Credit Risk: An Analysis of Banking Sector in Pakistan

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1. Credit – banks management
2. Risk management

APPROVAL SHEET

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Date of Viva Voce: 02-08-2016

A thesis submitted to International Institute of Islamic Economics, International Islamic University Islamabad, as partial fulfillment of requirement for the award of the degree of MS Islamic banking and finance.

Dedicated

To my parents

Declaration

I hereby declare that the work presented in the following 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.

Nadia Abbas

Acknowledgments

I would like to express my immense thankfulness to Allah Almighty the most Merciful, Who showered me with His countless blessings in my entire life and give me determination to complete my thesis. May blessings of Allah be upon our beloved Prophet Muhammad ﷺ who is the sole source of guidance and model to all mankind. Our love for him is ever-lasting and would remain forever.

Then I would like to devote very special thanks to my Supervisor Mr. Muhammad Khaleequzzaman. His kindness and soft spoken behavior always gave me courage and motivation to stick my work and carry forward the study. The way he structured my thesis and the way he guide me with his comments and suggestions were precious and helpful. Without his keen observation and proposition, it would not have been possible to undertake this study. I am deeply indebted to my Co-supervisor Dr. Abdul Rashid. With no doubts, he is the true scholar with knowledge of many areas of finance and economics. I am and will remain highly obliged to his endless guidance and support of my academic endeavors. His firm understanding and in depth guidance regarding, especially to technical part of thesis was very helpful to me. He supported me throughout the study. I am heartily thankful for his support from initial to final version of my thesis.

I am also thankful to my department staff especially to Hafiz Abdur Rehman and Tauqir Ahmed. They are surely very helpful to all students. A very special thanks goes

to them for providing solution promptly when everywhere else seem problems. I am happy to mention my friends Samia Shaheen and Ghulam Fatima whose wise advices will always bring light in my life. A very special gratitude goes to them for providing me support in my entire thesis.

Finally, my special gratitude goes to my beloved parents Mr. and Mrs. Abbas whose tireless efforts and trust make me able to reach at this point. My single thank is obviously not enough for their efforts, love and exceptional assistance. No words can ever be sufficient for the gratitude I have for my parents. I am also thankful to my brothers Imran Haider and Rizwan Haider for their love and becoming constant source of joy and relaxation. I am also grateful to my sisters for their trust and help in every matter of my life. A very special appreciation goes to my fiancé Capt. Shadab Hussain whose motivation and moral support always leads me to believe myself. You had faith even when I had my doubts.

I pray Allah (SWT) that may He bestow me with true success in both worlds and blessed me with knowledge which may not limit to only degree. Ameen

Abstract

The expansion of financial markets is leading interest in measuring and management of risks, facing by banking industry. The most important is credit risk which often becomes cause to bring other risk to the banks. The analysis of default probability of banks due to credit risk is a significant area that study has exploring. In this study the empirical analysis has been conducted for Pakistan's banking industry. The study has empirically investigated the sensitivity of conventional and Islamic banks to credit risk. The study has used data from Karachi Stock Exchange, Business Recorder and Financial Statement analysis published by State Bank of Pakistan for the years 2006 to 2013. By using the Naïve Model, based upon Black Scholes Merton Model, we have derived significant results for all banks. The results provide evidence that large banks are more efficiently managing the credit risk. The default probabilities of large banks are lower than small conventional banks. Financial crisis has affected overall banking industry in Pakistan and the default probabilities of the banking sector have been found higher during the financial crisis 2008-2009. However, Islamic banks have showed positive results, even though we were unable to include larger number of Islamic banks due to data constraint. The default probabilities of Islamic banks during financial crisis were comparatively lower than other large and small conventional banks.

List of Abbreviations

NAB	National Accountability Bureau
BSV	Bank Specific Variables
PLS	Profit and Loss Sharing
DD	Distance to Default
DP	Default Probability
KLIBOR	Kuala Lumpur Interbank Offered Rate
LIBOR	London Inter Bank Offer Rate.
EDF	Expected Default Frequency.
KMV	Kealhofer, Mcquown and Vasicek (Founders of a Company)
CAMAL	Capital Adequacy, Asset Quality, Management, Earnings and Liquidity.
CII	Council of Islamic Ideology
AAOIFI	Accounting and Auditing Organization for Islamic Financial Institutions.
IFSB	Islamic Financial Service Board
GIIS	Global Islamic Index Series
CIBAFI	Council for Islamic Banks and Financial Institutions
DJIM	Dow Jones Islamic Market

Contents

Chapter 1

Introduction

The concept of risk in financial terms is same as it is generally presumed. According to Greuning and Iqbal (2008), various risks including the interest rate, credit, operating, market, business, event and political risks affect the profitability and efficiency of banking sector. However, credit risk is the most important among all. Credit risk unwillingness and inability of a debtor to repay the credit obligation in full according to the pre agreed contract (Rahman and Shahimi (2010)). Banks have to face credit risk through both direct and indirect financing (Elgari (2003)).[1] Basel Committee (2000)[2] terms credit risk as primary risk and leading problem for all financial markets. The management of credit risk is immense dilemma for banking as the inefficiency created by credit risk led the banks' growth downward and badly affects on its viability (Ahmad and Ahmad (2004)). Therefore, while analyzing banking performance, the analysis of credit risk is considered among the important factors (Castro (2013)). According to Agnello et al. (2011), financial crises of the banking sector have left negative effects on the overall economies of the world. The worst effects of credit risk was demonstrated during the crisis of the mid 1980s when

[1] Fund based loans of banks are categorized as direct financing while non fund based guarantees and acceptance papers are examples of indirect financing.

[2] Basel Committee on Banking Supervision was established in 1974 by ten countries to enhance the cooperation on banking supervisory matters. The committee frames guidelines and standards for different areas. The mandate of committee is to strengthen the practices of banks and enhance the regulation and supervision.

financial sectors of the entire world faced huge defaults and loan loss provisions were increased significantly high proportions (How et al. (2005)).[3] Therefore, accurate risk pricing is necessary as less accuracy might increase the risk of loss (Bonfim (2009)). While credit risk is related to the non repayment of loans and the loans constitute major part of assets on the bank's balance sheet, it can affect the bank's assets badly (Misman (2011)). The empirical evidence also suggests a significant relationship between the quality of loans and the risk faced by banks (Brewer et al. (1996)). Since the loan loss provision affects the efficiency and management of commercial banks (Pasiouras (2008)). That is why it becomes necessary to properly evaluate the quality of loans to monitor the credit risk (Mester (1996)).

With an objective to meet the challenges of globalized world, as well, the financial services' quality of financial institution is considered most significant factors (Kiani (2005)). Since a sustainable growth of economy can be the result of healthy banking sector Doğan (2013), it becomes more important to give due consideration to financial sectors of the developing countries.

1.1 De-Regulation of Banking Industry and Credit Risk

As an effect of the de-regulation since 1980's, the financial sector is facing highly competitive environment. This has led the banks to employ all available resources in

[3] In 1980s, there was banking crisis when banks of whole world experienced a debt crisis and they were asking help to repay their international debts. This crisis involved long-term commercial banks debts. The crisis was started from Latin America and known as "Latin America debt crisis".

the most effective way (Doğan (2013)). After the Asian[4] financial crisis of 1997, the banking sector was required to bring forth the corporate governance and accounting disclosure practices more stringently. Afterwards, Basel has increased the intensity of international supervision, requiring the banking sector to enhance capital adequacy, reducing the operations more costly. As regards comparative advantages of local and foreign banks, Saif and Yaseen (2005) stated that local financial markets are affected by the intense competition, that can unstable the local financial market. Sabi (1996) compared Hungary's domestic and foreign banks, and concluded that foreign banks were more profitable. Because they did not give long term loans, as they were risk averse, whereas the domestic banks disbursed mostly the long term loans also to domestic firms. Isik and Hassan (2002) concluded that multinational local banks were more efficient in terms of technical management, resources management and cost management then those banks which are purely domestic based. The management of risk should be focused specifically in emerging markets as risk management is continuous process, all policies should be updated on continuous basis. So that in future any sudden shock can be avoided.

1.2 Credit Risk in Pakistan's Banking Industry

Pakistan has experienced significant development in financial sector during last 3 decades. However, the banking sector suffers from lack of management and resources due to political and economical conditions (Ali et al. (2011)). Eventually, Pakistan's

[4] The 1997 financial crisis was started from Thailand due to flotation of Baht. Indonesia, Thailand, and South Korea were severely affected by this crisis.

banking industry is facing high risk especially credit risk. Historically, an underdeveloped banking sector was inherited at the time of independence. With enactment and establishment of State Bank of Pakistan in 1948, a modest start was undertaken. Lesser amount of capital, lesser efficient management and political interventions brought many setbacks to the banking industry. In 1974, all domestic banks were fully nationalized with primary purpose of direct credit to specific sectors and to ensure the government funding. However, the prudential regulation applicable to commercial banks and credit related policies remained weak, (di Patti and Hardy (2005)), and banks enjoyed guaranteed margins policies. In this environment domestic banks had less incentive to reduce operational cost, increase saving and making good management policies. Reforms of banking sector and de-regulation of policies start by the end of 1980s. New prudential regulations were launched and privatization of the nationalized banks started in 1991. Under SBP 1956 Act, the powers of State Bank of Pakistan to control banking sector were enhanced. The privatization of banks attracted the private sector to open new financial institutions (Abdullah and Khan (2012)). In 1997, State Bank of Pakistan introduced the new guidelines for recovery of bad and doubtful loans, which efforts was splendid by establishing banking courts. Economic conditions improved, and also the banking performance increased. To improve the efficiency, the State bank of Pakistan was functionally divided into three parts in 2001.

- The State Bank of Pakistan (SBP) the Central Bank
- SBP Banking Services Corporation
- National Institute of Banking and Finance (NIBAF)

Such developmental efforts and technological innovations as well as the network of branches brought Pakistan to the level, where its financial sector was enabled to compete with global financial sector. A number of foreign banks also started their business in Pakistan as result of liberalization policies after privatization e.g. deregulation of interest rates and liberalization in foreign currency deposits. These modifications and other policies regarding management and ownership brought changes in the productivity of banking sector (Patti and Hardy (2005)).

At present seven foreign banks, five full-fledged Islamic banks, four specialized banks, three microfinance banks, five public banks, and seventeen private banks are operating in Pakistan. Current situation of the financial markets put many challenges on banking industry of Pakistan.

Banking industry is moving towards high competitive market after privatization of banks in Pakistan. Because of this environment Pakistan is facing huge challenges. Moreover, financial instability and huge expenditure are putting massive cost on financial sector. Over staffing, high cost, larger number of branches, which are stirring losses, and mismanagement of funds are main difficulties, which are putting high pressure on banking sector.

In Pakistan, there are high tendencies of loan defaults. The Bank of Punjab sent total 83 loan default cases to National Accountability Bureau (NAB) and State Bank of Pakistan in May 2013. However, non-performing loans of all commercial banks in Pakistan declined to 3.12% of their total net loans in December 2013. The overall amount of nonperforming loans declined from Rs. 183 billion in 2011 to Rs. 126

billion in 2013[5]. As Njanike (2009) observed that developing and unstable economies' borrowers find it difficult to pay back the loan as interest rates charged by banks led their real income to fall. Effective management and assessing of credit risk can reduce the credit risk. So banking sector need to assess properly the credit risk as to manage credit risk, there is need to measure it. According to the study of Njanike (2009) failure of banking system in Zimbabwe was occurred because of mismanagement and poor assessing of credit risk. As measurement of credit risk is important to manage credit risk, so institution should emphasize properly on credit risk measurement.

Since 2002, the banking industry in Pakistan is operating two main systems, one is conventional and other is Islamic. Conventional banking system follows the interest based system while Islamic banks follow the guidelines of the Islamic law. The policies and management tools of Islamic banking are different than conventional counterparts. Islamic banks follow *Sharihah* rules and they share risk with both, the financier and financed. Risks are faced by both conventional and Islamic banks while Islamic banks have to face some unique. Ahmad and Ahmad (2004) and Ariffin et al. (2009) explained that risks faced by Islamic banks are unique since the bank and the customer both are exposed to risk which is not case of conventional banking. These modes of financing are also unique and based on trading activities as profit and loss sharing principles. Moreover, Rahman and Shahimi (2010) explained that other *Sharihah* demands e.g. not charging of penalty on customer also implicate the credit risk problem. Therefore, it is important for conventional as well as Islamic banks to

[5] www.dawn.com.

manage these risks effectively. To measure the credit risk, most of the studies focused Islamic banks (e.g. M. K. Hassan and Bashir (2003); Sarker (1999); Bashir (1999); Samad and Hassan (1999); Yudistira (2003)). They concluded that Islamic banks were performing efficiently. Elsiefy (2012) assessed the resilience of Islamic and conventional banking sector of Qatar and concluded that both banking systems (conventional and Islamic) are facing same amount of credit risk. Further, Boumediene (2010) measures credit risk in both banking sector conducting empirical analysis by employing KMV Merton model to measure credit risk. The employment of advance model helped to give more meaningful results relating to control of credit risk. As the study explored that Islamic banks were more robust in controlling credit risk.

The present study employs data of all listed banks in Pakistan. The study focused on measuring credit risk of conventional and Islamic banks of Pakistan. Further, present study divides conventional banks in large and small bank. Capital buffer and strong market value helps large banks to achieve the robustness. Moreover, study focused on public banks also as capital buffer and public trust, both are high which, most favorable factors for public banks. The market value is also high of public banks, due to which customers have more trust on public banks. Islamic banks show robust results to control credit risk. However, due to data constraint problem, the study is unable to see more in depth to measure credit risk in Islamic banks.

