banks?

(c) What is the effect of high and low capital on the efficiency of commercial banks of Pakistan?

(d) What is the effect of capital on the efficiency of commercial banks of Pakistan in high and low inflation period?

(e) What is the effect of capital on the efficiency of commercial banks of Pakistan in different banking systems?

(f) What is the effect of market discipline on the efficiency of commercial banks of Pakistan?

3. What is the effect of different factors on the capital of commercial banks listed on Pakistan Stock Exchange (PSX) in Pakistan?

(a) What is the effect of various factors on the capital of commercial banks in different banking systems?

(b) What is the effect of different factors on the capital of commercial banks before and after financial crisis 2008?

## 1.10    Research Objectives

Specific objectives of the study are

1. To study the impact of capital regulations on the risk taking of commercial banks listed on Pakistan Stock Exchange (PSX) in Pakistan.

   (a) To provide insight on the Basel I and Basel II capital regulations on the risk taking of Pakistani commercial banks.

   (b) To explore the effect of capital regulations on the risk taking of Pakistani commercial banks during different political regimes.

   (c) To investigate the impact of capital regulations on the risk taking of big and small Pakistani commercial banks.

   (d) To examine the impact of high and low capital on the risk taking of Pakistani commercial banks.

   (e) To explore the impact of capital on the risk taking of Pakistani commercial banks in high and low inflation period.

   (f) To differentiate the effect of capital regulations on the risk taking of Pakistani commercial banks in Islamic and conventional banking systems.

   (g) To study the effect of capital on the risk taking of Pakistani commercial banks during financial crisis 2008.

   (h) To elaborate the effect of market discipline on the risk taking of Pakistani commercial banks.

2. To investigate the impact of capital regulations on the efficiency of commercial banks listed on Pakistan Stock Exchange (PSX) in Pakistan.

   (a) To quantify the Basel I and Basel II capital regulations on the efficiency of Pakistani commercial banks.

   (b) To explore the effect of capital regulations on the efficiency in big and small Pakistani commercial banks.

    (c) To differentiate the effect of high and low capital on the efficiency of Pakistani commercial banks.

    (d) To distinguish the effect of capital on the efficiency during high and low inflation period.

    (e) To elaborate the effect of capital on the efficiency of Pakistani commercial banks in different banking systems.

    (f) To explore the effect of market discipline on the efficiency of Pakistani commercial banks.

3. To explore the determinants of the capital adequacy ratios of commercial banks listed on Pakistan Stock Exchange (PSX) in Pakistan.

    (a) To study the effect of different factors on the capital of commercial banks in different banking systems.

    (b) To differentiate the effect of different factors on the capital of commercial banks before and after financial crisis 2008.

One of the major theories related to the study is the Agency Theory. The agency problem exists in banking sector as well because bank customers and investors (principle) have less information than the bank management (agent). There exist two types of agency problems in case of banks. The first according to (Berle and Means, 1991) the source of Agency Theory is based on the division of ownership and control. The work of (Jensen and Meckling, 1976) is considered to be pioneer in this regard and they defined it as "a contract under which one or more persons (principal) engage another person (agent) to perform some service on their behalf which involves delegating some decision making authority to the agent. If both parties to the relationships are in the process of utility maximizing, there is a good reason to believe that the agent will not always act in the best interests of the principal". The work of (Fama, 1980) is also notable in this regard and according to him agency problem offers the justification for presence of corporate governance. This is based on the idea that governance mechanisms and regulations are necessary to bring into line the interests of principals and agents. Second exists

in the form of moral hazard problem. Since deposits insurance schemes exists in majority of countries and by virtue of deposit insurance government safeguards depositors from the consequences of bank risk taking, their motivation to monitor and restrain risk taking is weak.

Another theory linked to this research is theory of regulation. As has been stated before despite the importance of banking regulations, conflicting views exist on the impact of bank regulation and monitoring. According to (Barth et al., 2006) advocates of the public interest view state that for the sake of safety of the common man government plays its role by regulating banks to encourage efficient banking practices to alleviate market malfunctions. The main rational of this theory is to protect common man from the malpractices and misconduct in the market place i.e. imperfect competition, monopolies and unbalanced market operations etc. According to (Moran, 1986) agency problem caused by the behavior of market players to achieve objectives at the expense of free shareholders and the public interest is root cause of this. The hidden logic of this public interest theory was that regulation is necessary to make businesses or organizations work in the interest of common man. (Baldwin et al., 2012) described the regulations under public interest view as the helping hand of common man against self-interest groups of individuals or firms. To achieve its aim of protecting public, regulators try to give all the information needed for decision making. According to (Barth et al., 2001) official supervision of banks, limits on bank activities, restrictions on bank entry and deposit insurance mechanisms all come under the umbrella of public interest view. Imposition of capital- based regulations also fall in this area. The protection of depositors money is the reason cited for regulator intervention through capital-based regulations in the banking sector. While the private interest view supports that rules are enforced to accommodate selected personnel, instead of the public. The work of (Stigler, 1971) is considered to be pioneer in this regard. He further states that regulated industries pressurize the regulator to change laws to protect their interests. In his words "as a rule, regulation is acquired by the industry and is designed and operated primarily for its benefits". Though public

interest view stresses the role of government to correct market failures, the private interest view cites the aspiration of politicians and government regulators to increase their own benefit for market failures. This theory also states that due to its discretionary power, regulators have the ability to shape banking guidelines, where private interest of groups will dictate the public interest.

## 1.11    Significance of Study

According to (De Guevara et al., 2007), there is abundance of literature available on Europe and U.S.; however there is not much literature available that examines the relationship of Basel Accord with efficiency and risk taking of Asian countries and Pakistan is no exception to this. In the last two decades Pakistan banking sector has witnessed radical and extensive reforms including implementation of Basel accord capital regulations. Moreover banking industry happened to be the one of the most profitable industries during this time. Besides, Pakistan has witnessed major political and economic events during the time period of study. Imposition of Martial Law, restoration of democracy and financial crisis of 2008 can be cited in this regard. So there is a need for an in-depth and comprehensive study to be carried out in Pakistani banking sector to check the effectiveness of capital regulations.

According to researcher's knowledge, research work conducted on the impact of Basel regulation on the bank risk and bank efficiency specifically focusing Pakistani banking industry is very limited. The study focuses on the area of financial intermediary regulation, which is relatively overlooked in Pakistan. There is a gap in the literature that examines the relationship of Basel Accord, efficiency and risk taking of Pakistani banks with respect to theoretical and policy implication.

It is one of the few studies which examine the empirical relationship between efficiency, risk and capital in Pakistani banking sector only. This study makes its contributions in several ways. First this study attempts to fill the gaps in literature by providing empirical evidences solely on the impact of Basel capital regulations on Pakistani banking sector. The second contribution of the study is

that it explains the impact of capital regulations on the various proxies of bank risk and efficiency. Third, this study includes the banking data from 1998 to 2015; this time period includes the latest round of Basel banking reform in Pakistan i.e. Basel III. The findings of this study are beneficial for State Bank of Pakistan and banks to assess the consequences of implementation of Basel regulations in terms of risk reduction and efficiency enhancement. The results of this study are significant as they facilitate State Bank of Pakistan to assess whether banks in Pakistan are following Basel regulation in its true Letter and Spirit, It will help the SBP in formulating and enforcing suitable policies and strategies regarding risk management and improvement of the efficiency of Pakistani banks for the betterment of the banking industry in particular and stability of financial system in general.

## 1.12   Limitation of Study

This research has the following limitations:

Although this study has used the data from 1998 to 2015, however, to quantify the effect of capital regulation, Basel I & II only have been used. The effect of Basel III capital regulation was excluded due to less no. of observation for Basel III.

This study has covered only listed commercial banks of Pakistan. Other types of banks i.e. specialized and foreign etc are excluded from this study.

This research has used accounting based proxies of variables of interest. This is especially true in case of calculation of bank efficiency. Literature also reports the use of parametric i.e. Data Envelopment Analysis (DEA) and non-parametric i.e. Stochastic Frontier Analysis (SFA) techniques for the calculation of bank efficiency. Moreover in case of bank risk and bank efficiency only two and in case of bank capital only one proxy is used for the analysis of results.

The study employs System Generalized Method of Moments (GMM) for the majority of its analysis However where there are less no of observation and GMM is

not applicable, Seemingly Unrelated Regression (SUR) approach is being used to obtain results.

## 1.13 Scheme of the Study

The dissertation is organized as follows:

Chapter two provides ample empirical literature with reference to Impact of bank capital on bank risk and bank efficiency, interrelationship of bank capital and bank risk and determinants of bank capital. Chapter three describes the data and methodology being used to arrive at the results section in chapter four. Chapter four also provides results and discussions of various aspects of relationship among bank capital, risk and efficiency along with citation to previous researches.

# Chapter 2

# Literature Review

## 2.1 Impact of Bank Capital on Bank Risk

Theory presents mixed agreement on effect of capital on risk. One school of thought advocates the positive connection of capital and risk by supporting the notion of regulatory hypothesis. This hypothesis states that regulators persuade banks to raise their capital substantially with the level of risk they acquire to counter the risk of default. However another school of researchers questioned the notion of forcing banks to maintain levels of capital. They supported the moral hazard hypothesis, that banks have advantages to make use of presented flat deposit insurance schemes, which reflect a negative relationship among two. There is another group of researchers who are of the view that bank hold above required capital ratio also called capital buffer and capital regulations do not affect risk taking behavior of the banks. They argue that banks are not forced by the capital requirements and they have their own chosen capital ratios and risk taken behavior.

Pioneer work on capital structure and risk was done by (Pettway, 1976). He explored the relationship on American banks and their holding firms during 1971 to 1974. He used equity-to-total-assets as proxy of capital and risk was captured by calculating beta of banks common share. By applying ordinary least square method, he found a favorable relationship between risk and capital. He supported

the notion of regulatory hypothesis, which also depicts a positive relationship between risk and capital.

(Jahankhani et al., 1979) explored the impact of certain financial policies on the risk of 95 bank and bank holding companies for five years from 1972 to 1976. They noted that along with other variables equity-to-total asset has negative impact on the systematic and total risks of the banks. Thus their findings supported the moral hazard theory, which also advocate a negative association between two.

(Koehn and Santomero, 1980) theoretically examined the effect of the permissible increase in regulatory capital ratio on portfolio risk. They specifically focused on portfolio allocation of the firm. They shed doubts on reduction of the risk taken by means of increase in capital ratio and argued in favor of high risk taking by the firms with the introduction of regulatory capital requirements. They claimed that an increase in capital requirements can provide the incentive of extra risk taking to a utility-maximizing bank.

(Brewer III and Lee, 1986) looked at the impact capital asset ratio on the market, industry and interest rate risks of 44 American bank holding companies from 1978 to 1984. By using panel data estimation techniques, they reported that capital is negatively related to the risks of the companies in their sample.

(Furlong and Keeley, 1989) theoretically examined the impact of strict capital regulation on portfolio risk of banks in USA. They found an unfavorable relationship among capital and risk. They were of the opinion that increase in capital reduces the incentive for banks to take more risk.

(Shrieves and Dahl, 1992) investigated the relationship of changes in risk and capital on 1,800 US bank holding companies. They used simultaneous equation model to calculate the result of changes in risk upon changes in capital and vice versa. The book value of ratio of equity capital to asset was used to measure capital, while asset portfolio risk was used for risk. They stated that risk exposures and capital levels are simultaneously determined and they reported positive relationship between risk and capital.

(Blum, 1999), by using a dynamic framework theoretically found that capital regulations might have increased the risk taking by the banks. He observed that banks find it very costly to meet additional capital requirements by means of raising new capital so they will increase the riskiness of their activities. He cited the main reason to move to new risk levels the lack of profits of the banks.

(Rime, 2001) examined the adjustment in risk and capital levels in Swiss banks. By applying the modified simultaneous equation model framework of (Shrieves and Dahl, 1992), he analyzed the relationship between risk and capital in Swiss banks during 1989 to 1995. He reported a significant positive impact of regulatory pressure on the capital of the banks; however its impact on the risk is insignificant. The banks in his sample increased their capital ratios to avoid the penalties for not maintaining required capital regulations.

(Konishi and Yasuda, 2004) examined the determinants of risk taking in 48 Japanese regional banks. By employing panel data technique and using various proxies of banks risk they reported their findings. They observed mixed impact of capital regulations on different proxies of risk. However overall they concluded that implementation of capital requirement reduced the risk taking by the banks. So they favored the notion of regulatory capital to curb the risk taking behavior of banks. They also reported that with an increase in bank risk franchise value of banks decreased.

(Hassan and Hussain, 2006) analyzed the effect of capital regulation on credit risks of banks in eleven developing countries for five years from 2000 to 2004. By using single equation and simultaneous model they arrived at the results. Both techniques concluded that that capital ratios and portfolio risk were inversely related. They also reported a negative relationship between credit risk and financial development. They concluded that countries with less developed financial systems, did not achieve the desired results.

(Altunbas et al., 2007) used a static simultaneous equation framework to explore the relationship between capital, risk and efficiency for a sample of European banks over the period 1992-2000. They used Zellners (1962) Seemingly Unrelated

Regression (SUR) approach for their estimation. They reported a positive relationship between risk and level of capital. They concluded in favor of regulatory hypothesis. They also stated that strength of corporate sector is playing a positive role in decreasing the capital ratios and risk taking behavior of the banks in their sample.

(Iannotta et al., 2007) explored the impact of ownership structure and different bank level variables on the risk and performance of 181 European big banks from 1999 to 2004. After applying panel data regression they reported that bank capital measured by Book Value of Equity to Total Assets has a positive impact on the risks taken by the banks.

(Agusman et al., 2008) examined the relationship between accounting and capital market risk measures. They performed their research on 46 listed Asian banks from 1998 to 2003. They reported mixed findings on the basis of their research. They results showed that that ratio of book-value-equity-to-total-assets has negative impact on the some proxies of risk, while it has positive impact on some proxies of risk.

(Van Roy et al., 2008) investigated the capital and their risk-weighted assets adjustment of six G-10 countries after the introduction of Basel 1 accord. He investigated the adjustment process of 576 G-10 commercial banks for the period from 1988 to 1995. They reported that in US low capitalized banks increased their capital ratios as compared to their well-capitalized counter parts. However this phenomenon was not evident in other G-10 countries. With respect to risk taking behavior is concerned, here there was no difference of weakly capitalized banks to well-capitalized banks in his sample. He concluded the effectiveness of Basel I in US banks, while its effect outside USA was rather limited.

(Zhang et al., 2008) investigated the effect of capital requirements on risk-taking behavior of Chinese commercial banks. They used dynamic GMM estimator to arrive at their results. They reported that changes in capital had a negative effect on the changes in risk. This showed that capital regulations had decreased the risks taken by the banks. So their findings supported the notion of moral hazard

hypothesis. They concluded that capital regulations have decreased the risks taken by the banks so they are useful in reducing the risks of the banks in their sample.

(Boudriga et al., 2009) analyzed the effect of regulatory capital on credit risk and determinants of non-performing loans of the banks of 59 countries over the period 2002-2006. They used panel data regression on macroeconomic variables. They results showed that higher capital adequacy ratio reduced the credit risks of the banks in their sample. However they recommended that instead of solely concentrating on supervising, governments should be amending legal system, enhancing transparency and stabilizing institutions through democracy.

(Shim, 2010) examined the effect of capital regulation on the risk of the US property liability insurance industry. He applied the three-stage least squares (3SLS) procedure of simultaneous equations model. His major finding was that less capitalized insurers increased capital to overcome regulatory costs and took more risks. Their study reported a positive connection of capital and risk.

(Awdeh et al., 2011) looked at the impact of capital requirements on bank risk-taking at Lebanese banks. They explored the simultaneous effect of capital and risk on a set of 41 commercial banks between 1996 and 2008. They concluded that profitability had a positive and significant impact on both capital and risk of the banks in their sample. They argued that use of use of retained earnings to increase capital rather than issue new equity. Size of the banks found to be negatively affecting both risk and capital of the banks. The superior ability of the big banks to manage risks can be reason cited for this negative relationship with risk taking. They argued the too-big-to-fail notion for big banks to hold less capital. They also noted that higher capital requirements are associated with increase in risk.

(Jokipii and Milne, 2011) explored the relationship between short-term capital buffer and portfolio risk adjustments of US bank holding companies and banks for the period from 1986 to 2008. By employing single and simultaneous equation, they obtained consistent results. According to their results the relation between these two variables is two way. They were of the view that banks would alter (increase or decrease) their capital levels with amount of risk taken respectively to

avoid costs associated with breach of regulatory requirement. Thus they reported positive impact of capital on risk and vice versa.

(Lee and Hsieh, 2013) analyzed the impact of capital on risk in 42 Asian countries. They applied the Generalized Method of Moments technique over the period of 1994 to 2008. They portrayed a mix picture of the two variables. Their results showed inverse relationship between capital and risk for banks in Far East & Central Asia in the sample, while data of high-income countries had the positive impact of capital on risk.

(Tan and Floros, 2013) assessed the relationship between the bank risk and capital of 101 Chinese commercial banks. They applied three stage least square estimation and time period of their research was from 2003 to 2009. They employed different proxies for risk (volatility of ROE, Z score etc.) and book value of capital to total assets for capital. They found a negative relationship between risk and capitalization.

(Ayaydin and Karakaya, 2014) looked at the impact of capital on the risk taking of the 23 Turkish commercial banks for the period 2003 to 2011. They reported mixed results on the basis of their research. They reported that Equity to total asset has negative impact on the one proxy of risk variance of ROE and it has significant positive effect on another proxy of risk. So they are supporting regulatory hypothesis for one variable and moral hazard hypothesis for another variable. They also found some other determinants of risk taken by the banks. They were of the view that instead of focusing on only one variable, regulators should try to assess the riskiness of bank activities by different methods and proxies and formulate policies accordingly.

(Haq et al., 2014) investigated the effect of capital on risk for 218 listed banks across 15 Asia-Pacific countries. They performed their research on 15 years' time span (1996-2010) using Generalized Method of Moments technique. By using different proxies of risk i.e. systematic risk and Z score and tier 1 for capital, they observed a positive association of bank capital with bank risk. Thus they took the line of regulatory hypothesis.

(Osei-Assibey and Asenso, 2015) examined the impact of regulatory capital on the non-performing loans of the commercial banks of Ghana from 2002-2012. They used system GMM approach in their research. They used the ratio of difference of the minimum capital required and a banks listed capital and ratio of non-performing loans to gross loans to measure bank capital and risk correspondingly. Their results showed that banks with high capital ratios tend to have high non-performing loan ratios.

(Miah and Sharmeen, 2015) looked at the relationship between capital and risk-taking behavior of Bangladeshi banks. The sample of the study consists of both Islamic and conventional banks of Bangladesh while time period of their study was from 2001 to 2011. By making use of Seemingly Unrelated Regression (SUR) approach, they reported that capital and risk are endogenous. They noted a positive association between capital and risk for Islamic banks thus supporting regulatory hypothesis, while with regards to conventional banks in their study, there existed an insignificant relationship between capital and risk.

(Rahman et al., 2015) examined the relationship between bank regulatory capital ratios and bank risk-taking. Their sample consisted of 30 commercial banks of Bangladesh, while time period of their study was from 2008 to 2012. They choose non-performing loans to gross total loans ratio and equity to total assets ratio to capture the effects of risk and capital respectively. They noted by increasing bank capital risk decreases. So they reported observed a negative relationship between risk and capital by using GMM method. They concluded that capital regulations are successful in their objective of reducing the risks of the banks in their study.

(Ashraf et al., 2016) studied the effect of capital regulations on the risk taking behavior of commercial banks of Pakistan from 2005-2012. By applying least squares dummy variable (LSDVC) and system GMM method on the various proxies of risk and capital, they reported that capital regulations have decreased the risk taken by the banks. In other words there exists a negative impact of capital requirements on the risk taken by the banks. They are in agreement with the notion of forcing banks to higher capital requirements as it forces them take less risks.

However they cite the lack of regulatory arbitrage opportunities in reducing the asset portfolio risks.

(Dushku, 2016) analyzed the determinants of loan loss provision for Albanian banks. He used quarterly data of 15 Albanian banks over the period 2010-2014. By employing generalized method of moments (GMM), he observed an insignificant impact of capital to asset ratio on loan loss provision thus defying the capital management hypothesis.

(Maraghni, 2016) looked at the simultaneous impact of changes in capital ratio at risk taking incentive for Tunisian banks. He did his research on 10 Tunisian banks during by adopting Shrieves and Dahl (1992) model during 1990 to 2012. He observed a negative impact of change of capital level on the risk taking by the banks, while there did not exist any impact of the change of risk on the change in capital. He noted that 1% increase in risk level forces the banks to reduce its capital ratio by 19% approximately thus defying the expectations of regulators.

(Abdul Wahab et al., 2017) investigated the relationship between levels of risky assets in the mixed banking system of Malaysia. They performed their research on 83 Malaysian banks during 2006-2013. They used dynamic OLS for their estimation. They observed that relationship between risk and capital is unidirectional and there exists a positive impact of capital on risk taking behavior of the banks in their study. They concluded on the basis of their findings that high capital allows additional incentive to take high risks as they are sure that extra capital buffer will safeguard them against any undesirable event. Behavior of Islamic banks in their study with respect to risk is identical to conventional i.e. positive.

(Basher et al., 2017) studied the association between bank capital and risk among 22 Islamic banks over a seven year period from 2007 to 2013. By using parametric and Bayesian utilizing techniques of the Kessler and Munkin (2015) and modeling frame works of Jacques and Nigro (1997), they performed their estimation. They reported a positive relationship between total capital and asset risks in their sample. They stated that to abide by the capital regulations requirements is not a big deal for Islamic banks; they should focus on the liquidity risk as it poses a significant threat to Islamic banks workings.

## 2.2 Impact of Bank Capital on Bank Efficiency

Literature presents mixed argument on effect of regulatory capital on banking performance. Despite a lot of empirical research there is no consensus on the relationship between the two. One school of thought advocates the negative impact of strict capital requirement on bank profitability and efficiency (Repullo and Suarez, 2008). However another school of researchers are of the view that severe capital requirement has a positive impact on cost efficiency(Pasiouras et al., 2009) and (Barth et al., 2004).

The pioneer work in the avenues of performance is of (Ho and Saunders, 1981). They presented a theoretical framework for determinants of performance in their dealership model. By treating a bank as a dealer between lenders and borrowers, and which is ready to offer liquidity to depositors, their results indicated that optimal performance depends upon risk aversion of the bank.

(Mester, 1996) investigated the efficiency of the banks operated in Third District region in USA. The time period chosen for his study was from 1991 to 1992. The proxy of bank capital i.e. capital asset ratio has negative impact on the inefficiency of the banks in his study. The negative sign is a symbol of high risk preventing moral hazard. Or high inefficiency leads to low profits, and this profit did not allow banks to have high capital ratios.

(Bhattacharyya et al., 1997) explored the effect of liberalization on the productive efficiency of the Indian Banks. Their sample consisted of 70 commercial banks while they performed their research during 1986 to 1991. Data Envelopment Analysis (DAE) was used to calculate technical efficiency. They reported mixed results on the basis of their estimation. Capital adequacy ratio had insignificant affect in case of public sector banks, while it had a negative effect on the performance of foreign and private Indian banks. They also reported that banks having high capital ratios are less efficient.

