Risk Taking Behaviour and Capital Adequacy in Banking System of Pakistan

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March, 2017

Capital adequacy norms

Risk analysis

APPROVAL SHEET

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Date of Viva Voce February 27, 2017

Acknowledgements

Foremost, thanks to Allah (S W T) the most forgiving & compassionate and blessing to His beloved Prophet Muhammad (s a w w) and the family of Muhammad (s a w w)

A special gratitude goes to my supervisor, Dr Abdul Rashid, for the guidance and support His valuable comments and remedial recommendations shaped up this dissertation in its final form Thank You so much Sir My acknowledgments also go to all my teachers and office staff of international institute of Islamic economics for their co-operation Furthermore, I would like express my special gratitude to my beloved parents whose prayers have always boosted my abilities Last but not least I am grateful to Hafiz Muhammad Javed & Hafiz Muhammad Jamshed and all family members for their unconditional support on every step And sincere thanks to all those friends who were involved directly or indirectly guiding me in my research work

Declaration

I hereby declare that work presented in the in this thesis is my own effort, except where otherwise acknowledged and that the thesis is my own composition No part of the thesis has been previously presented for any other degree

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Abstract

This study empirically examines the impact of capital level on the risk taking behaviour of banks in Pakistan using dynamic panel data from the period 2006 to 2015. We use risky asset as a measure of risk and capital adequacy ratio as a measure of capital level of banks. We also explore the impact of bank other specific variables namely, bank size, profitability and interest rate on the risk taking behaviour of banks. Dynamic ordinary least square (DOLS) and GMM are used for estimations. We find a significant and positive relationship between the bank capital level and risk taking behaviour. The short-run results also show that changes in capital level are positively and significantly related to risk taking behaviour in banks. The positive relationship between the risk and capital suggests that the banks having the capital level above regulatory requirements tend to invest more in the risky assets. The empirical results further suggest that the bank size has a negative impact on the risk taking behaviour and the interest rate is positively related to risk. Overall our results are in line with the theories and existing empirical literature on the risk and capital.

Key words: Risk, Capital, DOLS, GMM

Table of Contents

List of Tables

Chapter 1

Introduction

1.1 Background

In banking literature, the association between bank capital and risk taking has become an important issue since the financial crisis 2007-2008. One of the causes of financial crisis is the overvaluation of assets by the banks. Banks are the financial intermediaries and they invest the capital of depositors to gain the returns. According to the World Bank, a bank is in crisis when it has the liquidity and the solvency issue at the same time. This situation could be either due to the external shocks or because of the failures of big banks in the system. According to Cannata and Quagliariello (2009), in the financial crisis 2007-2008, many institutions were not in position to recover the losses. The capital reserves of banks were far below the overall debt ratios due to investments in risky assets and the credit expansion. According to Dajcman et al. (2012), financial crisis was helpful to recognize the bank risk determinants. One of the reasons of the high risk was the banks lower capital levels.

Therefore, policy makers have recommended some sustainable changes to the prudential regulations (Basel Accords[1]) of banks to enhance the stability of financial markets. The purpose of introducing such regulations is to make the financial markets much safer and to avoid such a risky situation in future. These changes also include the implementation of strict capital requirements for the banks. Lee and Hsieh (2013) state that the latest standards for the banks are better than the previous ones as they demand to raise the Capital level and also improve the quality of capital.

[1]The objective of Basel Accord 1998 was twofold, first was to make sure that all the banks have an equal opportunities as well as the putting some restrictions by increasing minimum capital requirement, which were normally at lower levels in many countries. second objective was to promote financial stability by distorting incentives for bank risk taking behaviour and also by introducing relatively simple technique to credit risk. First of all, the banks in developed countries adopted the guidelines. After few years these were adopted by the Asian banks. Pakistani banks are currently following the Basel III Accord.

Basel III is the latest addition to the existing rules and regulatory controls Their objective is to strengthen the stability of financial markets specially the banking institutions These new rules are not replacing the previous one but are an addition to the existing Basel I and II The centre of attention for Basel III is to save the banks from situation of 'bank run'[2]' Therefore, diverse reserve requirements for different accounts are introduced in it The major changes included are increase in the ratios of minimum capital requirements, leverage ratios and liquidity ratios More strict requirements of reserves are helpful in raising the overall capita levels of banks

The minimum capital requirements were first introduced in 1996 The minimum capital requirements clause exists in the current regulations Purpose of this mandatory requirement is to ensure that the banks are not involved in making investments in highly risky assets The minimum capital requirement is one of the effective tools, which ensures that the banks are not exposed to the risk of being insolvent According to Dalla and Pellegrina (2007), the requirements of minimum capital is not relevant to Islamic financial institutions as the investments made by Islamic banks are on the basis of the tangible assets As the deposit accounts in the Islamic banks are PLS (profit and loss sharing), therefore the chances of insolvency in these institutions are less than the conventional banks (Adebayo and Hassan, 2013) But due to imperfect market conditions conceptual theories are difficult to be translated practically Therefore, the importance of capital requirements still remains same for conventional banks as well as for the Islamic banks Therefore it needs further empirical analysis especially in the countries having the both Conventional and Islamic banking systems

[2] A panic situation where the depositors and investors tend to take out money from the banks The customers have no more confidence over the banks whether they will survive or not

Financial intermediation is normally the basic function of banks. According to Freixas and Rochet (1997), asset transformation[3] is one of the basic functions of banks. Further he suggests that financial intermediation, managing risks and resolving liquidity issues are also the core functions performed by the banks. On the contrast, Diamond and Rajan (2001) consider the banks as the backbone of financial markets, as they resolve the liquidity issues of market. While Brealey et al. (1977) explain that on the basis of the market knowledge, the banks can act as an investor on behalf of their customers and can generate high returns on their investments.

During the investment process, banks try to do the proper evaluation of risky assets and asset diversification. The banks run their business by collecting the deposits from the customers. Most of these funds are of short-term in nature. The investment in the long term securities of those funds can cause maturity problems. So it can generate the credit and liquidity risks for the banks. On the other hand, Adebayo and Hassan (2013) say that the Islamic banks are less exposed to the risk due to contracts based on profit and loss sharing. They distribute profits or share losses on the deposits of their customers instead of giving fix amount of interest to them.

There are different views in the theoretical literature of association between risk and capital. These contrastive views are based on the varying capital requirements. The minimum capital requirements became mandatory for the banks in response of bank behaviour in light of "moral hazard theory". The minimum capital requirements can not decrease the overall risk unless the assets portfolio is also of optimal nature (Kahane, 1977). Other than the strict the minimum capital requirements, banks have to implement the all other necessary regulations to avoid insolvency and collapse (Kareken and Wallace, 1978). Only the stringent capital requirements do not guarantee the stability of banks. Koehn and Santomero (1980) state that the capital requirement is not an efficient measure to restrict the banks from risk

[3] This is the process where the banks issue the loans to the borrowers from the amounts deposited by the depositors. In this process the bank is actually converting the liabilities into the assets.

taking activities Instead of implementing the rigid regulatory capital tool, levels of capital and the ways of its composition should be improved

In contrast, Furlong and Keeley (1989) suggest that overall risk levels in the banks can be decreased by the increasing the minimum capital requirements These requirements are an effective tool in controlling the credit risk as well Shrieves and Dahl (1992) also support the view that the minimum capital requirements can be helpful for the undercapitalized banks to maintain the adequate capital level However, these have not much strong impact on the banks having the high capital base

According to Goddard et al (2004), the excess capital above the regulatory requirements can reduce the risk in the banks The well capitalized banks are less exposed to risk as they hold higher capital and invest it by making optimal asst portfolios By raising the capital, the bank can increase its profitability ratios due to the lower debt and insurance expenses There is puzzle between the capital level and risk and both these important variables are affected by the profitability (Altunbas et al , 2007) According to Barth et al (2013), when government directs the banking sector to control the risk then banks in response increase the capital buffer and strengthen the capital level to meet the regulatory capital requirements In the competitive environment the association between the risk and capital is different as the minimum requirements of capital can decrease the lending (Opoku et al , 2016) Therefore, in the competitive market non bank financial institutions capture the market by investing in the projects bearing low risk Therefore, in presence of this restriction, banks actually become more risky

Besides the capital adequacy, bank size, profitability, and interest rate are also important variables in determining the risk taking behaviour of banks Profitability is one of the significant variables in explaining the risk taking behaviour of banks therefore, improper risk management can reduce the profits (Kargi, 2011) Due to the uncollectible amounts the profitability and credit risk have an inverse association (Berrios, 2013) According to Haq &

Heaney (2012), larger banks are less exposed to the credit risk due to the adequate capital levels they have Lower interest rates can increase the risk for the banks due to the higher investments (Ioannidou et al , 2015) So the previous literature suggests the relationship of these variables with the risk taking activities of bank

In Pakistan Basel accord was implemented by State Bank of Pakistan for the first time in 1997 The capital regulation is also in line with the Basel-I Accord The regulation linked the bank asset portfolio with the minimum capital level, which has to be maintained by the bank The banks in Pakistan are currently following the Basel III standard of the capital adequacy ratio (CAR) against the risk weighted assets (RWA) Banks calculate the risk weighted assets by using the four risk categories For the Government securities default risk is 0%, 20% is maintained for the low risk, 50% for the moderate risk assets and 100% for the high risk assets such as loans without securities In the year 2008, the capital adequacy ratio was initially 9% which has increased gradually Currently in light of Basel III, capital adequacy ratio (CAR) increased to 16 3% by the end of March 2016