1.3 Gap in the Literature

Existing studies (Misman (2011); Butt et al. (2012); Shafiq and Nasr (2010)) focus on efficiency of banks, determinants of credit risk, and conceptual issues of banking sector. Nevertheless, analysis of measuring credit risk is not as much of other studies. Most of the studies (Allen and Powell (2012); Elsinger et al. (2006); Lawrence et al. (1992)) conducted in advanced economies to measure the credit risk especially by using advance models, e.g. bivariate models of measuring credit risk. Unfortunately, very few studies focused on credit risk measurement for emerging economies like Pakistan. In case of Pakistan, mostly studies focused on performance of banks by using ratio analysis. However, there is no significant participation of any study in literature which specifically measures the credit risk of banks in Pakistan by using any advance model. The literature found on Pakistan's banking industry used univariate models while this study employed multivariate model. The study employs Naïve model which based upon Merton model. Our study analyzes the credit risk level faced by domestic banks of Pakistan. As it is well understood, to manage the risk, first stage is to assess it and measure it. Our study fills this gap in the literature significantly. The concerned study measure the trend of credit risk of banking industry of Pakistan.

Our study also includes Islamic banks, which are further helpful to analyze the amount by which Islamic banks are facing credit risk. Previous studies did not focused on measuring credit risk of Islamic banks. Most of the studies explained theoretically about risks of Islamic banks. The previous literature used questionnaire technique and ratio analysis technique to measure the efficiency of credit risk. But none of the

studies in Pakistan focused on measuring credit risk in Islamic banking industry of Pakistan. . However, due to data constraints it is not possible for this study to conduct comparative analysis with conventional banks.

The study also measured high credit risk of banks during financial crisis 2007-2009. The second phase of crisis hit the banking industry of Pakistan. The exploration of measuring credit risk is more helpful to fill the gap in literature.

Moreover, present study shows whether domestic banks are managing credit risk more effectively in Pakistan or not, as the economic, political and financial situation is much different in Pakistan than other countries, so these different worst situations put credit risk differently for banking sector. The most challenging environment of Pakistan places plenty of challenges to overall financial sector. So measuring risks and exclusively credit risk is the need of time. This study employs an empirical analysis for better understanding and measurement of credit risk, which is facing by private, public and Islamic banks in Pakistan.

1.4 Objectives of the Study

The aim of this study is to measure the credit risk and to analyze the extent to which the banking industry of Pakistan is facing credit risk. Specifically, the study has the following objectives;

1. To measure group-vise credit risk of Islamic banks, conventional banks, private banks, public banks.
2. To compare the credit risk of small banks and large banks.
3. To rank the banks in each group based on credit risk.

1.5 Significance of the Study

The study expected to help regulators and managements, to improve the credit risk management strategies of the banking sector. Moreover, there is a need of time to measure the credit risk of domestic banks in Pakistan and getting an approximation that whether financial sector of Pakistan is as strong to compete the well established global financial market. Therefore, the depositors can easily judge the amount, by which they are facing credit risk, as customers have to put their money in banks. This study also helps domestic banks to apply specific management tools for credit risk. To compete the highly strong and well-built financial market, domestic banks have to take the specific measures. Moreover, this study helps to analyze whether risk management techniques in banks of Pakistan are helping to effectively manage their credit risk or not. The current study employs the Naïve model which is based upon Black and Scholes option pricing formula and is helpful to look forward on the future standing of banks in Pakistan. The sample time period is helpful to check the stability of both banking sectors after the global financial crises of 2007-2010.

According to Berger and Humphrey (1997), those studies, which specifically focus on banks' efficiency and risks, they have significant importance because their findings help regulators, researchers, professionals and customers to evaluate banks' performance. The findings of this study are helpful to judge the future performance. Moreover, regulators can easily take the specific measure by keeping in view the results of this study. The wide extent of this study is also useful for management as

they can observe more critically and borrowed experiences of other banks as well as share their own experiences.

1.6 Structure of the Study

The dissertation is comprised upon five more chapters. Chapter 1 shed light on background of credit risk while presenting the introduction including gap in literature and objective of study. Chapter 2 presents the literature review about credit risk. The chapter highlights those studies which focused mainly credit risk. The focus of previous literature was mostly on factors and determinants of credit risk. In emerging economies ratio analysis was used to measure performance of banks and credit risk. The chapter concludes that how assessing and measuring credit risk is more important. The chapter also shadow light that in emerging economies measuring credit risk by using advance models is not as much of developed economies. Chapter 3 is comprised upon a brief background of importance of credit risk and risk management in Islamic banks. The chapter explores how credit risk is important. The measurement and assessment of credit risk helps financial institutions to avoid severe shocks. The chapter also enhances the development of models for measurement of credit risk. The chapter explores how Islamic banks are different in management of credit risk. The Islamic banks also have to face unique risk more than generic risks which are facing by whole banking industry. Chapter 4 presents data and methodology which is employs in this study. The chapter firstly presents the Black and Scholes Merton models and the extension which was done by KMV Corporation. The derivation of Naïve model presented by Bharath and Shumway (2008) is presents in the chapter

which is easy alternative of KMV Merton model. Chapter 5 presents the results of the study in which a brief but a deep analysis of credit risk in banking industry of Pakistan is carried out. The chapter also shows the comparative analysis of large, small and Islamic banks. Chapter 6 concludes the study by presenting main findings of the study and future recommendations. Limitations of the study also presents in the chapter which provide gap in literature for future researchers.

Chapter 2

Literature Review

The financial innovations in form of opening new markets and instruments are considered desirable as it bring favorable situation for diversification. Allen and Carletti (2006) argued that these innovations in form of new instruments bring financial crisis and different risk, predominantly, credit risk. The credit risk being a main issue was considered by many studies (e.g. Altman and Saunders (1998); Castro (2013); Allen and Powell (2012); Angbazo (1997)), as this risk has definite effects on bank solvency. This section specifically focuses on literature which brings forth the credit risk assessment and management techniques and also highlights that mismanagement can bring severe financial crisis. The last parts of this section states those studies which measured the credit risk previously prevailing in Pakistan's banking industry and how Islamic banks are considered more resilient in controlling the credit risk.

2.1 Development in Credit Risk Measurements

According to Altman and Saunders (1998), there is enough development from last 20 years in measurement of credit risk, they further explain that it is due to different factors e.g. bankruptcies, larger borrowers, declining value of real assets and increment on off balance sheet instruments. According to them, now most developed models are being used for measuring the credit risk and mostly financial institution not

just rely on so called 4 Cs of credit. Finally, most of financial institutions are moving away from relying on subjective based credit risk assessment model and tend towards using multivariate credit scoring models (Somerville and Taffler (1995)). There are different methodologies e.g. linear probability model and logit model which are used to develop multivariate credit scoring system. Different studies e.g. Smith and Lawrence (1995), Izan (1984), Lawrence et al. (1992) used these models to measure credit risk. These studies focused on those loans which were in default states. The data was borrowed from United States' major financial institutions. The finding of all these studies have approximately similar results as they conclude that payment history of defaulters have bigger effect on final state of loans. Martin (1977) used logit model to predicting default probability from 1975-1976 of 23 banks. This model gave significant results to prediction in failure and non failure. West (1985) used factor analysis method and logit model to predict the condition of an individual institution by using 1900 banks data. The study basically conducted to predict which institution will be problem institution in future, as this study's result could be used as early warning system. The results of this study are interestingly similar to CAMEL rating based results of institutions. This study suggested that combining two approaches, the classical approach for monitoring the credit risk and multivariate logit estimation model give significant results for prediction of early warning system. This is pretty much clear that just qualitative and experts opinions are not enough to assess and measure the credit risk, it need more advance tools to avoid severe results.

The expansion of market and new instruments demand more advance tools to monitor the credit risk. As literature expanded, different studies e.g. Altman and Saunders (1998), Caouette et al. (1998), criticized the multivariate model and new models came forth. They criticized that multivariate models were based upon book value which are unable to capture capital market fast movement. The other class of researcher which innovated models for predicting default probability, called "risk of ruin" models. These models basically have theoretical background that when assets value fall below the debt value the firm stands bankrupt. These models are similar to option pricing model of Black and Scholes (1973), Merton (1974) and Hull (2006). The underlying point of these models is that firms go to bankruptcy when their assets value fall below then their debt, and the equity volatility of firm increase. These models gained credence in financial markets.

Allen and Powell (2012) studied the performance of Australian banks by using the KMV Merton approach during the Global financial crises.[6] Australian banks' performance was better than other countries, so different variables of Australian banks and their sustainability, during global financial crisis, was examined. The data of 13 banks from 1999-2008 was investigated. The findings of study show that although earnings ratio and credit rating was good, but default probabilities were slightly better than other counterparts who were facing extremely higher level of default probabilities. The reason for higher level of default probability was that assets of

[6] Many analysts declared the global financial crisis 2007-2008 as worst crisis since the great 1930s depression. It also affected the developed countries UK, Germany, France and the USA. The causes of the crisis were easy credit conditions, high risk lending with higher level of default risk.

banks were facing higher level of fluctuations, which combine the lower level of equity and present result in form of higher level of default probability.

Tudela and Young (2005) employed KMV Merton model to estimates the default probabilities of UK based financial companies. The study then observed different indicators of default for failure companies. The probability estimates and indicators for surviving companies were also analyzed and then compared by theoretical background of Merton model. The study concluded that Merton model provide full information relating to default indicators. Final indicators of failure in study were reflecting same results and in line with Merton model theoretical background. Boumediene (2010) analyzed 18 banks including 9 Islamic and 9 conventional banks from overall globe and employed KMV Merton model. The results of the study accurately showed the default probabilities and distance to default of banks. The study concluded that Islamic banks were more resilient and efficient in controlling credit risk. Further, literature presents different models which are being applied for measuring credit risk are morality rate model and neural network analysis for classification of credit risk (Altman and Saunders (1998)). The invention of off balance sheet instruments in form of derivatives also increase default risk of banks. However, the models which are already being used in literature can apply for measuring default risk related to off balance sheet instruments with little modifications.

2.2 Credit Risk and Financial Crisis

Ariss (2010) explained two sources for better performance in financial market, first is market power can be achieved through implication of financial stability and the second is that competitive environment positively influences banks' performance. Keeping in view the worst effects of credit risk, it can easily utter that financial stability and market power can be achieved only by that sector which can efficiently manage the big problem of credit risk because mismanagement may lead to nastiest results. Angbazo (1997) empirically analyze 283 commercial banks from 1989-1993 and shows the interrelationship between interest margins and credit risk. The findings of the study shows that money centered banks and small banks are more sensitive to credit risk, while regional banks are not sensitive to credit risk. As Greuning and Iqbal (2008) explained that credit risk is the main cause of bank failure, Basel Committee on Banking Supervision (2000) also presented same views.

Safakli (2007) analyzed credit risk in Northern Cyprus and found that credit risk had unfavorable results during crisis. However, it has also been observed that strong financial, legal and administrative measure bring down the financial crisis severe effects. The study also added that new technology and qualified personnel are needed to manage and proper assessment of risk. It was also analyzed that credit risk had unfavorable contribution during the Turkish financial crisis which start in 1999-2000. However, to avoid the financial crisis worst results banks have to continue their operation more efficiently during crisis period to generate more profitability. The more efficient performance will avoid banks to collapse during financial crisis. There

are also some horizons of investments, banks have to rebalance their credit and portfolios horizons during financial crisis, otherwise crisis will prolong (Mittoo and Varotto (2011)). The more distressed situation can also be avoided through performance and management evaluation through the year. Kealhofer et al. (1998) and Kealhofer (2003) explained that there are two type of ratings point in time (PIT) and through the cycle (TTC), through the cycle rating are mostly produce by rating agencies. These agencies analyze the company performance over medium and long term period. Basel committee also favors the TTC as capital requirement fulfillment can be judged through this rating. While, on the other side, PIT is more favorable to avoid the sudden results as this rating is based on short term period. These rating are more helpful for banking industry to analyze management of risks. During the financial crisis, it is also important to hold the confidence of investors, because if investment decreases it will also impact adversely on financial market. As Liu et al. (2002) explained that it is most important to change the willingness of investors during financial crisis to bear it.

Njanike (2009) analyzed the Zimbabwe Banking crisis of 2003-2004. The main cause of this crisis was failure of management of credit risk. The findings of his study show that many factors e.g. less management skills, poor corporate governance and ill planned strategies leads the whole banking sector to crises. Moreover, the insiders' loans were written off without any procedure, management was less experienced and there was no action taken on the early stage of credit risk as management was aware of credit risk. The concerned study shows that there should be

diversification for good management of credit risk. Therefore, assessing and measurement of credit risk is most necessary to avoid such type of crises, as for management of credit risk there is needed to assess it first.