(Jackson and Fethi, 2000) investigated the effect of different factors on the technical efficiency of 48 Turkish banks for 1998. They calculated efficiency by using non-parametric Data Envelopment Analysis (DEA) technique, while capital adequacy

ratio was used to capture the effect of banking capital regulations. Tobit regression was used to arrive at the results. They found that a negative impact of capital adequacy on the efficiency in their research. In other words capital adequacy has decreased the performance of the banks in the sample. They also concluded that Turkish banks were risk averse.

(Mukherjee et al., 2001) explored the factors affecting improvement in efficiency of the 201 large US commercial banks during post-deregulation period from1984 to 1990. By measuring efficiency changes through DEA Malmquist Index and dividing changes in efficiency into technical changes, technical efficiency changes, and scale efficiencies, they reported their findings. According to them average productivity rose by 4.5% during this time period. Their findings indicated that there was negative impact of equity to asset ratio with efficiency. They also highlighted a positive effect of size and product diversification on the efficiency of the banks in their sample.

(Barth et al., 2004) explored the impact of bank regulation and supervision on the efficiency of the banks in 107 countries. This is one of the first studies that checked the impact of Basel II regulatory framework on the banks. They used self-developed indices to capture the effects of Basel II regulations. The results of this study failed to find any significant relationship between capital regulation and efficiency. They concluded that the role of private monitoring and market discipline is more important than the government intervention. There found variations on the impact of regulations on the basis of country, region and income. Overall study shed doubts on the reliance of government to control bank activities.

(Demirguc-Kunt et al., 2004) examined the effect of bank regulations on the efficiency of 1400 banks in 72 countries. By using Net Interest Margin as proxy of efficiency, they estimated their results by applying OLS. Their results showed that high capitalized banks have high efficiency. Their results supported the argument that capital allows the cushion to charge more for loans and pay less for deposits as the risk of bankruptcy is low.

(Barth et al., 2008) presented new evidence of the impact of regulations on the performance of the banks. They performed their research on huge data base of

cross country banks involving 142 countries. They challenged the notion of forcing banks into regulations for the sake of improvement in efficiency as they failed to find any evidence of it.

(Chiu et al., 2008) investigated the association between efficiency and capital adequacy of 46 Taiwanese banks during 2000 to 2002. They used two Data Envelopment Analysis (DEA) approaches to calculate efficiency scores. They findings signaled the Capital adequacy had a significant positive effect on the efficiency of banks. According to his results there is significant difference in the efficiency of the banks between high capital and low capital adequacy ratios. The banks who maintain large capital buffer are more efficient than their low capital buffer counterpart. Their results favored the notion of forcing banks to stringent capital adequacy requirements as it enhances their efficiency.

(Pasiouras, 2008) conducted a cross-country analysis of impact of capital regulations on the bank efficiency. His sample consisted of 715 commercial banks operating in 95 countries in 2003. They used Data Envelopment Analysis to calculate technical and scale efficiency, while Tobit regression model was used for estimation. Though they checked the impact of all three pillars of Basel on the efficiency of banks, however capital regulations did not significantly affect the efficiency in their sample. They also found some country specific variables are also affecting bank efficiency.

(Naceur and Kandil, 2009) looked at the impact of capital regulations on performance measured by the proxies of cost of intermediation and profitability. They based their results on the research performed over 28 banks during 1989-2004. They found affirmative relationship among strict capital requirements and bank efficiency.

(Pasiouras et al., 2009) analyzed the effect of the regulatory and supervision policies on the cost and profit efficiency of 615 public listed commercial banks working in 74 countries during the period 2000-2004. By using stochastic frontier analysis (SFA) to calculate efficiency, they reported that strict capital adequacy requirements have increased cost efficiency and reduced the profit efficiency of the banks

in their sample. Other regulatory and supervisory activities found to have mixed results in their sample.

(Burki and Niazi, 2010) analyzed the effect of financial reforms on the efficiency of domestic and foreign banks in Pakistan from 1991 to 2000. By employing DEA frontier efficiency measures on yearly data of 40 commercial banks they reported a decrease in efficiency during initial period of reforms; however efficiency of the banks increased gradually. They cited the inability of the banks in Pakistan to adjust with increase competition. Moreover they also stated that efficiency of foreign and private banks was superior to their state owned counterparts.

(Lozano-Vivas and Pasiouras, 2010) looked at the impact of non-traditional activities on the cost and profit efficiencies of the 752 publicly listed commercial banks working in 87 countries between 1999 and 2006. They found that impact of regulations including capital adequacy requirements have a positive effect on both cost and profit efficiencies in their sample. Banks in their sample have witnessed an increase in both efficiencies. Moreover this affect is more significant on profit efficiency then cost efficiency. As far as impact of non-traditional activities is concerned; they reported mixed results.

(Kablan, 2010) assessed the determinants of banking system efficiency in 137 banks in 29 sub-Saharan African (SSA) countries. He used stochastic frontier analysis to calculate the efficiency of banks in their sample. He observed that capitalization has negative impact on the efficiency of banks in his sample highlighting moral hazard problem. They blamed the poor economical and weak political systems of these countries for their less develop financial systems.

(Delis et al., 2011) examined the impact of regulatory and supervision framework on the productivity of 582 banks in 22 transition countries over the period 1999-2009. They reported mix findings after conducting their research. Some regulatory policies had positive impact, while others had negative effect on the efficiency of banks in their sample. They also noted that overall Basel II capital requirements and supervision by the central bank had no effect on the efficiency of the banks in their sample. However there is exception to this in case of after financial crisis

period. Another pillar of Basel II i.e. market discipline had a positive effect on the productivity of the banks in their study.

(Naceur and Omran, 2011) examined the effect of different factors including banking regulations and financial development variables on the performance of banks of the Middle East and North Africa (MENA) countries for 16 year period from 1989 to 2005. They utilized different accounting based ratios for company specific variables and macroeconomic data for country specific variables in their research. They concluded that well capitalized banks have high net interest margin, high cost efficiency and high profitability. They were of the view that financial development indicators have no significant impact on the performance of banks in their sample. Their results highlighted a positive impact of regulations on the MENA banking sector.

(Chortareas et al., 2012) investigated the impact of various regulatory and supervisory policies on cost efficiency of commercial banks for a sample of 22 EU countries. They used both non-parametric Data Envelope Analysis as and accounting ratios to calculate efficiency. They found a negative relationship between capital requirements and efficiency. They were of the view that regulation do not increase efficiency, rather they reduce the efficiency of financial institution. They also reported that regulation will play positive role on the efficiency of the counties which are more transparent and where democracy is strong,

(Lim, 2012) looked at the determinants of accounting based profit efficiency ratios of Philippian banks from 2003 to 2010. He used different company based financial indictors to check their impact on the profit efficiency of the banks in his sample. He observed capital to total assets ratio, loans to total assets ratio and provision for loan losses ratio had a positive impact on the profit efficiency of the banks. He argued that better capitalized banks have low risky loans due to good credit policies and they incur less funding cost and interest expense which contribute to profits.

(Barth et al., 2013) explored the effect of bank regulations on the operating efficiency of 4050 banks working in 72 countries for the period 1999-2007. The

purpose of their research was to explore factors that increase or reduce the capacity of banks to work smoothly. They observed mix findings in their study. Strict capital regulations found to have played a minute positive role in enhancing the efficiency of the banks in their sample.

(Lee and Chih, 2013) explored the relationship between financial regulation and the profit efficiency of the 242 Chinese banks from 2004 to 2011. They used Tobit regression to reach their findings. They formulated their results on the basis of size of the bank. They noted that capital adequacy did not affect the profit efficiency of the banks in their sample. The impact of leverage on the efficiency of large banks is insignificant; however it had a positive impact on the efficiency of the small banks. They also noted that cost-to-income ratio had inverse relationship with the efficiency of a bank. The relationship is negative both for small and large banks. They concluded that strict regulations are not beneficial for bank efficiency.

(Odunga et al., 2013) analyzed the effect of liquidity and capital adequacy on the operating efficiency of 44 commercial banks in Kenya for the period 2005-2011. They employed various proxies of liquidity and capital adequacy to formulate their results and used panel data regression to arrive their results. They reported that along with last year operating efficiency ratio, liquid assets to short-term liabilities ratio and total capital ratio had a positive effect on the bank operating efficiency.

(Pancheva et al., 2013) explored the factors affecting bank efficiency in time of crisis period 2008-2011 for the Bulgarian banks. He reported a negative impact of majority of variables affecting cost to income ratio of the banks. Due to quarterly nature of his data, some of the regulatory variables had to be excluded from his study.

(Pancurova and Lyócsa, 2013) estimated cost and revenues efficiencies and their determinants in Central and Eastern European Countries (CEEC) for the 2005-2008 period. They used Data Envelopment Analysis to calculate efficiency scores. They concluded that bank capitalization as measured by equity over total assets ratio has positive impact on both cost and revenue efficiencies of the banks in

their sample. They also reported that banks behave differently with respect to efficiency on the basis of their ownership structure.

(I. Maghyereh and Awartani, 2014) analyzed the efficiency score of the Gulf Co-operation Countries (GCC) banking sector. The sample included 70 banks and time period chosen for their study was from 2000 to 2009. They were of the view that regulation has significant effect on the efficiency of GCC banking industry. Their found that strict capital requirement have improved the efficiency of banks in their study.

(Mesa et al., 2014) explored the factors affecting the 3952 banks in the European Union for the year 2010. They arrived at their results by using accounting based measure of efficiency and by employing multivariate analysis. They did not find any impact of capital ratio on the efficiency of the banks in their sample. Level of competition had negative impact on the efficiency of the banks, while size had positive impact on the efficiency of the banks. They reported that determinants of bank efficiency changes with the size of the banks.

(Eldomiaty et al., 2015) analyzed the determinants of operating efficiency of 24 Egyptian banks from 2001 to 2008. They used accounting based operating efficiency ratio to calculate operating efficiency of the highly competitive banks. Their main focus was on the factors causing an improvement in the operating efficiency of the competitive banks. They concluded that asset quality, capital adequacy, credit risk and liquidity of banks had a positive impact on the operating efficiency of the highly competitive banks in their sample.

(Kale et al., 2015) investigated the factors affecting the efficiency of 19 Turkish banks for the period 1997-2013. Their primary focus was the effect of regulations, macroeconomic changes and political event on the efficiency in their sample banks. They noted that internal rather external factors were more responsible for change in efficiency of the banks. They observed a positive impact of capital adequacy on the efficiency of the banks. Their findings indicated that strict capital regulations, high regulatory monitoring and regulatory reforms tend to increase the efficiency. He did not find a significant effect of macroeconomic variables on the efficiency of

the Turkish banks in their study. They stressed the quality of management and soundness of banks to be the main reason for improvement in efficiency.

(Pessarossi and Weill, 2015) investigated the impact of capital ratio on bank efficiency of Chinese banks over the period 2004-2009. They performed their study after the implementation of capital adequacy requirements in China in 2004. They used efficiency score obtained by non-parametric technique Data Envelope Analysis. They found a positive impact of capital ratio on cost efficiency. They had seen an increase in the cost efficiency of Chinese banks after the implementation of capital regulations. They also reported the size of increase in cost efficiency is dependent upon the ownership type of bank.

(Eldomiaty et al., 2015) explored the determinants of operating efficiency of Egyptian commercial banks from 2001 to 2008. They used different proxies of bank risk, profitability, capital adequacy and liquidity for their study. They stated that almost all profitability and liquidity ratios had positive impact on the efficiency ratios. There is disagreement on the effect of capital adequacy and credit risks on the efficiency of the banks in their sample.

(Lešanovská and Weill, 2016) analyzed the relation between capital and efficiency for the 29 Czech banks for the period 2002 to 2013. They performed Granger-causality tests to check the bi directional relationship between capital and efficiency. Then by embedding Granger-causality estimations in the GMM dynamic panel estimator, they arrived at their results. They reported that though no causality exists in both directions. It can be interpreted as neither capital influences efficiency nor efficiency affects the capital. They also concluded that financial crisis did not affect the relationship of capital and efficiency. They opined that capital and efficiency should be treated separately and regulators should devise different policies for both capital and efficiency.

(Mongid, 2016) looked at the determinants of cost inefficiency of banks operating in the 8 countries of the Association of Southeast Asian Nations (ASEAN). He used the accounting based Cost to Income (CIR) to capture the effect of cost inefficiency. He observed a negative impact of capital adequacy ratio on the cost efficiency of the banks in his sample. Banks with high CAR had low cost efficiency

and vice versa. Same can be said about the risk taken by the banks which also showed a negative impact on efficiency. As far as the impact of Size and inflation is concerned; they had a positive impact on the cost efficiency of the banks in his sample. He also reported that banks with high liquidity positions tend to have high efficiency. He was of the view that high volatility of ASEAN countries economies would force the banks to have liquidity to improve it cost efficiency.

(Triki et al., 2017) looked at the impact of the 9 different regulatory activities on the efficiency of the banks of the 46 African countries. They calculated efficiency by applying Data Envelopment Analysis techniques. They observed mixed results in their study. Some activities had affected the efficiency of the banks, while some did not. They concluded that in addition to quality of supervision and presence of deposit insurance schemes, compliance to strict capital requirements do not have a robust effect on the efficiency of the banks in their sample. However they stated that compliance to regulations should not be used as punishing tool against small banks. Infect bank should follow the regulations according to their size and risks level.

## 2.3 Association of Bank Risk and Bank Efficiency

In a seminal study (Berger and DeYoung, 1997) explored the inter-temporal relationships among problem loans and cost efficiency of US banks. They proposed hypothesis 'bad luck, 'bad management', 'skimping' behavior for the risk and efficiency. By employing Granger-causality techniques over US bank data of 1985 to 1994 they reported in favor of bi-directional relationship loan quality and cost efficiency. Their data supported the bad luck hypothesis. According to this hypothesis increase in nonperforming loans to Granger-cause decrease in measured cost efficiency. They suggested that high values of problem loans caused banks to raise either expenditure on monitoring or dispose of these loans, and thus banks became more attentive in looking after the portion of their on hand loan portfolio.

(Kwan and Eisenbeis, 1997) tried to analyze the relationship among risk, capitalization and measured inefficiencies. They empirically tested the association on

254 large bank holding companies during the period 1986 to 1991. They used simultaneous equation framework and concluded that these three variables were simultaneously determined. They reported a negative relationship between risk and efficiency.

(Altunbas et al., 2000) explored the impact of risk and quality factors on the cost efficiency of Japanese commercial banks between 1993 and 1996. They calculated efficiency by using single-equation stochastic cost frontier model. They reported that non-performing loans have positive impact on the inefficiency of the Japanese banks in their sample. In other words risk has negative relationship with efficiency. However they reported that capital has more significant impact on efficiency than risk taking by the banks. They argued that efficiency allows extra cushion to evaluate risks and vice versa.

(Isik and Hassan, 2002) explored the effect of risk on the different types of efficiencies for the Turkish banks over the 1988 to 1996 period. They used the variance of return on equity for risk and applied parametric and non-parametric techniques to calculate efficiency scores. They reported mixed results on the basis of their study. They found a significant positive impact of the risk on the cost, technical, pure technical and scale efficiency while its impact on the scale efficiency is insignificant. Private banks were more efficient than public sector banks in their study. Moreover they also note that board having more independent directors in their board found to be more efficient than their counterparts where there are less independent directors.

(Das et al., 2004) studied the interrelationships among capital, risk-taking and operating efficiency of the Indian banking system. Their sample was 27 public sector banks operating in India from 1993-94 to 2000-2001.They reported that efficiency had a positive effect on credit risks of banks in their sample. He argued that efficiency allows extra cushion to evaluate risks and vice versa. Their findings supported the nation that capital, efficiency and risk are jointly determined and should not be looked at separately.

(Williams, 2004) investigated management behavior in European savings banks during 1990 and 1998. By applying Granger causality approach among problem

loans, efficiency and capitalization, they estimated their results. They tested the hypothesis proposed by Berger and De Young (1997). Although he supported the bad management hypothesis, which advocates a negative association between risk and cost efficiency, however he rejected skimping behavior hypothesis and bad luck hypothesis. They were of the view that incompetence of the management is root cause of low efficiency of European banks in their sample.

(Rao, 2005) explored the risk-efficiency relationship of UAE banks during 1998-2001. They used stochastic frontier models (SFA) to calculate the cost efficiency and for risk variables they used liquidity and default risk. He reported mixed results from his findings. He found an inverse relationship between liquidity risk and efficiency in their sample. However for capitalization risk, he observed a positive relationship. He did not find any relationship between banks' credit risk and cost efficiency. According to his findings foreign banks were more efficient than their local counterparts.

(Iannotta et al., 2007) looked at the impact of different micro and macroeconomic variables on the performance of the 181 large banks from 15 European countries over the 1999-2004. They used different accounting proxies of performance for their study. Their findings suggest that bank risk has positive impact on the performance as measured by the ratio of operating costs to total earning assets of the banks in their sample.

(Podpiera and Weill, 2008) investigated the causality between risk and cost efficiency to check their impact on the bank failures. They performed their research on 43 Czech banks from 1994 to 2005. They observed a negative association between risk and efficiency. Their results also advocated the foreign ownership as it helped in reducing the cost inefficiency. They highlighted the need of trainings to bank managers to enhance their competencies and abilities.

(Papanikolaou, 2009) examined the efficiency and risk-taking behavior in EU-27 countries. They performed their research on 900 banks from 1997-2006. The main aim of his research was to test risk efficiency relationship, when banks diversify from traditional financial intermediation activities to non-traditional i.e. noninterest income business. He measured both cost and profit efficiencies by Stochastic

Frontier Analysis (SFA). He reported a negative impact of liquidity risk on the efficiency of banks in his sample suggesting the importance of liquidity for the efficiency of the banks. He also concluded that efficient bank take lower credit risks. He also favored the effectiveness of regulations in enhancing the efficiency of the banks.

(Banker et al., 2010) investigated the impact of reforms on the productivity of the 14 Korean commercial banks over the period 1995-2005.By making use of various accounting based proxies of different variables, they observed that efficiency of Korean banks decreased during 1997-1998 financial crisis, however it did increased after the financial crisis. They reported a negative impact of non-performing loans on the bank productivity.

(Delis and Kouretas, 2011) explored the impact of different variables including efficiency on the risk taking behavior of Greek commercial banks from the 2001 to 2008. They captured the effect of risk by risky assets and non-performing loans while efficiency was calculated through ratio of total revenue to total expenses. By employing multiple regression analysis, they found a positive impact of bank efficiency on risk taking behavior in their sample.

(Sun and Chang, 2011) looked at the contribution of risk and various off balnce sheet activities in determining the cost efficiency of banks in eight emerging Asian countries from 1998 to 2008. They used credit, market and operational for risk assessment while SFA was used to calculate efficiency. They reported mixed results of different types of risk on the cost efficiency of the banks in their sample. They observed a negative relationship between credit risk and cost efficiency. The impact of market risk on efficiency was positive. While operational risk had negative effect on bank efficiency.

(Tabak et al., 2011) analyzed the relationship between risk and bank efficiency to determine the main reason for bank failure. They looked at 99 Brazilian banks from 2000 to 2007 by Panel Var and Arellano-Bond dynamic panel. Both estimation techniques produce almost same results. Granger-causality tests were employed to find the inter temporal relationship between risk and efficiency. Their estimation resulted in the direction of causality from bank efficiency to risk in both

techniques. The results of Arellano-Bond highlighted that there is no significant impact of risk taken by the banks on the allocative and economic efficiencies, while its impact on the allocative efficiency is positive in their sample. Panel Var results paint the similar picture.

(Radić et al., 2012) explored the cost and profit determinants of investments banks in G7 countries. They observed mixed findings in their research. Capital and security risks have negative impact on the cost, while liquidity and insolvency risks have positive impact on the cost efficiency of banks in their sample. As far as impact on the profit efficiency is concerned, liquidity risk is found to be positive while the securities risk has a negative impact.

(Chan et al., 2014) analyzed the effects of different risks on the cost and profit efficiencies of banks in seven East Asian countries between 2001 and 2008. They found that bank insolvency risk was positively associated to profit efficiency, while liquidity risk had positive impact on cost efficiency and had negative impact on profit efficiency.

(Spulbăr and Niţoi, 2014) investigated the impact of various variables including risk on the efficiency of 16 emerging countries during 2005 to 2011. They reported mixed results on the impact of bank risk on inefficiency in their sample. A low solvency risk will give rise to increase in inefficiency, while increase in credit risk will decrease the inefficiency.

(Nguyen and Nghiem, 2015) examined the relationship between efficiency and risk in Indian banks for the period from 1994 to 2011. They used stochastic frontier analysis (SFA) approach to calculate profit and cost efficiency while Z-score was used as proxy of bank risk. They estimated their results by using three-stage least squares. They reported an inverse relationship between risk and cost efficiency. There was difference of impact of risk taken by the banks on the efficiency of public and private banks.

(Delis et al., 2017) developed a model to incorporate risk into efficiency frontier of U.S. commercial banks from 1976 to 2014. Their model encapsulated the endogeneity of both risk and efficiency and this endogenity runs both ways. By using Bayesian techniques they observed negative relationship between two.

(Sarmiento and Galán, 2017) studied the relationship between different proxies of risk and efficiency of 31 Columbian commercial banks for the period 2002-2012. They calculated cost and profit efficiencies by using stochastic frontier analysis. They reported mixed findings in their study. According to their results credit risk has negative impact on cost efficiency, while its effect on profit efficiency is positive. They also noted that large and foreign banks take more risk, while size is also main determinants in their study.

## 2.4 Determinants of Bank Capital

(Jacques and Nigro, 1997) examined the impact of risk based standards on the capital and risk of US banks. By using three staged least square (3sls), they observed the interrelationship of equity capital to total assets and nonperforming loans as a percentage of total assets. They reported a positive impact of size on bank capital while risk changes had an inverse impact on capital changes. The impact of risk based capital standards had increased the capital ratios of the banks in their sample. So they argued in favor of risk based capital standards of Basel.

(Ediz et al., 1998) analyzed the effect of capital regulation on capital ratios of UK banks. By using balance sheet and income data for 94 banks in the UK in the years 19891994, they reported their findings. They were of the view that profitable banks tends to have low capital ratios and vice versa, while risks taken by the banks had a positive impact on the banks capital ratio in their sample. They concluded that introduction of capital requirements had forced the banks to increase their capital ratios. They also noted that as the capital ratio of banks reaches the minimum value required by the supervisor), banks increased their capital ratio in the following quarter.

(De Bondt and Prast, 2000) studied the capital behavior of commercial banks in the 1990s. They empirically investigated the determinants of changes in capital ratios of the banks in Germany, France, Italy, the Netherlands, the UK and the US. Overall credit and interest rate risk had a positive effect on the capital ratios of the banks in their sample. They reported mix findings of the impact of the

other variables on the basis of their research. The results of European countries were different to AngloSaxon countries with respect to off balance sheet activities and assets growth. They found the cost of capital an important determinant of capital ratio in the UK and USA. Return on equity had negative impact on the capital adequacy ratio in the UK and the US.

(Kleff and Weber, 2008) examined the determinants of bank capital of the German banks. By employing the generalized method of moments (GMM) on the German banking sector from 1992 to 2001, they reported their findings. They reported mixed findings in case of savings banks, cooperative banks and other banks. They observed a positive and significant effect of portfolio risk and profitability of the banks on the capital ratio for savings banks. Risk as measured by the loan loss provisions to total assets had a negative effect on the capital ratio for the savings banks, while it had a positive effect on other banks. They also reported that other big banks possessed low ratios and vice versa, while size had insignificant effect on the savings banks capital ratios.