According to Shafiq and Nasr (2010), Pakistani banks are exposed to country risk and political risk due to unstable political situations along with the other market risks Therefore the Pakistani banks have to follow the regulatory requirements and keep higher reserves Basel rules play a role in the making the banking institutions more stable and efficient (Nazir et al , 2012) There are different studies[4] available on empirical analysis of relationship between capital ratios and risks for different countries

Due to the financial innovations in the under developed capital markets like Pakistan, bank's capital regulations are likely to have more important affect on the risk In case of Pakistan, it not an easy task to analyse the association among the risk and capital levels and this empirical question deserve attention There are studies available on risk management

[4](Kahane 1977) (Shrieves& Dahl 1992) (Jacques & Nigro, 1997) (Blum 1999), (Claessens et al 2000), (Rime 2001) (Aiyar et al, 2007), (Iannotta et al 2007), (Agusman et al 2008) (Lee & Hsieh, 2013) (Karim et, 2014)

practices like, Ahmed et al (2011) have used the data of conventional banks of Pakistan to analyse the risk management In most recent study by Ashraf et al (2016) investigated the association among the capital and risk They used the panel data set for the year 2005 to 2012 of Pakistani banks They found that stringent risk based capital requirements have reduced the overall portfolio risk in the Pakistani banks

Previous research that examined the association among the capital and risk has mostly analyzed the banking systems of developed countries One of the rationales of limited studies regarding developing countries is the late adoption of Basel regulations Therefore, due to limitations of data on the risk and capital a very few studies are available in case of developing countries As Pakistan is also one of the developing countries, so not such particular studies available investigating the affects of capital and profitability on the risk taking behaviour Hence, the connection between the capital level and risk taking behaviour of banks stays statistically unresolved in case of Pakistan Therefore, it needs further studies to examine the association among the capital and risk of banks

1.2 Research Gap

Due to international banking crisis in the financial markets, the association among the risk, bank capital level and profitability has been subject to research for many years Existing literature on association among bank capital and risk have mostly concentrated on banking sectors of Europe and America Related to developing countries[5], we found very limited studies that have explained the relationship between the underlying variables The reason is late adoption of the Basel guidelines and data limitations in these countries Next, the existing literature[6] on banking sector of Pakistan is not providing any clear evidence of association between the risk and capital Most of the previous studies related to Pakistan banking sector have mainly concentrated on the risk management and profitability measures

[5] Ito and Sasaki (2002) and Chiuri et al (2002) are the few studies available on the developing countries those have assessed the relationship between the lending behaviour and capital requirements in banks

[6] The only study available on the banking sector of Pakistan is by Ashraf et al (2016), investigating the association between the risk and capital

To the best of our knowledge no prior studies available on mixed banking system of Pakistan investigating the short-run as well as long-run relationship between risk and capital Therefore, first this study contributes to the existing literature by conducting a research on the banking sector of one of the developing countries Secondly, it is an addition to the previous literature on the banking sector of Pakistan We examine the relationship between capital level and risk taking behaviour of mixed banking system of Pakistan Moreover, we aimed to check the impact of bank's size, profitability and interest/Financing rate on the risk taking behaviour

1.3 Objectives of the study

The study has the following objectives

1. To investigate the long-run relationship between capital level and risky assets of banks in Pakistan
2. To explore the short-run relationship between capital level and risky assets of banks in Pakistan
3. To check the impact of bank size and profitability on the risk taking behaviour of banks

1.4 Research questions of the study

The study addresses the following research questions

1. Is there any significant relationship between the capital level and risk taking behaviour of banks in the long run?
2. Is there any significant relationship between the capital level and risk taking behaviour of banks in the short run?
3. Is there any significant relationship between the size and risk of banks?
4. Is there any significant association between the profitability and risk?
5. Is there any significant relationship between the interest rate and bank risk?

1.5 Significance of the Study

This study contributes to the existing literature by finding the short-run as well as the long-run association among the bank capita level and risk of banks in Pakistan. Most of prior studies investigating the impact of capital on risk have focused on the developed countries banks. A very rare proportion of the existing literature has examined the relationship between risk taking behaviour and capital, using the data of banks in developing countries. Therefore, for efficient portfolio and risk management, it is vital to investigate the association among the capital level and risk taking behaviour of banks. The results of the study may help regulatory authorities to set the better capital requirements and improve asset quality of banks. The results may assist the bank managers to maintain adequate capital level and make better portfolio decisions while making investments. Most importantly, these findings can help the customers and investors to select the better financial intermediaries for their deposits and investments. Bank capital levels and its risk taking behaviours can reflect the preferences of banks. Therefore, the investors can deposit and invest their funds in banks having the appropriate capital levels and optimal asset portfolios.

1.6 Organization of the Study

This study consists of five chapters. Chapter 1 describes introduction, purpose of the study, research questions and the research gap on the basis of previous literature on the risk taking behaviour and capital adequacy. Next it explains that how this study contributes to existing literature. At the end it shows the scheme of study.

The second chapter of this study consists of critical analysis of the previous literature on the risk taking behaviour and capital. Particularly, the results of the theoretical and empirical existing studies on risk and capital are discussed in details in this chapter. At the end, this chapter also presents the findings of literature related to other variables like bank size, rate and profitability.

The chapter three comprises the methodology and empirical model for investigating the association between the capital adequacy and risk taking behaviour in banks In addition, first this chapter displays the dynamic OLS model for long-run statistical analysis and next it shows the VECM model to test the short run dynamics of variables Further the estimation technique that we have used to estimate the short run model is also described Finally, the chapter provides the details of data, its sources and variable

Chapter 4 provides the results of empirical models Particularly, first the chapter discuses the results of summary statistics and co-integration test Then the chapter provides the results of dynamic OLS model implemented to understand the long-run association among variables Next the results of VECM model are discussed in details Finally the chapter gives the results of post-estimation test, applied to check the validity of estimates

Chapter 5 of the study concludes background of dissertation and conclusions Next, this chapter provides the policy recommendations and economic justifications of the empirical results At the end, limitations of the study and directions for future are discussed in the chapter

Chapter 2

Literature Review

2.1 Theoretical Background

Capital requirements are an essential part of the banking regulations The regulators have been making efforts to set 'appropriate levels of capital for long time During the 1970s, the American regulators used different formulas to calculate the minimum capital requirements for different assets After various amendments, they introduced explicit capital ratios in 1981 at last Due to the heterogeneities of risks in managing assets portfolios of banks, the regulators of different nations were agreed at Basel Accord

The current theoretical literature on maintaining the minimum capital level against the risk is based on the "moral hazard theory[7]" This can encourage the banks to make the risky investments for high returns without diligent checking Managers believe that the insurance on the deposits can protect the banks from insolvency and they continue to take too much risk Therefore, to offset these risk inducements from the banks, minimum capital requirements are introduced On the basis of minimum capital requirements and risk, the theoretical literature is divided into different categories According to various studies, capital requirements clearly are able to stabilize the banks (Keely and Furlong, 1990. Berger et al , 1995, Gorton & Winton, 2000) In contrast, some studies suggest that capital requirements can make them much riskier than they would be without such requirements (Koehn and Santomero, 1980, Blum, 1999)

According to Kahane (1977), there is a role of capital constrained assets portfolios in the banking His study explains that if bank managers are risk averse, then the there is probability that the regulations can have effective role in reducing the risk It is important that

[7] It states that an institution or group take part in risky activities on the basis that other institution or group (e g insurance companies) will compensate in case of loss The guarantees of any third party against unexpected losses can motivate the managers to take excess risk

the asset portfolio must be equally regularized, so that to gain the results of effectiveness of capital regulations. Only capital regulation is not an effective tool to reduce the risks in banks until the asset composition of banks also not regularized.

Koehn and Santomero (1980) suggest that banks that are not much risk averse will choose riskier assets. They have demonstrated that the optimal asset portfolio is necessary for effectiveness of regulatory capital restrictions. More strict regulatory requirements can affect the financial institutions in a way by making it less or more safe. Both of the above conclude that the capital and asset regulations are necessary. They further explained that capital and asset portfolio must be regularized separately and must not be discontinued via ratio constraints.

Alfriend (1988) describes that the adoption of international capital standard under the Basle accord reduces the deficiencies in measurement of capital adequacy ratio that have emerged in the 1980s. However, international banking regulators should contribute more to a stable international banking system and help to minimize competitive inequalities among banks. The imperfection in minimum regulatory is that it is not good enough to explicitly remove the risk. So it resulted in involvement of the banks in taking high risks. His study further explains that regulators also should take account of all the risks to which banking institutions are exposed. Specifically, there could be the liquidity, management, funding, and portfolio quality risks.

Furlong and Keeley (1989) explain that the risk in the banks can be minimized by implementing the strict capital requirements. They are of view that most of the times bank prefer to raise their capital level by acquiring the loans and instead of retiring deposits or securities. In this way, banks try to increase their assets and also take the insurance subsidy. Therefore, the stringent regulatory requirements can decrease the level of risk.

Marshall and Prescott (2001) state that most of the times bank choose portfolio risk with having excess capital. They select the costly screening to determine the portfolio return.