2.3 Determinants of Credit Risk

Most of the studies on banking sector focused on determinants of credit risk for example, Castro (2013) conducted a study of macroeconomic determinants of conventional banks in which he took the data of GIPSI (Greece, Ireland, Portugal, Spain and Italy) banks over the period of 1997-2011. Castro (2013) found that credit risk was influenced by GDP growth, interest rate, unemployment rate and credit growth. Misman (2011) took data from all banks of Malaysia from 2004-2010 and focused on Islamic banks' credit risk determinant by taking bank specific variables (BSV), according to his study financing expansion, financing quality and capital buffer etc. are the BSV that impact on credit risk of Islamic banks

Demirgüç-Kunt and Detragiache (1998) stated that distressed economic situation lead the situation worst, when there is weak macroeconomic environment the economic situation becomes distressed and inflation rises. The increase in inflation leads the prices high and customers cannot manage their expenditure. Most of the loans default occurs in these cases. Basel committee introduced two additional capital requirements for absorbing more efficiently the loan default risk. These two additional capital requirements are incremental risk capital and stressed value at risk (Mittoo and Varotto (2011)). The study of Ayadi et al. (2008), which was conducted on Tanzania, analyzed the credit risk management practices in developed and less developed

countries. They concluded that environment in which any bank operate is significant factor, which lead to credit risk management system to be successful or not. The relevant study for management of credit risk and assessment of overall risk facing by banks was carried out by Powers et al. (2007). Jiménez and Saurina (2004) analyzed determinants for default loans in banks. This study employed the data of about three million loans of Spanish credit institutions from 1988-2000. The study concluded that close bank borrower relationship can cause borrower tend to default. The previous history of borrower, type of lenders and collateral are also explanatory variables for increasing default probability of loans. Das and Ghosh (2007) conducted an empirical research to determine the factors which were main causes of problem loans. They investigated state owned banks of India from 1994-2005 and found that credit risk is highly influenced by individual bank level variables. The study highlighted that rapid expansion of loans growth put banks in severe conditions as this expansion in loaning attitude tend banks towards poor quality of loans. The larger banks are more concentrated to large sectors of economy hence they have higher risky loans. Finally, banks capital buffer usually declines as there is higher tendency in loans growth which deteriorates the financial health of institutions.

2.4 Credit Risk in Pakistan's Banking Industry

Other stance of literature also focused on measuring credit risk through comparative analysis of different banking industries (e.g Doğan (2013); Muhammad and Siddiqui (2011); Butt et al. (2012); Chantapong (2005); Saif and Yaseen (2005)). In case of Pakistan, Abdullah et al. (2012) measured credit risk in foreign and domestic banks of

Pakistan by using the data of 10 banks from 2001-2010. The concerned study used Augmented Dickey Fuller test to analyze effective variables for credit risk. The findings of the study showed that bank size and debt to equity ratio have positive effects on domestic banks. Moreover, return on equity, investment to asset ratio and liquid assets have positive but insignificant effect on domestic banks. Ali et al. (2011) conducted an empirical analysis of banking sector of Pakistan and concluded that commercial banks of Pakistan were more efficient and able to cope on negative and distressed situation. The study measured the efficiency level from 2006-2009. Alam et al. (2011) showed the comparative analysis of domestic and state banks of Pakistan by using the ratio analysis from 2006-2009. The findings of study show that performance of state banks was better than other local banks. To achieve a sustainable growth banks should focus on loans as loans are the main component of banking system. Calem and Rob (1999) in their study claimed that Basel committee (1999) stated that most loans are riskier in their nature so banks need to emphasize it more.

The study of Butt et al. (2012) took data from Pakistan's domestic scheduled banks and foreign banks and used survey approach for answering the alternative hypothesis. The study focused mainly on comparing the overall efficiency level of domestic and foreign banks. According to the findings, domestic and foreign banks analyzed credit risk through credit scoring system and there is no difference in techniques for assessing the credit risk in both, foreign and domestic banking sector. However, there is difference in analyzing techniques for overall risk facing by foreign and domestic banks. Furthermore, study concluded that domestic banks are less

efficient as there were no systematic and developed techniques for assessment and measurement of risks.

The study of Shafiq and Nasr (2010) explore the risk management practices of commercial banks of Pakistan. Data was collected through primary and secondary channels and they conclude that although there is good understanding of management skills but still there is need to train the staff to acquire best skills to manage risks. Kiani (2005) did an empirical analysis by taking the data of 18 foreign and domestic banks of Pakistan from 1976-1996, and her findings showed that domestic banks performing less efficiently in Pakistan. The study of Ali et al. (2011) measured the efficiency of Islamic banks by using ROA and ROE. They concluded that different factor effect the efficiency of banking sector of Pakistan. The credit risk was one of them which severely affect the efficiency of banks as banks largely involved in lending activities. The high credit risk threats lead banks to increase loan loss provision which are created from retained earnings. The resulting figure of banks negatively affects the performance and efficiency of banks. Gul et al. (2011) analyzed the macro economic variables which effect on banks profitability by using top fifteen Pakistan commercial banks' data from 2005-2009. They also derived similar result as of Ali et al. (2011), that credit risk have negative relationship with profitability. However, the concerned study also found that banks with more loans have higher profitability. These results contradict with previous literature as where loans growth increase, banks have to face high credit risk which brings lower level of profitability. The literature which measure credit risk in Pakistan's commercial banks is focused on

measuring efficiency and profitability of banks. The studies did not focused on specifically measuring credit risk by using advance tools and models of credit risk management.

2.5 Credit Risk in Islamic Banks

The studies on measuring credit risk in Islamic banks have considerable contribution in literature. There are many studies conducted in overall globe and in Pakistan, to measure the efficiency and management techniques of Islamic banks, to handle the credit risk. Most of the studies e.g. Boumediene (2010); Hanif et al. (2012); A. Hassan (2009), concluded that Islamic banks were more efficient in managing credit risk.

The findings of A. Hassan (2009) showed that Islamic banks are more efficient to tackle the problems of management of credit risk, foreign exchange risk and operational risk. The analysis of concerned study specifically included banking sector of Brunei Darussalam. T. Khan and Ahmed (2001) findings showed that credit risk tend to high in *Musharakah* and Mudharabah contracts. The results of study reveals that credit risk in *Musharakah* was 3.69 out of score five and in *Mudharabah* it was 3.25. Elsiefy (2012) conducted a comparative study for measuring different risks in Qatari banking sector by pre and post implementation of CAR ratio and concludes that Islamic banks appear to have higher credit risk in both scenarios. Boumediene (2010) employed the data from overall globe of nine Islamic banks and nine conventional banks from 2005 to 2009. The finding of Boumediene (2010) showed that credit risk was not higher in Islamic banks. Hanif et al. (2012) took the data of 22 conventional banks and 5 Islamic banks from Pakistan. They concluded by using the ratio analysis

that Islamic banks were facing low level of credit risk than conventional banks, so Islamic banks were more efficient than commercial banks to manage the credit risk.

Samad (2004) analyzed comparative performance of Islamic and conventional banks of Baharain. The study used ratio analysis and for the data from 1991-2001. The study concluded very interesting results, there was no difference in profitability and liquidity of both banking sector. However, there was favorable difference in credit risk management. The study found that Islamic banks were managing credit risk very efficiently and facing less credit risk than conventional banks.

The study of Ahmed et al. (2011) analyzed different variables' linkage with credit risk. They analyzed 6 Islamic banks from Pakistan for the period of 2006-2009. The results indicated that bank size was significantly linked with credit and liquidity risk. Moreover, non performing loans were also directly associated with credit risk, while capital adequacy had negative and significant link with credit risk. Khalid and Amjad (2012) focused on risk management practices in Islamic banks of Pakistan. The sample data for study was comprised on 6 full fledged Islamic banks of Pakistan. The questionnaire technique by using regression method was used to derive results which show that Islamic banks were more efficient in managing credit risk. Moreover, credit risk had significant impact on banks' performance and Islamic banks were well doing to manage it.

As literature showed specifically in Pakistan, that most of the research were employing ratio analysis or questionnaire method to measure credit risk, which are not efficient techniques. The higher value of ratio and a lower value of ratio might not

explore the relevant bank's position clearly. While our study employ the methodology of Black and Scholes option pricing formula, which was extended by Merton (1974). According to Vassalou and Xing (2004), ratio analysis use the financial statements' data, which is backward looking of banks' performance, while in our methodology market value of equity is employed, which contain future information. Elsinger et al. (2006) also used market data to for risk management and efficiency analysis of banking sector. The study clearly uncovered the institution with high default risk. To measure the credit risk is essential for banking sector because it can help supervisory authorities for policy recommendations and specifying capital adequacy requirement etc. According to Agnello et al. (2011), it helps regulatory bodies to take specific measure to avoid possible banking crises. Furthermore, according to Heffernan (2005), to measure the credit risk is most important because bankruptcies of the bank are related to nonperforming loans.

The short review of literature indicates that most of the studies focused on profitability, efficiency and determinants of credit risk. There are developments in different advance models to manage credit risk. The literature is focused on implementing these models specifically to measure the credit risk in financial crisis era. Literature also indicated that credit risk bring severe results in form of financial crisis if it does not manage and assess properly. The wide stance of literature presented favorable situation for Islamic banks, as most of the studies concluded that Islamic banks were more efficient in handling credit risk. The experts of finance developed many advance tools to measure credit risk but still there is wide gap in literature of

emerging markets, as very few studies used these advance models to measuring the default probabilities of banks. Literature identifies different factors which badly impact on banks' performance but those studies did not concentrate on measurement of default risk, so the banks can analyze the performance of their management techniques over the time period. The measuring of credit risk can also help banks senior management that how was the trend of credit risk in their institution in specific time span. Specifically if literature of Pakistan banking sector analyzes, there are very few studies which considerably focused on whole banking sector of Pakistan to measure credit risk by using advance tools. The present study is able to fill this gap in literature.

Chapter 3

Theoretical Framework

3.1 Credit Risk

Revolutionary changes are happening to manage the credit risk in financial markets at present. In past, the risk related to loan was used to continue on the balance sheet of lender unless the whole amount of loan was paid off. But now the risk associated to loans is being resold. Traditionally, lenders associated the credit risk as cost of business but now the lenders take credit risk to be traded. However, many tools are created to manage and measure the credit risk. In this section of the study, we look at the history of credit risk, evolution of its measuring tools, managing techniques and also the currently developed models to measure and manage it.

3.1.1 Credit Risk Measurement Techniques and its Models

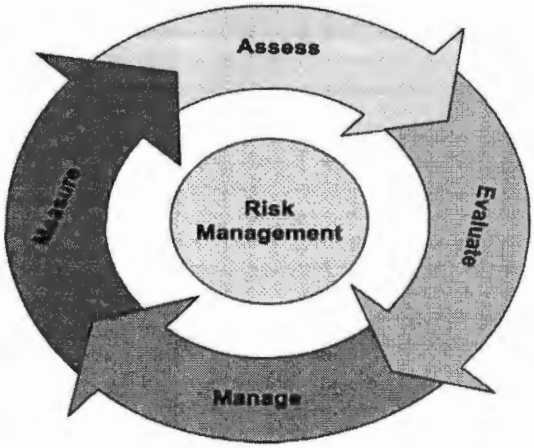
Financial crisis occurrence is not so shocking in financial markets however, it puts markets to evaluation of updating the entire system of credit risk measurement. The basic fundamental method for measuring the credit risk was measuring credit worthiness of customer which is calculated through five Cs;

- Character
- Capacity
- Capital
- Collateral

- Conditions

However, the twenty first century has seen many changes and development in financial markets. Now financial markets have become global and highly innovative. Now credit risk is seen in the organizations overall risk management perspective. An organization has to manage all other reputational and operational risk to manage the credit risk. Also, there are regulation and policies which emerged in form of Basel agreements. Credit rating agencies are playing role to measure the credit risk and rate institutional performance. From the last decades the new management tools like credit derivatives have emerged. Many mathematical and scientific models have been introduced to measure credit risk .e.g. credit scoring model and correlation model for credit swap defaults Caouette et al. (1998). Markets also develop due to technological growth and innovation of easy reporting and modeling. Practitioners of credit risk management also interested in new techniques after poor results of their portfolios in 1980s. This is why, in many institution credit risk management techniques were redesigned (Bryan (1988)). Currently as bank borrowing has been increased, institution are spending heavily on gathering the credit related information and other analytical information which is related to risk enhanced by loan. Increased competition and regulatory changes for capital requirement in Basel I and II bring innovative changes in credit risk measurement. Asset backed securities, exchange and clearing houses and credit derivates are among the new products. Risk management being continuous process has been illustrated in Figure 3.1. For every stage there are different models to measure the credit risk.

Figure: 3.1. Cycle of credit risk management.



Financial derivatives have earned more importance since last two decades. Whenever there is generation of any trade activity an instrument is generated the basic transaction. In derivatives investor plays with piece of paper rather than physical good. Financial derivatives present right and option relating to that instrument. Financial derivative dealers are mostly organized companies which are mostly linked to commercial banks in derivative markets dealers know each other. Market participants of derivative markets are more concerned to manage financial risks (Altman and Saunders (1998)). Exchanges are other way to reduce counterparty risk, as trading and scope increases exchanges get more importance. Clearing houses are also used to handle the counterparty risk, they provide the guarantee that trade will be completed. The collateral also prevents the defaults.

3.1.2 Credit Risk Models

Financial markets are developing rapidly and there is also much innovation to manage the risk, specifically the credit risk. Innovations have taken place due to number of reasons, including deregulation, expansion of credit markets, an increase in the risk of off balance sheet items etc. The credit risk models are important as decision maker are helped to look through these models. Through these models, the value of the asset can be judged easily, which otherwise remain undisclosed.

3.1.2.1 Portfolio Management Model

The pioneer work of Markowitz (1959) relating to portfolio received much importance in risk management system. A simple principle of not putting all eggs in one basket is used to define the diversification of portfolio theory. This model is basics for measurement of credit risk and also helpful to hedge the risk. A traditional objective of all investors, to maximize the return and minimize the risk can be achieved through this model. These concepts have been widely used on geographical level. The institutions and loan management departments are spending resources to reduce the probability of loan defaults. The financial crisis of 2009 has led many banks to default due to insufficient level of risk management (Altman and Saunders (1998). However, effective loan management techniques have needed to be more efficient.