(Al-Sabbagh, 2004) looked at the determinants of capital adequacy of Jordanian banks before and after the implementation of Basel regulations. They focused on factors affecting the 17 Jordanian banks from pre Basel period of 1985 to 1994 and post Basel period from 1995 to 2001. He observed mixed findings on the basis of his research. The effects of some variables remain same during the two periods, while some changed their directions. He also stated that majority of banks in his sample maintained the regulatory ratio of 8% while few had higher capital ratio than the required level of 8%.

(Alfon et al., 2004) investigated the determinants of capital holdings of banks and building societies of Great Britain from 1997 to 2002. They concluded their findings by using both qualitative and quantitative approach. They found that firms which take high risk, they tend to have less capital. They were of the view that market discipline and regulatory capital also affect the decision of capital held.

(Wong et al., 2008) looked at the determinants of capital levels of banks in Hong Kong. They observed the level of bank capital ratios from first quarter of 1992 to

third quarter of 2004. Their results indicated that big banks maintain less capital ratio and vice versa. They also concluded that growth and profitability of the banks had negative impact on the capital ratios of the banks. They did not notice the impact of bank risk taking on the capital ratios in their sample.

(Asarkaya et al., 2007) analyzed the determinants of capital ratio in the Turkish banking sector. Their focus was on the factors affecting the capital buffer i.e. additional capital held by the banks from December 2002 to April 2006. They found that big banks tend to have less capital ratio. Moreover they also found a negative impact of portfolio risk on the capital adequacy ratio maintained by the banks in their sample. Same can be said about the share of deposits, as the greater share of non-equity liabilities in deposits make them low risk so it helps in decreasing buffer capital.

(Ahmad et al., 2008) analyzed the determinants of bank capital ratios in Malaysia during 1995 to 2002. By applying panel data techniques on unbalanced data, they concluded earning as proxy by net interest margin has a negative impact on bank capital. This is in contradiction to early studies and the rejection of charter-value hypothesis. They also reported a positive impact of bank risk taking on the capital ratios maintained by the bank. There existed a negative impact of size on the capital ratios of the banks. In other words big banks had low capital ratios and vice versa.

(Boucinha et al., 2008) analyzed the influence of risk measures on capital buffers of Spanish banks. They reported a positive relationship between the capital buffer and risk of banks in their sample. He was of the view that stringent regulation of Basel II did not have the desired effect on capital ratios of Spanish banks.

(Deelchand and Padgett, 2009) explored the factors affecting the capital of 263 Japanese cooperative banks during 2003 to 2006. They employed Two stage least squares method to check the relationship between risk, capital and cost inefficiency of Japanese cooperative banks. They reported risk has negative while profitability and size has positive impact on the capital ratios of the bank. They attributed the negative effect on the part of regulators for not forcing banks to increase capital

ratios to hold more capital. The positive effect of size can be explained by the easy access gained by the big banks to boost their capital levels.

(Fonseca and González, 2010) investigated the bank and country specific determinants of capital buffers of 1,337 banks in 70 countries between 1992 and 2002. They found a positive impact of cost of deposits and bank market power on the capital buffer of the banks in their sample. Accounting disclosure procedures and strict bank constraints on bank activities were found to have a positive impact on the capital buffers.

(Büyüksalvarci and Abdioglu, 2011) conducted a study on the Turkish banks to investigate the determinants of capital adequacy ratio. By using panel data regression technique, they used different firm specific variables to check their impact on the capital ratio. According to them credit risk measured by loan loss reserve ratio had a negative impact on the CAR, while they did not find any significant effect of efficiency and size in their study.

(Bokhari et al., 2012) analyzed the capital adequacy determinants of banks in Pakistan for the period 2005 to 2009. They find a negative impact of risk taken on the capital adequacy ratio. In other words risky banks have low capital ratio and vice versa.

(Abusharba et al., 2013) explored the determinants of capital adequacy ratios in Islamic banks of Indonesia. They used multiple regression technique to reach at their conclusion. They did not find any relationship between operational efficiency and capital adequacy. Profitability has positive and risk has negative impact on the capital ratios of the banks in their sample.

The results of (Aspal and Nazneen, 2014) presented a bit different picture to other researches in this area. They conducted their research on the Indian private sector banks. They reported a positive impact of liquidity and efficiency on the CAR by using multiple regression method for estimation. The banks whose asset exposure is risky they have high capital ratios. One justification can be in order to overcome the chance of default, banks possess high capital ratios and vice versa. They also observed that banks in their sample maintain a higher level of capital than required by Reserve Bank of India.

(Bateni et al., 2014) studied the effect of different bank specific factors on the capital adequacy and its impact on the financial positions of 18 Iranian banks for the period 2006 to 2012. They used regression analysis on different proxies of various variables to reach at the conclusion of their study. They concluded that risk does not affect the capital adequacy ratio of banks; however size has negative impact on the capital adequacy ratio in their sample. They were of the view that large banks possess low capital ratios and vice versa. One justification can be they might use their size in case of any unexpected event.

(Aktas et al., 2015) investigated cross country determinants of capital adequacy ratio of banks of South Eastern Europe from 2007 to 2012. Their interest was to see the effect of environmental and bank specific factors on the capital ratios of the 71 banks form 10 different countries. Size, leverage, risk, growth in GDP and governance were found negatively affecting the CAR of the banks, while profitability, liquidity, Eurozone stock market volatility and deposit insurance to GDP per capita were positively influencing capital ratios of the banks in their study.

(El-Ansary and Hafez, 2015) looked at factors influencing capital adequacy ratio of the Egyptian commercial banks for the period before and after the 2007- 2008 international financial crises. They reported liquidity, size and management quality as the most significant variables for the whole time period of study. The results of the pre financial crisis period showed that asset quality, size and profitability as the most significant variables. The results of post financial crisis period found asset quality, size, liquidity, management quality and credit risk as the most significant variable that explain the variance in Egyptian banks' CAR. There results highlighted the difference in regulatory capital and market based factors between pre and post financial crisis period.

(Shingjergji and Hyseni, 2015) explored the factors affecting the capital adequacy ratio of Albanian banks for the period 2007 to 2014. They used quarterly data for different company specific variables. They estimated their results by using ordinary least squares method. They observed that profitability of the bank did not affect the capital ratio maintained by the banks in their sample. However

credit risk had a negative impact on the capital adequacy ratio, while the size had a positive effect in their research.

(Masood and Ansari, 2016) focused on the bank specific factors which had an impact on the determination of capital adequacy ratio (CAR) of Pakistani banks from 2008 to 2014. By using panel data technique, they reported mix findings. Impact of risk measured by the loan loss reserves was positive and significant, while another proxy of risk i.e. non-performing loan did not affect the capital ratio of banks in their study. Similarly deposit asset ratio and equity asset ratio had a significant positive, while loan to asset ratio had significant negative effect on the capital ratio. According to their results size, and profitability had no impact on CAR.

(Mili et al., 2016) analyzed the factors affecting the capital adequacy ratio (CAR) of 340 subsidiaries of 123 foreign banks. Their focus was on the impact of home country's economic conditions and regulatory environment on the CAR of its foreign subsidiaries. They observed a positive effect of risks taken by the parent bank on the capital adequacy of the subsidiary. One reason can be that risks taken by the parent bank increased the risk of subsidiary as well, so they opt for high capital ratios to cover the risk of parent bank. As far the efficiency of parent bank is considered, it has a positive but insignificant impact upon the CAR of the subsidiary. Size of holding bank along with economic growth and real interest rates in home country had significant effect on the capital of the associated company.

(Alraheb Ab et al., 2017) investigated the impact of intuitional environment on capital ratios of 187 banks working in the MENA region for the period 2004 to 2014. They used different institutional and company specific factors to determine their effect on capital adequacy ratios in their research. They also employed an indicator of regulatory capital stringency covering every risk in regulator jurisdiction. By employing panel data regression techniques they obtained their results. According to their results risky banks possess high capital ratios and vice versa. This could be to overcome high risks by any potential unexpected loss; banks need to have high capital ratios. They also reported that banks in politically stabled countries

tend to have high capital ratios and vice versa. They also advocated the role of bank size in determining the capital ratios of banks.

## 2.5 Hypotheses

### 2.5.1 Risk and Capital Theoretical Hypotheses

Regulatory hypothesis is presented by (Pettway, 1976). Regulatory hypothesis advocates the positive connection of capital and risk. This hypothesis states that regulators persuade banks to raise their capital substantially with the level of risk they acquire to counter the risk of default.

However, another school of researchers led by (Kim and Santomero, 1988) questioned the notion of forcing banks to maintain levels of required capital. They supported the moral hazard hypothesis, that banks have advantages to make use of presented flat deposit insurance schemes, which reflect a negative relationship among capital and risk.

H1: Bank risk decreases with bank capital.

### 2.5.2 Risk and Efficiency Theoretical Hypotheses

(Berger and DeYoung, 1997) proposed Bad management, Bad luck and skimping hypothesis.

Under the skimping hypothesis banks, there is positive relationship between risk and efficiency. Banks can choose to devote fewer resources to monitor loans and non-performing loans remain unaffected in short term.

Bad management hypothesis proposes an inverse relationship between risk and cost efficiency. According to this hypothesis due to poor management, cost efficiency of bank is decreased. As a result of this bad management, less efficient banks will take more risk to compensate the effect of inefficiency.

Bad luck hypothesis also advocates the negative relationship between risk and cost efficiency. However this hypothesis states that instead of bad management,

external events caused nonperforming loans to rise. This increase in risk gives rise to additional costs and as a result cost efficiency of banks decreased.

H2: Bank risk decreases with bank efficiency.

### 2.5.3 Capital and Efficiency Theoretical Hypotheses

With regards to impact of capital on efficiency shareholders-debt holders hypothesis states that due to conflicts of interest between shareholders and debt holders, there will be less debt financing. This will lead to low agency cost i.e. high efficiency and high capital ratios.

However, shareholders-managers hypothesis states that capital has a negative impact on efficiency. Due to moral hazardous behavior of managers, agency cost increases and free cash at the disposal of managers i.e. equity-to-assets ratio decreases. So, high capital ratio has a negative impact on efficiency and vice versa.

H3: Bank capital decreases with bank efficiency.

### 2.5.4 Efficiency and Capital Theoretical Hypotheses

The causality may exist in opposite direction i.e. from efficiency to capital as well. Two contradictory hypotheses have been stated by (Berger and Di Patti, 2006) for it.

The "franchise value hypothesis predicts a positive relationship between two. According to this hypothesis high efficiency allows banks extra income to maintain high capital ratios to overcome the possibility of bankruptcy. In other words a high efficient bank is keen to avoid the possibility of bankruptcy by holding large amount of capital.

The efficiency-risk hypothesis advocates a negative effect of cost efficiency on the capital of bank. They are of the view that high efficiency is symbol of good quality as chances of bank failure is reduced by virtue of this enhanced efficiency. So banks can afford to have less capital.

H4: Bank efficiency decreases with bank capital.

## 2.5.5 Market Discipline Theoretical Hypotheses

According to the market discipline hypothesis depositors discipline their banks by demanding high interest rate for their deposits or with drawl of deposits from risk banks to less risky banks to counter their interests. This will restrict the managers from taking excessive risk.

H5: Market discipline decreases bank risk.

Market discipline hypothesis also employs that monitoring by bank depositor should increase efficiency as they have more motivation to look after banks due to their special interests.

Deposit holders cannot effectively monitor banks due to lack of resources to implement effective monitoring.

H6: Market discipline increases bank efficiency.

## 2.5.6 Empirical Hypotheses

H7: There is significant difference in the impact of capital regulation on bank risk in different Basel Accords.

H8: There is significant difference in the impact of capital regulation on bank risk in different regimes.

H9: There is significant difference in the effect of bank size on the impact of capital regulation on bank risk.

H10: There is significant difference in the impact of capital regulation on bank risk in highly capitalized banks and marginally capitalized banks.

H11: There is significant difference in the impact of capital regulation on bank risk in different inflationary periods.

H12: There is significant difference in the impact of capital regulation on bank risk in different banking system.

H13: There is significant impact of capital regulation on bank risk in Financial Crisis.

H14: There is significant difference in the impact of capital regulation on bank efficiency in different Basel Accords.

H15: There is significant difference of the effect of bank size on the impact of capital regulation on bank efficiency.

H16: There is significant difference in the impact of capital regulation on bank efficiency in highly capitalized banks and marginally capitalized banks.

H17: There is significant difference in the impact of capital regulation on bank efficiency in different inflationary periods.

H18: There is significant difference in the impact of capital regulation on bank efficiency in different banking system.

H19: There is significant difference in effect of factors affecting bank capital in different banking system.

H20: There is significant difference in bank capital before and after financial crisis.

# Chapter 3

# Research Methodology

As has been stated before, the objective of this research is to examine the relationship between capital, risk and efficiency of Pakistani banks from 1997 to 2015. This chapter describes the research methodology and data collection procedure. Sample selection along with data collection and time period for this study is presented in section 3.1, while in section 3.2 measurement and proxies of variables used throughout the thesis, are presented. These include dependent, independent and control variables used in this study. In Section 3.3 equations for econometric modeling are presented while section 3.4 contains data analysis for this study. This includes panel data regression models and other methods used for robustness test in this study.

## 3.1 Sample Design & Data Collection

The population of this study consists of all commercial banks in Pakistan. The list of all banks is obtained from State Bank of Pakistan. The time frame of implementation of Basel Accords in Pakistan is also taken from SBP. Although some mergers and acquisitions of banks are observed during the time period of study however, no details on the basis of bankruptcy are available during sample. Though banks in Pakistan started implementing Basel I in December 1997,

Pakistani banks prepared the financial statements of 1998 for the first time according to the guidelines of Basel I accord. So the sample of this study consists of all listed commercial banks from 1998 to 2015 in Pakistan. The data is gathered from the financial statements of those banks from their websites. Bank scope database, which contains widespread data of banks worldwide, including banks' balance sheets and income statements are used to verify and find the missing data. The sample consists of all listed banks of Pakistan from 1998 to 2015.

## 3.2 Measurement of Variables

Previous studies have used accounting-based measures of bank risk, bank efficiency and bank capital. This study also follows the foot prints of (Altunbas et al., 2007), (Mongid, 2016) etc. in using different accounting-based proxies of bank risk, bank capital and bank efficiency variable.

### 3.2.1 Bank Risk

For bank risk though Basel II and III accords talk about different risks i.e. market, interest rate, operational and liquidity risks etc, however, credit risk is the only risk which is catered by all three Basel accords. To quantify the effect of different Basel accords capital regulation on bank risk, proxy representing credit risk is used in this research. Non-Performing Loans to Gross Loans (NPLGL) represents credit risk and it is used in this research. A high value of this ratio is a signal of high risk and vice versa. The seminal study of (Berger and DeYoung, 1997) also employs this proxy.

$$NPLGL = (NonPerfromaingLoans/GrossLoans) * 100$$

Risk taken by the banks is also measured by Loans Loss Provision to Net Interest Revenue (LLPNIR). A low value of this ratio indicates that provision for losses expressed as percentage of net interest revenue is low and hence risk is low and vice versa. (Reda et al., 2016) have used this in their study.

$$LLPNIR = (LoansLossProvision/NetInterestIncome) * 100$$

### 3.2.2 Bank Efficiency

For the measurement of bank efficiency, Cost to Income (CIR) is employed as proxy. As a high value of this ratio is a measure of bank inefficiency so results are stated with respect to bank inefficiency and then they are also interpreted with regards to bank efficiency. (Mongid, 2016) also uses the same to measure inefficiency of bank.

$$CIR = (OperatingExpense/OperatingIncome) * 100$$

The other proxy of efficiency is non-interest expense to net income ratio (NIENI). A high values is a signal of low efficiency and vice versa.

$$NIENI = (NonInterestExpense/NetIncome) * 100$$

### 3.2.3 Bank Capital

To measure bank capital, Total Capital to Total Risk Weighted Assets (TCTR) is used. It is also called Capital Adequacy ratio (CAR) of the bank. It is the ratio of the capital of a bank to its risk. It is calculated by dividing the Total Risk Weighted Assets of a bank to the sum of Tier 1 and Tier 2 capital.Though banks are bound to have TCTR of 8% and 10.5% in Basel I, II and III respectively, however banks maintain usually high TCTR than required. (Jacques and Nigro, 1997) have used this in their study.

$$TCTR = (TotalCapital/TotalRiskWeightedAsset) * 100$$

### 3.2.4 Net Loans to Total Assets

In order to measure the liquidity of the banks, Net loans to Total asset (NLTA) is used in line with (Alam, 2013). A high value of this ratio is a signal of high liquidity and vice versa.

$$NLTA = (NetLoans/TotalAsset) * 100$$

### 3.2.5 Net Interest Margin

Net Interest Margin (NIM) is being employed in this study. Banks having high NIM have more interest income than interest expense. (Dumičić and Rizdak, 2013) use this to measure efficiency in their work.

$$NIM = (NetInterestIncome/AverageEarningAsset) * 100$$

### 3.2.6 Liquid Asset to Short Term Funding

This is the ratio of the value of liquid assets which are easily convertible to cash to short-term funding plus total deposits.

$$LASTF = (LiquidAssets/ShortTermFunding) * 100$$

### 3.2.7 Return on Average Asset

In order to measure the profitability of bank Return on Average Assets (ROAA) is used in this study. (Popovici et al., 2014) employed the same in his research.

$$ROAA = (NetIncome/AverageTotalAssets) * 100$$

### 3.2.8 Size

Size is used as control variable in this study. Size of bank is obtained by taking natural log of total assets for bank. (Miah and Sharmeen, 2015) and (Alam, 2013) etc. use the same in their study.

$$SIZE = LOG(TA)$$

### 3.2.9 Inflation

Inflation is used as control variables in this study by following the work of (Tan and Floros, 2013). It has been multiplied by the size of the banks to accommodate this macroeconomic variable with other bank level variables.

## 3.3 Empirical Model

By following ([Shrieves and Dahl](https://), 1992), ([Jacques and Nigro](https://), 1997), ([Kwan and Eisenbeis](https://), 1997) and ([Altunbas et al.](https://), 2007), the econometric models of this study are presented below.

$$NPLGL_{it} = \alpha_0 + \beta_1 TCTR_{it} + \beta_2 CIR_{it} + \beta_3 NLTA_{it} + \beta_4 SIZE_{it} + \beta_5 INF + \epsilon_i \quad (3.1)$$

$$CIR_{it} = \alpha_0 + \beta_1 TCTR_{it} + \beta_2 NPLGL_{it} + \beta_3 NIM_{it} + \beta_4 SIZE_{it} + \beta_5 INF + \epsilon_i \quad (3.2)$$

$$TCTR_{it} = \alpha_0 + \beta_1 NPLGL_{it} + \beta_2 CIR_{it} + \beta_3 LADSTF + \beta_4 ROAA_{it} + \beta_5 SIZE_{it} + \beta_6 INF + \epsilon_i$$
$$(3.3)$$

Equation 3.1, 3.2 and 3.3 correspond to risk, efficiency and capital models respectively.

## 3.4 Data Analysis

The purpose of this study is to check the link between Basel Accords regulations, efficiency and risk. For this panel data methodology has been used to analyze the relationships between bank capital, bank risk and bank efficiency.

### 3.4.1 Panel Data Analysis

Panel data has several distinctive benefits over simple cross sectional or time series data as argued by ([Hsiao](https://), 1986). For example, panel data caters for unobserved heterogeneity and offers us large data points that results in more degrees of freedom and lower collinearity among explanatory variables. Panel data enables us to study more complicated behavioral models. The following techniques are used for the analysis

- Common Effect Model
- Fixed Effect Model

- Random Effect Model

- The Hausman Test: Random Effects or Fixed Effects

The random effect model is used when we know that there are no omitted variables or omitted variables have no influence on variables used in study. But when it is known that there are some omitted variables which may impact on dependent and independent variables then fixed effect model is used for controlling the influence of these omitted variables. In the words of (Torres-Reyna, 2007) this model controls the impact of unique characteristics e.g. culture, race, religion, etc. of entities on the variables used in study. And Pooled effect model is appropriate when we assume that individual effect of cross section or time period does not exist. First of all, Breusch and Pagan Lagrangian multiplier test (LM test) is used for selection of model between pooled or random effect models. The null hypothesis is that the individual effects are not correlated with other regressors in the model. The rejection of null hypothesis suggests that the random effect is appropriate over the pooled OLS model. To test the suitable model between random effect and fixed effect Husman test is used. The null hypothesis is that the individual effects are not correlated with other regressors in the model. Rejection of null hypothesis leads to fixed effects model and vice versa.

## 3.4.2 Generalized Method of Moments

The existing literature suggests that there is a need for a robustness test. The robustness of the relationship between bank risk, efficiency and capital is examined by carrying out additional estimations and tests. The banking literature points that endogeneity may be the potential problem in the relationship between bank risk, efficiency and capital. According to (Baum, 2006) problem of endogeneity arises when the independent variable correlates with the error term in a regression model. When this happens the regression coefficient in an Ordinary Least Squares (OLS) regression will be biased. This will yield to spurious regression. Robustness of the effect of Basel capital regulations on the bank risk and bank efficiency is checked by using the System Generalized Method of Moments (GMM).

GMM approach has been adopted due to the likelihood of endogeneity issues of bank capital, bank risk and bank efficiency, individual time-invariant fixed effects heterogeneity, autocorrelation and the fact that the cross-sections are greater than the time periods for the available data.

Previous studies have used different methodologies e.g. panel-corrected standard error estimates, instrumental variable, the two-stage least square and the three-stage least square. However due to lack of suitable instrumental variables, model will be under-identified. So 2SLS and 3SLS cannot be employed. Moreover, weak strength of the available instrumental variables also make GMM technique more appropriate and robust than other techniques. (Lee and Chih, 2013)), (Haq et al., 2014) have also used System Generalized Method of Moments (GMM) in their respective studies. To overcome the problem of too many instruments, collapse option as suggested by (Roodman et al., 2009) is used. According to (Roodman, 2006), rule of thumb in estimation of GMM is the number of units(banks) must be greater than the instruments being used. The validity of the instruments is checked by the Hansen tests of over-identifying restrictions.

### 3.4.3 Seemingly Unrelated Regression (SUR)

There are some hypotheses which cannot be tested by GMM as the numbers of units(banks) are less than instruments for those estimations. As (Roodman, 2006) rule of thumb is being violated in those observations, so Seemingly Unrelated Regression (SUR) (Zellner, 1962) approach is applied for estimation. This allows for simultaneity between banks' risk, capital and efficiency while also controlling for important other bank-specific factors.