The higher capital levels give incentives to banks to select suboptimal higher level of risky assets Their study on the bank capital regulations and risk explains that the capital requirements are an effective tool to minimize the default probability and portfolio risk However without the state-contingents penalties, it is not possible to set optimal capital regulations

In contrast, Barth et al (2004) explore the effects of regulatory capital on the overall risk taking behaviour of banks They conclude that, the major causes of banking crisis are, the huge investments in the property and also the proprietorship of bank with other then the professional institutions In addition, they find that the bank private supervision is much better option to restrict bank instead of imposing restrict capital regulations on the banking sector However, they do not explain whether the bank risk-taking activates changes in accordance with the variations in capital restrictions

Vanhoose (2007) describes that the capital requirements alone do not guarantee the soundness of the banks To some level these restrictions can discourage the managers to investing in the risky assets, but not eliminating the risk completely Therefore, the theoretical literature concludes that the compulsory regulation of the CAR pressurize banks with capital below the required, to increase the capital level

2.2 Empirical Evidence on Association between Capital and Risk

Relationship between the capital level and bank risk is one of the central topics in the banking sector as it has the potential implications for regulatory policies Normally there is assumption that the impact of capital regulation on the banking sector has homogeneous impact Due to heterogeneity of the countries and banks that assumption may be questioned[8] The impact of capital regulation may vary across different countries due that country own

[8] According to the Beatty and Gron (2001) the capital level has significant impact on the lower level capital banks but not on the others They report that neglecting the heterogeneity factor in estimating bank risk taking behaviour can cause inconsistent results Banks in the different countries are exposed to the different risks due to heterogeneous factors, therefore the results of association between the capital level and risk are different in different countries (Delis et el 2010)

specific economic variables When we comprehensively analyse the previous literature on this issue, several studies show that an increase in capital can also enhance the risk of banks, (Blum, 1999, Shrieves and Dahl, 1992, Jokipidi and Milne, 2011) Whereas, some of the studies show that the increase in capital can reduce the risk in the banks For instance, Konishi and Yasuda (2004), Rime (2001) and Tan et al (2008) have found a negative association between capital and risk

2.3 Empirical Evidence of Negative Association between Risk and CAR

If increase in the capital requirements reduces the risk taking activities of banks then there is negative or inverse association between the risk and capital The inverse association between these variables describes that capital requirements are one of the effective tool for maintaining the financial stability in banks There are various studies available finding negative or inverse association between the capital and risk

In this connection, Dothan and Williams (1980) tested the effects of more strict capital controls on the behaviour of banks They tried to explore the relationship between banks insolvency and the public regulation The banks selected by them were insured by the popular insurance companies of America By using the simple state preference model they reported that if there is an increase in the regulatory capital of the banks, then there is decrease in asset portfolio risk Their study further explained that the monitoring of bank loans is very important as they may be involved in making very risky portfolios

Brewer and Lee (1986) have worked on an issue that how the financial market is inter-linked with risk taken by the banks They used the data set of 44 American banks and holding companies from 1948 to 1978 They concluded that higher levels of capital can motivate the management of banks to invest less in risky assets, and augmented an inverse association between the risk and capital levels They further explained that banks invest in risky assets to gain high profits However, the stringent capital regulations are helpful to control the banks from taking high risk

Similarly, Karels et al (1989) investigated relationship between risk and capital by using the unsystematic and systematic risk as proxies for risk. A quarterly data of 24 American banks over the period 1977-1984 is used and estimation was carried on by using the CAPM and correlation. Their empirical findings suggest that for each of thirty quarters, the results suggested the negative correlation between the unsystematic risk coefficients and levels of capital. Further they founded a negative correlation among the total risk and CAR, which depict an inverse association between them. Moreover, mixed signs have been observed between the coefficients of capital and systematic risk.

Jacques and Nigro (1997) estimated the relationship between bank profitability and risk by using data of 2570 US banks with time span 1990-1991. They concluded that with the increase in minimum capital requirements, the capital ratios of banks also become higher. The higher CAR of the banks reduced the overall risk for banks. Therefore, their results supported the view that strict capital requirements are one of the efficient tools in making the commercial banks much safer for depositors.

Furthermore, Salas and Saurina (2003) have examined the results of regulatory requirements on the credit risk. They used the sample of 21 commercial banks in Spain for the time span 1968 to 1998. By applying simple OLS they found that the increased capital levels have negative effects on bank credit risk takings. They further explained that the concerns regarding the credit risk must be resolved. So there is a need to strengthen the capital regulation to avoid risk.

To determine the risk factors, Konishi and Yasuda (2004) empirically examined the ten years data of commercial banks in Japan. By applying the regression model, they concluded that CAR can be effective in minimizing the risk in banks. They also found that the ownership structure have also an impact on the risk. Stability of share holders, having the ownership of banks has also negative impact on the risk. So they also showed a negative association between the risk and minimum capital requirements.

Hussain and Hassan (2005) have empirically examined the data of large commercial banks in the eleven developing countries They found the inverse association between capital and risk Further they explained that the minimum capital requirements have capability to decrease the overall risk in banks In their study they also analyzed the association between the bank capital and financial development and suggested a negative relationship It was also explained by them that new sources of capital can reduce the credit risk

Gonzalez (2005) examined the robust impact of regulatory capital on risk in thirty six developed countries They argued that, higher regulatory capital reduce bank charter values and decrease the overall risk in banks So they reported that the relation between the risky assets and capital levels is negative He further examined the relationship between the satability of banks and regulatory capital and also found that they are also negatively correlated

Silva (2007) has also argued that strict capital regulation can reduce the investment by banks in risky assets The data used by him was seminal and model developed by Blum (1999) was used to examine the link between risk and capital According to his findings, risk can be reduced by increase in the capital requirements His study further suggested that Monitoring and supervision could be an effective tool to reduce risk and to implement capital regulations

In another study, Zhang (2008) examined the effect of regulatory capital on the risk by using the data of 12 Chinese Commercial banks including the 3 government banks for the period 2004 to 2006 By using the dynamic methodology they found a negative association between the changes in capital requirements and change in risk behaviours The regulatory clause of minimum CAR insists on bank to raise their capital levels at least according to the regulatory requirements However, strict capital requirements have not a noticeable control over the risk of banks

Agusman et al (2008) conducted a study to check the nature of association between the risk and capital among the Asian banks They have taken 10 years panel data of these banks They used the ratio of equity capital to measure the capital levels and risk by taking the variance of return ratios Their empirical results depicted a non-linear relationship between capital and risk level of Asian banks, but not statistically significant

Agoraki et al (2011) explored the impact of the regulatory requirements on the bank risky assets They used the data of eastern and central European banking sector for the period 1998 to 2005 Based on study findings they concluded that increase in the capital requirement can reduce the overall risk They found a negative relationship between the underlying variables They further explained that limited capital requirements can strongly restrict the risk and also decrease the non performing loans Their study also stated that the market power of banks is also an important determinant of risk taking

Klomp and De Haan (2012) carried out a study on the banks of member countries of OECD They used the 6 years data to examine the association between the regulatory capital and risk Their study showed that high ratio capital requirements can constrain the banks from taking high risk However, impact is not much significant for low capitalized banks Further they suggest that bank size is positively related to both capital and risk

In similar lines, Haq and Heaney (2012) used the data of European banks to investigate the determinants of bank risk The data sample of 117 banks was taken for the period 1996 to 2010 Their results showed the negative association between the CAR and the credit risk They further explained that regulatory capital is one of the potential indicators in determining the risk They suggested that if banks are pressurized to raise their capital level then the unsystematic risk may also goes up for the bank

Tan and Floros (2013) analyzed the sample of Chinese banks to examine the association between the risky assets and capital level They used the data of commercial banks for the period 2003 to 2009 Their findings suggested that the CAR is negatively and

significantly related to the bank risk taking behaviours It was also explained that the bank with higher liquidity prefer to maintain higher capital level As they prefer to keep higher capital levels, therefore they are not involved in making investments in the higher risky assets or risky portfolios

Bouheni et al (2014) carried out a study on the European banks from the year 2005 to 2011 to analyse the impact of regulatory requirements on the profits and bank risk They concluded that the minimum CAR requirements can decrease the risk in banks Further they also found a negative association between the strict regulation and profit Moreover, they explained that these requirements can increase the profitability and boost the performance of banking sector of Europe

Lee at al (2015) studied the impact of minimum capital requirements on the risk the risk taking behaviour A sample of 171 Chinese commercial banks for the year 1997 to 2011 is selected for estimations They found that capital is significantly and negatively associated with the risk taking activities of banks They further explained that after joining the WTO in 2001, bank capital level has noteworthy affects on the bank risk taking behaviour and profitability in Chinese banking sector The affect of capital level on the risk taking is different for small and large banks due to different variables used in the banking industry

Ben Selma et al (2016) analysed the data of 30 commercial banks of MENA region for the period 2002 to 2009 They concluded that risky assets and capital adequacy ratios are significantly and negatively associated to each other Further, they separately tested the samples of CBs and IBs to examine the association between capital and risk However the results also showed negative relationship between the underlying variables for the separate sample as well They also tested the effect of ownership structure on the bank risk taking

2.3.1 Empirical Proof of Positive Association between CAR and Risk

In contrast, previous literature also shows a positive association between the minimum capital requirements and risk. The positive association is in accordance with the moral hazard theory where manages take risk on the basis of miss-priced insurance. The other reason behind this direct association is the low return on investments in presence of such restrictions. As these requirements put pressure on the banks to limit their investments, therefore, the banks tend to rearrange their portfolios and invest in the risky assets. We discuss the previous literature in details, showing the positive association between risk and capital.