3.1.2.2 Credit Scoring System

A univariate credit scoring model helps assessing key accounting ratios of borrower with industry norms. Univariate model is basically one variable model. A credit analyst using this approach can assess as to whether specific ratio differ from industry norms for particular borrower or not. In this approach particular ratio is analyzed to determine the potential borrower. However univariate approach is constrained to trade off between variables. For example, a corporate has poor profitability ratio may have good liquidity ratio, but credit analyst can make wrong decision relating to bad profitability ratio. This reason leads to conversion or extension of univariate model to multivariate model (Caouette et al. (1998)). Deakin (1972) used 14 variables and applied them in multivariate model.

3.1.2.3 Altman's Z-Score Model

Altman's Z-score model developed in 1968 is based upon multivariate approach. The values of this model are built on both ratio level measure and categorical measures of univariate model. The values are, then combined and weighted to develop a measure or credit score. On the basis of this scoring system it can be concluded whether a firm is failing or not due to credit risk. On basis of this scoring system a bank can accept or reject a loan application. Z-score model is being used, nowadays, by many manufacturing companies, emerging firm and commercial banks. Caouette et al. (1998) extend Z-score model as ZETA score model. The purpose of this model construction was to enhance the failure of firms and changing in accounting reporting.

Moreover Z-score model was limited to analyze those firms whose assets were below 25 million.

3.1.2.4 RiskCalc Model by Moody's KMV

This model is widely used to manage credit risk in financial market. This model is based upon ratios and variables like Z-score model. But its methodology differs from them. RiskCalc model uses the defaulting firm as dependent variable, while in Z-score model it is the prior group which is selected for analysis. Also this model is used for large firms. This model also concerns for the firm size and industry in which it has to be deployed. The RiskCalc model is based on three components, financial statement only method (FSO), industry adjustment method and credit cyclical adjustment (CCA).

3.1.2.5 Mortality Model

The mortality model of Altman (1989) is based on capital markets. The mortality rate model generates the probability on the basis of past data of the firms. All rating agencies have used this model and updated it. This model has also been extended from bonds to loan but banks yet not adopted perhaps lack of data base (Altman and Suggitt (2000). McAllister and Mingo (1994) estimates that to get exact default probability, an institution needs to have 20,000 to 30,000 borrowers in data base. This data requirement is quite huge for any institution. Therefore, very few institutions reach closed to this number of data requirement.

3.1.3 Importance of Stock Prices

Stock price is important instrument to analyze the performance of companies that are listed on stock exchange. Information about economies and industry changes all the time that is why stock prices also change each day. The stock market prices help to judge the credit worthiness of any company. Caouette et al. (1998) state it as readymade credit risk management tool which is also powerful and reliable. The leading example of stock price model is KMV Merton model which also called EDF model. There is price option theory on the background of Merton KMV model. The study, firstly, sheds light on option pricing theory and then proceeds to the model.

Modigliani and Miller (1958) explored that capital structure of any corporation is the combination of firm's debt, equity and other liabilities through which it finances its assets. The study presents the view that more debt required more returns and at some level debt becomes undesirable. Moreover, Modigliani and Miller (1958) presented the view that investment and financing plans of firm should be treated separately. Investment plans create the value of firm and equity debt and all other liabilities are added into firm value. If value of debt has been increased it should be treated separately and there should be no effect on firm performance. However at that time there was no technique through which equity and debt could know to separate. Later on option pricing theory develops.

3.1.4 Equity as Call Option

The option pricing theorem of Black and Scholes (1973) and Merton (1971) explains that value of firm equity can be determine through underlying market value of firm.

The theory explains that a firm has equity and debt, if value of assets is greater than debt, the firm will pay off the debt and will retain the difference between debt and value of assets. On other side if value of debt is higher than value of assets the firm will default and debtor will acquire the firm, as equity will be worthless when value of assets will be less then value of debt.

In Black Scholes model equity is just like call option on assets with exercise price debt D. the option will be exercise if the stock prices have higher worth then debt D. the difference will be the earning. But if value of debt is more than assets value of the firm at maturity date, the firm will not exercise the option and choose to default. So equity is just like call option on the firms' assets where exercise price would be face value of debt (Bharath and Shumway (2008)).The equity of firm can easily be measured if one can know the face value of debt and value and volatility of assets. To measure these values Black and Scholes formula is used. So it is understandable now that default of firm can be considered as failure of option.

3.1.5 KMV Merton/EDF Model

Moody's KMV Corporation in 1995 presented an estimation approach to measure the default probability which is based upon Black Scholes Merton model. To derive the default probability model they use three steps thorough EDF (expected default frequency) model. Firstly, value and volatility of equity observed through market value of stock. Secondly firm's liabilities and value of firm asset is determined and finally with firm assets value volatility the distance to default is calculated and by using normal distribution default probability could be approached (Bharath and

Shumway (2008)). Chapter 5 presents the derivation and complete understanding of the model.

3.2 Islamic Banking and Risk Environment

Over the last three decades, Islamic banking grew at remarkable pace. The number of Islamic financial institutions has risen to 300 from one since 1975 spread over 75 countries (Qorchi (2005)). Bahrain and Malaysia have become of hubs of Islamic banking. However, Islamic finance is also extending in the markets of Europe and United States. According to Global Financial Development Report 2014 of The World Bank the assets of 120 Islamic financial institutions were USD$ 1 trillion while branch network of these institutions extended to 21,353 worldwide. The Earnest and Young Global Limited presented a report of worldwide Islamic banking 2014-2015 and declare that Islamic banking assets continued to grow around 17% during 2009-2013 which is three time faster than conventional banks. The World Bank and the General Council for Islamic Banks and Financial Institutions (CIBAFI) have entered in Memorandum of Understanding to help the development and faster growth of Islamic finance industry in both Muslim and non Muslim countries.

Two indices were launched in 1999 to provide a standardized benchmark for equity price by Dow Jones Islamic Market (DJIM) Index in Bahrain and the Financial Times Stock Exchange Global Islamic Index Series (GIIS). More indices have been added to date. According to World Islamic Banking Competitiveness Report 2014–15 the profit pool of 20 largest Islamic banks in world has increased by USD$ 0.5b USD$ 6.7b in 2013. Return on equity also increased by 11.9% in 2013. There were 19 largest

banks of world in 2012 which have capital base of USD$ 1b while in 2014 these banks are raised to 21 which have large capital base. On average there are 20 large banks which capitalization has been increased by 14.4% from 2011-13.

The *Sukuk* market is also growing rapidly, *Sukuk* issuance is an innovative good effort to attract the broader range of customers and investors. In 2005 Islamic Development Bank created the program of repeat issuance of *Sukuk*. Total market capitalization of *Shari'ah* complaint securities is 61.6% in 2015[7].

3.2.1 Islamic Banking in Pakistan

An initial effort to Islamize the banking industry took place in 1977. The laws relating to banking i.e. SBP Act 1956, Companies Ordinance 1984 and Negotiable Instruments Act 1984 were amended to promote and facilitate the interest free banking. In 1979 the Council of Islamic Ideology (CII) was formed and was mandated to get interest free banking established at national level within time period of three years. The House Building financial institutions, National investment Trust and Mutual Funds Investment Corporation had to remove interest based financing from their operation on immediate basis. The elimination of interest from all conventional banks was difficult task as there were no recommendations and suggestion from CII to convert entire financial system (Khan and Mirakhor (1990)). Such policies ended up in useless efforts as there were no proper policy recommendations and lacking of homework at central bank level. Moreover, this sudden conversion from conventional system to Islamic system in such short time period was not possible.

[7] www.sc.com

Learning lesson from the past experience, Islamic Banking was re-launched in 2001. This time the efforts were made to promote the Islamic banking industry parallel to the conventional banking. SBP established an Islamic Banking Department on 15th September 2003 to promote and establish a best framework in line with international banking practices. After re-launching the Islamic banking industry is developing tremendously in Pakistan by growing 30% annually in terms of assets. Currently, five full fledged Islamic banks are working in Pakistan which are also licensed by SBP. There are fourteen conventional banks which's standalone Islamic banking branches are working all over in country[8].

Islamic banking continues its rapid growth as deposit and assets increased in 2015. Assets reached to Rs. 1495 billion in second quarter of 2015 with 14.8% growth rate, while deposits increased by Rs. 1281 billion. Total share of Islamic banking industry's assets was increased by 62.1% in second quarter of 2015. Investments of Islamic banking sector are also increasing tremendously. In 2015 it increased by Rs 379.2 billion with 3% growth. In overall investment increment federal government securities have largest share by 68.1%. Financing of Islamic banks reaches to Rs 511.9 billion with the largest and attractive mode of diminishing *Musharakah* as its share was 34.72 in overall financing. *Musharakah* and *Murabahah* also have larger share of 10.23 and 24.81 respectively. Among other sector in which financing was made includes production of energy and in pharmaceuticals. However, non performing assets has increased by Rs 34.1 billion in second quarter of 2015, this incremented was

[8] http://www.sbp.org.pk

attributed to inclusion of KASB bank Limited portfolio in Bank Islami, as KASB bank merged with Bank Islami in May 2015. Non performing financing reached to 90.4% which is higher than market average of 80.8%. Overall capital and profit also increased by Rs 6.7 billion and Rs 4.2 billion respectively.

3.3 Risks in Islamic Banking

Globally there is significant interest present in literature on risk analysis and management prevailing in Islamic banking. The reason can be rapid developments and innovation of many new products due to which Islamic banks have to face new risks. Islamic financial institutions follow the *Shari'ah* principles, so there are unique risks which Islamic banks have to face in addition of generic risks which are facing by overall banking industry. *Shari'ah* principles present its own unique approach to risk management and sharing in Islamic banks. The assets and liability sides of Islamic banks are different from conventional banks. The assets side of Islamic banks contains different instruments and contracts. The maturity and functionality of those instruments is also different from the conventional banking. That is why risk profile of these instruments and contract is different from conventional banks. The liability side is also different as the equity risk is treated differently for investments account holders and depositors. As Islamic banks have to face all generic risks also but in case of credit risk Islamic banks have also face other externalities more than just counterparty risk. However, as Islamic banks deals in commodities, which is less risky comparatively (Greuning and Iqbal (2008)).

This section illustrates an analysis of generic and unique risks which faced by Islamic banks. Further, risk managements techniques and principles are described.

3.3.1 Types of Risks Faced by Islamic Banks

The success and progress can be achieved through taking risks, societies which want to face less risk might be turn towards passive approach in future. Islamic banking is growing industry and yet risks which are inherited are not well described or comprehended. According to *Shari'ah* rules Islamic banks have to share their risk with their clients, which aware investors to bear risk also not just receiving the returns. In this section asset and liability side of Islamic bank are analyzed which expose different risks which are facing by Islamic banks on both side of balance sheet.

3.3.1.1 Liability

As Islamic bank follow *Shari'ah* induction and are only authorized to collect deposits mainly in two forms (Iqbal, et al., 1998), current and investments account. Current account bear no interest and customer get only his principal back when he want to withdraw while investment bear return or profit under PLS system. This arrangement provides bank safe side during critical economic situation. Conventional banks considering debt holder of depositors have to separate a part of funds as liquid and keep it with themselves so that they can make arrangement at sudden withdrawals. While Islamic banks consider their depositors more than like equity holders. Islamic banks are limited to their own management of funds at point of need as they have limited access to liquid markets. The Islamic money market is fledging and only large

institutions have access (Eid (2012)). Islamic banks face constraints in active liability management techniques as conventional banks do.

As Islamic banks deposit side had large share of investment, and payoff the returns are contingent to performance. in this case Islamic banks have to face two type of customers, one which are strictly religious and they are ready to take even less returns against their investments while on other side mostly customers are risk averse and they demand higher returns. This problem imposes great discipline on Islamic banks (Eid (2012)). The investment account holder have their eye on performance of bank and if performance of banks is not as good as they expect they move their funds to higher return banks or even in conventional banks which increase withdrawals risk (Khan and Ahmed (2001)). Larger payoff to investment account holders also increase risk as shareholders raise capital equity to balance and maintain their capital ratio to prevent the dilution of their rights. On the contrary banks have to face solvency and liquidity risk. Equity holders of Islamic banks are at risk if they payoff investment account holders from their profit to avoid withdrawals risk, according to AAOFI (1999) this risk is called as displace commercial risk.

3.3.1.2 Assets

In the process of financing any project Islamic banks do not put PLS arrangements as calculation and measurement of performance of project is complicated. This can arise non *Shari'ah* compliant risk as Islamic banks do not collect collateral they have to monitor performance more strictly and put more efforts in selection and monitoring however in *Mudarabah* Islamic banks can intervene in management. Eid (2012)

claimed that PLS arrangements for short term financing are not viable. According to (Khan and Ahmed (2001)) Islamic banks use less PLS mode for financing even then they have to face withdrawals risk.

3.4 Risks and Risk Management in Islamic Banks

Risks which are facing by Islamic banks are divided in two types, generic and unique risks. This section explains generic risks of banking.

- Credit risk
- Market risk
- Liquidity risk
- Operational risk

3.4.1 Credit Risk

Credit risk is defined as counterparty inability to meet its obligation according to pre agreed contract terms. Islamic financial institutions face credit risk in their receivables and leases contract which include *Murabahah*, diminishing *Musharakah* and *Ijarah* and through working capital agreements of *Istisna'*, *Salam* and *Mudarabah*. Islamic banks have to manage these risks to avoid the downgrading.

IFSB proposed risk management techniques to Islamic banks as all instruments have different commencement stages so IFSB suggest to Islamic financial institutions to monitor the risk of each instrument separately. Islamic financial institutions also consider other risks which can be raised with credit risk. To manage the credit risk Islamic banks should have proper framework to assess, monitor and manage the risk.

discouraged and face losses during bearish market. Islamic banks usually do their business locally, they are rarely players of international market which lead to geographical concentration risk.