# Chapter 4

# Results and Discussion

As has been described in previous sections, the purpose of this study is to investigate the effectiveness of Basel capital regulations on risk and efficiency of banks listed on the Pakistan Stock Exchange (PSX) from 1998 to 2015 inclusive. This chapter is organized in eight parts. The first part of this section describes descriptive statistics of the dependent and independent variables. Here descriptive statistics have been provided of full time period i.e. 1998 to 2015. In addition to the whole time period, descriptive statistics of Basel I, Basel II and Basel III has been provided as well. In the second section different assumptions of the data is tested. In the first sub part of this section stationarity of the data is tested. Then the multicollinearity, homoscedistics and autocorrelation assumptions are also tested in subsequent sub parts. Then in the third, fourth and fifth part regression estimates with different dependent variables i.e. bank risk, bank efficiency and bank capital are reported. Hausman test is applied in each model to select the appropriate panel data model for regression. After selecting the appropriate panel data model for each model, regression results are presented. In the six part of this section, robustness of risk model is checked and impact of different factors on the risk taking behavior of banks is studied. The seventh part deals with factors affecting bank efficiency of Pakistani banks. In the eighth and last part of determinants of bank capital is investigated. By going through the results of each model, corresponding section discusses and compares the results with previous studies.

## 4.1 Descriptive Statistics

In this section, descriptive statistics are presented.

TABLE 4.1: Descriptive Statistics for Year 1998 to 2015

|  | NPLGL % | CIR % | TCTR % | NLTA % | LASTF % | ROAA % | NIM % | SIZE | INF % |
|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 12.74 | 74.83 | 16.07 | 45.92 | 17.96 | 0.52 | 3.91 | 11.45 | 8.75 |
| **S.D** | 10.22 | 56.04 | 10.22 | 11.30 | 13.28 | 2.00 | 1.88 | 1.44 | 4.85 |
| **Min** | 0.2 | 0 | 0.08 | 10.05 | 0.06 | -12.29 | -1.45 | 7.85 | 2.54 |
| **Max** | 78.76 | 494.7 | 65.43 | 70.94 | 77.54 | 5.11 | 9.3 | 14.61 | 20.29 |

Table 4.1 shows the distribution, central tendency and the dispersion of the variables for all banks in the sample. By having a look at Table 4.1 it is apparent that Pakistani banks have average 12.74% non-performing loans to gross loans ratio during 1998-2015. The deviation between maximum and minimum non-performing loans to gross loans ratio is high. The maximum value of non-performing loans to gross loans ratio is 79% approximately (KASB 2002) and its lowest value is .2% (Habib Metro 2005). The same can be said about the cost to income ratio of banks in the sample. Here cost to income ratio of banks varies from very high of 495% (Dubai Islamic Bank 2006) to low of zero (JS Bank 2006). JS Bank started its operations on December 2006 and its first annual statement was prepared for the period ended December 31, 2006, so cost to income ratio is zero for this period. While the average value of cost to income ratio of banks stood at 75% approximately. Table also tells us that average total capital to total risk weighted assets ratio of Pakistani banks was 16% roughly. While the bank has maximum total capital to total risk weighted assets ratio of 65% while the minimum value of total capital to total risk weighted assets ratio held by a bank is 8%. Net loans to total asset ratio has average value of 45.92%. This shows that net loans to total asset ratio has average value of 46%. While it's maximum and minimum value ranges from low of 10.05% to high of 71%. Liquid asset to short term funding ratio has values from a low of 6% to high of 78% with average value being 18%. Return on average asset (ROAA) has mean value of 0.52% and its value ranges from high

of 5% to low of -12% (Dubai Islamic Bank 2006). Net interest margin has values ranges from high of 9.3% to low of -1.45% (Bank of Punjab 2009) while its average value is 3.91%. With respect to bank specific variable size is used by taking it's log and it has mean value of 11.45 while maximum of 14.61 and minimum of 7.85. Similarly the macroeconomic control variables inflation is also reported in Table 4.1 with it's values varies from high of 20.29% to a low of 2.54%.

Table 4.2 shows the descriptive statistics of banks during 1998 to 2007. It is the time period of Basel I in Pakistan.

TABLE 4.2: Descriptive Statistics Basel I 1998 - 2007

|  | NPLGL % | CIR % | TCTR % | NLTA % | LASTF % | ROAA % | NIM % | SIZE | INF % |
|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 11.42 | 69.90 | 15.00 | 47.60 | 23.43 | 0.73 | 3.48 | 10.89 | 6.04 |
| **S.D** | 11.87 | 52.80 | 9.89 | 12.42 | 13.23 | 2.09 | 1.81 | 1.36 | 2.24 |
| **Min** | 0.20 | 0 | 3.33 | 10.05 | 6.16 | -12.29 | -1.36 | 7.85 | 2.91 |
| **Max** | 78.76 | 494.7 | 65.43 | 70.89 | 77.54 | 5.11 | 9.3 | 13.54 | 11.92 |

During 1998 to 2007 average value of non-performing loans to gross loans ratio by Pakistani Banks was 11.42%. This is slightly less than the same ratio of the banks during whole sample 1998-2015. Highest and lowest value of non-performing loans to gross loans ratio are same as whole sample i.e. from a high of 79% to a low of .2%. As far as the average value of cost to income ratio of banks is concerned, it is showing a sign of decline with an average value of 70% as compared to 75% of the whole sample. The maximum and minimum values of cost to income ratio of banks is same as that of full sample i.e. from high of 495% to low of zero. The average value of total capital to total risk weighted assets ratio of banks during Basel I stand at 15% which is slightly less than the average value of same ratio during 1998-2015. While the maximum and minimum capital ratio ranges from 65% to 3% roughly. The minimum value is showing a sigh of improvement while maximum value remains same as that of full sample value. Net loans to total asset ratio has average value of 47.60%. This shows that NLTA average and middle values of 47%. While it's maximum and minimum value ranges from low of 10.05% to high of 71%. Again the average value of this ratio has seen a slight improvement;

however there is not much difference in highest and lowest values from full sample figures. Average value of liquid asset to short term funding ratio has increased to 23% from the previous table and its values ranges from a low of 6% to high of 78%. Here only the minimum value of Liquid asset to short term funding ratio has risen 23% while its maximum value is showing no sign of increase or decrease from the whole sample values. Return on average asset has mean value of 0.73% and its value ranges from high of 5% to low of -12% same as previous table. Net interest margin highest and lowest values ranges from high of 9.3% to low of -1.36% while its average value is 3.48%. This is quite similar to the statistics of net interest margin in the whole time period. Bank specific variable size has mean value of 10.89 with a maximum of 13.54 and minimum value of 7.85. Inflation values vary from high of 11.92% to a low of 2.91%. Table 4.3 displays descriptive statistics of banks during the Basel II i.e. from 2008-2013. From 2008 to 2013 average non-performing loans

TABLE 4.3: Descriptive Statistics Basel II 2008 - 2013

|  | NPLGL % | CIR % | TCTR % | NLTA % | LASTF % | ROAA % | NIM % | SIZE | INF % |
|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 14.66 | 85.27 | 17.26 | 45.97 | 16.76 | 0.08 | 4.46 | 11.78 | 13.73 |
| **S.D** | 10.48 | 66.29 | 11.54 | 9.52 | 9.40 | 2.09 | 2.08 | 1.28 | 3.83 |
| **Min** | 85 | 0 | .08 | 24.59 | 2.44 | -7.62 | -1.45 | 8.9 | 7.6 |
| **Max** | 51.37 | 433.35 | 59.66 | 70.94 | 59.3 | 4.99 | 9.1 | 14.29 | 20.29 |

to gross loans ratio of Pakistani Banks is 14.66%. This is higher than the value of same ratio of the Pakistani banks during whole sample and Basel I time period. This shows banks had more non-performing loan ratio in this period. Highest and lowest value of non-performing loans to gross loans ratio ranges from 51.37% to a low of .85% during Basel II time period. Here minimum value is showing a sign of increase while maximum value shows a signal of decrease from the previous two time periods. As far as, the cost to income ratio is concerned it is also showing sign of improvement with average cost to income ratio of 85.27%. Its values are ranging from very high of 433.35% to low of zero. Here low value remains same, however maximum value has decreased from the previous two time periods. The average total capital to total risk weighted assets ratio of banks during Basel II

is 17.26%. It is also showing a sign of improvement. While the maximum and minimum capital ratio ranges from 59.66% to 8%. Net loan to total asset ratio has average value of 45.97% with standard deviation of 9.52. The average value of this ratio is slightly less than the Basel II value and almost identical to overall sample mean value. While it's maximum and minimum value ranges from low of 24.59% to high of 70.94%. Here minimum value is showing sign of improvement from the Basel I. Liquid asset to short term funding ratio has average value of 16.76% and its values range from a low of 2.44% to high of 59.3%. The average value of this ratio is decreasing from both whole sample time period and Basel I as well. Here maximum value of this ratio has decreased while minimum value is less than Basel I and higher than the overall time period. The indicator of profitability Return on Average Asset (ROAA) has mean value of .08% and its value ranges from high of 5% to low of -7%. The profitability of the banks has decreased during Basel II. Net interest margin is showing an increasing trend with average value of 4.46% while its highest and lowest values ranges from high of 9.1% to low of -1.45%. Similarly Bank size and inflation means, standard deviation, minimum and maximum values are also given in Table 4.3. Moreover descriptive statistics of Basel III are reported in table 4.4. Descriptive statistics of banks during Basel

TABLE 4.4: Descriptive Statistics Basel III 2014 - 2015

|  | NPLGL % | CIR % | TCTR % | NLTA % | LASTF % | ROAA % | NIM % | SIZE | INF % |
|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 11.43 | 63.78 | 16.80 | 39.26 | 0.13 | 0.94 | 4.01 | 12.65 | .86 |
| **S.D** | 6.69 | 20.98 | 6.49 | 8.93 | 0.08 | 0.94 | 0.98 | 1.10 | 2.34 |
| **Min** | 2.02 | 35.79 | 9.14 | 23.38 | 0.06 | -2.53 | 2.31 | 9.84 | 2.54 |
| **Max** | 28.18 | 121.1 | 41.23 | 66.81 | 0.46 | 2.81 | 6.61 | 14.61 | 7.19 |

III are presented in Table 4.4. Here averagely non-performing loans to gross loans ratio by banks have reduced with mean non-performing loans to gross loans ratio value of 11.43%. Similarly maximum and minimum non-performing loans to gross loans ratio of banks have changed with a high of 28% to low of 2%. The statistics of cost to income ratio are also decreasing during Basel III. Here average cost to income ratio of banks stands at 64% roughly. The risk adjusted capital held

by banks is showing signs of improvement with mean value of 16.80%. Similarly descriptive stats of other bank specific variables are presented in Table 4.4.

## 4.2  DIAGNOSTIC TESTS

### 4.2.1  Panel Unit Root Testing

Before examining the interrelationship between risk, efficiency and capital, the stochastic properties of the data are checked. There is similarity between unit root tests carried out on a single series and panel unit root test, however they are not completely identical to each other. There are number of test available to check the stationarity of data. However keeping in mind the unbalanced nature of the data used in this thesis, the stationarity of the variables is checked using unit root test developed by (Maddala and Wu, 1999) for unbalanced panels based on (Fisher, 1932) test that uses (Phillips and Perron, 1988) test. As this test to has more power than the conventional univariate time series tests. The null hypothesis for this test is data is non stationarity in all the series and the alternative hypothesis is that at least one series is stationary.

TABLE 4.5: Panel Unit Root Test

| Variable | Inverse chi squared $\chi^2$ | P Value |
|----------|------------------------------|---------|
| TCTR  | 172.9063 | 0.0000 |
| NPLGL | 105.8.87 | 0.0002 |
| CIR   | 212.6107 | 0.0000 |
| NLTA  | 78.8392  | 0.0519 |
| NIM   | 91.2562  | 0.0057 |
| LASTF | 149.2512 | 0.0000 |
| ROAA  | 163.0014 | 0.0000 |
| SIZE  | 157.348  | 0.0000 |
| INF   | 85.8546  | 0.0159 |

According to (Choi, 2001) if the number of panels in the data are finite, the use of inverse chi-square is preferable. As can be seen in the table 4.5, the P values of all variables are significant so data is stationary.

### 4.2.2  Testing for Multicollinearity

According to (Gujarati, 2009) one of the assumptions of the classical linear regression model is that there is no multicollinearity among the explanatory variables. The multicollinearity is verified to check that the independent variables are not highly correlated with each other and no multicollinearity amongst independent variables exists. To test this problem, the Pearson correlation and the variance inflation factor (VIF) are used. The correlation coefficients of independent variables for panel data (1998-2015) are illustrated in table 4.6 According to (Gujarati,

TABLE 4.6: Correlation Analysis

|  | TCTR | NPLGL | CIR | NLTA | NIM | LASTF | ROAA | SIZE | INF |
|---|---|---|---|---|---|---|---|---|---|
| **TCTR** | 1.0000 | | | | | | | | |
| **NPLGL** | 0.0215 | 1.0000 | | | | | | | |
| **CIR** | 0.0565 | 0.4206 | 1.0000 | | | | | | |
| **NLTA** | -0.4241 | -0.2935 | -0.0375 | 1.0000 | | | | | |
| **NIM** | 0.1898 | -0.3413 | -0.3356 | -0.0570 | 1.0000 | | | | |
| **LASTF** | 0.3615 | 0.0012 | 0.0138 | -0.1996 | 0.0090 | 1.0000 | | | |
| **ROAA** | -0.0668 | -0.4273 | -0.6248 | 0.0506 | 0.4291 | -0.1166 | 1.0000 | | |
| **SIZE** | -0.3716 | -0.0578 | -0.2191 | 0.0709 | 0.3670 | -0.4581 | 0.3133 | 1.0000 | |
| **INF** | 0.1087 | -0.0348 | 0.1371 | 0.2247 | 0.2852 | 0.0222 | -0.1761 | 0.0931 | 1.0000 |

2009) correlation coefficient value of over 0.8 or 0.9 create major issue. As can be seen from the table 4.6 that the highest correlation coefficients is -0.62, so though some correlation does exist but it is not too high so multicollinearity is unlikely to be a problem.

This research also used the variance inflation factor (VIF) to check multicollinearity. As a rule of thumb, multicollinearity is considered as a serious problem when the VIF values for independent variables are higher than 10 (Gujarati, 2009). As can be seen from the values in table 4.7 multicollinearity is not an issue. Similarly VIF values for model 3.2 and 3.3 are presented as well in table 4.8 and 4.9 and they also suggest the no multicollinearity in their respective models.

TABLE 4.7: Variance Inflation Factor Risk Model

| Variable | VIF | 1/VIF |
|----------|-----|-------|
| TCTR | 1.56 | 0.6407 |
| CIR | 1.39 | 0.7208 |
| NLTA | 1.30 | 0.7720 |
| SIZE | 1.20 | 0.8362 |
| INF | 1.09 | 0.9152 |

*Mean VIF = 1.31*

TABLE 4.8: Variance Inflation Factor Efficiency Model

| Variable | VIF | 1/VIF |
|----------|-----|-------|
| TCTR | 1.39 | 0.7205 |
| NPLGL | 1.17 | 0.8551 |
| NIM | 1.66 | 0.6027 |
| SIZE | 1.54 | 0.6501 |
| INF | 1.10 | 0.9117 |

*Mean VIF = 1.37*

TABLE 4.9: Variance Inflation Factor Capital Model

| Variable | VIF | 1/VIF |
|----------|-----|-------|
| NPLGL | 1.33 | 0.7528 |
| CIR | 1.76 | 0.5694 |
| LASTF | 1.29 | 0.7751 |
| ROAA | 1.91 | 0.5226 |
| SIZE | 1.46 | 0.6845 |
| INF | 1.09 | 0.9136 |

*Mean VIF = 1.45*

### 4.2.3   Testing for Homoscedasticity

The variance of residuals should be homogeneous is one of the important assumption of regression for adequate fitness of model. Assumption of heteroskedasticity is checked by using Breusch-Pagan/Cook-Weisberg test. The results in table 4.10 shows the heteroskedasticity does exist in the data. In the presence of heteroskedasticity the standard errors are biased which affects t-test and significance of model. So, the robust approach is applied for the remedy of heteroskedasticity an unbiased estimation of the regression model. Similar observations are found

TABLE 4.10: Homoscedasticity Test Breusch- Pagan / Cool- Weisberg test Risk Model

| | |
|---|---|
| Chi2(31) | = 186.20 |
| $Prob > Chi2$ | = 0.000 |

in case of model 3.2 and 3.3. Table 4.11 and 4.12 reports the presence of heteroskedasticity in the models respectively. So, robust approach is being applied for the remedy of heteroskedasticity.

TABLE 4.11: Homoscedasticity Test Breusch- Pagan / Cool- Weisberg test Efficiency Model

| | |
|---|---|
| Chi2(31) | = 7.21 |
| $Prob > Chi2$ | = 0.0072 |

TABLE 4.12: Homoscedasticity Test Breusch- Pagan / Cool- Weisberg test Capital Model

| | |
|---|---|
| Chi2(31) | = 4.80 |
| $Prob > Chi2$ | = 0.0284 |

## 4.3 The Impact of Bank Capital on Bank Risk

As discussed earlier panel data has several advantages over simple cross-sectional or time series data. Panel data has several appropriate models e.g. fixed effect (fe) or random effect (re). So here panel data is being applied to arrive at results. This section presents the results of impact of Basel capital regulations on the risk taking behavior of the banks

### 4.3.1 Hausmen Test for Bank Risk Model

In order to test the appropriate model between random effect and fixed effect Hausman test is used as recommended by (Shah et al., 2014). The result of Hausman test in table 4.13 favor the use of fixed effect model for model 3.1.

TABLE 4.13: Hausman Test Risk Model

| | |
|---|---|
| Chi2(10) | = 14.02 |
| $Prob > Chi2$ | = 0.0155 |

### 4.3.2 Impact of Bank Capital on Bank Risk

The results of fixed effect for model 3.1 are shown in table 4.14. Result shows that the model is highly significant at 1% with F value (19.72). From the results table it can be seen that variable bank capital has negative impact on bank risk as the proxy Total Capital to Total Risk Weighted Assets of bank capital variable has a coefficient of -0.431 and it is significant at 1%. It also shows with a 1% rise in bank capital, risk decreases by 43% and vice versa. So this study proves that bank capital has negative impact on bank risk. The impact of bank efficiency on bank risk is also negative and it is highly significant at 1%. This is evident by the sign and size of Cost to Income Ratio. The coefficient of Net loans to Total asset is negative and highly significant at 1%. This implies liquidity has negative impact on bank risk. Bank size does not affect the risk taking of banks in the sample as the impact of size is insignificant. With respect to the impact of inflation on bank risk is considered, it is insignificant as well.

TABLE 4.14: Regression Estimates of Impact of Bank Capital on Bank Risk

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | -0.431*** | 0.132 |
| CIR | 0.080*** | 0.017 |
| NLTA | -0.453*** | 0.118 |
| SIZE | -1.605 | 1.142 |
| INF | 0.207 | 0.124 |
| R Square | 0.2361 | |
| F Statistics | 19.72*** | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

## 4.4 The Impact of Bank Capital on Bank Efficiency

This section presents the results of impact of Basel capital regulations on the efficiency of the banks.

### 4.4.1 Hausmen Test for Bank Efficiency Model

The result of Hausman test for the model 3.2 is reported in table 4.15 and it has the P value of 0.0000 and it also suggests the use of fixed effect model.

TABLE 4.15: Hausman Test Efficiency Model

| | |
|---|---|
| Chi2(10) | = 10.54 |
| $Prob > Chi2$ | = 0.0614 |

### 4.4.2 Impact of Bank Capital on Bank Efficiency

Table 4.16 presents the result of model 3.2. In this model bank capital has positive impact on bank inefficiency and it is significant at 1%. So it can be inferred that Basel capital regulations has decreased the efficiency of the banks. This study did not find evidence of impact of bank risk on bank efficiency as coefficient of Non-Performing Loans to Gross Loans is -0.357 and it is insignificant.

TABLE 4.16: Regression Estimates of Impact of Bank Capital on Efficiency

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | 1.890*** | 0.331 |
| NPLGL | -0.357 | 0.642 |
| NIM | -6.101** | 2.236 |
| SIZE | 1.843 | 2.518 |
| INF | 1.489*** | 0.346 |
| R Square | .2259 | |
| F Statistic | 8.89*** | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

With regards to impact of Net Interest Margin on bank efficiency is given, it is negative and significant at 5%. The impact of control variable size on bank efficiency is insignificant. This depicts that size has no impact on the efficiency of the banks. The same cannot be said about the other control variable inflation as it is positive and highly significant at 1%.

## 4.5   Determinants of Bank Capital

This section describes the results of determinants of capital adequacy ratio of Pakistani banks in their sample.

### 4.5.1   Hausmen Test for Bank Capital Model

Table 4.17 states the result of Hausmen Test for model 3.3 and it also tells us the same story i.e. use of fixed effect

TABLE 4.17: Hausman Test Capital Model

| | |
|---|---|
| Chi2(10) | = 36.82 |
| $Prob > Chi2$ | = 0.0000 |

### 4.5.2   Factors Affecting Bank Capital

As far as the result of Fixed Effect regression estimate with TCTR as dependent variable are reported in table 4.18. By looking at Table 4.18 it is evident that only the control variable Return on Average Assets and Liquid Asset to Short Term Funding has a positive and significant impact on bank capital as the coefficient of Return on Average Assets and Liquid Asset to Short Term Funding has value of .717 and .178 respectively and both are it is significant at 1%. Other variables have no significant impact on the regulatory capital of the banks in sample of this research.

TABLE 4.18: Regression Estimates of Determinants of Bank Capital

| Variable | Coefficient | Standard Error |
|----------|-------------|----------------|
| NPLGL | -0.021 | 0.404 |
| CIR | -0.006 | 0.008 |
| ROAA | 0.717*** | 0.235 |
| LASTF | 0.178*** | 0.030 |
| SIZE | 0.2667 | 0.434 |
| INF | 0.0174 | 0.064 |
| R Square | 0.1781 | |
| F Statistics | 19.68*** | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

## 4.6 Robustness Checking of Bank Risk Model

In this section we check the robustness of results as the current literature recommends the need for the robustness test. GMM approach has been used for robustness.

### 4.6.1 Endogenity of Bank Risk Model

First endogenity in risk model is tested as banking literature expects bank capital and bank efficiency to be endogenius. Durbin and WuHausman test is employed for this purpose and values reported in Table 4.19 are highly significant. So both Total Capital to Total Risk Weighted Assets (TCTR) and Cost to Income ratio (CIR) are endogenous.

TABLE 4.19: Endogenity Test Risk Model

| Regressors tested | TCTR CIR |
|-------------------|----------|
| **Instrument Variable Used** | L.TCTR L.CIR |
| **Hausman test for endogeneity** | 25.772 |
| **(p-value)** | (0.0000) |

## 4.6.2 Impact of Basel Capital Regulation on Bank Risk

Table 4.20 shows the factors affecting the risks of banks. According to the findings of this research, Total Capital to Total Risk Weighted Assets (TCTR) has negative impact on the credit risks taken by the bank. This is evident by the negative sign and value of coefficient of Total Capital to Total Risk Weighted Assets. It can be interpreted as banks with higher TCTR incline to take lower risks and vice versa. This study concludes that risk-based capital regulations are successful in decreasing bank credit risks in Pakistan thus accepting H1 hypothesis. So here moral hazard hypothesis is accepted, which also advocates a negative association between the two. Here the results of this research are in agreement with (Jacques and Nigro, 1997), (Lee and Hsieh, 2013), (Haq et al., 2014) etc. Those reporting a negative relationship between two variables cite the presence of deposit insurance for this inverse relationship. However in Pakistan there was no deposit insurance scheme existed during the time period of this study. The results in Table 4.20 also highlight that impact of bank inefficiency on bank risk is negative and it is significant at 10%. Here results of this study are pointing towards positive impact of bank efficiency on bank risk thus rejecting H2. So according to results of this study, an efficient bank takes more risk. One reason can be that cost efficiency allows banks cushion to take on more risk. The skimping hypothesis accepted by this study also advocates a positive relation between the two. (Fiordelisi et al., 2011) and (Tan and Floros, 2013) also report the same relationship in their study.