To explore the association between the minimum capital requirements and risk taking behaviour, Shrieves and Dahl (1992) selected the American banks. Their results suggested that risk taking behaviour of banks varies with the capital levels. They found a significant and positive association between the capital and risk. The banks invest more in the risky assets as there is an increase in the required capital. Due to restrictions, banks have limited options to invest therefore they tend to increase the investments in the risk bearing assets.

Altunbas et al. (2007) investigated the association between the risk and capital. They used the dataset of 15 banks for the year 1992 to 2000 from European countries. Their results suggested that capital levels and risky assets have the positive association. Moreover, the liquidity ratio has the direct association with the risk. The relationship between the bank size and risk was also found positive. Further they suggested that the incompetent banks keep the capital level high but also make not many investments in the risky portfolios. Their study also related the capital and risk of banks with industry and found that financially strong industry can have positive influence on the risk and capital levels of banks. Finally, they concluded that the affects of capital on risk is different among the banks on the basis of functions of banks and behaviour of managers. Therefore, the results of this relationship were different for the commercial, saving and co-operative banks.

Shim (2010) conducted the research on American financial institutions to examine the association between the regulatory capital, profitability and risk. He used 3SLS technique to estimate his empirical model with time span from 1993 to 2004. He concluded a strong positive relationship between the capital and bank profitability by taking the return on assets ratio to measure the profit. Further, the risk has also the positive association with capital.

In similar lines, Lee and Hseih (2013) have taken the data of Asian banks to explore the statistical relationship between the risk and capital by using the GMM technique. They concluded that risk taking behaviour of banks has the direct relationship with the capital. They justify that higher level of capital will lead to enhance the profits of banks. They further suggested that profitability and risk can affect the profit on the basis of functions of banks. The impact of capital varies in the banking systems of different countries on the basis of their income levels as well.

By using the sample of banks of OIC countries, Karim et al. (2014) have confirmed the positive association between the risk taking behaviour and capital levels. These countries have the mixed banking and therefore they estimated the data of both type of banks separately. Their results suggested that with the increase in the capital, the conventional banks tend to make investments in risky assets. The results of association between the capital and risk are also same for the IBs as well for the CMs means they also take more risk when they have surplus capital.

2.4 Mixed Findings

Some of previous literature on risk and capital has also concluded that the capital has no specific effects on the risk of banks. Few studies are of view that there is no significant relationship between these variables while some of these existing studies concluded mixed results for banks in different regions due to the other specific variables and various risks.

Sheldon (1996) used the information of eleven G-10 countries to check the impact of capital on risk. By using the option-pricing model he found that the due to increase in the

regulatory capital, banks portfolio was unchanged These results also showed that the regulatory and non regulatory influences were not there to control risk in making assets portfolios Further he explained that the country wise the regulatory capital have different effects on the risk and it also varies due to different proxies used by researchers

Aggarwal and Jacques (1998) have showed the diverse results in determining link between the capital level and risk They used the data of 2552 American insured banks from period 1990 to 1993 to determine effects of the "PCA[9]" standards on the portfolio risk and capital level They agreed that their findings do not assure the strong association between risk and capital It is not necessary that the risk taking attitude of the banking industry would relate to the capital all over the banks in world

Rime (2001) tested the relationship between the risk and capital by using the data of Swiss banks He showed that when the threshold limit of capital requirements is adjusted, then the banks try to increase their capital levels However, his empirical results showed that there is no significant relationship among the risk level and capital Further, he suggested that the positive relationship between the risk and capital level is not prejudiced by the minimum capital requirement clause The increase in the level is risk influenced by the bank manager personal decisions Therefore, the association between risk taking behaviour and capital level is not providing any clear evidence

2.5 Empirical Literature on Association between Risk and Size

The size of banks shows their ability to take risks Big banks have normally the greater reserves and capital levels They also have the tendency to bear the losses in results of the investments made in the risky portfolios In contrast the smaller banks are not well capitalized but they normally invest less in the risky assets Therefore due to less risky investments, they are less exposed to risk However "too big to fail" theory argues that the in case of failure, large bank have noteworthy affects on all financial markets They also can invest more in the

[9] Prompt Corrective Action

risky assets, as they are leveraged by the insurance companies and also state can support them in crisis Therefore, the bank size can have the positive or negative impact on the risk taking behaviour of banks Here we discuss some previous studies on the association of banks size with the risk

Jacques and Nigro (1997) examined the effect of size on the bank risk by using the data of U S banks of period 1990-1991 Their results suggested that the size affects the bank investments in risky assets positively and significantly Large banks are more involved in taking risks to gain the higher returns Aggarwal and Jacques (1998) have found that bank size has negative impact on the capital level Further, bank size and risk taking activities are negatively and significantly associated The impact of PCA was also observed by them on the American banks

Rime (2001) described that due to the relationship with the investment opportunities, equity capital and risk diversification, risk is significantly related to size of bank He explained that larger banks take low risk as compared to smaller banks So his study also confirmed that risk taking activities are negatively linked to bank size Iannotta et al (2007) conclusions were in support of theory "too big to fail" and found positive association between the bank size and risk taking activities They argued that the big banks invest more in the risky assets to gain high returns, therefore risk of loss is also high for them Larger banks take high risks and smaller banks have fewer incentives for investing in risky assets (Garcia-Marco and Robles-Fernandez, 2008) They were analyzing the data of saving and commercial banks of Spain for the period of 1993 to 2000

Van Roy (2008) carried out a study on the commercial banks of G-10 countries to investigate the relationship between size and the capital of banks Their results suggested that size is positively and significantly related to the risk of the banks The market discipline has a vital role in the banking industry He further explained that bank size is negatively associated to the capital requirements Zhang (2008) has also found a positive relationship between the

bank size and risk by using the data of Chinese banks He explained that the large banks have tendency to invest more in the risky assets Laeven and Levine (2009) have examined the data of 270 largest banks in 48 countries They were of the view that bank size is positively related to the risk

Zribi & Boujelbene (2011) examined the affects of macro and micro economic variables on the risk by for the period 1995 to 2008 They used the data of Tunisian banks and found that size is also one of the determinants of risk in banks They documented that size and risk are negatively and significantly associated Abdelaziz et al (2012) have investigated the association between size and risk by using the data of Tunisian banks for the period 1980 to 2010 They reported that the size and risky assets are significantly and negatively associated They explained further that most of the macro variables have negative impact on the bank credit risk

Afzal and Mirza (2012) investigated the relationship between the bank size, risk and diversification by using the data of Pakistani banks for the period 2004 to 2009 They reported that although the large banks invest in the highly risky assets but they also have the ability to diversify Therefore, they reported that the bank size is positively related to the risk Beltratti and Stulz (2012) carried out study on the 164 large banks in the world for the period of 2007-2008 Financial Turmoil They concluded that the risk and bank size are negatively related However, their results were not statistically significant due to the small cross sections Haq& Heaney (2012) investigated the determinants of risk by using the information of commercial banks in Europe They showed a positive correlation between the total risk and bank size However, their results suggested an inverse association of bank size with the risk taking activities

Laeven et al (2015) concluded that the risk is directly proportional to the bank size and inversely proportional to capital level of banks In a most recent study by Ben Selma et al (2016) used the sub sample of Islamic and conventional banks to check the effect of bank size

on the risk. They found that bank size is negatively related to the risk. However, the results of this relationship were not significant.

2.6 Review of Previous Literature on Association between Risk and Interest Rate

According to Delis and Kouretas (2011), the interest/financing rate has the capability to increase the risk taking behaviour of banks. In the mid 2000s, due to low interest rates there was increase in the bank level of risk. The reason is that due to low interest rates, there is reduction in the profit margins and banks invest in highly risky assets to gain high returns. So it can be observed clearly that, the banks react in the low interest environment by softening the lending standards and thus investing in risky assets.

Previous studies on the empirical analysis of association between the risk and interest rate are limited. Most of the existing literature exhibits that interest rate and the risk are negatively related. Like, Rajan (2006) tested the association among interest rate and risk of banks and suggested the negative association between them. He argued that nominal interest rate is normally coupled with a decrease in the margins. So it pressurizes the banks to invest in more risky assets. Keeley (1990) have also argued that the interest rate is negatively associated with the risk.

McNamara and Bromiley (1999) found a positive association between the financing rate and risk. They further explained that increase in the interest rate can increase the overall risk of bank. Delis and Brissimis (2010) tested the affects of monetary policy on the banks risk and performance. They used the data of American and Euro Area banks. Their findings suggest that different banks response varies due to change in the financing rate policies.

Delis and Kouretas (2011) concluded that risk taking and interest rate are inversely proportional to each other. They further argued that lower interest rate can reduce the volatility and margins of rate. So this can motivate banks to search for more risky products. Ioannidou et al. (2015) examined the low rate policy in Bolivia and found that lower rate

policy can encourage the banks to grant loans to borrowers with poor credit history and low rating. They also found a negative relationship between the risk and interest rates. So the overall results of previous literature on association among financing/interest rate and risk shows a negative relationship.