3.5.2 Mark-Up Risk and Benchmark Risk

Islamic banks are also exposed to mark-up risk. Islamic banks usually for example in *murabahah* contract, are agreed for fixed rate for the whole duration of the contract. In market mark-up rate fluctuates, which cause Islamic banks to face losses. The reason that Islamic banks have to lock rates, they cannot get benefits of higher rate as prevailing in market.

Benchmark risk is related to domestic rate of return and the benchmark return rate. Islamic banks have still no standardized benchmark except Kuala Lumpur Interbank Offered Rate (KLibor) but in all countries this benchmark is not viable (Mahlknecht (2009)). This absence of standardized bench mark leads Islamic banks to use LIOBR as proxy.

3.5.3 Price and Commodity Risks

Islamic banks have to face commodity price risk in *Salam* contracts. They have to face volatility of price risk during the delivery of the commodity and sale at current prevailing market price. Islamic banks used to hedge this risk by entering into new contract of *bay-Salam*. The same case of *Istisna'* contract, where delivery of commodity decided at future specific date when price can be unfavorable. Moreover, slam contracts are mostly ended up with deliveries and ownership. The inventories can

lead to storage cost and price risk also increases. In *ijarah* Islamic banks are exposed to fall in value of the asset at maturity of the lease agreement (Ahmed and Khan, 2007).

3.5.4 Displaced Commercial Risk

Displace commercial risk arises when Islamic banks have to face shortfall in liquidity. This liquidity risk can arise withdrawals risk. When withdrawals increases bank have to pay higher returns to avoid withdrawals. In this situation usually equity holders have to forgo their profits for depositors. This leads to displace commercial risk. This risk can even happen when banks are working fully *Shari'ah* compliant mode and because of losses in investment bank could not fulfill the expectation of investors.

3.5.5 *Shari'ah* Non Compliance Risk

This risk can be defined as inability of Islamic financial institutions to maintain *Shari'ah* complaint transaction. It is related to functioning *Shari'ah* board which can further be divided in four parts

3.5.6 Lack of Standardization

The *Shari'ah* interpretation relating to economic and financial transaction is known to be as *fiqh ul muamlat*. There are four school of thought and *Shari'ah* scholars give their *fatwas* according to that school of thought which they follow. The thin line of differences in all schools of thought can also bring difference in their *fatwas*. The tendency of difference in derivative acceptance is one of examples. There are different regions which have tendency towards specific school of thought, e.g. Saudi Arabia

follows Hunbli school of thought, Turkey, China and Pakistan follow Hanafi, and Africa follows Maliki. The *fatwas* and regulation of *Shari'ah* boards follows specific school of though and those regulation impact on Islamic banking. Multiplicity of methods brings differentiation in products and policies which is constraint in growth of Islamic banking. It also bring hinders in risk management. Moreover, regulators find difficulty about policies and standardization if Islamic banking, which is why they get hesitate in issuing license to Islamic banks especially in non-Muslim countries. This practice also creates confusion in understanding of Islamic banking. Most of investors and customers also get hesitate to make investment in Islamic banks when the encounter such type of confusions.

3.5.7 Shortage of Scholars

As Ainley et al. (2007) state s that any person who acts as director or executive of the company must have relative experience and academic background. So same is the case of Islamic finance where *Shari'ah* scholars need to have strong *Shari'ah* knowledge so that they can understand any discrepancy of the matter and they can appropriate *fatwas* on them. Ainley et al. (2007) also claimed that Islamic finance is facing shortage of *Shari'ah* scholars because there is very less expertise in this field. A *Shari'ah* scholar should also have knowledge about financial and capital market. Moreover, they are also expected to have Arabic language knowledge so that they can easily understand *Shari'ah* matters.

3.5.8 Litigation Risk

Islamic banks have to face risk related to policies enforcements and documentation. According to Khan and Ahmed (2001) there are also no proper and standard formats for implementation of different contracts. Most of the time Islamic banks have to prepare their own documentation of legal contracts according to their *Shari'ah* knowledge and local laws. Islamic banks are already facing lack of standardization, which increase the risk of no proper enforcement of contracts.

Chapter 4

Data and Methodology

The Black and Scholes formula extended by Merton (1974) which theoretically extended and further implemented as a Naive model by Bharath and Shumway (2008) has been used for calculating the credit risk in domestic banks. Boumediene (2010) has used the Black and Scholes Merton model for measuring the credit risk of Islamic and conventional banks from overall globe. But Boumediene (2010) used its alternative practical form, which is called KMV Merton model. As KMV corporation extended the Merton model by using its functional form but involving solution of two non linear equations simultaneously and iteration procedure. This is certainly a rigorous exercise. While the alternative Naive model is simple, quite efficient and able to capture all information. In this methodology firstly Black and Scholes Merton model is used. Furthermore, the formulas for calculating the default probability and distance to default is derived through KMV Merton model. Finally, study presents the Naive model through which default probability of all banks is derived. This presentation is proficient to demonstrate the difference in KMV Merton model and Naive model. In Naive model formulas of distance to default and default probability are same after slight modification.

This methodology is useful as it can be used irrespective of differences in size of banks. Default probability is directly linked to quality of assets as bad quality of

assets leads to default (Boumediene (2010)). Ronn and Verma (1986) also incorporated the Black and Scholes Merton Model for assessing the pricing risk of deposit insurance.

The balance sheet of banks consists of liability side and asset side. For the purpose of credit risk measurement, we need to know the default risk and distance to default of bank. To measure these two terms, we employ Black-Scholes-Merton model.[9] Validity of this model depends upon several assumptions.[10] Merton (1974) assumed that "dynamics of the value of firm V through time can be described" as stochastic differential equation, which follows a geometric Brownian motion.[11]

$$dV = \alpha_v V dt + \beta_v V dz \qquad (1)$$

In which α_v shows the return on value of assets, while β_v shows its volatility and dz is the standard Weiner process (Brownian motion).[12]

For getting the default probability and distance to default, we need to know banks' equity, volatility of equity, assets and asset volatility. The liability side of a bank's balance sheet contains the bank's liabilities and equity so equity can be located

[9] Myron Samuel Scholes and Robert Cox Merton received the Nobel Prize in 1997 in Economics Sciences (unfortunately Fischer Black passed away at that time). They done great work by introducing the new method for derivative valuation and facilitate efficient risk management.

[10] Merton (1974)

[11] Merton (1974) developed as model for pricing of corporate debt when there is significant probability of default. He ignores the pricing when there is any structural change in interest rate or investors preferences for risk etc. Through the Black and Scholes formula, he extended the empirical analysis for pricing of corporate liabilities.

[12] Brownian motion is stochastic process, which is often using to present the evaluation of random variables. It provides the model to evaluate the asset price over time.

from liability side. If V shows the value of assets and D shows the liabilities,[13] the contingent claims analysis Black and Scholes (1973) and Merton (1974) shows that on maturity if V>D at T, the shareholders will get after subtracting D, while if V<D the debt holders will take control on the company. It means at maturity the value of equity will be either 0 or V-D. This claim is clearer with boundary conditions of Black and Scholes (1973).[14]

$$E = max(0; V - D) \tag{1.1}$$

Black and Scholes option pricing formula was derived for pricing the corporate liabilities in which option value was function of the value of stock and time of maturity (Black and Scholes (1973)).[15] In this methodology, equity is function of value of assets at time of maturity E(V,T) (Boumediene (2010)). The equity E can be professed as a call option on value of asset V, while D is the exercise price on the value of assets at maturity T. Equity holders exercise their option if strike price is less then assets value, otherwise they will leave the firm on debt holders (Boumediene (2010)). Equity holders have the right to pay off the debtor, not the obligation.

[13] The off -balance sheet liabilities are not included for analysis.

[14] Two boundary conditions exist in Black and Scholes formula, when the stock price will be much higher than exercise price, the difference between both will be value of option, the other one, when the exercise price will be higher than stock price, value of option will be zero.

[15] Under certain assumption of Black and Scholes (1973), the value of option just depends on stock price at time of maturity while keeping certain other variables constant. Those variables include that there will be no transaction cost, short-term interest rate is known, option will be European option, stock price follow random walk, no penalties of short selling etc. while in case of this methodology we are not considering interest rate and for short selling, we are considering short term assets and liabilities in bank's portfolios. Some other assumptions are not effecting in case of bank e.g. European option etc, because here we are not dealing with options.

However, debt holders essentially hold the company until the equity holders paid off all the debt.

Equity is the function of value of assets V at time T. Therefore, change in volatility of assets will bring the change in equity position at time T.

$$E(V,T) \tag{2}$$

In short, interval ΔT brings ΔE;

$$\Delta E = E(V + \Delta V, T + \Delta T) - E(V,T) \tag{2.1}$$

Through expansion of equation (2.1) and using stochastic calculus, we can get Black and Scholes option pricing formula.[16]

$$E = VN(d1) - DN(d2) \tag{3}$$

Where;

$$d1 = \frac{\left[\ln\left(\frac{V}{D}\right) + 1/2(\beta_v^2 T)\right]}{\beta_v\sqrt{T}} \tag{3.1}$$

$$d2 = \frac{\left[\ln\left(\frac{V}{D}\right) - 1/2(\beta_v^2 T)\right]}{\beta_v\sqrt{T}} \tag{3.2}$$

[16] The basic idea behind this formula was to hedge the option through changing position, short and long position. The implication of this formula on call option data by Black and Scholes shows the result which were somehow different from actual prices , the price which were predicted for option buyers were somehow lower than actual prices , which might include transportation cost on buyers.

The only difference in $d1$ and $d2$ is their signs, if β will higher in $d1$, it means that it will increase the value of stock while in $d2$ if β will increase, it will lower the whole term as the term is subtracting here, it means when β is increasing in $d1$ it will increase the value of equity.

After applying, the assumption in Black and Scholes option pricing formula, the risk free interest rate is appeared when there is discounting factor[17], but here we assume that face value of debt is the exercise price of the value of asset so the risk free rate of interest will not appear. Based on this argument Black and Scholes formula can be used for Islamic Banking (Boumediene (2010)) Dividend will also not appear in the formula, as equity is fully dividend protected (Boumediene (2010) and Ronn and Verma (1986)) and "it is modeled as fully dividend protected call" (Boumediene (2010)).

E is the market capitalization of the bank and D can be extracted from the balance sheet of banks. However, the value of assets and its volatility is still unknown. To compute the value and volatility of assets, we need one more equation. For the

[17] Black and Scholes (1973) have assumption that short term interest rate is known , so the Black and Scholes
option pricing formula also have term of 'r' for short term interest rate.
The Black and Scholes equation is

$$w(x,t) = xN(d1) - ce^{r(t-t^*)}N(d2)$$

where $d1$ and $d2$ is:

$$d1 = \frac{\left[\ln\left(\frac{x}{c}\right) + \left(r + \frac{1}{2}v^2\right)(t^* - t)\right]}{v\sqrt{t^* - t}}$$

$$d2 = \frac{\left[\ln\left(\frac{x}{c}\right) + \left(r - \frac{1}{2}v^2\right)(t^* - t)\right]}{v\sqrt{t^* - t}}$$

Where 'w' is value of option which is function of stock price 'x' and time 't'. v^2 is variance of stock. The 'c' is showing the exercise price of an option and t^* is showing the maturity time of an option.

purpose of expansion of Black and Scholes option pricing formula, Merton (1974) explains that the market value of E is function of market value of assets of the firm V at time T. The functional form of relationship of E with V and T is $E\ (V,T)$. The stochastic differential form of the equation $E\ (V,T)$ is;

$$dE = \alpha_E E dt + \beta_E E dZ_E \qquad (4)$$

α_E and β_E is the expected return and variance respectively on this security, while, the dZ_E is the standard Weiner process.