Net Loans to Total Asset (NLTA) has negative effect on the risk taken by commercial banks as the coefficient of NLTA is negative and highly significant at 1%. A high NLTA is sign of small liquidity, which may increase funding cost and also increase the credit risk of the bank. In that case, the effect of liquidity ratio may be negative. Here the results of this study are in line with (Tan and Floros, 2013). Bank size has highly significant negative impact on the bank risk. This is shown by the sign of coefficient and p value of size. It indicates that larger banks have lower risks than smaller ones. One reason might be that their size allows them to diversify their portfolios from risky loans or big banks may not be making risky loans

TABLE 4.20: Impact of Basel Capital Regulation on Bank Risk 1998-2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | -0.380*** | 0.141 |
| CIR | -0.243* | 0.13 |
| NLTA | -0.650*** | 0.102 |
| SIZE | -0.348*** | 0.101 |
| INF | 0.172*** | 0.056 |
| Chi Sq | 60.81*** | |
| No. of Observations | 311 | |
| No. of Banks | 31 | |
| No. of Instruments | 10 | |
| Hansen test (p-value) | 0.194 | |
| AR (2) test (p-value) | 0.577 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

and they might be opting for less risky options e.g. treasury bills etc. (Jacques and Nigro, 1997), (Aggarwal and Jacques, 1998), (Altunbas et al., 2007) etc. also point towards this. As far as impact of inflation is concerned, it is positive and highly significant at 1%. One justification can be given that during this time period average inflation was around 8%, so these inflationary pressures played their part in enhancing the level of impaired loans, which increase the credit risks of banks. Here the results of this study are following (Fofack et al., 2005) results.

In order to generalize the results, this study checks the impact of capital regulations on another proxy of risk taken by the banks. This other proxy of risk taken by the banks is Loans Loss Provision to Net Interest Revenue (LLPNIR). It is a measure of quality of loans of a bank. It is calculated by dividing the provisions in the profit and loss account to the net interest income of the same period. Table 4.21 reports the results of impact of capital regulations on the Loans Loss Provision to Net Interest Revenue. As can be seen from the table that effect of bank capital on bank risk as measured by Loans Loss Provision to Net Interest Revenue is negative and this is significant at 10%. So capital regulations have decreased the Loans Loss Provision to Net Interest Revenue ratio. In other words capital regulations have decreased the risk taking by the banks. Here our results are in agreement with

(Bikker and Metzemakers, 2005) and (Moyer, 1990). These researchers have also found a negative relationship between capital ratios and loan-loss provisions in their respective study. So this proxy of risk is also accepting hypothesis H1 i.e. moral hazard hypothesis. As far as the impact of bank inefficiency on the risk taking behavior of banks, here cost to income ratio has a negative effect on the risk taken by banks, and this is highly significant at 1%. So bank inefficiency has negative impact on the risk taking activities of the banks in this research. This can be interpreted as the bank efficiency has positive impact on the risks of the banks. This implies that efficiency allows extra cushion to the banks to take more risk and vice versa thus pointing towards the rejection of H2 hypothesis. With respect to the impact of Net loans to Total Asset on the bank risk taking is concerned, it is insignificant. This shows that banks liquidity does not influence the risk taking of banks. Same can be said about size as it also does not affect the risk taken by the banks in this study. As far the effect of the inflation on the Loans Loss Provision to Net Interest Revenue ratio is concerned, it is positive and significant.

TABLE 4.21: Impact of Basel Capital Regulation on Bank Risk with LLPNIR
as Dependent Variable 1998-2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | -0.083* | 0.047 |
| CIR | -0.140*** | 0.044 |
| NLTA | 0.012 | 0.031 |
| SIZE | -0.016 | 0.03 |
| INF | 0.096*** | 0.024 |
| Chi Sq | 83.95*** | |
| No. of Observations | 322 | |
| No. of Banks | 31 | |
| No. of Instruments | 18 | |
| Hansen test (p-value) | 0.531 | |
| AR (2) test (p-value) | 0.768 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

So from the results presented in the Table 4.20 and 4.21, it is quite clear that overall Basel capital regulations have decreased the risks taken by banks. One

reason of this negative impact can be in the absence of clear deposit insurance scheme in Pakistan, capital regulation might be one of main tool to decrease risk taken by the Pakistani banks. Deposit protection laws are only applicable to nationalize banks in Pakistan and majority of banks in Pakistan are private, so in the absence of clear deposit insurance scheme for private banks, these Basel capital regulations might be restricting banks from taking extra risk. So in countries with no explicit deposit insurance scheme, strict capital regulations can be used as a tool to refrain banks from making risky investment. It can act as deterrent to stop banks from indulging in risky activities. According to SBP financial stability review (2000) capital adequacy reduces the risk of bankruptcy by focusing on the amount of bank capital.

### 4.6.3 Impact of Basel Capital Regulation on Bank Risk in Different Basel Accords

In order to quantify the impact of different Basel regulations, the sample of this study is divided according to the timeframe of implementation of Basel Accords in Pakistan. Since Basel III was implemented from 2014, so there were not enough annual observations to check the effect of Basel III capital regulations on bank risk. So two subsamples, Basel I and Basel II are formed. Table 4.22 presents the results of determinants of bank credit risk of Pakistani commercial banks for the sub samples Basel I and Basel II.

Table 4.22 shows that Basel I capital regulation has no impact on the risk taking activities of banks, as the coefficient of capital is insignificant in case of Basel I. While the Basel II has reduced the risks taken by banks as is evident by the significant negative sign of capital. This is surprising due to the fact that though over all there is considerable difference between Basel I and Basel II regulations; however capital requirements were same in both Basel I and Basel II. Here hypothesis H7 is being accepted which advocates the different impact of capital regulations on risk taking by the banks in different Basel accords.

TABLE 4.22: Effect of Basel I and II Capital Regulations on Bank Risk

| Variable | Basel I (1998-2007) | | Basel II (2008-2013) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | -0.1 | 0.16 | -0.282** | 0.116 |
| CIR | -0.541** | 0.276 | 0.468*** | 0.062 |
| NLTA | -0.601*** | 0.073 | -0.345*** | 0.097 |
| SIZE | -0.065 | 0.114 | -0.072 | 0.124 |
| INF | -0.257 | 0.157 | 0.055 | 0.038 |
| Chi Sq | 439.30*** | | 44.48*** | |
| No. of Observations | 148 | | 135 | |
| No. of Banks | 28 | | 30 | |
| No. of Instruments | 12 | | 12 | |
| Hansen test (p-value) | 0.105 | | 0.327 | |
| AR (2) test (p-value) | 0.296 | | 0.39 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

The impact of cost inefficiency has statistically significant negative impact on bank risk in Basel I and II. Thus it can be concluded that during Basel I and Basel II time period, efficiency allowed banks incentive to take more risk. The impact of Net loans to Total asset (NLTA) on bank risk is same across all the sub samples i.e. negative and remains significant in all sub samples. The same can be said about the impact of size in Basel I and II. The impact of inflation on bank risk in Basel II is in aligning with the impact of effect of inflation on Bank risk during the whole time period i.e. 1998-2015. However its impact is not significant in Basel I time period. The results of sub sample II are painting the same story as of main sample. The different impact of inflation on risk taken by banks can be attributed to the fact that during Basel II Pakistan was experiencing high inflation than Basel I.

So it can be concluded from the above discussion that Basel II has played its part in reducing the risk taken by the banks, while Basel I has neither decreased nor increased risk taking activities of banks. One justification can be put forward that Basel 1 might be implemented just to harmonize with international community.

Though State Bank of Pakistan was incorporated under the State Bank of Pakistan Act, 1956, however it was made fully independent in May 1997. Since the implementation of Basel I started in 1997 soon after the autonomy of State banks so banks in Pakistan might not ready to implement Basel regulations in its true letter and spirit. Banks might have implemented Basel capital regulations as instructed by the SBP to show compliance with international community; however neither banks nor SBP was prepared for this. So this inability of the SBP or banks can be the presented as the main reason of the failure of the Basel I accord capital regulations in curbing the risks taken by the banks. As far as the significant impact of Basel II is concerned, though CAR for Basel II is same as that of Basel I i.e. 8%, however increase in Minimum Capital Requirements (MCR) through State bank of Pakistan BSD Circular No. 06 dated October 28, 2005 might played its part in reducing bank risky investments.

## 4.6.4 Impact of Bank Capital Regulation on Bank Risk in Different Political Regimes

There were many important political events occurred during the time period of this study i.e. from 1998 to 2014. However one such event was most significant of all. General Musharraf, then chief of Army staff took over the charge of the country by imposing Martial Law on 12 October 1999. Prime minister and key member of his cabinet and family were taken into custody and constitution was suspended. By doing so General Musharraf first declared himself as CEO and then president of Pakistan and ruled out the democracy from the country. He governed the country for almost nine years and he did introduce many economic and political reforms during his regime. His martial law regime ended in 18 February 2008, when after general elections peaceful transition of power occurred. On March 24, 2008 National Assembly of Pakistan elected a democratic prime minister. From that time period to 2015 there is democracy in Pakistan. To assess the impact of capital regulations on the risk taken by the banks in different political systems, this study has divided the sample into sub sample on the basis of different political

regimes i.e. from 1999 to 2008 as non-democratic and 2009 to 2015 as democratic regime. Table 4.23 presents the results of both regimes.

Although there is an old cliché that the worst democracy is better than the best type of military rule or dictatorship, however by having a look at Table 4.23 it becomes clear that this cliché does not hold true in this study. There is not much difference of the impact of Basel capital regulations in non-democratic and democratic administrations. Both the regimes have decreased the risk taken by the banks; however results in democratic system are more statistically significant. Thus here findings of this study are rejecting H8 hypothesis. This same effect is bit surprising as fundamentally working and nature of non-democratic administration is different from that of democratic one. Moreover banking was one of profitable industry during 1999-2007 and banks provided more loans as well. One justification can be that though usually non-democratic and democratic administrations are different in their working and policies, however in Pakistan that is not the case. There is not much difference in Musharraf Martial Law and democratic governments' economic strategies and procedures. Or it could be democratic government continued the economic reforms of previous government and did not deviate significantly from the non-democratic regime in this regard. With regards to impact of liquidity measure is concerned, it exhibits same effect in both timeframes. It has statistically significant negative effect in both administrations. The impact of other variables e.g. efficiency, size and inflation is different in both political systems owing to different reasons.

### 4.6.5 Effect of Basel Capital Regulations on Bank Risk in Big and Small Banks

This study also checks the impact of size on the risk taking by the banks. Theory proposes a negative relationship between the two variables. Theoretical arguments suggest that larger banks can afford to have lower risks due to their ability to hold more diversifiable portfolios. However empirical evidence shows mixed results.

TABLE 4.23: Impact of Capital Regulations on Risk Taking during Different Regimes

| Variable | Non-Democratic (1999 - 2008) | | Democratic (2009-2015) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | -0.247* | 0.144 | -0.311** | 0.164 |
| CIR | -0.143 | 0.307 | 0.175* | 0.096 |
| NLTA | -0.589*** | 0.105 | -0.240*** | 0.075 |
| SIZE | -0.132 | 0.135 | -0.274** | 0.125 |
| INF | 0.158** | 0.061 | 0.008 | 0.049 |
| Chi Sq | 39.85*** | | 31.62*** | |
| No. of Observations | 161 | | 135 | |
| No. of Banks | 30 | | 29 | |
| No. of Instruments | 12 | | 12 | |
| Hansen test (p-value) | 0.240 | | 0.282 | |
| AR (2) test (p-value) | 0.312 | | 0.565 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

Those advocating a positive relationship cite the better risk management techniques as the main reason for this affirmative relationship. To quantify the effect of the size on the risk taken by the banks, the sample is divided into two sub-samples on the basis of size. Two panels' data are considered respectively large and small banks in order to compare Pakistani banks according to their size. The banks having size less than the mean value of size of the sample are considered small while banks whose size is equal or greater than mean value of sample are taken as big banks.

Table 4.24 shows that as far as the impact of size on risk taking is considered, there is not much difference in the impact of capital regulations on the risk taken by the banks thus rejecting H9 hypothesis. Capital regulations have decreased the risk taken by the banks in both big and small banks. One reason can be that majority of banks in Pakistan are private due to denationalization of the banking sector at that time, so fear of lack of support from the government in case of failure might have restrained banks from taking risk. Moreover there were some

activity in banks mergers and acquisition during after the issuance of State Bank of Pakistan BSD Circular No. 06 dated October 28, 2005 to increase its MCR, so that consolidation of banks might have restricted banks to take less risks. In other words consolidation and privatization might have nullified the advantage of size of the banks. Efficiency and liquidity have negative effect on the risk taking in case of big banks. With respect to small banks, they take less risk, however this effect is less significant. This is evident by statistically significance of the 5% for small banks. Here results of this study are rejecting too-big-to-fail (TBTF) hypothesis. This hypothesis states that big firms such as banks are so important to economic systems that government will bail out big banks as banks can't be allowed to fail due to their adverse impact on economy. However in Pakistani case it is not true. Similarly the effect of liquidity is also negative in case of small banks. The effects of inflation and efficiency on the risk taken by the banks are different in big and small banks. So it can be concluded on the basis of results presented in Table 4.24 that size does not facilitate in enhancing the risk taken initiatives of the Pakistani banks. In other words banks in this research's sample do not rely on their size in increasing risk appetite.

TABLE 4.24: Impact of Size on Bank Risk

| Variable | Big (Size>=11.4527) | | Small (Size<11.4527) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | -0.648*** | 0.18 | -0.188** | 0.086 |
| CIR | 0.687*** | 0.19 | -0.149 | 0.124 |
| NLTA | -0.402*** | 0.074 | -0.704*** | 0.106 |
| INF | 0.0596 | 0.039 | . 0.241*** | 0.071 |
| Chi Sq | 194.11*** | | 113.83*** | |
| No. of Observations | 164 | | 147 | |
| No. of Banks | 22 | | 25 | |
| No. of Instruments | 12 | | 11 | |
| Hansen test (p-value) | 0.421 | | 0.115 | |
| AR (2) test (p-value) | 0.225 | | 0.311 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

Table 4.25 presents the results of more comprehensive analysis of the moderating effect of bank size on the relationship between bank risk taken and bank efficiency. Here size is playing the role of moderator. Keppel and Zedeck (1989) suggested that the proposed moderator should be used as independent variable and then as an interaction term. By following (Keppel and Zedeck, 1989), this study perceives size as moderator by using the interaction term of bank inefficiency and bank size. The insignificant negative effect of the interaction term on the bank credit risk advocates that bank size is not playing its role as moderator in reducing the risks taken by the banks in this study. This is in line with above findings where size has no impact on the reducing the risk taken by the banks.

TABLE 4.25: Impact of Size as Mediator between Risk & Efficiency 1998-2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | -0.734** | 0.349 |
| CIR | -0.08 | 0.163 |
| NLTA | -0.649*** | 0.094 |
| SIZE | -0.349*** | 0.109 |
| INF | 0.165*** | 0.059 |
| CIR*SIZE | -0.448 | 0.323 |
| Chi Sq | 89.22*** ||
| No. of Observations | 311 ||
| No. of Banks | 31 ||
| No. of Instruments | 12 ||
| Hansen test (p-value) | 0.375 ||
| AR (2) test (p-value) | 0.788 ||

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

### 4.6.6   Impact of High and Low Bank Capital on Bank Risk

SBP has made it mandatory for the banks to comply with capital regulations of Basel accords through the issuance of various directives at different dates. To abide by the Basel capital regulations, banks are maintaining mandatory capital adequacy ratio. However there is no consensus on the amount of additional capital held. This extra capital above regulatory ratio is also called capital buffer. Some banks maintain marginal capital adequacy ratio and there is no substantial capital buffer in those banks. While some banks are highly capitalized banks and they have considerable capital buffer. In order to check the effect of capital regulations on the risk taking of banks on the basis of capital buffers, the sample of this study is divided into marginal capitalized and highly capitalized banks. Here marginally capitalized banks have Total Capital to Total Risk Weighted Assets ratio less than 9% while ratio for highly capitalized banks is greater than or equal to 9%. Though Basel III has different capital requirements than Basel I and Basel II, however there are not a lot of observations in Basel III period. So keeping this limitation in mind the comparison between impact of capital regulation on marginal capitalized and highly capitalized banks is provided for Basel I and Basel II only and Basel III has been excluded. The results are reported in Table 4.26.

According to the results the banks having capital ratios well above the minimum capital requirements have insignificant effect on the risk taking of banks. In other words highly capitalized banks have no effect on the risk taken by the banks. One justification of this insignificant effect can be by having well above capital ratios they are not restricted by the capital regulations and they might have their own capital and risk-taking limits. (Berger et al., 2008) arrived at the same findings in their research. The banks having high capital buffer also have no impact of efficiency on the risk taken by the banks. In case of marginally capitalized banks, they have seen a decrease in the risk taking behavior. As far as the impact of efficiency in case of marginally capitalized banks is considered, here results report that cost efficiency has negative impact on the risk taking of the banks.

So from the above discussion it is quite clear that there is considerable difference on the risk taking of banks on the basis of additional capital held thus accepting

TABLE 4.26: Impact of High/low Capital on Bank Risk 1998-2015

| Variable | Highly Capitalized Banks (TCTR>=9%) | | Marginally Capitalized Banks (TCTR<9%) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | -0.071 | 0.101 | -3.404*** | 1.151 |
| CIR | -0.128 | 0.211 | 0.381*** | 0.112 |
| NLTA | -0.594*** | 0.109 | 0.18 | 0.374 |
| SIZE | -0.249** | 0.108 | 0.457 | 0.373 |
| INF | 0.146** | 0.06 | -0.15 | 0.269 |
| Chi Sq | 38.85*** | | 682.98*** | |
| No. of Observations | 242 | | 41 | |
| No. of Banks | 31 | | 13 | |
| No. of Instruments | 10 | | 10 | |
| Hansen test (p-value) | 0.451 | | 0.178 | |
| AR (2) test (p-value) | 0.245 | | 0.252 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

H10 hypothesis. Those who have additional large capital held have no impact on the risks of the banks while lowly capitalized banks have seen their risk taking reduced.

## 4.6.7 Effect of Basel Capital Regulations on Bank Risk during High and Low Inflation Period

Along with firm level variables, macroeconomic variables like inflation also affect the risk taking by the banks. (Hussain, 2005) advocates that inflation rate of about three to six percent to have good effects on the economy of country like Pakistan. Since average inflation rate in Pakistan during the time period of this research is about 8.75% with minimum and maximum inflation range from 2.54% to 20.29 %, so it is a good idea to see the impact of capital regulations on risk taking pattern of banks during high inflationary and low inflationary periods. To compare the impact of capital regulations on risk taking behavior of banks during high and low inflation time period, in this section sample is divided into high inflationary and

low inflationary periods. Highly inflationary period constitute time period where inflation in greater than or equal to 6% while low inflationary periods cover years where inflation is less than 6%. (Rajan, 2006) states that low inflation in the economy may force the asset managers to take high risk due to earn more revenue or some other contractual, behavioral or institutional reasons.

From the results reported in Table 4.27, it is evident that impact of capital regulations on bank risk taken is negative during high inflation. In other words capital regulations have decreased the risks of the banks. We can say that Basel capital regulations have played its part in reducing the risks taken by the banks in high inflationary period. While in the period of low inflation, its impact is though negative, however it is statistically insignificant. We can infer on the basis of this result that capital regulation do not affect risk taking behavior of banks in low inflationary periods. Thus findings of this study are accepting H11 hypothesis. There exist significant difference in the impact of capital regulations on risk taking by the banks in high inflationary periods and low inflationary periods.

TABLE 4.27: Impact of Capital Regulations on Bank Risk during High and Low Inflationary Periods 1998-2015

| Variable | High Inflationary Period (Inflation >=6%) | | Low Inflationary Period (Inflation <6%) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | -0.293*** | 0.096 | -0.333 | 0.292 |
| CIR | 0.026 | 0.098 | 1.370*** | 0.227 |
| NLTA | -0.405*** | 0.061 | -0.353*** | 0.072 |
| SIZE | -0.155 | 0.101 | 0.072 | 0.109 |
| Chi Sq | 49.51*** | | 139.02*** | |
| No. of Observations | 219 | | 92 | |
| No. of Banks | 31 | | 26 | |
| No. of Instruments | 11 | | 11 | |
| Hansen Test (p-value) | 0.323 | | 0.471 | |
| AR (2) Test (p-Value) | 0.914 | | 0.691 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

## 4.6.8 Impact of Basel Capital Regulation on Bank Risk in Different Banking System

In order to have more meaningful analysis this study also divides the sample according to the nature of banks as depicted in Table 4.28. Although banks can be classified into various categories on the basis of their working; however in this section the sample is distributed into conventional and Islamic banks subsamples. Pakistan being an Islamic country has Islam its religion of majority of its population and since country's independence in 1947, State Bank of Pakistan has taken different initiatives in banking sector. However, according to Errico and (Errico and Farahbaksh, 1998), Basel Accord capital requirements do not treat conventional and Islamic financial differently. So it will be interesting to see impact of capital regulation on risk taking behavior of Islamic banks as well.

TABLE 4.28: Impact of Capital Regulations on Bank Risk in Different Bank Types

| Variable | Islamic Banks | | Conventional Banks | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | -0.017 | 0.098 | -0.137** | 0.069 |
| CIR | 0.331** | 0.136 | 0.509*** | 0.057 |
| NLTA | -0.124 | 0.082 | -0.382*** | 0.061 |
| SIZE | 0.049 | 0.129 | -0.028 | 0.059 |
| INF | -0.028 | 0.062 | 0.047 | 0.056 |
| chi2 | 14.06 | | 135.45 | |
| p-value | 0.0153 | | 0 | |
| RMSE | 0.3715 | | 0.9121 | |
| R-sq | 0.2753 | | 0.298 | |
| No. of Observations | 37 | | 319 | |
| Parameters | 5 | | 5 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

As the no. of observation for Islamic are not enough to apply GMM, so here (Zellner, 1962) Seemingly Unrelated Regression (SUR) approach is applied for estimation. According to the results of this study the effect of bank capital on

bank risk is though negative, however this is insignificant. So capital regulation does not affect bank risk taking of Islamic banks. This result is surprising, because Basel capital regulations were adopted to reduce the risk taking behavior of banks; however in this case, it neither increased nor decreased the risk taken by the Islamic banks. One possible explanation of this result can be that banks which hold capital ratios well above the minimum capital requirements; they are not affected by these capital restrictions. They usually have their own capital and risk taking points as advocated by the (Maji and De, 2015). Since average TCTR of Islamic banks is 22% in this study, which is way above than the 8% and 10.5% proposed by Basel II and Basel III respectively, so capital regulations did not affect risk taken by banks. Here the results of this study are rejecting both regulatory and moral hazard hypothesis. As far as impact of capital regulations in case of conventional banks are concerned, it is showing a negative impact. So capital regulations have decreased the risk taking behavior of conventional banks in line with the main results of this study. This is understandable as the majority of banks are conventional in this study so this result confirms the baseline findings of this study. Here the findings of this study are accepting H12 as the effect of capital regulations on risk taking of both Islamic and conventional banking is different. The impact of other variables on the risk taking behavior of both Islamic and conventional banks is also presented in Table 4.28.