2.7 Review of Literature on Association between Risk and Profitability

It is basic standard rule of finance that high risk generate the high returns. Normally, this rule of risk and return is implied on everywhere irrespective of any field or industry. In banking sector the relationship between the risk and return depends upon the type of banking business. Most of the investment banks take high risk and have high chances of loss. As their main business is financial intermediation and making investments on behalf of customers. Empirically we found many studies having positive relationship between the risk and return (Fisher and Hall, 1969, Boahene et al., 2012). On the other hand various studies have represented the contrary view as well.

Jegers (1991) explained that there is significant and negative association among the risk and return. Miller & Noulas (1997) also showed a negative association among the profitability and risk by using the data of American banks. McNamara and Bromiley (1999) concluded that risk and return are negatively related. Godlewski (2005) examined the association among the profitability and risk by using the data of different banks. The results of study also suggested a negative association between the risk and profitability. So the findings regarding risk and return also remained inconclusive in the previous literature.

Kargi (2011) analyzed the association between banks profit and the risk by using the data of Nigerian banks. His findings concluded an inverse and significant association between the overall profits of banks and the risk. Improper risk management has the direct association with the loan loss provisions which can reduce the profits. This study further explained that lending attitude of banks must be assessed and securities market to be strengthened to stable the profit ratios of banks.

Boahene et al (2012) analyzed the association between the profitability and risk They used the data of banks in Ghana for the period 2005 to 2009 Their results suggested a positive and significant association between the risk taking behaviour and profits of banks So their study supported the hypothesis that high risk can generate the higher returns They further explained that bank debt capital, bank growth and bank size influence the bank profitability positively and significantly

Berrios (2013) tested the connection between the profitability and credit risk by using the data of banks in the United States He concluded that the higher risk can condense the profitability due to the greater uncollectible amounts It is further explained that the negative association among the credit risk and capital level shows that the higher credit risks are associated with higher debts Moreover, the prudent regulations can cause to increase the net interest margin for banks

In recent study, Tan et al (2016) have tested the association between the profit levels and risk of banks They used the data of Chinese banks for the year 2003 to 2013 They found a negative and significant association between the credit risk and bank overall risk They further documented that bank profits has significant association with the risk of banks Banks has the tendency to raise their profits by making investments in the high risky assets

We conclude that the previous theoretical and empirical literature on this issue shows the mixed findings Next, most of the empirical literature has concentrated on the banking sectors of developing countries Therefore, on the basis of previous literature the purpose of our study is twofold First, we check the association among risk and capital level in banking sector of Pakistan, which is one of the developing countries Next we also examine the impact of bank size and profitability on the risk taking behaviour of these banks

2.1: Summary of Literature on Association between Risk and Capital

Author(Year)	Period	Countries	Model/Methodology	Findings
Hussain and Hassan(2005)	2000-2004	11 Developing countries	Simultaneous equation	Their findings showed an inverse (negative) association among risk and capital
Altunbas et al (2007)	1992-2000	15 banks of European countries	Panel model	Positive relationship among risk and capital is found
Zhang (2008)	2004-2006	12 Chinese commercial banks including 3 state owned	Dynamic panel methodology	The study showed a negative impact of capital level on risk taking behaviours
Agoraki et al (2011)	1998-2005	Easteren and central European banks	Dynamic panel model	Their results showed a negative relationship between the risk and capital level
Fmcis and Osborne(2012)	1996-2007	254 England's commercial banks	Fixed panel methodology	They found that capital is positively related to risk taking behaviour
Lee and Hseih(2013)	1994-2008	2276 banks of 42 Asian countries	Two-step GMM	Direct relationship between the risk and capital was found
Karim et al (2014)	1999-2009	186 commercial and 50IBs	Pooled EGLS	Direct relationship between the capital and

		inOIC countries		risk was found in commercial as well as in Islamic banks
Lee at al (2015)	1997-2011	171 Chinese commercial banks	Dynamic GMM	Mixed results were found between the capital and risk on the basis of different variables used
Ben Selma et al (2016)	2000-2009	15 conventional and 15 Islamic banks	GLS,Random effect and GMM	Empirical results showed mixed results of association between risk and capital

Chapter 3

Data and Methodology

3.1 Introduction

We show the estimation techniques and empirical model for estimations in this chapter In particular, First of all the co-integration relationship among dependent and independent variables is tested Once co integration relationship is established, then we use Dynamic OLS (DOLS) to explain the long-run dynamics of model Finally we present the Vector error correction (VECM) model and estimate it through GMM estimators to test the short-run relationship and causality between them This chapter also provides the explanation of data and definitions of variables

3.2 Specification of Empirical Model and Technique

3.2.1 Panel Unit Root Test

In estimation of panel data, the first step is to check whether the data is stationary or not It is necessary for stationarity of series that the mean, variance and co-variance of series must not be dependent of time In contrast, if the variance co-variance of series is changing with the time period then the series is not stationary Unit root tests are the used to test the stationarity, formally Panel unit root tests are different from the unit root tests used for a single series Most of the panel unit root tests have the null hypothesis that there is unit root Hadri, LLC and Breitung tests also presume the null hypothesis of existence of unit root in series By following the general unit root process ρ_i is same in all the cross-sections Exclusive of Hadri test, both of remaining two tests follow the null hypothesis of unit root For the test with normal process of unit root, basic ADF specification is

$$y_{it} = \alpha y_{it-1} + \sum_{i=1}^{n} \beta_{it} \Delta y_{it-i} + X_{it}\delta + \varepsilon_{it} \qquad (3.1)$$

Here the cross sections are represented through $i=1,2 \ldots,N$ for the time periods $t=1,2 \ldots\ldots,T$ and any of the trends and exogenous variables used in the model are represented by X_{it}. Any of the fixed or individual trend effects if there, are also included in it. While the errors ε_{it} are presumed to be separate and also independent. Here we assume a common $\alpha=\rho-1$ (ρ_i are the autoregressive coefficients). But different lags are allowed for the various terms, ρ_i differ for all cross-sections. We can write the null hypothesis for test as

$$H_0: \alpha=1$$

$$H_1: \alpha<1$$

"*There is unit root*" under the null hypothesis while alternative hypothesis assumes that there is no unit root.

3.2.2 Panel Co-integration Test

To indicate the log-run association between the risk and capital, it is critical to assure the co-integration relationship. Besides that the co-integration is a source to test the dilemma of spuriousness, originating from non-stationary series. If the variables are co-integrated then the statistical outcome gives vital theoretical information. To some degree, these theoretical details assist us to recognize the relationship between bank risk level and capital ratio. If co-integration association is found then the corresponding error correction model is helpful to narrate short-run and long-run dynamics (Engle and Granger, 1987).

We use the Pedroni methodology to ascertain the co-integration association, proposed by Pedroni (1999). The null hypothesis for Pedroni test is that there is no co-integration. In test, usually seven statistics are created. Out of these seven statistics, four are the panel statistics and remaining three are group panel statistics. The first four results are the non-parametric results and other three are the parametric results. These statistics are in accordance

with the different scale of characteristics Properties of these statistics indicate power and size for various N and T To test the null hypothesis, we suppose the following equation

$$y_{it} = \alpha_i + \delta_{it} + \beta_{1i}x_{1i,t} + \beta_{2i}x_{2i,t} + \quad + \beta_{Mi}x_{Mi,t} + e_{i,t} \qquad (3\ 2)$$

$$t = 1, \ldots, T$$

$$i = 1, \ldots, N$$

$$m = 1, \ldots, M$$

We suppose that y and x have the same order of integration, e g I (1) α_i and δ_{it} are the different factors to indicate the individual and tendency effects Value of these effects can be could be set as zero, if needed Under the null hypothesis of no co-integration, The residuals $e_{i,t}$ would be I (1) to test the null hypothesis Residuals are obtained from equation (3 2) Underlying equation (3 3) is used to check the order of integration The subsequent equation can be written as follows Test

$$e_{i,t} = \rho_i e_{i,t-1} + \mu_{it} \qquad (3\ 3)$$

To test the null hypothesis of no co-integration ($\rho_i = 1$), Pedroni illustrates different techniques Pedroni describe various methods of constructing statistics for testing for null hypothesis Homogeneous alternative $\rho_i = \rho < 1$ which is also referred as the panel statistics test and heterogeneous hypothesis $\rho_i < 1$ also called the group statistics test are the two alternative hypotheses

3.2.3 Dynamic OLS (DOLS)

To examine the panel data set of banks in Pakistan, we choose the dynamic panel methodology for the data analysis due to diversity of the risk banks take over time to time The optimal DOLS model we use to analyse the long-run statistics of the variables is as follows

$$\Delta Rwa_{it} = \beta_0 + \sum_{i=-k}^{i=k} \beta_1 \Delta Car_{it} + \sum_{i=-k}^{i=k} \beta_2 \Delta Rate_{it} + \sum_{i=-k}^{i=k} \beta_3 \Delta Size_{it} + \sum_{i=-k}^{i=k} \beta_4 \Delta Roa_{it}$$

$$+ \sum_{i=-k}^{i=k} \beta_5 \Delta Roe_{it} + \varepsilon_{it} \qquad (3\ 4)$$

where,

Rwa_{it} are risk weighted assets

Car_{it} represents capital adequacy ratio

$Rate_{it}$ is the interest/Financing rate

$Size_{it}$ represents the bank size

Roa_{it} is the return on assets

Roe_{it} represents return on equity

In the model, it represents the time period and cross section, while B_0 and B are the intercept and slope coefficients of the regressors. Whereas, e_{it} is the error term which captures shocks in the model. Equation (3.4) indicates that risk weighted asset (used as proxy for risk) is our dependent variable

$$\hat{e}_{it} = \Delta Rwa_{it} - \left\{ \hat{\beta}_0 + \sum_{i=-k}^{i=k} \hat{\beta}_1 \Delta Car_{it} + \sum_{i=-k}^{i=k} \hat{\beta}_2 \Delta Rate_{it} + \sum_{i=-k}^{i=k} \hat{\beta}_3 \Delta Size_{it} + \sum_{i=-k}^{i=k} \hat{\beta}_4 \Delta Roa_{it} + \sum_{i=-k}^{i=k} \hat{\beta}_5 \Delta Roe_{it} \right\} (3\ 5)$$

In the equation (3.5), we get the estimated error term to be used in the error correction model. The lag value of error correction term will be used in the VECM model. We do not use the conventional OLS to estimate the dynamic model. Because the simple OLS can experience the problem of biasness, heteroscedasticity and serial correlation due to which it does not provide desired results. Therefore the use of simple OLS does not seem to be practical as it cannot find effective estimator. To estimate the dynamic model the dynamic OLS recommended by Stock and Watson (1993) can be used. According to Stock and Watson (1993), Dynamic OLS is the most appropriate model to be used for the small sample as they proved it in Monte Carlo Simulation.