The relationship can established explicitly through Ito's Lemma[18], which consists of two parts, the Brownian motion (1),

$$dV = \alpha_v V dT + \beta_v V dz \qquad (5)$$

and Taylor approximation (this Taylor approximation is derived through (3)).

$$dE = (\partial E/\partial V.dV) + (\partial E/\partial T.dT) + 1/2(\partial^2 E/\partial V^2.dV^2) + (\partial^2 E/\partial V \partial T.dVdT) + 1/2(\partial^2 E/\partial T^2.dT^2) \qquad (6)$$

For getting the value of dV^2, take the square of dV;

[18] A detailed approach to application of Ito's Lemma can be seen from Merton (1973).

$$dV^2 = (\alpha_v V dT + \beta_v V dz)^2 \quad (6.1)$$

$$dV^2 = \alpha_v^2 V^2 dT^2 + 2\beta_v V dz \alpha_v V dT + \beta_v^2 V^2 dz^2 \quad (6.2)$$

The Ito's multiplication rule is;

	Dz	*dT*
Dz	*dT*	*0*
dT	*0*	*0*

After applying the Ito's multiplication rule the equation (1) is;

$$dV^2 = \alpha_v^2 V^2(0) + 2\beta_v V(0)\alpha_v V(0) + \beta_v^2 V^2 dT \quad (6.3)$$

so

$$dV^2 = \beta_v^2 V^2 dT \quad (7)$$

The term $dVdT$ is zero in Taylor's approximation as;

$$dVdT = (\alpha_v V dT + \beta_v V dz)dT \quad (8)$$

$$dVdT = \alpha_v V dT^2 + \beta_v V dz dT \quad (8.1)$$

As according to Ito's multiplication rule $dT^2 = 0$ and $dzdT$ is also equal to 0 so;

$$dVdT = 0 \tag{8.2}$$

After applying the Ito's multiplication rule and by putting the values in Taylor's Approximation the equation (6) is ;

$$dE = \frac{\partial E}{\partial V}(\alpha_v V dT + \beta_v V dz) + \frac{\partial E}{\partial T}dT + \frac{1}{2}\frac{\partial^2 E}{\partial V^2}\ \beta_v^2 V^2 dT + \frac{\partial^2 E}{\partial V \partial T}(0) + \frac{1}{2}\frac{\partial^2 E}{\partial T}(0)$$

$$dE = \frac{\partial E}{\partial V}(\alpha_v V dT) + \frac{\partial E}{\partial T}dT + \frac{1}{2}\frac{\partial^2 E}{\partial V^2}\ \beta_v^2 V^2 dT + \beta_v V dz \frac{\partial E}{\partial V} \tag{9}$$

We get the Ito's Lemma (after rearranging terms) as;

$$dE = \left(\frac{1}{2}\frac{\partial^2 E}{\partial V^2}\ \beta_v^2\ V^2 + \alpha_v V \frac{\partial E}{\partial V} + \frac{\partial E}{\partial t}\right) dT + \beta_v V \frac{\partial E}{\partial V}.dz \tag{10}$$

By comparing terms in stochastic differential equation and Ito's Lemma;

$$dz_E \equiv dz$$

$$\beta_E E = \beta_v V \partial E / \partial V$$

$$\frac{\beta_E E}{\beta_v V} = \frac{\partial E}{\partial V} = N(d1)$$

$$\beta_E E \beta_v V N(d1) \tag{11}$$

To calculate the value and volatility of assets, in KMV Merton model one should have to solve (3) and (11) simultaneously. The solution of non linear simultaneous equation and iteration procedure is in fact rigorous exercise. Furthermore, the study approaches to calculate the distance to default and default probability in KMV model. The probability of default shows that value of assets will be less then debt at time of maturity T (Boumediene (2010)). If we write in equation form, it is;

$$pT = prob(V_T \leq D_T) = prob(lnV_T \leq lnD_T) \tag{12}$$

Now, if G is equal to (ln V) the Taylor approximation is;

$$d(lnV) = f'(V)dV + \frac{1}{2}f''(V)dV^2$$

$$f' = \frac{1}{V} \;\&\; f'' = \frac{1}{V^2}$$

$$= \frac{1}{V}(\alpha_v V dT + \beta_v V dz) + \frac{1}{2}[-\frac{1}{V^2}(V^2\beta_v^2 dT)]$$

$$= \frac{1}{V}(\alpha_v dT + \beta_v dz)V - \frac{1}{2}\beta_v^2 dT$$

By rearranging the values, we can get Ito's Lemma as following;

$$dG = (\alpha_v - 1/2\beta_v^2)dT + \beta_v dz \qquad (13)$$

The change in lnV in time 0 and time T is normally distributed with mean $(\alpha_v - 1/2\beta_v^2)T$ and variance $\beta_v T$ (Hull (2006)).

The change of time in lnV from time zero to time T;

$$lnV_T - lnV_0 = (\alpha_v - 1/2\beta_v^2)T + \beta_v \epsilon\sqrt{T} \qquad (14)$$

Where;

$$\epsilon \sim N(0,1)$$

The equation of default probability becomes;

$$pT = prob(lnV_0 + (\alpha_v - 1/2\,\beta_v^2)T + \beta_v \epsilon\sqrt{T} \leq lnD_T) \qquad (15)$$

$$pT = prob(lnV_0 + (\alpha_v - 1/2\beta_v^2)T \leq -\beta_v \epsilon\sqrt{T} + lnD_T)$$

After changing the equality sign;

$$pT = prob(lnV_0 + (\alpha_v - 1/2\beta_v^2)T - lnD_T \geq -\beta_v \epsilon\sqrt{T}) \qquad (15.1)$$

After rearranging;

$$pT = prob\left[-\frac{\left\{ln\left(\frac{V_0}{D}\right) + (\alpha_v - 1/2\,\beta_v^2)T\right\}}{\beta_v\sqrt{T}} \geq \epsilon\right]$$

Because ϵ has standard normal distribution with N (0, 1) so;

$$pT = N\left[-\frac{\left\{ln\left(\frac{V_0}{D}\right) + (\alpha_v - 1/2\,\beta_v^2)T\right\}}{\beta_v\sqrt{T}}\right]$$

According to Hillegeist et al. (2004), the probability of default is function of distance between assets value and their volatility and face value of debt V_0/D, which are adjusted for expected growth return in asset value $(\alpha_v - 1/2\,\beta_v^2)$ and their volatility β_v.

$$DD = \frac{\left[\ln(V_0/D) + \left(\alpha_v - \frac{1}{2}\beta_v^2\right)T\right]}{\beta_v\sqrt{T}} \qquad (16)$$

$$pT = N(-DD) \qquad (17)$$

So in KMV model equation (3) and (11) have immense importance to calculate market value of assets and their volatility (V, β_v) by iteration method.

4.1 Expected rate of return in KMV Merton model

α_v is the expected rate of return of assets, which is calculated at the end of year as level of assets and liabilities can only be judge at the end of year. The α_v follows the formula;

$$\alpha_v = \Delta V / V_i$$

Here, i denotes the time which is one year and $\Delta V = V_{i+1}$. After estimating the both unknowns β_v and V we put all values in formula for calculation of distance to default and default probability.

4.2 Naive Model

Values of assets and their volatility can only be achieved through solving above two non linear simultaneous equations, which need rigorous iteration procedure in KMV Merton model. Bharath and Shumway (2008) presented the alternative Naive model, which use all other attributes of Merton model except KMV approach of solving two non linear simultaneous equations. They separated Merton model in two components, one is functional form of model and other is solution of non linear simultaneous equation. According to Bharath and Shumway (2008) KMV Merton model approach is unable to capture the default probability and concluded that alternative naive model is more efficient and simple. Most of academic researchers and practitioners are applying this model for prediction of default probability. Campbell et al. (2008) estimates some models using KMV approach for bankruptcy, but they concluded that KMV approach have little forecasting power. So this methodology is now extended to Naïve model.

To start the construction of Naïve model, we approximate the market value of debt with the face value of debt.

2012	-2.171	0.985	2012	0.197	0.422
2013	2.110	0.017	2013	0.984	0.163

	MCB			*United Bank*	
Year	**Naïve DD**	**Naïve DP**	**Year**	**Naïve DD**	**Naïve DP**
2006	2.602	0.005	2006	10.896	0.000
2007	1.973	0.024	2007	1.322	0.093
2008	1.702	0.044	2008	0.762	0.223
2009	-2.100	0.982	2009	-4.106	1.000
2010	3.371	0.000	2010	2.803	0.003
2011	1.437	0.075	2011	1.512	0.065
2012	-0.918	0.821	2012	-0.403	0.657
2013	2.089	0.018	2013	2.307	0.011

	Bank Al-habib			*Standard Cahrtered*	
Year	**Naïve DD**	**Naïve DP**	**Year**	**Naïve DD**	**Naïve DP**
2006	1.574	0.058	2006		
2007	0.240	0.405	2007		
2008	0.521	0.301	2008	0.524	0.300
2009	-3.068	0.999	2009	-3.545	1.000
2010	1.268	0.102	2010	0.382	0.351
2011	0.802	0.211	2011	0.135	0.446
2012	-0.507	0.694	2012	0.141	0.444
2013	1.005	0.158	2013	1.808	0.035

$$\alpha_v = \Delta V / V_i$$

Here, i denotes the time which is one year and $\Delta V = V_{i+1}$. After estimating the both unknowns β_v and V we put all values in formula for calculation of distance to default and default probability.

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To start the construction of Naïve model, we approximate the market value of debt with the face value of debt.

$$NaiveD = F \tag{18}$$

As equity risk and debt risk are correlated of those firms which are closed to default, the volatility or risk of debt is calculated through following equation;

$$Naive\ \beta D = 0.05 + 0.25 * \beta_E \tag{19}$$

This model includes five percentage points to present the term structure volatility and twenty five percent times equity volatility. So this helpful to derive the asset volatility as it includes total volatility of firm;

$$Naive\ \beta_V = \left(\frac{E}{E+Naive\ D}\right)\beta_E + \frac{Naive\ D}{E+Naive\ D} Naive\beta_D \tag{19.1}$$

$$Naive\ \beta_V = \left(\frac{E}{E+F}\right)\beta_E + \left(\frac{F}{E+F}\right)(0.05 + 0.25 * \beta_E) \tag{19.2}$$

Through equation (21) volatility of asset is calculated. To calculate distance to default we further need the value of expected returns of the banks. Expected return of the firm is equal to last year stock returns of the bank. So expected return is;

$$Naive\ \alpha = r_{it-1}$$

Through this information Naive model is also able to capture same results which derived in other studies through using the method of two non linear simultaneous equations and iteration procedure. The Naive distance to default is;

$$Naive\ DD = \frac{\left[\ln\left\{\frac{E+F}{F}\right\} + \{r_{it-1} - 0.5\ Naive\ \beta_V^2\}T\right]}{Naive\ \beta_V\sqrt{T}} \quad (20)$$

$$Naive\ DP = N\ (-Naive\ DD) \quad (21)$$

The present study uses equation (20) and (21) to calculate the default probability and distance to default.

4.2.1 Annualized Volatility

According to Hull (2006) annualized volatility can be calculated as;

$$r_i = ln\left(\frac{pr_t}{pr_{t-1}}\right)$$

r_i denote the daily return on stocks and pr_t denotes closing price of the day while pr_{t-1} symbolize the closing price of previous day. The formula for calculating annualized volatility of equity is ;

$$\beta_E = \frac{1}{\sqrt{\frac{1}{n}}} = \sqrt{\left(\frac{1}{n-1}\right)\sum_{i=1}^{n} r_i^2 - \frac{1}{n(n-1)}\left(\sum_{i=1}^{n} ri\right)^2}$$

Here n denotes the number of observations in whole year. For calculation of daily stock prices study includes trading days' stock prices.

4.3 Data

The empirical study employs the data of 22 listed scheduled banks of Pakistan, including Islamic and conventional banks (See Appendix). These conventional banks consist of private and public banks of Pakistan. Furthermore, private and public banks are divided in small and large banks. Small banks are categorized on basis of their asset size. The time period for analysis is 2006-2013. The daily stock prices are observed from stock exchange and business recorder. The time span also covers financial crisis era. The pre financial crisis era is measured from 2006-2008 while post financial crisis era is measured as 2009-2013. Market based data is used in this methodology. The detail for variable is given below;

Variables	Notations	Notes
Market value of equity	E	Share price*Share outstanding
Volatility of equity	β_E	Standard deviation of Share price.
Debt	D	Total liabilities from balance sheet
Market value of assets	V	Derived through model
Volatility of assets	β_v	Derived through model
Maturity	T	One year
Return of assets	α_v	r_{it-1}
Distance to default	DD	$\frac{\left[\ln\left\{\frac{E+F}{F}\right\}+\{r_{it-1}-0.5\ Naive\ \beta_V^2\}T\right]}{Naive\ \beta_V\sqrt{T}}$
Default probability	pT	N(−DD)

Chapter 5

Results and Discussion

In this chapter, we present an empirical analysis of our research. The chapter explains firstly the volatility of banks which is calculated through daily closing market prices of banks stock. Further, the distance to default and default probability of all banks is measured through Naïve model. In which the results clearly show that when banks' default probability is tend to rise, distance to default (DD) narrow down and when default probability decreases, the distance to default (DD) increases which shows negative relationship between two variables. Further chapter contains the comparison of distance to default with logit default probability. In this part results are clearer, and comparison depicts smoother picture of results.

Finally, the last part of chapter presents that how financial crisis effected the profitability and robustness of banks. To serve this purpose, we conduct pre and post financial crisis analysis of all banks. In this part the study shadows light on Islamic banks' default probability and distance to default during and after financial crisis.

5.1 Summary Results of Volatility of Equity (δE)

To identify the credit risk of banks, we calculated the historical annualized volatility of equity. Stock prices have valuable importance for valuing companies which are listed on stock exchange. As the information regarding economies and companies

change rapidly, the value of equity change whole day. The equity volatility put dramatic result on companies' performance. The study observes the stock prices on daily basis as Hull (2006) explained that a definite time intervals are used to calculate the volatility of equity. Table 5.1 clearly depicts that commercial banks in Pakistan are facing huge volatility in their stock prices. This volatility is not favorable in financial companies and directly impacts on profitability of banks. The increase in volatility also depicts public lesser interest in that specific company. As Public banks in Pakistan are showing somehow less volatile price of equity, it shows that investors have trust on public banks because they are stable and backed by the government. The volatility of public banks remain stable in 2006 and 2007, while in 2008 the equity volatility of Bank of Khayber increased by 1.7 points. The obvious impact of financial crisis is reflected in increase of volatility of equity, which started in 2007 but it stroke Pakistan financial industry in second phase. Most of the banks in Pakistan controlled their default probability by increasing capital buffer in 2010 after facing downward market trend in 2009. However, public banks of Pakistan were able to control market value in 2012 and 2013. The volatility of public banks is relatively stable across the selected time period of the study.

The equity volatility of National Bank of Pakistan shows relatively stable trend, the volatility increased to 5% when financial crisis was on its peak in 2009. The equity volatility of Bank of Punjab is also showing same results. Its volatility remains stable in sample time period. However, the financial crisis of 2009 also affects its market value as its increases to 6% in 2009. Lemmon and Lins (2003) concluded that

financial crisis leave negative impact on market value of firms. The study found that investment opportunities became fewer during financial crisis which impacted negatively on market value of firms. Bank of Khyber showed higher volatility which reflecting in higher default probability as shown in Table 5.5, the main reason being the worse law and order situation in the province. Moreover, the Bank of Khyber is smaller in size as compared to the National bank and the Bank of Punjab which, also, impacted on its market value.