The findings of this study are pointing towards the ineffectiveness of Basel regulations in reducing the risks taken by the Islamic banks. So there should be separate regulations for Islamic banks. One possible reason can be since fundamental principles and working of Islamic banks are opposite to conventional banks so impact of Basel regulations on risk taking is also different.

### 4.6.9 Impact of Basel Capital Regulation on Bank Risk in Financial Crisis

During the implementation of Basel framework in Pakistan, world witnessed International Financial Crisis of 2008. The Financial Crisis of 2008 has exposed

the weaknesses of the financial system of develop countries like USA and UK. Pakistan being a developing country has also been affected by this. This study seeks to shed light on the impact of capital regulation on the risk taking behavior of banks during the financial crisis as well. In line with estimation methodology used in previous section, here also Seemingly Unrelated Regression (SUR) is being employed due to small No. of Observations in the year of financial crisis i.e. 2008. According to the results reported in Table 4.29, there is no significant impact of capital regulation on bank risk taking during financial crisis of 2008 thus rejecting H13. According to the State Bank of Pakistans Financial Stability Review 2007-08, banking sector of Pakistan was in good condition in spite of challenges faced since late 2007 due to strong regulatory supervision. CAR of banking sector stood at 12.1% at end-June 2008 well above required 8 %. Another possible reason for this insignificant effect is the absenteeism of amalgamation of the domestic financial sector with the international financial sector. More over this could be due to low share of Pakistani banks in international financial markets. According to a senior Pakistani banker "We have been able to escape the affect not because of some superior more efficient safeguards that we had but because we are too weak to figure in global financial matrix".

TABLE 4.29: Impact of Capital Regulations on the Bank Risk during Financial Crisis Year 2008

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | -0.171 | 0.183 |
| CIR | 0.432*** | 0.137 |
| NLTA | -0.261 | 0.214 |
| SIZE | 0.164 | 0.2 |
| INF | -0.046 | 0.165 |
| chi2 | 11.25 | |
| p-value | 0.0466 | |
| RMSE | 0.7561 | |
| R-sq | 0.2601 | |
| No. of Observations | 32 | |
| Parameters | 5 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

## 4.6.10 Impact of Market Discipline on Bank Risk

Before discussing the effect of market discipline on the risks taken by the banks in the sample of this study, it is a good idea to talk about the market discipline. (Berger et al., 1991) defined Market discipline as the method, by which different private stakeholder e.g. depositors, investors take necessary actions to protect their investments or deposits. These actions can be either demand high interest rate for their deposits or with drawl of deposits from risk banks to less risky banks to counter their interests. This will restrict the managers from taking excessive risk. So market discipline should decrease risk. (Flannery, 2001) defines two faces of Market discipline one the ability to monitor bank conditions and second the ability to influence banks' actions. The concept of Market Discipline was one of two additional pillars along with capital regulations introduced in the Basel II as Basel I did not talk about it. The notion behind the introduction of Market Discipline is to increase transparency of the banks. The more information banks will disclose, the more easily private stake holders will be to take actions to safeguard their interests. There are two types of mechanism used by the depositors to regulate the behavior of banks. First is price-based perspective and second is quantity-based mechanism.

As describe in the previous paragraph depositors claim high interest rate for their deposits with the increase in risks taken by the banks. Banks are obliged to pay more cost and this is called price based mechanism of market discipline. Table 4.30 checks the existence of price based mechanism during 1998 to 2015. In order to measure the presence of price based market discipline, Interest Expense to Average Earning Liabilities (IEAEL) is being used as dependent variable in the model. By using this proxy this study is following (Afzal, 2012), who have also used this proxy in her research. The Theoretical argument presented in this regard is that as banks take on more risk they will pay more cost and Interest Expense to Average Earning Liabilities ratio will be high. So a positive sign of risk taken by the banks on the Interest Expense to Average Earning Liabilities is expected. From the Table 4.30, it is clear that the sign of coefficient of bank risk is positive and it is significant as well. This shows as the banks take more risk, they need

to pay high interest to depositors to compensate the excessive risk taken. This indicates that price based market discipline does exist in Pakistani Banks during 1998-2015.

TABLE 4.30: Existence of Price Based Market Discipline Mechanism 1998-2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | -0.051 | 0.087 |
| CIR | 0.2 | 0.133 |
| NPLGL | 0.146* | 0.079 |
| NIM | -0.151** | 0.075 |
| SIZE | -0.319*** | 0.061 |
| INF | 0.211*** | 0.024 |
| Chi Sq | 299.19*** | |
| No. of Observations | 292 | |
| No. of Banks | 30 | |
| No. of Instruments | 13 | |
| Hansen test (p-value) | 0.265 | |
| AR (2) test (p-value) | 0.418 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

The second approach is quantity-based method by which depositors regulate banks. In it depositors will withdraw their deposits from that bank, if they are not satisfied with the level of risks bank is taking. To measure the presence of quantity based market discipline, Growth in Deposits (GRD) is being used as dependent variable in the model. Growth in deposits is estimated as year on year change on deposits. It is measured by dividing the deposits of this year by deposits of previous year. (Tovar-García, 2014) has used this proxy for quantity based mechanism in his research. Theoretical argument presented in this regard that as banks take on more risk, deposit holder of the banks will take necessary action by withdrawing their deposits from that bank. So a negative sign of the risk taken by the banks on the growth in deposits is expected. Table 4.31 tests the quantity based mechanism of market discipline.

The presence of quantity based market discipline is validated from the Table 4.31 as the sign of coefficient of bank risk is negative and highly significant. This

TABLE 4.31: Existence of Quantity Based Market Discipline Mechanism 1998-
2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | 0.126 | 0.112 |
| CIR | 1.133*** | 0.123 |
| NPLGL | -0.409*** | 0.077 |
| NIM | 0.078 | 0.087 |
| SIZE | 0.086 | 0.072 |
| INF | -0.233*** | 0.04 |
| Chi Sq | 273.38*** | |
| No. of Observations | 303 | |
| No. of Banks | 31 | |
| No. of Instruments | 16 | |
| Hansen test (p-value) | 0.831 | |
| AR (2) test (p-value) | 0.243 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

shows as the banks take more risk, they see a decrease in their deposits. The depositors who are not comfortable with the level of risk taken by the banks move their deposits to other places by withdrawing from the banks. As far as the other variables are concerned, here cost inefficiency has positive effect on the risk taken by the banks. In other words cost efficiency has negative impact on the risks of the banks. So it can be concluded that cost efficient banks take less risk.

In order to check the existence of market discipline in Basel Accords separately, sample is divided into two subsamples Basel I and Basel II. Table 4.32 reports the results. From this table it is obvious that price based market discipline does exist in both Basel I and Basel II as the sign of coefficient of bank risk is positive and significant. This shows that price based market discipline existed in the Pakistani banks during Basel I, even when it was not explicitly incorporated in it.

By having a look at the results reported in Table 4.33, quantity based market discipline also exists in both Basel I and Basel II as the significant negative coefficients of bank risk in Basel I and Basel II depicts this.

Table 4.34 reports the results of effect of price based market discipline on the risk taken by the banks. Here Interest Expense to Average Earning Liabilities

TABLE 4.32: Existence of Price Based Market Discipline Mechanism in Basel and Basel II

| Variable | Basel I (1998-2007) | | Basel II (2008-2013) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | -0.109 | 0.213 | 0.03 | 0.085 |
| CIR | -0.229 | 0.261 | -0.009 | 0.079 |
| NPLGL | 0.172** | 0.07 | 0.162** | 0.069 |
| NIM | -0.186* | 0.104 | -0.336*** | 0.098 |
| SIZE | -0.598 *** | 0.091 | -0.262*** | 0.095 |
| INF | -0.137 | 0.104 | 0.116*** | 0.026 |
| Chi Sq | 194.91*** | | 257.82*** | |
| No. of Observations | 140 | | 125 | |
| No. of Banks | 25 | | 29 | |
| No. of Instruments | 13 | | 13 | |
| Hansen test (p-value) | 0.158 | | 0.144 | |
| AR (2) test (p-value) | 0.279 | | 0.945 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

(IEAEL) is used as proxy of price based market discipline. The coefficient of IEAEL is 0.552 and it is negative and significant with a p-value less than 0.01. This indicates market discipline reduces the risk taken by the banks thus accepting H5 hypothesis.

Table 4.35 states the results of impact of quantity based market discipline on the risk taken of the banks. Here Growth in Deposit (GRD) is used as proxy of quantity based market discipline. The significant negative result of the GRD indicates as the growth in deposits increases, banks take less risk. As a positive value of growth in deposits is signal of market discipline so here quantity based market discipline is reducing the risks taken by the banks thus accepting H5 hypothesis.

TABLE 4.33: Existence of Quantity Based Market Discipline Mechanism in Basel I and Basel II

| Variable | Basel I (1998-2007) | | Basel II (2008-2013) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | 0.188 | 0.245 | 0.421*** | 0.068 |
| CIR | 0.954*** | 0.174 | 0.054 | 0.129 |
| NPLGL | -0.335*** | 0.083 | -0.373*** | 0.137 |
| NIM | 0.091 | 0.082 | -0.311** | 0.12 |
| SIZE | -0.094 | 0.138 | 0.101 | 0.074 |
| INF | -0.141* | 0.085 | -0.058 | 0.049 |
| Chi Sq | 112.48*** | | 146.28*** | |
| No. of Observations | 143 | | 133 | |
| No. of Banks | 25 | | 30 | |
| No. of Instruments | 16 | | 16 | |
| Hansen test (p-value) | 0.392 | | 0.135 | |
| AR (2) test (p-value) | 0.216 | | 0.737 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

TABLE 4.34: Impact of Price Based Market Discipline on Bank Risk 1998-2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | -0.544*** | 0.088 |
| CIR | -0.216* | 0.124 |
| IEAEL | -0.552*** | 0.103 |
| NLTA | -0.316*** | 0.071 |
| SIZE | 0.076 | 0.076 |
| INF | 0.017 | 0.034 |
| Chi Sq | 101.04*** | |
| No. of Observations | 291 | |
| No. of Banks | 30 | |
| No. of Instruments | 19 | |
| Hansen test (p-value) | 0.288 | |
| AR (2) test (p-value) | 0.277 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

TABLE 4.35: Impact of Quantity Based Market Discipline as Moderator between Capital & Risk 1998-2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | -0.194*** | 0.039 |
| CIR | 0.508*** | 0.048 |
| GRD | -0.377*** | 0.063 |
| NLTA | -0.383*** | 0.066 |
| SIZE | -0.008 | 0.089 |
| INF | 0.006 | 0.042 |
| Chi Sq | 371.34*** | |
| No. of Observations | 263 | |
| No. of Banks | 30 | |
| No. of Instruments | 19 | |
| Hansen test (p-value) | 0.245 | |
| AR (2) test (p-value) | 0.5 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

## 4.7 Robustness Checking of Bank Efficiency Model

### 4.7.1 Endogenity of Bank Efficiency Model

Similarly Table 4.36 checks the endoegenity of efficiency model. Here it can be seen both the variable Total Capital to Total Risk Weighted Assets and Non-Performing Loans to Gross Loans are endogenous as the value of Durbin and WuHausman test is significant.

TABLE 4.36: Endogenity Test Efficiency Model

| Regressors tested | TCTR NPLGL |
|---|---|
| **Instrument Variable Used** | L.TCTR L.NPLGL |
| **Hausman test for endogeneity** | 12.630 |
| **(p-value)** | (0.0018) |

## 4.7.2 Impact of Basel Capital Regulation on Bank Efficiency

With respect to Total Capital to Total Risk Weighted Assets (TCTR) as determinant of bank inefficiency is concerned, the greater is the capital ratio; greater is the inefficiency of the banks. This corresponds that capital regulations have negative impact on the efficiency of banks in our sample. Here the results of this study are accepting H3 i.e. shareholders-managers hypothesis. This hypothesis advocates negative impact of capital on efficiency. Here according to estimation of this research, capital regulations of Basel accords have decreased the efficiency of banks in this sample. One possible reason can come from agency theory. As majority of banks in this study are listed and private. Due to conflicts of interest between shareholders and managers, managers may minimize their efforts instead of increasing the firm value of company thus in turn decreasing the efficiency of banks. So in order to reduce the moral hazard behavior of managers and monitor their activities, depositor may force banks to increase capital ratios. Thus there might be negative impact between the two. Or it may be due to the fact that high capitalized banks take less risk. Due to this they lend less so their income is less as compared to their cost. This is especially applicable in Pakistan where majority of the banks have invested in government securities. Here the results of this research are in agreement with the results of (Berger and Di Patti, 2006) and (Mongid, 2016).

The results also point out that the impact of credit risk taken by the banks on bank efficiency is negative. According to the results efficient banks take less risk. This is intuitively justifiable that banks whose non-performing loans are higher might need to allocate additional resources to monitor those loans. So during this process, cost efficiency decreases. One justification of this negative relationship can be inefficient management, as depicted by the low cost efficiency, may not monitor the loans so credit risks of these inefficient banks increases. Or it might be due to unavoidable economic circumstances outside the bank's control that bad loans may arise. The less efficient banks will take more risk to compensate the effect

of inefficiency. Thus all this discussion highlights that efficient banks are better at managing their credit risk and hence it leads to lower non-performing loans. So here bad management or bad luck hypothesis is being accepted. Here results are in agreement with the results put forward by (Altunbas et al., 2000). Table 4.37 also shows that net interest margin (NIM) of banks in sample has positive impact on bank efficiency. The banks with high NIM have high cost efficiency and this impact is significant at 1%. This is according to the expectations as high interest income means interest generated is greater than interest expensed. Thus less amount interest expenses allow banks to be more cost efficient. Bank size negatively affects bank inefficiency. However this impact is not significant. So size has no impact on the cost efficiency of banks in our sample. The impact of inflation on the bank inefficiency is concerned, its result depicts that Inflation has negative impact on cost efficiency in our main sample. It is because during inflationary period as was the case in Pakistan during the time period of this research, banks may be spending more to catch up with increasing expenses such as personnel as well as other inputs. So it might have decreased the efficiency.

TABLE 4.37: Impact of Basel Capital Regulation on Bank Efficiency 1998-2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | 0.194* | 0.106 |
| NPLGL | 0.260** | 0.104 |
| NIM | -0.285*** | 0.075 |
| SIZE | -0.06 | 0.062 |
| INF | 0.118*** | 0.03 |
| Chi Sq | 109.68*** | |
| No. of Observations | 303 | |
| No. of Banks | 31 | |
| No. of Instruments | 10 | |
| Hansen test (p-value) | 0.51 | |
| AR (2) test (p-value) | 0.353 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

For generalization purposes, this research also checks the impact of capital regulation on another proxy of efficiency. This other proxy of inefficiency is non-interest

expense to net income ratio (NIENI) and it is calculated by dividing non-interest expense of a bank to its income. This ratio is a measure of the bank's operational expenses as a percentage of its revenue. An inefficient bank will have high non-interest expense to net income ratio and vice versa. Table 4.38 displays the results of impact of capital regulation on the inefficiency ratio. As can be seen from this table that higher is the capital regulations; greater is the value of inefficiency ratio. In other words capital regulation has reduced the efficiency of the banks and this effect is significant at 10%. The results of this variable are also accepting H3 hypothesis. So it can be concluded that capital regulations have decreased the efficiency of the banks. Result of this variable is also in agreement with previous results. The results of other variables are also reported in Table 4.38. The impact of credit risks taken by the banks has no significant effect on the efficiency of the banks in this case. Similarly results of other variables on this proxy of efficiency are reported in this table.

TABLE 4.38: Impact of Basel Capital Regulation on Bank Efficiency with NIENI as Dependent Variable 1998-2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | 0.158** | 0.083 |
| NPLGL | 0.087 | 0.096 |
| NIM | -0.274*** | 0.053 |
| SIZE | -0.269*** | 0.065 |
| INF | 0.229 | 0.024 |
| Chi Sq | 200.10*** | |
| No. of Observations | 292 | |
| No. of Banks | 30 | |
| No. of Instruments | 12 | |
| Hansen test (p-value) | 0.169 | |
| AR (2) test (p-value) | 0.468 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

So we are concluding that capital regulations have failed to increase the efficiency of banks in our research. Infect Basel capital regulations have decreased the efficiency of the banks in this studys sample.

### 4.7.3 Impact of Basel Capital Regulations on Bank Efficiency in Different Basel Accords

Table 4.39 shows the results of impact of capital regulations on the cost inefficiency in Basel I and Basel II. There are mix observations found in these results. Here some variables are impacting the cost inefficiency in the same way as in the main sample i.e. 1998 to 2015, while some variables are behaving in different manner. As far as impact of Basel I capital regulations on the inefficiency of banks are concerned, though it has increased bank inefficiency, however its effect is not significant. However there is positive impact of Basel II capital regulations on the inefficiency of the banks. So it can be concluded that Basel I capital requirements have neither decreased nor increased the efficiency of the banks while Basel II capital requirements have decreased the efficiency of the banks thus accepting H14 hypothesis. This is again somewhat unexpected as there is not much difference with respect to capital requirements of Basel I and Basel II. Here the results of impact of Basel II regulations are in agreement with result of full sample i.e. from 1998 to 2015, however impact of Basel I regulations are in disagreement to full sample. These results again highlight the weakness of Basel I capital regulations in effecting the efficiency of the banks.

As far as impact of bank risk on bank efficiency is concerned, results of Basel I accord are same as those of Basel II. There is positive impact of risk taken by banks on bank efficiency during Basel I and II. However it is statistically more significant in Basel I. The impact of net interest margin on bank efficiency is positive in all sub samples consistent with the results of sample. Impact of size is different in both subsamples and same is true about impact of inflation as well.

Hence it can be concluded from the results presented in Table 4.39 that Basel II capital requirements have lowered the cost efficiency of banks, however Basel I had no impact on the cost efficiency. This again points to the inability of Basel I in affecting the efficiency of banks.

TABLE 4.39: Effect of Basel I and II Capital Regulations on Bank Efficiency

| Variable | Basel I (1998-2007) | | Basel II (2008-2013) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | 0.059 | 0.052 | 0.234*** | 0.081 |
| NPLGL | 0.292*** | 0.035 | 0.216* | 0.131 |
| NIM | -0.198*** | 0.029 | -0.507*** | 0.131 |
| SIZE | -0.073** | 0.039 | -0.147 | 0.101 |
| INF | 0.133** | 0.063 | 0.065 | 0.06 |
| Chi Sq | 153.62*** | | 167.42*** | |
| No. of Observations | 143 | | 133 | |
| No. of Banks | 25 | | 30 | |
| No. of Instruments | 16 | | 12 | |
| Hansen Test (p-value) | 0.465 | | 0.55 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

## 4.7.4 Impact of Basel Capital Regulations on Bank Efficiency in Big and Small Banks

There is considerable difference of the impact of capital regulations on cost efficiency of big and small size banks as shown in Table 4.40. In big banks capital regulations have a negative impact on the cost inefficiency as is shown by the significant negative coefficient of Total Capital to Total Risk Weighted Assets. While in small banks effect of capital regulations on the inefficiency is positive as is evident by coefficient of capital regulations proxy variable. This can be taken as in big banks effect of capital regulation on bank efficiency is positive, while it is negative in small banks thus pointing towards acceptance of H15.

The results of this table conclude that big banks have seen their cost efficiency increased and small banks reduced by virtue of implementation of capital adequacy requirements. One possible justification can be economies of scale enjoyed by the big banks allows them to have lower inefficiency or big banks have greater bargaining power, which allows them to have high cost efficiency. Here the results of this study seconds the results of (Hughes and Mester, 2013), (Feng and Serletis,

TABLE 4.40: Impact of Size on Bank Efficiency 1998-2015

| Variable | Big (Size>=11.4527) | | Small (Size<11.4527) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | -0.362* | 0.189 | 0.248*** | 0.087 |
| NPLGL | 0.339*** | 0.05 | 0.139 | 0.198 |
| NIM | -0.151*** | 0.052 | -0.302*** | 0.095 |
| INF | -0.003 | 0.018 | 0.221*** | 0.059 |
| Chi Sq | 161 | | 142 | |
| No. of Observations | 26 | | 25 | |
| No. of Banks | 11 | | 10 | |
| No. of Instruments | 0.217 | | 0.41 | |
| Hansen Test (p-value) | 0.16 | | 0.472 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

2010) etc. Risk has significant negative relation with efficiency of big banks while in case of small banks its impact is insignificant. Similarly there is difference of other factors on the efficiency of the small and big banks. One exception is Net Interest Margin, which has significant negative effect on the inefficiency of both big and small banks.

## 4.7.5 Impact of High and Low Bank Capital on Bank Efficiency

As stated earlier capital regulation of Basel I and Basel II are different from Basel III, however due to not enough observation in Basel III time period a comparison is presented on the impact of capital regulation on marginal capitalized and highly capitalized banks on cost inefficiency for 1998 to 2015 in Table 4.41.

As can be seen from the this table that highly capitalized banks have seen their inefficiency increased, while in marginally capitalized banks it has neither increased nor decreased the cost efficiency. These results clearly show that effect of capital regulations on bank efficiency is different in high and low capitalized banks. So hypothesis H16 is accepted here. Table 4.41 also shows that there is huge difference

Table 4.41: Impact of High and Low Capital on Bank Efficiency 1998-2015

| Variable | Highly Capitalized Banks (TCTR>=9%) | | Marginally Capitalized Banks (TCTR<9%) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | 0.328*** | 0.086 | 0.381 | 0.458 |
| NPLGL | 0.1 | 0.08 | 0.474** | 0.201 |
| NIM | -0.272*** | 0.067 | -0.381 | 0.258 |
| SIZE | -0.015 | 0.054 | -0.288 | 0.188 |
| INF | 0.116*** | 0.033 | 0.113** | 0.045 |
| Chi Sq | 43.39*** | | 932.94*** | |
| No. of Observations | 236 | | 40 | |
| No. of Banks | 31 | | 13 | |
| No. of Instruments | 10 | | 12 | |
| Hansen Test (p-value) | 0.236 | | 0.506 | |
| AR (2) test (p-value) | 0.844 | | 0.412 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

in the effect on the cost inefficiency of other variables in marginal capitalized and highly capitalized banks.

## 4.7.6 Impact of Basel Capital Regulations on Bank Efficiency during High and Low inflation Period

According to the results in Table 4.42 banks have seen their efficiency decreased with the implementation of capital regulations in the period of high inflation, however there is no effect on the efficiency during low inflationary periods. This result accepts the H17 hypothesis which states there is difference on the efficiency between two periods. (Huybens and Smith, 1999) argue that inflationary trends have a negative impact on the bank performance due to disharmony in credit market. With the increases in inflation, number and volume of loans made by the banks reduce, so the productivity of banks reduces.