The use of DOLS renders many advantages such as it provides the solution to the problem of simultaneity by allowing repressors having different orders of integration To deal with the variables having different orders of integration, the DOLS use the parametric technique The DOLS suppose that all the variables used in the model have the co-integration relationship According to Masih and Masih (1996), the DOLS has the ability to resolve the issue of simultaneity by taking the lead and lag values of variable

The use of DOLS is feasible in our estimation as our data is relatively small and application of conventional OLS can cause the issue of endogeniety and biasness Therefore, we use the DOLS methodology to examine the log-run association between the risk and capital Secondly, the long-run model also tells the impact of bank size, interest rate and profitability (ROA and ROE) on the risk taking behaviour of bank The long-run association covers the theoretical element which is helpful in making policies

3.2.4 Panel VECM using Dynamic System GMM

The basic aim of our study is to examine the association between the risk and capital We also analyze the association of risk with the other variable including size, rate and profitability For this purpose, we use the vector error correction model and estimate it through Generalized Method of Moments It is the advantage of ECM that without losing the long-run information, there is a possibility of integration of short-run dynamics with long-run equilibrium

$$\Delta \mathrm{RWA}_{it} = \theta_{1i} + \sum_{k} \theta_{11k} \Delta RWA_{it-k} + \sum_{k} \theta_{12k} \Delta CAR_{it-k} + \sum_{k} \theta_{13k} \Delta Rate_{it-k} + \sum_{k} \theta_{14k} Size\Delta_{it-k} + \sum_{k} \theta_{15k} \Delta Roa_{it-k} + \sum_{k} \theta_{16k} \Delta Roe_{it-k} + \lambda_{1i} \hat{e}_{it-1} + \mu_{1it} \quad (3\ 6)$$

Here in the equation (3 6), the lagged error term $\hat{e}_{it-1}$ is obtained from equation (3 5) In response to any of co-integrating relationship there is related vector error correction model (Engle and Granger 1987) Therefore the error correction mechanism and co-integration relationship are linked The error correction model describes the disequilibrium function through error correction term We employ the panel vector error correction model as

replacement for conventional error correction model The generalized method of moments is used as the estimator of vector error correction model GMM controls the endogeniety and biasness in estimating the dynamic model which can be faced in implementation of conventional OLS (Arellano and Bond, 1991)

Later on, the system GMM has replaced the standard GMM One of the good features of system GMM is that it decreases the biasness and impreciseness by adding the moment conditions at level and also at difference By suggesting the various options for constructing variance-covariance matrix it shows elasticity It is fact that due to small sample size there are more chances of biasness and endogeniety According to Lee and Hseih (2013), GMM has the ability to control the biasness and endogeniety even in estimating the short sample

The system GMM is good estimator as all the moment conditions are availed in it by using the first difference Despite of several advantages of system GMM, researchers are not satisfied with the selection process of instruments used in it Therefore, without prior information the use of instruments can cause problems In system GMM, the application of correct instrumental variables is necessary to obtain the valid results We use serial autocorrelation test proposed by Arrelano and Bond (1991) to test whether the instruments used in model are robust or not While to ensure the validity of instruments, we employ the Sargan test

We also check causality in the long run The purpose of checking the causality is the right selection of dependent variable used for model We make use of the DOLS residuals in the VECM model as the explanatory variable Therefore, correct choice of dependent variable is much necessary and causality is helpful in selection of correct dependent variable The significant error term used in the model shows the causal relationship and its sign shows the direction of causality

3.3 Data and Sample

To empirically examine the association among the risk taking behaviour, size, interest rate, profitability and capital levels of banks, we have taken annual panel data set of 26 commercial banks[10] of Pakistan, regulated by State Bank of Pakistan for the period 2006 to 2015. The information is collected from the income statements, balance sheets of the relevant banks and financial analysis reports of State Bank of Pakistan. The foreign banks working in Pakistan are not included in our sample because of non availability of data.

3.3.1 Definition of Variables

Although the major purpose of our research is to check the association between the capital level and the risk taking behaviour of banks, yet we incorporate other bank variables in this study which have the association with the bank risk taking behaviour. These variables include bank size, profitability and interest rate. To measure the risk, we use risk weighted assets as its proxy. Further we have used ROA and ROE as proxy to determine the profitability. Majority of the prior studies used these bank variables which are used by us in this study.

3.3.2 Risk

Reviewing the previous literature, we find that the researchers have utilized different proxies[11] to measure the risk in banking sector. Risk is the dependent variable in our estimation and we take risk weighted assets (RWA)[12] as proxy for risk. According to Avery and Berger (1991), risk weighted asset ratio can be good of indicator of bank risk-taking in risky assets. The studies by Shrieves and Dahl (1992), Agarwal and Jacques (1998) and Delis & Kouretas (2011) have also used RWA as proxy for risk. We estimate it by dividing the total RWA over the T.A in our model.

[10] Name of banks are given in appendix.
[11] In reviewing the previous literature we find that loan loss provisions, Z score and Ratios of non-performing loans to total assets have been used to measure the risk in banking sector.
[12] (RWA) is the sum of categorized assets of the entire banks multiplied by their specified risk weights.

3.3.3 Capital Adequacy Ratio (CAR)

Car represents the capital level of banks[13] It helps banks to analyse that how much a bank is enable to recover from unexpected losses Capital ratios are one of the stability indicators of the banks Higher capital ratios indicate that the banks have more capital available to meet its financial obligations As referred by Shrieves and Dahl (1992) and Altunbas et al (2007), we use CAR as the ratio of total capital to total assets It has been calculated by dividing the capital base over the total assets Further, we calculate the total capital base by adding Tier I plus Tier II capital Jacques and Nigro (1997) have also used this capital as capital base

3.3.4 Interest/Financing Rate

Interest/Financing rate is the control variable used in the model The reason for incorporating it is that it has the association with the bank risk According to Delis and Kourtetas (2011) the interest rate is capable to raise the investments by the banks in risky assets When the interest rate is high, it might lead to decline in money demand from the borrowers Therefore, the managers tend to increase their investments in the market without diligent scrutinizing It can cause to rise in the overall risk of banks Therefore, in this study there is expectation of positive association among the interest rate and risk taking behaviour Interest rate has been calculated by has been calculated by dividing the total income of interest over the net profit

3.3.5 Bank Size

The size of bank has an important role in determining the risk-taking behaviour due to the relationship of bank size with investment opportunities, risk diversification and access to equity capital (Rime, 2001) On the basis of better information of market and desired portfolio diversification the larger banks can get the high returns The probability of being insolvent is

[13]Ratio of risk weighted car (RWCAR) was a measure for capital adequacy ratio by Jacques & Nigro (1997) We do not employ it to avoid the serial multicollinearity As risk weighted asste is dependent variable in the model so use of RWCAR in model is not appropriate The solution to deal with this issuers to discover a substitute measure of car Thus we use the sum of all assets in place of rwa as denominator The same variable was used by Rime (2001) and Shrieves & Dahl(1992)

less compared to banks small in size as they have greater asset reserves Therefore, we also expect negative association among size of bank and bank risk Negative association between the banks size and risk is also confirmed by Zribi and Boujelbene (2011), Beltratti and Stulz (2012) and Ben Selma et al (2016) Size of bank is calculated by taking natural log (*ln*) of total assets of banks of Pakistan

3.3.6 Profitability

We use two variables return on assets (ROA) and return on equity (ROE) for profitability measures The Return on asset ratio has been calculated by the total profit of banks over the total assets and return on equity is defined as the total profit over the total equity of the bank According to Atunbas et al. (2001) higher profits can improve the overall capital level of banks and can restraint the bank from investing in the risky assets We also expect a negative association among the risk and profitability of the banks

3.1: Definitions and Abbreviations of Variables

Variable Name	Abbreviations	Expected Sign	Definitions
Dependent Variable			
Risk Taking Behaviour	Risk		Risk weighted assets/Total Assets
Independent Variable			
Capital Adequacy Ratio	CAR	+ve	Total Capital base Total Assets
Interest/Finance Rate	Rate	-ve	Total Interest income/ Net Income
Bank Size	Size	-ve	Natural logarithm of Total Assets
Return on Assets	ROA	-ve/+ve	Total Income/Total Assets
Return on Equity	ROE	-ve/+ve	Total Equity Total Assets

Chapter 4

Empirical Results

4.1 Introduction

In this chapter, we present the results of estimations based on the estimation technique described in Chapter 3. In particular, first we explain the summary statistics of all the variables. Next the co-integration relationship is confirmed after checking stationarity of data. After this, the chapter shows the results of long-run association among the risk, capital, interest rate, size and profitability by implying the dynamic OLS regression. Finally, we present the results of Vector Error Correction (VECM) model in the chapter. We use GMM technique to estimate VECM model. For this, we have selected 26 commercial banks of Pakistan. The empirical results and analysis of estimations are discussed in details.