Table 1. Volatility of equity (public banks).

National Bank		*Bank of Khyber*		*Bank of Punjab*	
Year	**δE**	**Year**	**δE**	**Year**	**δE**
2006	0.474	2006	0.359	2006	0.441
2007	0.319	2007	0.362	2007	0.475
2008	0.429	2008	1.753	2008	0.511
2009	0.516	2009	0.815	2009	0.671
2010	0.393	2010	0.540	2010	0.480
2011	0.421	2011	0.601	2011	0.504
2012	0.373	2012	0.420	2012	0.511
2013	0.418	2013	0.443	2013	0.515

The study, also, analyzed the volatility of large and medium sized banks of Pakistan. Our findings of volatility of equity suggest that it has significant impact on default

probability of banks. The overall volatility of all large and medium sized banks was stable before and after financial crisis. However, it was more efficiently controlled after facing high volatility in market value during 2009. As Table 5.2 shows that volatility of equity across 2006 and 2007 was approximately 40%. However, the trend dramatically changed during financial crisis when it increases 50 % to 61%. After financial crisis most of the banks increased their capital buffer by considerable amount which helped them to achieve sustainable results after financial crisis. As results shows the positive control in overall market value across 2010-2013.

The results are more favorable for Allied Bank, United Bank and Bank Al-habib, where equity volatility was 48%, 48% and 38% respectively. The trend does not show dramatic change in volatility during financial crisis which shows efficiency of these banks to control the sudden shocks. the results are also favorable for Habib Bank as the volatility of equity remain stable and constructive for the bank in the whole sample time period. The volatility of equity for Faysal Bank, NIB Bank and Alfalah Bank is high comparatively with other large banks. the results also shows that these banks had to face severe shocks during financial crisis as their equity volatility increased by 57% to 70%. The following Table presents the detailed picture of volatility of equity from 2006-2013.

Table 2. Volatility of equity (large and medium sized banks).

Alfalah Bank		*Allied Bank*		*Asakri commercial*	
Year	**δE**	**Year**	**δE**	**Year**	**δE**
2006	0.506	2006	0.377	2006	0.452
2007	0.421	2007	0.407	2007	0.469
2008	0.455	2008	0.466	2008	0.491
2009	0.570	2009	0.482	2009	0.506
2010	0.327	2010	0.247	2010	0.392
2011	0.307	2011	0.269	2011	0.355
2012	0.304	2012	0.250	2012	0.364
2013	0.321	2013	0.280	2013	0.382
Habib Bank		*MCB*		*UBL*	
Year	**δE**	**Year**	**δE**	**Year**	**δE**
2006		2006	0.463	2006	0.451
2007	0.138	2007	0.357	2007	0.414
2008	0.440	2008	0.461	2008	0.459
2009	0.508	2009	0.503	2009	0.481
2010	0.288	2010	0.275	2010	0.275
2011	0.258	2011	0.282	2011	0.242
2012	0.236	2012	0.248	2012	0.286
2013	0.294	2013	0.341	2013	0.300
Bank Al-habib		*Standard Chartered*		*NIB*	

Year	δE	Year	δE	Year	δE
2006	0.352	2006		2006	0.438
2007	0.500	2007	0.272	2007	1.085
2008	0.421	2008	0.434	2008	0.710
2009	0.464	2009	0.534	2009	0.704
2010	0.341	2010	0.412	2010	0.493
2011	0.287	2011	0.463	2011	0.482
2012	0.269	2012	0.402	2012	0.631
2013	0.283	2013	0.382	2013	0.456

Habibmetro politan		*Faysal Bank*	
Year	δE	Year	δE
2006	0.470	2006	0.463
2007	0.559	2007	0.353
2008	0.377	2008	0.390
2009	0.384	2009	0.617
2010	0.387	2010	0.423
2011	0.332	2011	0.377
2012	0.229	2012	0.360
2013	0.305	2013	0.386

New emerging banks and specially those which are smaller in size are facing higher scale of volatility, they have to face high credit risk as well as less trust of

public. As its also explains in SBP risk management guidelines, that for smaller banks it's not easy to establish such hierarchy level through which they can perform credit policy formation and document monitoring. The trend analysis of equity volatility is very unfavorable for all small sized banks. The time span of 2006- 2013 is showing high volatility of equity. The results are more drastic during financial crisis era. The equity volatility is continuously high, the volatility increased to 70% to 86% of these banks in 2009. Results are also depicting that small sized banks were unable to control equity volatility even after facing critical results in 2009.

The equity volatility of Soneri Bank is slightly low then all other small sized banks. Table 5.3 shows that volatility of equity of Soneri Bank was 53% during financial crisis which is low in all other small sized banks. However, the results of Silk bank are adverse, as the volatility of the bank increased to very critical figure which is 86% during 2009. The dreadful fact is that bank was unable to control the equity volatility until 2012. The following table also presents most dreadful results of Samba Bank. The volatility of equity is constantly increasing. There is no efficient control to lower down the volatility of equity. The higher amount of volatility is also able to elaborate that most of small sized banks emerged in last decade, they need time to get stable in competitive market.

Table 3. Volatility of equity (small sized banks).

JS Bank		*KASB Bank*		*Summit Bank*	
Year	**δE**	**Year**	**δE**	**Year**	**δE**
2006		2006	0.474	2006	
2007	0.420	2007	0.428	2007	
2008	0.708	2008	0.318	2008	1.356
2009	0.694	2009	0.748	2009	0.722
2010	0.518	2010	0.715	2010	0.616
2011	0.583	2011	0.671	2011	0.613
2012	0.774	2012	0.725	2012	0.645
2013	0.527	2013	0.521	2013	0.443
Soneri Bank		*Silk Bank*		*Samba Bank*	
Year	**δE**	**Year**	**δE**	**Year**	**δE**
2006	0.591	2006	0.520	2006	0.621
2007	0.406	2007	0.377	2007	0.393
2008	0.416	2008	0.554	2008	0.580
2009	0.539	2009	0.861	2009	0.768
2010	0.425	2010	0.675	2010	0.553
2011	0.462	2011	0.526	2011	0.628
2012	0.499	2012	0.478	2012	0.686
2013	0.398	2013	0.352	2013	0.687

As only 2 Islamic banks were included in sample due to data constraints, this is why the Table 5.4 does not contain wide analysis of Islamic banks' volatility of equity. However, study explore that Meezan bank have relatively more stable trend in controlling volatility of equity. The overall trend of volatility of equity is favorable except 2009. But there is difference in Islamic and conventional banks as conventional banks were hit directly by financial crisis. Islamic banking sector was immunized from subprime lending however, due to impact of financial crisis on real economy Islamic banks were also affected (Boumediene (2010)). Results also show that Meezan Bank was efficient to control the equity volatility after financial crisis. The equity volatility decreases to 24% in 2013 which is very constructive for the bank. If these results compare to those of large sized conventional banks, its shows that Meezan Bank is more efficient then long historic stable conventional banks.

However, Bank Islami have higher level of equity volatility. The reason is that Bank Islami is comparatively smaller in size then Meezan banks and other conventional banks, which might affect its profitability and stability. But if we compare the results with small sized conventional banks it can easily conclude that Bank Islami is more efficient in controlling equity volatility.

Table 4. Volatility of equity (Islamic banks).

Bank Islami		*Meezan Bank*	
Year	**δE**	**Year**	**δE**
2006	0.376	2006	0.478
2007	0.463	2007	0.317
2008	0.559	2008	0.399
2009	0.610	2009	0.543
2010	0.559	2010	0.325
2011	0.440	2011	0.307
2012	0.700	2012	0.301
2013	0.433	2013	0.248

5.2 Summary Results of Naive DP and Naive DD

Distance to default (DD) basically shows the robustness of banks, if DD of any bank is high, its mean that specific bank is more stable and away from default. Default probability (DP) and distance to default (DD) have negative relationship as when DP increases, DD decrease and vice versa. As this study is specifically consider analysis of credit risk in banking sector of Pakistan so default probabilities presents the clear depiction of trend in default probabilities. So Table.5 shows the results of Naïve DD and Naïve DP of all banks. The results explain in same stream as in volatility of equity.

Firstly, we analyze the public sector banks' Naïve DD and Naïve DP. As results show that DD was stable across 2006 and 2007, but narrows down sharply in 2009 which show the affect of financial crisis 2009. The trend of default probability is decreasing after financial crisis, specifically in 2013. The default probability is showing high values in 2011 and 2012 due to many reasons.

The qualities of assets deteriorate in 2011 and 2012 as toxic loans of NBP increased in books by 36 percent.[19] The high default probability depicts that effect in 2012. In addition banking industry was not much growing during 2011 and 2012. Nonperforming loans increased by 10.8% from last 5 years (2009-13).[20] In 2012 all banks' default probability is increasing, as there was bad situation of law and order in country and the severe effect of flood which occur in late 2011. Its effect on markets is clear till the end of January 2012. Approximately 8.9 million people were affected by this flood. The main effected area of this flood was Sindh province. Sindh have very fertile land and this region is known to be "breadbasket" of the country. Approximately 1.7 million acres of fertile land was swamped. The damage of this flood on agrarian economy was huge. All small and large banks were affected because of the economic situation. There are also some other factors including terrorism, which participated in downfall of economy and stock markets. In January 2012 approximately 9 suicide attacks occur in different cities of Pakistan. The PKR value was also down in 2012, it was depreciated 7.8% against US Dollar which was compared unfavorably with last 10 years' average depreciation of 3.7%. In November

[19] Forex.pk
[20] Investorguide360.com

2012 CPI (consumer price index) was fallen down to 6.9%. During the year foreign exchange reserves also down by US$13.3bn which were US$17.0 in start of 2012.

Bank of Punjab also have same results with less default probability in starting years of sample data while its default probability rises to 100% in 2009. In 2012 the default probability increased to 0.98%. Bank of Khyber also bears inauspicious results, as its default probability is continuously high, the reason can be the law and order situation of the province. There were almost 15 incidents of terrorism during January 2012. However, comparatively the performance of National Bank of Pakistan is better than both other public banks. The default probability is less except 2009 and 2011, which is showing National Bank's robust performance during the whole sample time period.

Table 5. Results: Naïve DD and Naïve DP (public banks).

National Bank of Pakistan			*Bank of Khyber*		
Year	**Naïve DD**	**Naïve DP**	**Year**	**Naïve DD**	**Naïve DP**
2006	2.296	0.011	2006		
2007	1.257	0.104	2007	-1.015	0.845
2008	0.656	0.256	2008	-1.151	0.875
2009	-3.934	1.000	2009	-1.505	0.934
2010	1.698	0.045	2010	-0.615	0.731
2011	0.407	0.342	2011	-0.329	0.629
2012	-1.746	0.960	2012	1.081	0.140
2013	0.829	0.204	2013	0.996	0.160

Bank of Punjab		
Year	**Naïve DD**	**Naïve DP**
2006	1.402	0.081
2007	0.286	0.387
2008	0.288	0.387
2009	-4.985	1.000
2010	1.506	0.066
2011	-2.640	0.996
2012	-2.281	0.989
2013	2.058	0.020

The more favorable results can be analyzed of larger banks from Table 5.6 which are showing stable condition as their default probability is much low in whole sample data except 2009. The results are very encouraging in 2006 as default probability was very low in all large sized banks. however, default probability get a little rise during 2007 and 2008 as results of most banks depicts. The severe results of default probability can be analyzed in 2009 which gets flat in 2010. But as results show that only those banks which are robust and healthy financial system get smoother results in 2010. The medium sized banks were not able to bear the severe shocks of financial crisis which leads them to get higher values of default probability even after 2009. However, default probability lower down in 2013 again in all banks.

If we analyze the trend of default probability in different banks across the whole sample period, it can evaluate that large banks were more efficient in controlling the default probability. Specifically if results of United bank, Allied bank and Habib bank are highlighted it can easily be pointed out their stability when their default probability was 8%, 0% and 2%, respectively. These banks were sharply affected by financial crisis and their robustness shaken down. However, mostly banks show negative DD in 2012. The stock price sharply fell down in end of September 2011. The stock price for example of United bank fell down to 52 from 60 per share in October 2011, and it recovered in start of February 2012. MCB stock prices fell down 134 from 170 per share during same date. The default probability of MCB in 2009 is 98%. In 2010 MCB default probability is zero which shows that bank manage its portfolios efficiently during financial crisis era. As Mittoo and Varotto (2011) explained that to avoid severe affects of financial crisis financial institution needs to manage their portfolios efficiently. The increment in capital in 2010 also helps the bank to avoid the higher level of default probability, as MCB doubled its capital in 2010. The capital of MCB was 826,008,098 million in 2009 and is increased by 1,641,684,293 billion in 2010. Depreciation in PKR by 7.8%,[21] and increase in inflation by 12% put negative impact on stock market. Deposits of commercial banks were also 66% which were not so high. The increase in inflation and economic situation led savings decrease. Eventually low savings translate into low investments,

[21] http://www.brecorder.com

which direct to stock market down[22]. Safakli (2007) also showed same results while analyzing Northern Cyprus financial crisis.

Table 6. Naïve DD and Naïve DP (large and medium size banks).