TABLE 4.42: Impact of Capital Regulations on Bank Efficiency during High and Low Inflationary Period

| Variable | High Inflationary Period (Inflation >=6%) | | Low Inflationary Period (Inflation <6%) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | 0.201*** | 0.065 | -0.13 | 0.369 |
| NPLGL | 0.261** | 0.118 | 0.088 | 0.092 |
| NIM | -0.367*** | 0.098 | -0.149* | 0.085 |
| SIZE | -0.087 | 0.097 | 0.011 | 0.029 |
| Chi Sq | 100.88*** | | 23.02*** | |
| No. of Observations | 212 | | 91 | |
| No. of Banks | 31 | | 26 | |
| No. of Instruments | 12 | | 12 | |
| Hansen Test (p-value) | 0.148 | | 0.551 | |
| AR (2) test (p-value) | 0.352 | | 0.433 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

## 4.7.7 Impact of Basel Capital Regulation on Bank Efficiency in Different Banking System

Table 4.43 shows the determinants of banks cost inefficiency of Islamic and conventional banks. The effect of the bank capital on the bank inefficiency is positive and significant in Islamic banks. So Basel capital regulation has decreased the cost efficiency of Islamic banks in this sample. The results of this research also report that capital regulations have no impact on the inefficiency of conventional banks. So we can conclude that capital adequacy ratio of the banks is not determinant of cost efficiency of conventional banks in the sample of this research. From the findings it is clear that here hypothesis H18 is accepted. Table 4.43 shows the value of coefficient of proxy of bank risk is positive and it is significant at 1% in both Islamic and conventional banks. It means that bank risk negatively affects the bank efficiency. In other words bank which take more risk have less efficiency. Similarly other variables effect on both Islamic and conventional banks is also reported.

TABLE 4.43: Impact of Capital Regulations on Bank Efficiency in Different Bank Types

| Variable | Islamic Banks | | Conventional Banks | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| TCTR | 0.190* | 0.103 | -0.009 | 0.053 |
| NPLGL | 0.479*** | 0.167 | 0.298*** | 0.042 |
| NIM | 0.151 | 0.117 | -0.265*** | 0.055 |
| SIZE | -0.123 | 0.152 | -0.084 | 0.054 |
| INF | -0.046 | 0.082 | 0.197*** | 0.045 |
| chi2 | 29.48 | | 144.47 | |
| p-value | 0 | | 0 | |
| RMSE | 0.4068 | | 0.7691 | |
| R-sq | 0.4435 | | 0.3117 | |
| No. of Observations | 37 | | 319 | |
| Parameters | 5 | | 5 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

### 4.7.8 Impact of Market Discipline on Bank Efficiency

This section reports the results of impact of III pillar of Basel II i.e. Market discipline on the cost efficiency of the banks. Theory states that market discipline increase or decrease bank efficiency for different reasons. Table 4.44 presents the effect of price based mechanism on the efficiency of the Pakistani banks. As can be seen in the table below that coefficient of price based mechanism variable IEAEL is negative and significant so the effect of price based mechanism on the bank inefficiency is negative. In other words there is positive effect of price based mechanism on the bank efficiency. This can be interpreted as market discipline increases bank cost efficiency. So here H6 is accepted.

As far as the impact of quantity based mechanism is concerned, here quantity based mechanism is also increasing the bank efficiency as evident by the significant sign of quantity based mechanism variable GRD in Table 4.45 below. So in this case also H6 is accepted.

TABLE 4.44: Effect of Price Based Market Discipline Mechanism on Bank Efficiency1998-2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | 0.477** | 0.204 |
| NPLGL | 0.247** | 0.109 |
| NIM | -0.424***0 | 0.078 |
| SIZE | 0.039 | 0.098 |
| INF | 0.121*** | 0.034 |
| IEAEL | -0.168** | 0.084 |
| Chi Sq | 66 | |
| No. of Observations | 285 | |
| No. of Banks | 30 | |
| No. of Instruments | 11 | |
| Hansen test (p-value) | 0.25 | |
| AR (2) test (p-value) | 0.383 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

TABLE 4.45: Effect of Quantity Based Market Discipline Mechanism on Bank Efficiency1998-2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| TCTR | 0.318*** | 0.099 |
| NPLGL | 0.14 | 0.095 |
| NIM | -0.277*** | 0.067 |
| SIZE | -0.005 | 0.092 |
| INF | 0.192*** | 0.04 |
| GRD | -0.396** | 0.179 |
| Chi Sq | 71.27*** | |
| No. of Observations | 258 | |
| No. of Banks | 30 | |
| No. of Instruments | 11 | |
| Hansen test (p-value) | 0.142 | |
| AR (2) test (p-value) | 0.334 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

## 4.8 Robustness Checking of Bank Capital Model

### 4.8.1 Endogenity of Bank Capital Model

The endogenity of capital model is checked by employing Durbin and WuHausman test in line with the methodology used in risk and efficiency model. Both Non-Performing Loans to Gross Loans and Cost to Income (CIR) are endogenous as is shown by the p value of Durbin and WuHausman test in Table 4.46.

TABLE 4.46: Endogenity Testing Capital Model

| Regressors tested | NPLGL CIR |
|---|---|
| **Instrument Variable Used** | L.NPLGL L.CIR |
| **Hausman test for endogeneity** | 17.671 |
| **(p-value)** | (0.0001) |

### 4.8.2 Factors affecting Bank Capital

The results of having bank capital as dependent variable using GMM are reported in Table 4.47. The coefficient of bank risk has a positive sign, however this is not significant. As far as impact of bank inefficiency on bank capital is concerned, it has a positive sign and it is highly significant at 1%. So the results of this study are advocating a highly significant negative impact of bank efficiency on bank capital. In this study sample efficient bank possesses low capital ratios and vice versa. The relation can be justified by the accepting H4 or "efficiency-risk hypothesis. This hypothesis argues that high efficiency signals low bankruptcy. As a result banks can afford to lower their capital as they have low default risk due to high efficiency. The effect of liquid asset to short term funding (LASTF) on bank capital is positive and statistically significant.

A high value of LASTF indicates high liquidity and this increase in bank liquidity have a positive impact on the capital ratio through its effect on the changes in required rate of return on bank shares. As per expectations, we obtain a positive relationship between return on assets (ROAA) and capital, such that banks with

TABLE 4.47: Determinants of Bank Capital 1998-2015

| Variable | Coefficient | Standard Error |
|---|---|---|
| NPLGL | 0.021 | 0.085 |
| CIR | 0.337**** | 0.104 |
| LASTF | 0.249*** | 0.073 |
| ROAA | 0.332*** | 0.068 |
| SIZE | 0.140*** | 0.059 |
| INF | 0.033 | 0.0297 |
| Chi Sq | 36.33*** | |
| No. of Observations | 303 | |
| No. of Banks | 31 | |
| No. of Instruments | 13 | |
| Hansen test (p-value) | 0.341 | |
| AR (2) test (p-value) | 0.1 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

higher earnings also tend to operate with high capital. The impact of size on bank capital ratio is positive. Thus our study reports that big banks have high capital ratio and vice versa. This positive impact can be justified by the franchise value hypothesis. According to this higher earnings lead to greater diversification, so to more investment opportunities and thus lowering the cost of capital provide incentives for large banks to raise more equity capital to avoid taking extraordinary risk. Inflation does not affect capital ratio in our sample.

### 4.8.3 Determinants of Bank Capital in Different Banking Systems

This study also investigates the determinants of bank capital in conventional and Islamic banks. To do this study divides sample on the basis of bank type. Results in Table 4.48 paint a very different picture in case of conventional and Islamic banks.

There is enormous difference in different factors affecting the capital ratio of conventional and Islamic banks accepting H19 hypothesis. In case of conventional

Table 4.48: Determinants of Bank Capital in Different Banking Systems 1998-2015

| Variable | Islamic Banks | | Conventional Banks | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| NPLGL | 0.16 | 0.312 | 0.083* | 0.049 |
| CIR | 0.961 | 0.632 | -0.025 | 0.065 |
| LASTF | 0.027 | 0.155 | 0.243*** | 0.055 |
| ROAA | 0.25 | 0.536 | 0.150** | 0.066 |
| SIZE | -0.658** | 0.269 | -0.273*** | 0.056 |
| chi2 | 46.93 | | 75.63 | |
| p-value | 0 | | 0 | |
| RMSE | 0.6796 | | 0.8231 | |
| R-sq | 0.5563 | | 0.1917 | |
| No. of Observations | 37 | | 319 | |
| Parameters | 6 | | 6 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

banks risk, liquidity and profitability has a positive impact on the regulatory capital maintained by the banks, while there is no impact of these variables on the capital ratio of Islamic banks. The only exception is size which negatively affects the capital ratio of both types of banks. One reason can be since the working of conventional and Islamic banking is different so the factors affecting capital are also different.

## 4.8.4 Determinants of Bank Capital before and after Financial Crisis

The financial crisis of the 2007- 2008 affected the world wide banking system and Pakistan being an emerging country is no exception to this. In line with researches done by (Nilsson et al., 2014) and (El-Ansary and Hafez, 2015), this study also investigates the factors affecting the capital adequacy ratios of banks before and after the financial crisis 2008. Table 4.49 reports the findings of factors affecting the capital adequacy ratios of banks before and after the financial crisis 2008.

TABLE 4.49: Determinants of Capital Ratios (Before and After Financial Crisis)

| Variable | Pre Financial Crisis (1997-2007) | | Post Financial Crisis (2009-2015) | |
|---|---|---|---|---|
| | Coefficient | Standard Error | Coefficient | Standard Error |
| NPLGL | -0.016 | 0.031 | 0.019 | 0.088 |
| CIR | 0.256*** | 0.071 | 0.002 | 0.046 |
| LASTF | 0.334*** | 0.081 | 0.282*** | 0.094 |
| ROAA | 0.209*** | 0.054 | 0.346*** | 0.077 |
| SIZE | -0.142** | 0.056 | -0.660*** | 0.126 |
| No. of Observations | 179.36*** | | 56.45*** | |
| No. of Banks | 170 | | 133 | |
| No. of Instruments | 29 | | 29 | |
| Hansen test (p-value) | 0.484 | | 0.515 | |
| AR (2) test (p-value) | 0.801 | | 0.782 | |

*\*\*\*, \*\*, \* Significant at 1%, 5%, and 10% levels*

By having a look on this table it is apparent that there is not much difference of impact of bank specific variables on the capital ratios of the banks before and after the crisis rejecting H20. The only exception is cost to income ratio. One reason can be since Pakistan and its banking sector was not hit by financial crisis directly so there is not a lot of difference before and after the crisis. Though Pakistan is an emerging country, however the share of its banking in international banking is very small. Moreover exposure of Pakistani banks in international assets is not huge as well.

# Chapter 5

# CONCLUSIONS AND POLICY IMPLICATIONS

## 5.1    Conclusion

Purpose of this study was to examine the interrelationship among Basel capital regulations, risk and efficiency of Pakistani commercial banks from 1998-2015. Moreover the study tried to shed light on the effect of other factors like size, market discipline etc. on the relationship of capital adequacy, risk taking and efficiency in the commercial banks of Pakistan. Results of this study reaffirmed the fact that bank capital, risk and efficiency are endogenous. The results also revealed that overall Basel capital regulations have reduced the bank risks taking. In the absence of clear deposit insurance scheme, these Basel capital regulations might be restricting banks from taking extra risk. The results of this study also highlighted the inability of Basel I in reducing the risk taken by the banks rather than Basel II. Basel II was more successful in reducing the risk taken by the banks than Basel I. This study found that both martial law and democracy have decreased the risk taken by the banks and there was no substantial difference on the risk taking by the banks during different political regimes. Continuation of economic reforms originated by the martial law can be cited as the main reason for this. Both big and small banks had seen their risk taking ability reduced by

virtue of capital regulation in this study; moreover size did not play its role of moderator in reducing the risks taken by the banks. The study also reported that lowly capitalized banks have seen their risk taking reduced as compared to their highly capitalized banks that have no impact on their risks. The extra capital might have allowed the banks to be insensitive to the risks. The banks in this study have seen their risk taken reduced in high inflationary period. The findings of this study also pointed towards the ineffectiveness of Basel regulations in reducing the risks taken by the Islamic banks. So this ineffectiveness of Basel capital regulations on Islamic banks demands for different capital requirements or mechanism for Islamic banks. This study did not find any significant impact of capital regulation on bank risk taking during financial crisis of 2008. A small exposure of Pakistani banks in global financial transactions could be a reason of this. This study reaffirmed the presence of market discipline in Pakistani banking sector. An interesting observation was that though Basel II introduced the notion of market discipline, however it was present in Pakistani banking during Basel I accord, much before the Basel II implementation in Pakistan banking industry.

The results of this study also highlighted that Basel capital regulations were ineffective in increasing the efficiency of Pakistani banks. Infact Pakistani banks had witnessed a decrease in their efficiency. As far as the quantification of effect of Basel accord capital regulations on the bank efficiency was concerned, there was considerable difference of the impact of Basel I and Basel II despite the unchanged value of 8% capital adequacy ratio. Basel II capital regulations had decreased the efficiency of the banks, whereas Basel I capital requirements had no impact on the efficiency of the banks. The impact of size on the bank efficiency was substantial. Here big banks had seen their cost efficiency increased while efficiency of small banks was reduced by virtue of implementation of capital adequacy requirements. Similar story was presented in case of capitalization where efficiency of highly capitalized was increased, as opposed to marginally capitalized banks where efficiency neither increased nor decreased. As far as market discipline is concerned it is enhancing the cost efficiency of the banks.

This study also explored the determinants of capital adequacy ratio and it found

cost inefficiency, liquidity, profitability and size as the main determinant of the capital ratios. The study also noted that banks in Pakistan maintained capital ratio well above required regulatory ratio thus justifying capital buffer theory. The results of this study also highlighted that factors affecting the capital ratio were different in case of conventional and Islamic banks. The results of this research also suggested that financial crisis of 2008 did not affect the capital ratios of Pakistani banks, thus highlighting the insensitiveness of Pakistani banking to the 2008 financial crisis. The findings of this study will help the SBP in assessing the consequences of implementation of Basel regulations in terms of risk reduction and efficiency enhancement. Moreover it will help the SBP in devising and implementing suitable mechanism for the betterment of the banking industry and thus in turn stabilizing the financial system of Pakistan.

## 5.2 Policy Implications

The findings of this study will help the SBP in assessing the consequences of implementation of Basel regulations in terms of risk reduction and efficiency enhancement. The policy implications from this study can be summarized as follows:

The results of this study support the effectiveness of Basel capital regulations with respect to risk reduction only. Though there does not exist explicit deposit insurance in Pakistan; however banks in Pakistan have reduced their risk taking after the implementation of Basel capital regulations. So countries with no deposit insurance schemes; regulators can use the capital regulations to refrain banks from indulging in risky activities. The results of this study also highlighted that Basel capital regulations were ineffective in increasing the efficiency of Pakistani banks. Infect Pakistani banks had witnessed a decrease in their efficiency. So there should be separate measures of efficiency enhancement.

Another implication in this regard is that now focus should be on the facilitating banks to move towards advanced approaches for the calculation of capital adequacy ratios. Banks are using Standardized Approach (SA) and Basic Indicator Approach (BIA) for calculating different types of risks. It will be useful to apply

Advanced Measurement Approach (AMA) for calculation of risks. This approach is being used by the internationally active banks of advanced countries. By doing this banking sector of Pakistan will be harmonized with international community in this regard.

The ineffectiveness of Basel I points that regulators should look at their countrys specific culture, demographics, circumstances and financial sector needs before implementing the regulations. The effectiveness of Basel II than Basel I also highlights the need for capacity building of banks in calculating different risk ratios as well. Although SBP has revised its roadmap for implementation of Basel regulations in Pakistan, however it needs to do more in this regard. Special attention is needed in the areas of hiring and training of human resource, information technology and data security etc.

Banking reforms originated by one government should carry on by the preceding governments. Implementation of banking reforms is time taking and it takes even more time to gain the rewards of those reforms. This is especially true in case of third world countries where policies change as the government changes. Moreover an autonomous and independent banking sector regulator is the key ingredient for a smooth and well functioned financial sector.

Ineffectiveness of Basel capital regulations with respect to Islamic banks demands for different capital requirements or mechanism for Islamic banks. The difference in the fundamental principles and working of Islamic banks and conventional banks can be cited as the main reason for this recommendation.

## 5.3 Suggestions For Future Research

The results of this study can be expanded by increasing the population size of the research. This study has used only listed commercial banks, however future research can done by including all specialized and foreign banks as well. The time period of this study can be enhanced to latest figures available. Though this study has used data up to 2015; however in future data of banks up to 2017 can be included. By doing so, effect of Basel III can be quantified as well.

This study has used multiple proxies of bank risk and efficiency. In future research can be done by using additional proxies of these variables. More over literature also advocates the use of parametric and non-parametric techniques to calculate efficiency. These techniques can be applied to calculate efficiency and capital regulation effect on those can be looked at. Moreover a comparison of effect of capital regulation on parametric and non-parametric can be given in addition to accounting based efficiency calculation.

Though this study has used GMM as estimation technique, other techniques such as 2sls and 3sls can be used to check the interrelationship among bank capital, risk and efficiency.

# Bibliography

Abdul Wahab, H., Saiti, B., Rosly, S. A., and Masih, A. M. M. (2017). Risk-taking behavior and capital adequacy in a mixed banking system: New evidence from malaysia using dynamic ols and two-step dynamic system gmm estimators. *Emerging Markets Finance and Trade*, 53(1):180–198.

Abidi, A. R., Chandio, F. R., Soomro, H. J., et al. (2014). Banking sector in pakistan: An overview. *International Journal of Management Sciences*, 3(10):797–805.

Abusharba, M. T., Triyuwono, I., Ismail, M., and Rahman, A. F. (2013). Determinants of capital adequacy ratio (car) in indonesian islamic commercial banks. *Global review of accounting and finance*, 4(1):139–170.

Afzal, A. (2012). *Interest Rate Spreads, Loan Diversification and Market Discipline in Pakistan's Commercial Banking Sector*. PhD thesis, © Lahore School of Economics.

Aggarwal, R. and Jacques, K. T. (1998). Assessing the impact of prompt corrective action on bank capital and risk. *Federal Reserve Bank of New York Economic Policy Review*, 4(3):23.

Agusman, A., Monroe, G. S., Gasbarro, D., and Zumwalt, J. K. (2008). Accounting and capital market measures of risk: Evidence from asian banks during 1998–2003. *Journal of Banking & Finance*, 32(4):480–488.

Ahmad, R., Ariff, M., and Skully, M. J. (2008). The determinants of bank capital ratios in a developing economy. *Asia-Pacific financial markets*, 15(3):255–272.

Aktas, R., Acikalin, S., Bakin, B., and Celik, G. (2015). The determinants of banks' capital adequacy ratio: Some evidence from south eastern european countries. *Journal of Economics and Behavioral Studies*, 7(1):79.

Al-Sabbagh, N. (2004). Determinants of capital adequacy ratio in jordanian and evidence. *Journal of Monetary Economics*, 32(1):513–542.

Alam, N. (2013). Impact of banking regulation on risk and efficiency in islamic banking. *Journal of Financial Reporting and Accounting*, 11(1):29–50.

Alfon, I., Argimon, I., and Bascuñana-Ambrós, P. (2004). *What determines how much capital is held by UK banks and building societies?*

Ali Shah, S. A. (2011). Why pakistani banks failed to adopt advanced approaches of basel accord according to road map of state bank of pakistan. Master's thesis, SUPERIOR UNIVERSITY.

Alraheb Ab, T., Nicolas, C., and Tarazi, A. (2017). Institutional environment and bank capital ratios. Technical report, HAL.

Altunbas, Y., Carbo, S., Gardener, E. P., and Molyneux, P. (2007). Examining the relationships between capital, risk and efficiency in european banking. *European Financial Management*, 13(1):49–70.

Altunbas, Y., Liu, M.-H., Molyneux, P., and Seth, R. (2000). Efficiency and risk in japanese banking. *Journal of Banking & Finance*, 24(10):1605–1628.

Arrow, K. J. and Debreu, G. (1954). Existence of an equilibrium for a competitive economy. *Econometrica: Journal of the Econometric Society*, pages 265–290.

Asarkaya, Y., Özcan, S., et al. (2007). Determinants of capital structure in financial institutions: The case of turkey. *Journal of BRSA Banking and Financial Markets*, 1(1):91–109.

Ashraf, B. N., Arshad, S., and Hu, Y. (2016). Capital regulation and bank risk-taking behavior: evidence from pakistan. *International Journal of Financial Studies*, 4(3):16.

Aspal, P. K. and Nazneen, A. (2014). An empirical analysis of capital adequacy in the indian private sector banks. *American Journal of Research Communication*, 2(11):28–42.

Awdeh, A., El-Moussawi, C., and Machrouh, F. (2011). The effect of capital requirements on banking risk. *International Research Journal of Finance and Economics*, 66:133–146.

Ayaydin, H. and Karakaya, A. (2014). The effect of bank capital on profitability and risk in turkish banking. *International Journal of Business and Social Science*, 5(1).

Baldwin, R., Cave, M., and Lodge, M. (2012). *Understanding regulation: theory, strategy, and practice*. Oxford University Press on Demand.

Banker, R. D., Chang, H., and Lee, S.-Y. (2010). Differential impact of korean banking system reforms on bank productivity. *Journal of Banking & Finance*, 34(7):1450–1460.

Barth, J. R., Caprio, G., and Levine, R. (2001). *The regulation and supervision of banks around the world: A new database*, volume 2588. World Bank Publications.

Barth, J. R., Caprio, G., and Levine, R. (2006). *Rethinking Bank Regulation: Till Angels Govern*. Cambridge University Press.

Barth, J. R., Caprio, G., and Levine, R. (2008). Bank regulations are changing: for better or worse? *Comparative Economic Studies*, 50(4):537–563.

Barth, J. R., Caprio Jr, G., and Levined, R. (2004). Bank regulation and supervision: what works best? *Journal of Financial Intermediation*, 13:205–248.

Barth, J. R., Lin, C., Ma, Y., Seade, J., and Song, F. M. (2013). Do bank regulation, supervision and monitoring enhance or impede bank efficiency? *Journal of Banking & Finance*, 37(8):2879–2892.

Basher, S. A., Kessler, L. M., and Munkin, M. K. (2017). Bank capital and portfolio risk among islamic banks. *Review of Financial Economics*.

Bateni, L., Vakilifard, H., and Asghari, F. (2014). The influential factors on capital adequacy ratio in iranian banks. *International Journal of Economics and Finance*, 6(11):108.

Baum, C. F. (2006). *An introduction to modern econometrics using Stata.* Stata press.

Berger, A. N. and DeYoung, R. (1997). Problem loans and cost efficiency in commercial banks. *Journal of Banking & Finance*, 21(6):849–870.

Berger, A. N., DeYoung, R., Flannery, M. J., Lee, D., and Öztekin, Ö. (2008). How do large banking organizations manage their capital ratios? *Journal of Financial Services Research*, 34(2-3):123–149.

Berger, A. N. and Di Patti, E. B. (2006). Capital structure and firm performance: A new approach to testing agency theory and an application to the banking industry. *Journal of Banking & Finance*, 30(4):1065–1102.

Berger, A. N. et al. (1991). Market discipline in banking. In *Federal Reserve Bank of Chicago Proceedings*, number 328.

Berle, A. A. and Means, G. G. C. (1991). *The modern corporation and private property.* Transaction publishers.

Bhattacharyya, A., Lovell, C. K., and Sahay, P. (1997). The impact of liberalization on the productive efficiency of indian commercial banks. *European Journal of operational research*, 98(2):332–345.