4.2 Summary Statistics

Table 4.1 presents the summary statistics of the all variables. Mean, standard deviation, minimum, and maximum values of risk, capital, rate, size, profitability ratios, are given in the table. These statistics are helpful to understand the economic significance of the variables used in estimation. It is also a test that whether the data selected for estimation is consistent or not. To measure the central tendency and central value of underlying variables, mean or simple average is used. The standard deviation describes the spread or dispersion among all the variables. It also explains that how far the variable is from the actual value. To explain the range and limit of variables, minimum and maximum values are estimated. Like the values of size, ranges from 14.71 to 21.41. The standard deviation of ROA (2.37) shows the highest dispersion among all the variables, while interest rate has the lowest value of dispersion (0.24). Bank size has the highest mean value (18.75) and ROA has the lowest value (0.01).

accepting the alternative hypothesis of no unit root Hence all the variables are integrated of order 1

4.2: Results of Unit Root Tests

Variable	Order of Integration	Im, Pesaran and Shin W-stat
RISK	I(1)	-4 4333
		(0 000)
CAR	I(1)	-6 0595
		(0 000)
RATE	I(1)	-4 6992
		(0 000)
SIZE	I(1)	-2 9558
		(0 000)
ROA	I(1)	-5 9895
		(0 000)
ROE	I(1)	-5 9833
		(0 000)

4.4 Results of Pedroni Panel Co-integration test

After examining the stationarity, the process of co-integration is implied Co-integration is important as it tells that is there any meaningful association among the variables exist or not It is essential to ensure that co-integration relationship exists between variables risk, capital. rate, size. profitability When the variables are co-integrated then we say that the long-run association among the variables exists The co-integration models are normally used to find out the long-run equilibrium among the variables

We use the Pedroni panel co-integration test to check the association among the variables in the long-run The test has many benefits and one of them is testing the co-integration with multiple regressors This test also allows considerable heterogeneity between the panel members individually The null hypothesis for the Pedroni test is that there is no co-

integration relationship between the variables We choose the lag on the basis of procedure of automatic lag selection having maximum lag of 1 Here we present the results from the pedroni co-integration test

There are seven statistics given in the summary of Pedroni co-integration test There are three statistics show the "between dimensions" (groups of rho, ADF and pp) and the other four values represent the "within dimensions" statistics According to Pedroni (1999), "between dimensions" method tests the co-integration association among the variables by taking the average of individual group coefficients while "within dimensions" technique tests it across the panel group by pooling the autoregressive coefficients All these statistics are normally distributed asymptotically One of the advantages of using Pedroni panel co-integration test is that it allows considerable heterogeneity among the panel members and also in co-integrating vectors

The test results of "between the dimensions" shows that out of three (group rho[14], group ADF and group pp), we have two statistics significant at the 5 percent level while two statistics are significant in the within dimensions test Overall we see that out of seven statistics, four are significant at 5 percent level So these significant values provide a strong evidence of presence of co-integration relationship among the variables where risk is our dependant variable

Hence the results in table 4 3 confirm the existence of long-run association among the risk, capital, size and profitability variables when the risk is taken as dependent variable Co-integration rectifies any of disturbances affecting the underlying variables in the similar way It indicates that while following the equilibrium restraint, the variables are moving jointly The results of our test are in line with the study by Wahab et al (2014) They conducted the research by using the data of Malaysian banks

[14] The name 'rho' derived to indicate that that the statistics are based on estimation of autoregressive parameters

4.3: Results of Panel Co-integration Test

Test	Statistics	p-value
Within Dimensions		
Panel v-Statistic	-3 3598	1 0000
Panel rho-Statistic	3 6196	0 9999
Panel PP-Statistic	-2 5027	0 0062
Panel ADF-Statistic	-2 4019	0 0082
Between Dimensions		
Group rho-Statistic	6 1674	1 0000
Group PP-Statistic	-9 9491	0 0000
Group ADF-Statistic	-4 7489	0 0000

4.5 Results of Dynamic Ordinary Least Square (DOLS)

The long-run relationship between the risk and capital is estimated by using the dynamic OLS Based on the equation mentioned in previous chapter risk has been selected as our dependent variable We use *Stata* procedure to regress the equation with DOLS Dynamic OLS is used to estimate the model due to small sample size The estimates of DOLS provide much more consistent and efficient results

The results of estimated equation are provided in table 4 4 Here the dependent variable is capital ratio (CAR), while rate, size, return on asset (ROA) and return on equity (ROE) are our independent variables The values of chi square and R-square suggest that the model is good fit The values of CAR and ROA are significant given by the p values less than 5 percent The positive sign of coefficients of these variables indicate that capital level and

return on assets has the positive association with the risk. The sign of coefficient of the interest rate indicates the significant and positive association between financing rate and the risk taking behaviour of banks. The estimates of other two variables reveal that size and ROE have a negative impact on the risk taking behaviour of banks. The findings of our study are in line with the results of Blum (1999) and Jokipi and Milne (2011). We discuss the results of the long-run estimates in details to compare the results with the previous literature.

4.5.1 Impact of CAR on Risk

The results indicate that the capital and risk are linked significantly in the long-run. Further the results suggest that capital has a positive impact on the risk. The findings further imply that the banks having the capital level greater than the required one tend to invest more in the risky assets. As the banks having the more capital from the investor, motivate them to invest in the assets without diligent scrutinizing. Hence, this can result in formation of risky portfolio. The positive and significant association between the risk taking behaviour and capital level is common with the previous empirical literature of Koehn and Santomero (1980), Jokipii and Milne (2011), Altunbas et al. (2007), Francis & Osborne (2012), and Karim et al. (2014) etc. and in contrast to Ashraf et al. (2016). The outcome of R^2 is also acceptable and it indicates that there is not much variation.

4.5.2 Impact of Bank Size on the Risk

The results suggest a statistically significant and negative long-run association among the bank size and risk taking behaviour. Specifically, the results of estimation show that the large banks are less risky as compared to the small banks. The reason is that larger banks have more diversified portfolio. On the other hand smaller banks have the limited options and they may not be able to make the better asset composition. The results of our estimation are in line with the findings of Aggarwal and Jacques (1998).

4 5.3 Impact of Interest/Financing Rate on risk

The coefficient of interest rate indicates the significant association among the interest rate and risk Further, our results suggest that interest rate is positively associated to risk taking behaviour of banks The results are common with the studies of Bromiley (1999) and Delis and Brissmis (2010) Due to the higher rates banks can reduce the lending and can invest in the financial markets like stock exchange etc Therefore, these investments without diligent checking can increase the risk

4.5.4 Impact of ROA on Risk

The connection among the variables, bank risk and return on assets (ROA) appears to be positive and statistically significant In our model we used ROA as proxy variable for the profitability Here we observe the long-run association among the return on asset and risk The point estimation implies that an increase in 1 percent of ROA can increase the risk by 9 percent Our result is in support to the theory of risk and return however, in few studies the return is inversely proportional to the risk also The results of our estimation are in line with the study by Tan et al (2016) and contrast to the findings of Miller and Noulas (1997)

4.5.5 Impact of ROE on Risk

The coefficients of ROE indicate the negative and significant association among the risk and return on equity The results suggest that a 1% increase in return on equity will reduce the risk by 0 13% on average Return on equity has been used as the control variables in our estimation As it has the capacity to affect the risk taking behaviour of banks in the long-run The results of our estimation are in line with the studies of McNamara and Bromiley (1999), Godlewski (2004) and Tan et al (2016)

4.4: Results of Dynamic Ordinary Least Square

Variable	Statistics
Dependant Variable: Risk	
CAR	0 5525
	(0 003)
Size	-0 1375
	(0 056)
Rate	0 3820
	(0 095)
Roa	0 0951
	(0 001)
Roe	-0 1351
	(0 012)
Wald chi2(6)	29 13
Prob> chi2	0 000
R-squared	0 9630
Adj R-squared	0 1999

Notes: The estimation method used is Dynamic ordinary least square (DOLS) for the dynamic panel data Risk is the only dependent variable used in estimations CAR represents the capital adequacy ratio Rate is the Interest/Finance rate of banks Size here represents size of bank calculated by taking log of the total assets, ROA is the return on assets and ROE is the return on equity The study used the balanced panel data set of underlying variables from 2006 to 2015

4.6 Results Panel VECM using Dynamic System GMM

we employ VECM to examine the short-run association among the risk, capital, size, rate and profitability Error Correction model is used with general specifications which include short-run dynamics and long-run dynamics Co-integration is a procedure of adjustment that does not permit the residuals to move into long-run association Therefore, error correction model has the tendency of estimating the speed of adjustment at which the dependent variable gets back the equilibrium after the changes in variables So after the confirmation of co-

integration relationship between the variables, we move forward to VECM To estimate the error correction model, system GMM is applied The GMM methodology become popular among the researchers and it allows using the lags in form of instrumental variable to minimize the chance of endogeneity OLS and IV are special cases of this estimator GMM estimators are consistent, efficient and asymptotically normal GMM estimators are considered best for estimation of dynamic models as they provide correct results without complete specification of probability distribution However it is mandatory to check the consistency of used instruments in GMM

We ensure the consistency of instruments used in our model by the implying Sargan test of over identifying restrictions The model used for estimation contains the first lag of risk, the dependent variable and also the lag values of CAR, ROA, interest rate and size, the independent variables We use the instrumental variables to eliminate the biasness It is important to mention that the lagged value of error term of DOLS has been used as input or independent variable in the VECM model The residuals are obtained from DOLS while testing the long run association among the underlying variables

The evidence of short-run impact of variables on the dependent variables is measured by the extent of the relevant variables characterized by the symbol " Δ " denotes the variation Table 4 5 represents estimation results of coefficient of variables obtained from VECM using GMM The error correction term exhibits the speed of adjustment at which the banks get back the equilibrium We further explain that after any of the adverse shocks like Global Financial Crisis 2007-2008, the financial system will take how much time to come back to the equilibrium It is important for the stability of model that the sign of coefficient of error term must be negative it has the significant value

Table 4 5 presents the results VECM by using the GMM The estimated results indicate the significant and positive association among the capital level and risk The bank profitability and risk are also positively and significantly associated Further the estimation results indicate

that bank size and the interest rate have a negative impact on the risk taking behaviour in short-run The results of capital level, size, rate and profitability are discussed below in details The purpose of the underlying details discussion is to compare our findings with the existing empirical literature

In view of the fact that the key objective of our study is to test the relationship among risk and capital therefore, CAR is the main variable in our VECM model Here we observe the positive association among risk and CAR in the short-run model as well The supervisory bodies persuade the banks to raise the capital level in accordance with the increase in risk level The probability value shows a highly noteworthy short-run association among the risk and capital The findings suggest that the banks having higher level of capital can invest more in the risky assets Highly capitalized banks tend to invest more in the risky assets to gain the high returns As the level of capital above the minimum requirements can motivates the banks to invest in the assets without diligent scrutinizing Therefore, this can result in formation of risky portfolio These positive significant results of risk taking behaviour and capital level common with the previous empirical literature of Kochn and Santomero (1980), Jokipi and Milne (2011), Atunbas et al (2007) and Karim et al (2014) are in contrast to Ashraf et al (2016)

It is important in our model to check the relationship among bank size and risk The estimated results suggest significant and negative association among the bank size and risk The findings indicate that the big banks are more diversified and have the high capital cushion It is helpful for them to mitigate the risk So large banks can minimize the risk by making much safer portfolio and also high capital reserves protect them from insolvency risk These results are consistent with the existing studies of Aggarwal and Jacques (1998) zribi and Boujelbene (2011) and Abdelaziz et al (2012)

The result showed that the interest rate is negatively related to risk Although the results are in line theoretically but we are not going to discuss them further due to the insignificant p-

value of interest rate variable ROA and ROE in the model are used as proxy variables for the profitability Here, it is also observed that the profitability and risk are positively and significantly associated The point estimation implies that the increase in equity returns can cause the risk to increase These results are in support to the theory of risk and return but in few studies the return in directly proportional to the risk also Given results of estimation are in line with the findings of Tan et al (2016) and contrast to the results of study by Miller and Noulas (1997)

In two steps GMM, we eradicate the complication of endogeneity by using the lag of variables as instrument variable To confirm the validity of instrumental variables the Sargan test is used The estimated value of Sargan test (1 000) does provide considerable proof to accept the null hypothesis of over identifying restrictions The p-value (0 17) of autocorrelation test does provide evidence to accept the null hypothesis which means there is no the serial correlation in the model

4.5: Results of VECM using GMM

Variables	Statistics
$\Delta Risk_{t-1}$	0 3538
L1	(0 000)
e_{t-1}	-0 3156
	(0 000)
ΔCar_{t-1}	0 4503
	(0 000)
$\Delta Size_{t-1}$	0 1439
	(0 000)
$\Delta Rate_{t-1}$	-0 0750
	(0 636)
ΔRoa_{t-1}	0 0141
	(0 276)
ΔRoe_{t-1}	0 0206
	(0 000)
Cons	2 9726
	(0 000)
Sargan Test	24 4031
	(1 0000)
Test for Autocorrelation	
Order 2	1 3528
	(0 1761)

Notes: The estimation method used is two steps GMM. The 1st lag of all the variables used as instrumental variables. Dependent variable in the model is risk. First difference or lag of risk is used as one of the independent variables in our estimation. CAR represents the capital adequacy ratio, Rate is the Interest/Finance rate of banks, and Size here represents the log of assets of banks. ROA is the return on Assets and return on equity is represented as ROE. The study used the balanced panel data set of underlying variables from 2006 to 2015. To confirm that the there is no correlation among the instrumental variables and residuals we imply the Sargan test. We also imply the serial correlation test to ensure that the errors have serial correlation.

Chapter 5
Conclusion and Policy Implications

5.1 Background of Thesis

Regarding the theoretical and empirical literature, there is found a significant association among the risk and capital Further, the previous studies about the determinants of risk taking behaviour of banks have provided evidence that bank size, interest rate profitability are significant in explaining the overall risk of banks This is important that most of previous studies are related to the America and European countries In contrast, when the previous literature viewed on the risk behaviour of banks in developing countries, we found that researchers have focused on the bank profitability variables those have impact on the risk taking activities However, they ignored the capital levels in determining the overall risk of bank

The major objective of our study is to investigate the association of capital level with the risk taking behaviour of banking sector Specially, we predict that the banks holding excess amount of capital above the regulatory requirements tend to take more risk By doing this, we understand that how capital level affects the banks choice of investing in the risky assets We also measure the impact of other bank specific variables which have role in determining the risk taking behaviour of banks We use the data of 26 Pakistani banks during the period from 2006 to 2015 To check the association among the risk and capital level, we used the dynamic ordinary least square and GMM technique

5.2 Summary of Findings

In this study, we examine that how capital level is related to the bank risk taking behaviour of banks in Pakistan Specifically, we empirically analyze whether banks with higher amount of capital takes high risk We take risk weighted assets and capital adequacy radios as proxy for risk and capital level The outcome of this study shows that higher levels of capital leads

to increase in the investments in risky assets suggesting that capital level is positively associated to the risk taking behaviour in banks The empirical results of dynamic OLS show the relationship of capital with risk in the long run and results of GMM indicate their relationship in the short run The banks are likely to invest more in the risky assets when they have an excess capital levels above the regulatory requirements

This shows that in the banking sector of Pakistan the capital levels of banks are positively and significantly related to the risk taking behaviour of banks These findings are in accordance with the hypothesis that higher levels of capital boost risk taking behaviour of banks The findings of our study are in line with the results of previous studies by Jokipi and Milne (2011), Francis and Osborne (2012) and Karim et al (2014) which show that the highly capitalized banks prefer to invest in the higher risk assets

The study also examines the relationship of bank other variables like size, interest rate, profitability with the risk taking behaviour of banks These variables are bank size, interest rate and profitability The results reveal that risk taking behaviour of banks is negatively and significantly related to the size of bank Whereas the financing rate and return on asset are positively and significantly associated to the risk taking behaviour of banks

5.3 Policy Recommendations and Gap for Future Work

The findings of this study can be useful to the regulators and the bank managers Further this study can benefit to the customers and investors to choose the banks having the adequate capital levels and optimal asset portfolios The results of the study also recommend that the banks should maintain an adequate capital level to run banking business The soundness of banking sector is strongly related to their capital levels Banks should meticulously reallocate the investments to find best combination of asset portfolio and get the desired return on investment

From the customers and investors point of view, it is recommended that depositors should keep their deposits to the banks which tend to invest in the less risky assets As the banks

invest the money of its customers and play an intermediary role The investors should also keep in view the capital levels of banks as well As the capital reserves can reduce the chances of loss Higher capital buffers are helpful to provide additional safety and confidence of customers over the banks

The unavailability of data of Islamic banks in Pakistan is the limitation of study Further research can be made on the current topic by taking the data of full fledge Islamic banks and its subsidiaries in Pakistan One can also extend our analysis by taking into account other than the credit risk In future it is possible to include the data of countries in the Asia The comparative analysis of banks in different countries in the region can also be helpful

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Appendix

Table A.1

List of Banks	
1	Allied Bank Limited
2	Al Baraka Bank Ltd
3	Askari Bank Ltd
4	Bank Alfalah Ltd
5	Bank Al Habib
6	Bank Islami Ltd
7	Faysal Bank
8	Habib Bank Limited
9	Habib Metropolitan Bank
10	MCB Bank
11	Meezan Bank
12	NIB Bank
13	Samba Bank
14	Soneri Bank
15	Standard Charted Bank
16	Silk Bank
17	Summit Bank
18	UBL
19	National Bank of Pakistan
20	Bank of Punjab
21	Bank of Khyber
22	Sindh Bank
23	Firtst Women Bank
24	Industrial Development Bank
25	The Punjab Provincial cooperative Bank
26	Zarai Taraqiati Bank Ltd