Bikker, J. A. and Metzemakers, P. A. (2005). Bank provisioning behaviour and procyclicality. *Journal of international financial markets, institutions and money*, 15(2):141–157.

Blum, J. (1999). Do capital adequacy requirements reduce risks in banking? *Journal of Banking & Finance*, 23(5):755–771.

Bokhari, I. H., Ali, S. M., and Sultan, K. (2012). Determinants of capital adequacy ratio in banking sector: An empirical analysis from pakistan. *Academy of Contemporary Research Journal*, 2(1):1–9.

Bolton, P. and Freixas, X. (2000). Equity, bonds, and bank debt: Capital structure and financial market equilibrium under asymmetric information. *Journal of Political Economy*, 108(2):324–351.

Boucinha, M. et al. (2008). The determinants of portuguese banks? capital buffers. Technical report.

Boudriga, A., Boulila, N., Jellouli, S., et al. (2009). Does bank supervision impact nonperforming loans: cross-country determinants using agregate data? Technical report, University Library of Munich, Germany.

Brewer III, E. and Lee, C. F. (1986). How the market judges bank risk. *Federal Reserve Bank of Chicago Economic Perspectives*, 10(6):25–31.

Burki, A. A. and Niazi, G. (2010). Impact of financial reforms on efficiency of state-owned, private and foreign banks in pakistan. *Applied Economics*, 42(24):3147–3160.

Büyüksalvarci, A. and Abdioglu, H. (2011). Determinants of capital adequacy ratio in turkish banks: A panel data analysis. *African Journal of Business Management*, 5(27):11199.

Chan, S. G., Karim, M. Z. A., Burton, B., and Aktan, B. (2014). Efficiency and risk in commercial banking: empirical evidence from east asian countries. *The European Journal of Finance*, 20(12):1114–1132.

Chiu, Y.-H., Jan, C., Shen, D.-B., and Wang, P.-C. (2008). Efficiency and capital adequacy in taiwan banking: Bcc and super-dea estimation. *The Service Industries Journal*, 28(4):479–496.

Choi, I. (2001). Unit root tests for panel data. *Journal of international money and Finance*, 20(2):249–272.

Chortareas, G. E., Girardone, C., and Ventouri, A. (2012). Bank supervision, regulation, and efficiency: Evidence from the european union. *Journal of Financial Stability*, 8(4):292–302.

Crick, W. (1927). The genesis of bank deposits. *Economica*, (20):191–202.

Daniela, Z. and Raluca-Dorina, G. (2009). The limits of basel ii accord. *University of Oradea, Faculty of Economics*, pages 723–729.

Das, A., Ghosh, S., et al. (2004). Risk, capital and operating efficiency: Evidence from indian public sector banks. Technical report, University Library of Munich, Germany.

Davenport, H. J. (1919). *The economics of enterprise*. Macmillan Company.

De Bondt, G. J. and Prast, H. M. (2000). Bank capital ratios in the 1990s: cross-country evidence. *Banca Nazionale del Lavoro Quarterly Review*, 53(212):71.

De Guevara, J. F., Maudos, J., and Pérez, F. (2007). Integration and competition in the european financial markets. *Journal of International Money and Finance*, 26(1):26–45.

Deelchand, T. and Padgett, C. (2009). The relationship between risk, capital and efficiency: Evidence from japanese cooperative banks. Technical report, Henley Business School, Reading University.

Delis, M., Iosifidi, M., and Tsionas, M. G. (2017). Endogenous bank risk and efficiency. *European Journal of Operational Research*, 260(1):376–387.

Delis, M. D. and Kouretas, G. P. (2011). Interest rates and bank risk-taking. *Journal of Banking & Finance*, 35(4):840–855.

Delis, M. D., Molyneux, P., and Pasiouras, F. (2011). Regulations and productivity growth in banking: Evidence from transition economies. *Journal of Money, Credit and Banking*, 43(4):735–764.

Demirguc-Kunt, A., Laeven, L., and Levine, R. (2004). Regulations, market structure, institutions, and the cost of financial intermediation. *Journal of Money, Credit, and Banking*, 36(3):593–622.

Dewatripont, M., Rochet, J.-C., and Tirole, J. (2010). *Balancing the banks: Global lessons from the financial crisis*. Princeton University Press.

Diamond, D. W. (1984). Financial intermediation and delegated monitoring. *The review of economic studies*, 51(3):393–414.

Dumičić, M. and Rizdak, T. (2013). Determinants of banks? net interest margins in central and eastern europe. *Financial theory and practice*, 37(1):1–30.

Dushku, E. (2016). Some empirical evidence of loan loss provisions for albanian banks. *Journal of Central Banking Theory and Practice*, 5(2):157–173.

Ediz, T., Michael, I., and Perraudin, W. (1998). The impact of capital requirements on uk bank behaviour. *Federal Reserve Bank of New York Economic Policy Review*, 4(3):15.

El-Ansary, O. and Hafez, H. M. (2015). Determinants of capital adequacy ratio: An empirical study on egyptian banks. *Corporate Ownership & Control*.

Eldomiaty, T., Fikri, A., Mostafa, W., and Amer, H. H. (2015). The financial determinants of operating efficiency for low and high competitive banks in egypt. *Journal of Finance*, 3(2):07–23.

Errico, L. and Farahbaksh, M. (1998). Islamic banking; issues in prudential regulations and supervision. Technical report, International Monetary Fund.

Fama, E. F. (1980). Banking in the theory of finance. *Journal of monetary economics*, 6(1):39–57.

Feng, G. and Serletis, A. (2010). Efficiency, technical change, and returns to scale in large us banks: Panel data evidence from an output distance function satisfying theoretical regularity. *Journal of Banking & Finance*, 34(1):127–138.

Fiordelisi, F., Marques-Ibanez, D., and Molyneux, P. (2011). Efficiency and risk in european banking. *Journal of Banking & Finance*, 35(5):1315–1326.

Fisher, R. (1932). *Statistical methods for research workers*. Cosmo Publications.

Flannery, M. J. (2001). The faces of ?market discipline? *Journal of Financial Services Research*, 20(2):107–119.

Fofack, H. L. et al. (2005). Nonperforming loans in sub-saharan africa: causal analysis and macroeconomic implications. Technical report, The World Bank.

Fonseca, A. R. and González, F. (2010). How bank capital buffers vary across countries: The influence of cost of deposits, market power and bank regulation. *Journal of banking & finance*, 34(4):892–902.

Furlong, F. T. and Keeley, M. C. (1989). Capital regulation and bank risk-taking: A note. *Journal of banking & finance*, 13(6):883–891.

Gujarati, D. N. (2009). *Basic econometrics*. Tata McGraw-Hill Education.

Gurley, J. G. and Shaw, E. S. (1960). Money in a theory of finance (washington, dc: Brookings institution, 1960). *GurleyMoney in a Theory of Finance*.

Hai, S. S., Minhaj, S. Q., and Ahmed, R. (2007). Implementation of basel ii: Issues, challenges and implications for developing countries. *Preprint. http://www. hull. ac. uk/php/ecskrb/GDP2007/SESARO-58110. pdf [Accessed on April 27th 2011]*.

Haq, M., Faff, R., Seth, R., and Mohanty, S. (2014). Disciplinary tools and bank risk exposure. *Pacific-Basin Finance Journal*, 26:37–64.

Hassan, M. K. and Hussain, M. E. (2006). Basel ii and bank credit risk: Evidence from the emerging markets. Technical report, Indiana State University, Scott College of Business, Networks Financial Institute.

Ho, T. S. and Saunders, A. (1981). The determinants of bank interest margins: theory and empirical evidence. *Journal of Financial and Quantitative analysis*, 16(4):581–600.

Hsiao, C. (1986). Analysis of panel data.

Hughes, J. P. and Mester, L. J. (2013). Who said large banks don?t experience scale economies? evidence from a risk-return-driven cost function. *Journal of Financial Intermediation*, 22(4):559–585.

Husain, I. et al. (2011). Financial sector regulation in pakistan: The way forward. *SBP Research Bulletin*, 7(1):31–44.

Hussain, M. (2005). Inflation and growth: Estimation of threshold point for pakistan. *Pakistan Business Review*, 17(3):1–15.

Huybens, E. and Smith, B. D. (1999). Inflation, financial markets and long-run real activity. *Journal of Monetary Economics*, 43(2):283–315.

I. Maghyereh, A. and Awartani, B. (2014). The effect of market structure, regulation, and risk on banks efficiency: Evidence from the gulf cooperation council countries. *Journal of Economic Studies*, 41(3):405–430.

Iannotta, G., Nocera, G., and Sironi, A. (2007). Ownership structure, risk and performance in the european banking industry. *Journal of Banking & Finance*, 31(7):2127–2149.

Isik, I. and Hassan, M. K. (2002). Technical, scale and allocative efficiencies of turkish banking industry. *Journal of Banking & Finance*, 26(4):719–766.

Jackson, P. M. and Fethi, M. D. (2000). Evaluating the efficiency of turkish commercial banks: An application of dea and tobit analysis.

Jacques, K. and Nigro, P. (1997). Risk-based capital, portfolio risk, and bank capital: A simultaneous equations approach. *Journal of Economics and business*, 49(6):533–547.

Jahankhani, A., Lynge, M. J., et al. (1979). Commercial bank financial policies and their impact on market-determined measures of risk/bebr no. 556. *Faculty working papers; no. 556*.

Jensen, M. C. and Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics*, 3(4):305–360.

Jokipii, T. and Milne, A. (2011). Bank capital buffer and risk adjustment decisions. *Journal of Financial Stability*, 7(3):165–178.

Kablan, A. (2010). Banking efficiency and financial development in sub-saharan africa. Technical report, International Monetary Fund.

Kale, S., Eken, M. H., and Selimler, H. (2015). The effects of regulations on the performance of banks: Evidence from the turkish banking industry. *Journal of Centrum Cathedra: The Business and Economics Research Journal*, 8(2):109–145.

Keppel, G. and Zedeck, S. (1989). *Data analysis for research designs*. Macmillan.

Khan, M. A. and Khan, S. (2007). Financial sector restructuring in pakistan. *Lahore Journal of Economics*.

Kim, D. and Santomero, A. M. (1988). Risk in banking and capital regulation. *The Journal of Finance*, 43(5):1219–1233.

Kleff, V. and Weber, M. (2008). How do banks determine capital? evidence from germany. *German Economic Review*, 9(3):354–372.

Koehn, M. and Santomero, A. M. (1980). Regulation of bank capital and portfolio risk. *The journal of finance*, 35(5):1235–1244.

Konishi, M. and Yasuda, Y. (2004). Factors affecting bank risk taking: Evidence from japan. *Journal of Banking & Finance*, 28(1):215–232.

Kubat, M. et al. (2014). Does basel iii bring anything new? a comparison between capital accords basel ii and basel iii. In *Proceedings of Economics and Finance Conferences*, number 0401713. International Institute of Social and Economic Sciences.

Kwan, S. and Eisenbeis, R. A. (1997). Bank risk, capitalization, and operating efficiency. *Journal of financial services research*, 12(2-3):117–131.

Lee, C.-C. and Hsieh, M.-F. (2013). The impact of bank capital on profitability and risk in asian banking. *Journal of international money and finance*, 32:251–281.

Lee, T.-H. and Chih, S.-H. (2013). Does financial regulation affect the profit efficiency and risk of banks? evidence from china's commercial banks. *The North American Journal of Economics and Finance*, 26:705–724.

Leland, H. and Pyle, D. H. (1977). Informational asymmetries, financial structure, and financial intermediation. *Journal of Finance*, 32(2):371–87.

Lešanovská, J. and Weill, L. (2016). Does greater capital hamper the cost efficiency of banks? a bi-causal analysis. *Comparative Economic Studies*, 58(3):409–429.

Levine, R. (1997). Financial development and economic growth: views and agenda. *Journal of economic literature*, 35(2):688–726.

Lim, E. (2012). A study on credit interest margin and efficiency ratios of selected universal banks in the philippines for the year 2010. *International Journal of Information Technology and Business Management*, 2(1).

Lozano-Vivas, A. and Pasiouras, F. (2010). The impact of non-traditional activities on the estimation of bank efficiency: international evidence. *Journal of Banking & Finance*, 34(7):1436–1449.

Maddala, G. S. and Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and statistics*, 61(S1):631–652.

Maji, S. G. and De, U. K. (2015). Regulatory capital and risk of indian banks: a simultaneous equation approach. *Journal of Financial Economic Policy*, 7(2):140–156.

Makwiramiti, A. M. (2009). The implementation of the new capital accord (basel ii): A comparative study of south africa, switzerland, brazil and the united states. Master's thesis, Rhodes University.

Maraghni, H. (2016). Bank regulation, capital ratio behaviour and risk taking in a simultanious approach. *International Journal of Financial Research*, 8(1):43.

Masood, U. and Ansari, S. (2016). Determinants of capital adequacy ratio? a perspective from pakistani banking sector. *Revista de Contabilidad*, 4(7):247–273.

Mesa, R. B., Sánchez, H. M., and Sobrino, J. N. R. (2014). Main determinants of efficiency and implications on banking concentration in the european union. *Revista de Contabilidad*, 17(1):78–87.

Mester, L. J. (1996). A study of bank efficiency taking into account risk-preferences. *Journal of Banking & Finance*, 20(6):1025–1045.

Miah, M. D. and Sharmeen, K. (2015). Relationship between capital, risk and efficiency: A comparative study between islamic and conventional banks of bangladesh. *International Journal of Islamic and Middle Eastern Finance and Management*, 8(2):203–221.

Mili, M., Sahut, J.-M., Trimeche, H., and Teulon, F. (2016). Determinants of the capital adequacy ratio of foreign banks? subsidiaries: The role of interbank market and regulation. *Research in International Business and Finance.*

Mitchell, D. W. (1986). Some regulatory determinants of bank risk behavior: Note. *Journal of Money, Credit and Banking*, 18(3):374–382.

Mongid, A. (2016). Business efficiency of the commercial banks in asean. *Investment Management and Financial Innovations*, 13(1):67–76.

Moran, M. (1986). Theories of regulation and changes in regulation: The case of financial markets. *Political Studies*, 34(2):185–201.

Moyer, S. E. (1990). Capital adequacy ratio regulations and accounting choices in commercial banks. *Journal of Accounting and Economics*, 13(2):123–154.

Mukherjee, K., Ray, S. C., and Miller, S. M. (2001). Productivity growth in large us commercial banks: The initial post-deregulation experience. *Journal of Banking & Finance*, 25(5):913–939.

Naceur, S. B. and Kandil, M. (2009). The impact of capital requirements on banks? cost of intermediation and performance: The case of egypt. *Journal of Economics and Business*, 61(1):70–89.

Naceur, S. B. and Omran, M. (2011). The effects of bank regulations, competition, and financial reforms on banks' performance. *Emerging markets review*, 12(1):1–20.

Nguyen, T. P. T. and Nghiem, S. H. (2015). The interrelationships among default risk, capital ratio and efficiency: evidence from indian banks. *Managerial Finance*, 41(5):507–525.

Nilsson, V., Nordström, J., and Bredmar, K. (2014). The need for liquidity and the capital structure of swedish banks following the financial crisis. *International Journal of Finance & Banking Studies*, 3(2):10.

Odunga, R., Nyangweso, P., and Nkobe, D. (2013). Liquidity, capital adequacy and operating efficiency of commercial banks in kenya. *Research Journal of Finance and Accounting*, 4(8):76–81.

Ong, M. K. (2007). *The Basel Handbook: A guide for financial practitioners*. Risk books.

Osei-Assibey, E. and Asenso, J. K. (2015). Regulatory capital and its effect on credit growth, non-performing loans and bank efficiency: Evidence from ghana. *Journal of Financial Economic Policy*, 7(4):401–420.

Pancheva, A. et al. (2013). Determinants of the bank?s operating efficiency. *Izvestiya*, (1):74–85.

Pancurova, D. and Lyócsa, S. (2013). Determinants of commercial banks' efficiency: Evidence from 11 cee countries. *Finance a Uver*, 63(2):152.

Papanikolaou, N. (2009). How output diversification affects bnak efficiency and risk: an intra-eu comparison study. *Productivity in the Financial Services Sector*, pages 245–273.

Pasiouras, F. (2008). International evidence on the impact of regulations and supervision on banks? technical efficiency: an application of two-stage data envelopment analysis. *Review of Quantitative Finance and Accounting*, 30(2):187–223.

Pasiouras, F., Tanna, S., and Zopounidis, C. (2009). The impact of banking regulations on banks' cost and profit efficiency: Cross-country evidence. *International Review of Financial Analysis*, 18(5):294–302.

Pessarossi, P. and Weill, L. (2015). Do capital requirements affect cost efficiency? evidence from china. *Journal of Financial Stability*, 19:119–127.

Pettway, R. H. (1976). Market tests of capital adequacy of large commercial banks. *The Journal of Finance*, 31(3):865–875.

Phillips, P. C. and Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2):335–346.

Ping, H. W. (2014). Banking regulation in china: Why, what, and how? In *Banking Regulation in China*, pages 51–69. Springer.

Podpiera, J. and Weill, L. (2008). Bad luck or bad management? emerging banking market experience. *Journal of financial stability*, 4(2):135–148.

Popovici, M.-C. et al. (2014). Measuring banking efficiency by using roaa and roae: evidence from the european union. *CES Working Papers*, 6(1):146–153.

Radić, N., Fiordelisi, F., and Girardone, C. (2012). Efficiency and risk-taking in pre-crisis investment banks. *Journal of Financial Services Research*, 41(1-2):81–101.

Rahman, M. M., ZHENG, C., and ASHRAF, B. N. (2015). Bank size, risk-taking and capital regulation in bangladesh. *Eurasian Journal of Business and Economics*, 8(15):95–114.

Rajan, R. G. (2006). Has finance made the world riskier? *European Financial Management*, 12(4):499–533.

Rao, A. (2005). Cost frontier efficiency and risk-return analysis in an emerging market. *International Review of Financial Analysis*, 14(3):283–303.

Reda, I. A., Rjoub, H., and Alrub, A. A. (2016). The determinants of banks? profitability under basel regulations: Evidence from lebanon. *International Journal of Economics and Finance*, 8(10):206.

Repullo, R. and Suarez, J. (2008). The procyclical effects of basel ii. Technical report, Center for Monetary and Financial Studies.

Rime, B. (2001). Capital requirements and bank behaviour: Empirical evidence for switzerland. *Journal of Banking & Finance*, 25(4):789–805.

Roodman, D. (2006). How to do xtabond2: An introduction to difference and system gmm in stata.

Roodman, D. et al. (2009). How to do xtabond2: An introduction to difference and system gmm in stata. *Stata Journal*, 9(1):86–136.

Sahajwala, R. and Van Den Bergh, P. (2000). Supervisory risk assessment and early warning system. basel committee on banking supervision working papers.

Saidenberg, M., Schuermann, T., et al. (2003). *The new Basel capital accord and questions for research*. Wharton School, University of Pennsylvania.

Santos, J. A. (2001). Bank capital regulation in contemporary banking theory: A review of the literature. *Financial Markets, Institutions & Instruments*, 10(2):41–84.

Sarmiento, M. and Galán, J. E. (2017). The influence of risk-taking on bank efficiency: Evidence from colombia. *Emerging Markets Review*.

Scholes, M., Benston, G. J., and Smith, C. W. (1976). A transactions cost approach to the theory of financial intermediation. *The Journal of Finance*, 31(2):215–231.

Scholtens, B., van Wensveen, D., et al. (2003). The theory of financial intermediation: An essay on what it does (not) explain. *Chapters in SUERF Studies*, pages 7–53.

Sealey, C. W. and Lindley, J. T. (1977). Inputs, outputs, and a theory of production and cost at depository financial institutions. *The journal of finance*, 32(4):1251–1266.

Shah, A. et al. (2014). The impact of corporate governance and ownership structure on earnings management practices: Evidence from listed companies in pakistan. *Lahore Journal of Economics*, 19(2):27–70.

Shim, J. (2010). Capital-based regulation, portfolio risk and capital determination: Empirical evidence from the us property–liability insurers. *Journal of Banking & Finance*, 34(10):2450–2461.

Shingjergji, A. and Hyseni, M. (2015). The determinants of the capital adequacy ratio in the albanian banking system during 2007-2014. *International Journal of Economics, Commerce and Management*, 3(1):1–10.

Shrieves, R. E. and Dahl, D. (1992). The relationship between risk and capital in commercial banks. *Journal of Banking & Finance*, 16(2):439–457.

Siddiqi, A. H. (1998). *Practice and law of banking in Pakistan.* Royal Publishing Company.

Spulbăr, C. and Niţoi, M. (2014). Determinants of bank cost efficiency in transition economies: evidence for latin america, central and eastern europe and south-east asia. *Applied Economics*, 46(16):1940–1952.

Stigler, G. J. (1971). The theory of economic regulation. *The Bell journal of economics and management science*, pages 3–21.

Sun, L. and Chang, T.-P. (2011). A comprehensive analysis of the effects of risk measures on bank efficiency: Evidence from emerging asian countries. *Journal of Banking & Finance*, 35(7):1727–1735.

Tabak, B., Craveiro, G., and Cajueiro, D. (2011). Bank efficiency and default in brazil: Causality tests. Technical report, Central Bank of Brazil, Research Department.

Tan, Y. and Floros, C. (2013). Risk, capital and efficiency in chinese banking. *Journal of International Financial Markets, Institutions and Money*, 26:378–393.

Tobin, J. (1963). Commercial banks as creators of'money'. Technical report, Cowles Foundation for Research in Economics, Yale University.

Torres-Reyna, O. (2007). Panel data analysis fixed and random effects using stata (v. 4.2). *Data & Statistical Services, Priceton University.*

Tovar-García, E. D. (2014). Market discipline: a review of the mexican deposit market. *Latin American Economic Review*, 23(1):6.

Triki, T., Kouki, I., Dhaou, M. B., and Calice, P. (2017). Bank regulation and efficiency: What works for africa? *Research in International Business and Finance*, 39:183–205.

Valencia, F. and Laeven, L. (2008). Systemic banking crises; a new database. Technical report, International Monetary Fund.

Van, P. (2005). Credit ratings and the standardised approach to credit risk in basel ii. Technical report, ECB Working Paper.

Van Roy, P. et al. (2008). Capital requirements and bank behavior in the early 1990s: Cross country evidence. *International Journal of Central Banking*, 4(3):29–60.

Werner, R. A. (2014). Can banks individually create money out of nothing?the theories and the empirical evidence. *International Review of Financial Analysis*, 36:1–19.

Werner, R. A. (2016). A lost century in economics: Three theories of banking and the conclusive evidence. *International Review of Financial Analysis*, 46:361–379.

Williams, J. (2004). Determining management behaviour in european banking. *Journal of Banking & Finance*, 28(10):2427–2460.

Wong, J., Choi, K.-F., and Fong, T. P.-W. (2008). Determinants of the capital level of banks in hong kong. *The Banking Sector In Hong Kong: Competition, Efficiency, Performance and Risk*, page 159.

Zellner, A. (1962). An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. *Journal of the American statistical Association*, 57(298):348–368.

Zhang, Z.-Y., Jun, W., and Liu, Q.-F. (2008). Impacts of capital adequacy regulation on risk-taking behaviors of banking. *Systems Engineering-Theory & Practice*, 28(8):183–189.