Alfalah Bank			*Allied Bank*		
Year	**Naïve DD**	**Naïve DP**	**Year**	**Naïve DD**	**Naïve DP**
2006	2.890	0.002	2006	12.377	0.000
2007	-2.916	0.998	2007	0.609	0.271
2008	0.972	0.165	2008	1.147	0.126
2009	-4.543	1.000	2009	-4.093	1.000
2010	-0.830	0.797	2010	3.876	0.000
2011	-1.314	0.906	2011	1.487	0.069
2012	0.196	0.422	2012	-0.346	0.635
2013	2.242	0.012	2013	1.963	0.025
Askari Bank			*Habib Bank*		
Year	**Naïve DD**	**Naïve DP**	**Year**	**Naïve DD**	**Naïve DP**
2006	1.051	0.147	2006		
2007	-0.126	0.550	2007		
2008	0.231	0.409	2008	-1.148	0.875
2009	-6.208	1.000	2009	-2.714	0.997
2010	2.172	0.015	2010	2.839	0.002
2011	-1.589	0.944	2011	0.799	0.212

[22] http://tribune.com.pk

2012	-2.171	0.985	2012	0.197	0.422
2013	2.110	0.017	2013	0.984	0.163

	MCB			*United Bank*	
Year	**Naïve DD**	**Naïve DP**	**Year**	**Naïve DD**	**Naïve DP**
2006	2.602	0.005	2006	10.896	0.000
2007	1.973	0.024	2007	1.322	0.093
2008	1.702	0.044	2008	0.762	0.223
2009	-2.100	0.982	2009	-4.106	1.000
2010	3.371	0.000	2010	2.803	0.003
2011	1.437	0.075	2011	1.512	0.065
2012	-0.918	0.821	2012	-0.403	0.657
2013	2.089	0.018	2013	2.307	0.011

	Bank Al-habib			*Standard Cahrtered*	
Year	**Naïve DD**	**Naïve DP**	**Year**	**Naïve DD**	**Naïve DP**
2006	1.574	0.058	2006		
2007	0.240	0.405	2007		
2008	0.521	0.301	2008	0.524	0.300
2009	-3.068	0.999	2009	-3.545	1.000
2010	1.268	0.102	2010	0.382	0.351
2011	0.802	0.211	2011	0.135	0.446
2012	-0.507	0.694	2012	0.141	0.444
2013	1.005	0.158	2013	1.808	0.035

	NIB			*Habibmetro Politian*	
Year	**Naïve DD**	**Naïve DP**	**Year**	**Naïve DD**	**Naïve DP**
2006	1.294	0.098	2006	1.485	0.069
2007	-0.826	0.796	2007	-0.604	0.727
2008	-0.086	0.534	2008	0.702	0.241
2009	-2.657	0.996	2009	-2.764	0.997
2010	0.189	0.425	2010	-3.611	1.000
2011	-0.660	0.745	2011	0.190	0.425
2012	-1.005	0.843	2012	-1.986	0.977
2013	1.461	0.072	2013	0.901	0.184

	Faysal Bank	
Year	**Naïve DD**	**Naïve DP**
2006	1.629	0.052
2007	0.129	0.449
2008	0.891	0.187
2009	-4.540	1.000
2010	1.866	0.031
2011	-0.260	0.602
2012	-2.554	0.995
2013	1.080	0.140

Banks, which are smaller in size, have high default probabilities. Table 5.7 show that mostly smaller banks could not achieved high DD after financial crisis even after increase in paid up capital. As Samba bank's DD is continuously low after financial crisis which show the high volatility in equity and also low performance of the bank. However, after continues falling down of DD Samba bank again gets stable in 2013. The volatility of equity was badly unstable during 2009-2012; share price of Samba bank was lowest at 1.3 and highest at 6.95. Approximately same results shown for Silk bank, JS bank and Soneri bank which have 99%, 100% and 98% default probabilities in 2009. Results are consistent with Angbazo (1997), which concluded that money centered banks and small banks are more sensitive to credit risk, while regional banks are not sensitive to credit risk.

Table 7. Naïve DD and Naïve DP (small size bank)

	JS Bank			*KASB*	
Year	**Naïve DD**	**Naïve DP**	**Year**	**Naïve DD**	**Naïve DP**
2006			2006	0.633	0.264
2007			2007	0.415	0.339
2008	1.031	0.151	2008	1.444	0.074
2009	-2.280	0.989	2009	-0.100	0.540
2010	-0.052	0.521	2010	-1.660	0.952
2011	-1.639	0.949	2011	-1.955	0.975
2012	-1.155	0.876	2012	-2.053	0.980
2013	3.196	0.001	2013	1.960	0.025

	Summit Bank			*Soneri Bank*	
Year	**Naïve DD**	**Naïve DP**	**Year**	**Naïve DD**	**Naïve DP**
2006			2006	0.884	0.188
2007			2007	0.115	0.454
2008			2008	0.301	0.382
2009	-0.905	0.817	2009	-3.368	1.000
2010	0.271	0.393	2010	0.189	0.425
2011	-1.465	0.929	2011	-0.674	0.750
2012	-2.362	0.991	2012	-2.393	0.992
2013	2.125	0.017	2013	2.290	0.011
	Silk Bank			*Samba Bank*	
Year	**Naïve DD**	**Naïve DP**	**Year**	**Naïve DD**	**Naïve DP**
2006	0.316	0.376	2006	0.675	0.250
2007	0.380	0.352	2007	1.102	0.135
2008	1.055	0.146	2008	1.171	0.121
2009	-3.075	0.999	2009	-1.960	0.975
2010	-0.010	0.504	2010	-0.810	0.791
2011	-1.286	0.901	2011	-0.983	0.837
2012	-0.993	0.840	2012	-0.568	0.715
2013	1.472	0.070	2013	1.243	0.107

Islamic banks are more resilient than conventional banks as Boumediene (2010) results declare. The trend of default probability is low in start of sample time

period, as Table 5.8 shows that Meezan Bank's default probability is only 14% in 2006. The results are also continuously favorable in 2011 to 2013. , Meezan Bank shows the robust result during the whole sample years except 2009. Meezan bank have 87% default probability in 2009, which is less than most of other conventional banks, as all conventional banks' default probabilities are 90% even some conventional banks' default probabilities are 100% during financial crisis. It shows that Meezan Bank is more efficient in controlling credit risk as most of conventional banks shows very high default probabilities in 2009. In 2013 default probability lower down to only 1% which can also be interpret in way that general public was not aware to Islamic banking in few years back. However, recently due to development in Islamic banking most of people are aware and interested in Islamic banking. Yet, in our results Bank Islami do not have more favorable results, as default probability is high in most of years of sample data. However, even then the results are better than most of other small sized conventional banks. as we compare the results with Silk and Soneri Bank, the Bank Islami have low default probability in 2009. The default probability of Bank Islami is 92% while Soneri and Silk Bank have 100% and 99% default probabilities. Hanif et al. (2012) and A. Hassan (2009) also showed same results while analyzing credit risk in Islamic banks.

concludes that stocks were more risky then indicated through normal distribution. Furthermore, the study used Paretian distribution for capturing high volatility of data. As previous table is definitely showing more rigid results, most of the banks default probability is so high; also there are some results where DP_{normal} have zero values or 100% is. So the study analyze the logit model by using logistic probability distribution for better and smooth results .Boumediene (2010) defines Y as DD and P as default probability;

$$p = \frac{1}{1 + e^{-Y}}$$

$$DP_{logit} = \frac{1}{1 + e^{DD}}$$

Furthermore, DD capture company's information specially its earnings expectations, asset volatility. Distance to default increase as performance, earning and asset value of company increases. So the main factors which decide the company performance are its earning, leverage and assets value which are being capture in distance to default. For this reason distance to default is being used as ordinal measure. While the results for default probability derive through equation. However, Table 9. shows more interesting and smooth results. National bank of Pakistan DP_{normal} was 100% in 2009, but it converge to 98% in DP_{logit}. Bank of Khyber DD is not more favorable but the interesting point is that even DD is down but result in

DP_{logit} are not so worst. If default probability of same year analyzed through DP_{normal}, then result show unconstructive image of the bank.

Table 9. DD and DP by using logit model (public banks).

National Bank of Pakistan			*Bank of Khyber*		
Year	**Naïve DD**	**DP logit**	**Year**	**Naïve DD**	**DP logit**
2006	2.296	0.091	2006		
2007	1.257	0.221	2007	-1.015	0.734
2008	0.656	0.342	2008	-1.151	0.760
2009	-3.934	0.981	2009	-1.505	0.818
2010	1.698	0.155	2010	-0.615	0.649
2011	0.407	0.400	2011	-0.329	0.582
2012	-1.746	0.851	2012	1.081	0.253
2013	0.829	0.304	2013	0.996	0.270

Bank of Punjab		
Year	**Naïve DD**	**DP logit**
2006	1.402	0.198
2007	0.286	0.429
2008	0.288	0.428
2009	-4.985	0.993
2010	1.506	0.182
2011	-2.640	0.933
2012	-2.281	0.907

2013	2.058	0.113

It can clearly be analyzed from Table 5.10 that zero probabilities and 100% default probabilities have been omitted e.g. Bank Alfalah has 100% default probability in Table.2 while DP_{logit} in 2009 is 0.98%. Likewise Allied bank had zero default probability in 2006 with simple normal distribution function but in DP_{logit} model it has been converted to 4.21E-06. Askari bank's default of probability in 2009 is 100% in DP_{normal} table, while it converges to 99% in DP_{logit}.

Table 10. DD and DP by using logit model (large and medium size banks).

	Alfalah Bank			*Allied Bank*	
Year	**Naïve DD**	**DP logit**	**Year**	**Naïve DD**	**DP logit**
2006	2.890	0.053	2006	12.377	4.21E-06
2007	-2.916	0.949	2007	0.609	3.52E-01
2008	0.972	0.274	2008	1.147	2.41E-01
2009	-4.543	0.989	2009	-4.093	9.84E-01
2010	-0.830	0.696	2010	3.876	2.03E-02
2011	-1.314	0.788	2011	1.487	1.84E-01
2012	0.196	0.451	2012	-0.346	5.86E-01
2013	2.242	0.096	2013	1.963	1.23E-01
	Askari Bank			*Habib Bank*	
Year	**Naïve DD**	**DP logit**	**Year**	**Naïve DD**	**DP logit**

2006	1.051	0.259	2006		
2007	-0.126	0.532	2007		
2008	0.231	0.442	2008	-1.148	0.759
2009	-6.208	0.998	2009	-2.714	0.938
2010	2.172	0.102	2010	2.839	0.055
2011	-1.589	0.830	2011	0.799	0.310
2012	-2.171	0.898	2012	0.197	0.451
2013	2.110	0.108	2013	0.984	0.272

	MCB Bank			***United Bank***	
Year	**Naïve DD**	**DP logit**	**Year**	**Naïve DD**	**DP logit**
2006	2.602	0.069	2006	10.896	0.000
2007	1.973	0.122	2007	1.322	0.210
2008	1.702	0.154	2008	0.762	0.318
2009	-2.100	0.891	2009	-4.106	0.984
2010	3.371	0.033	2010	2.803	0.057
2011	1.437	0.192	2011	1.512	0.181
2012	-0.918	0.715	2012	-0.403	0.599
2013	2.089	0.110	2013	2.307	0.091

	Bank Al-habib			***Standard Cahrtered***	
Year	**Naïve DD**	**DP logit**	**Year**	**Naïve DD**	**DP logit**
2006	1.574	0.172	2006		
2007	0.240	0.440	2007		

2008	0.521	0.373	2008	0.524	0.372
2009	-3.068	0.956	2009	-3.545	0.972
2010	1.268	0.220	2010	0.382	0.406
2011	0.802	0.310	2011	0.135	0.466
2012	-0.507	0.624	2012	0.141	0.465
2013	1.005	0.268	2013	1.808	0.141

NIB Bank			*Habib Metropolitian*		
Year	**Naïve DD**	**DP logit**	**Year**	**Naïve DD**	**DP logit**
2006	1.294	0.215	2006	1.485	0.185
2007	-0.826	0.695	2007	-0.604	0.647
2008	-0.086	0.521	2008	0.702	0.331
2009	-2.657	0.934	2009	-2.764	0.941
2010	0.189	0.453	2010	-3.611	0.974
2011	-0.660	0.659	2011	0.190	0.453
2012	-1.005	0.732	2012	-1.986	0.879
2013	1.461	0.188	2013	0.901	0.289

Faysal Bank		
Year	**Naïve DD**	**DP logit**
2006	1.629	0.164
2007	0.129	0.468
2008	0.891	0.291
2009	-4.540	0.989

2010	1.866	0.134
2011	-0.260	0.565
2012	-2.554	0.928
2013	1.080	0.253

Smaller banks are also showing low default probability through this model. Meezan bank is showing more robust results with DP_{logit} as its default probability decrease to 0.75%. Meezan bank distance to default is more enhanced and favorable in logit model. Table 5.11 and 5.12 show these results.

Table 11. DD and DP by using logit model (small size banks).

JS Bank			*KASB Bank*		
Year	**Naïve DD**	**DP logit**	**Year**	**Naïve DD**	**DP logit**
2006			2006	0.633	0.347
2007			2007	0.415	0.398
2008	1.031	0.263	2008	1.444	0.191
2009	-2.280	0.907	2009	-0.100	0.525
2010	-0.052	0.513	2010	-1.660	0.840
2011	-1.639	0.837	2011	-1.955	0.876
2012	-1.155	0.760	2012	-2.053	0.886
2013	3.196	0.039	2013	1.960	0.124

	Summit Bank			*Soneri Bank*	
Year	**Naïve DD**	**DP logit**	**Year**	**Naïve DD**	**DP logit**
2006			2006	0.884	0.292
2007			2007	0.115	0.471
2008			2008	0.301	0.425
2009	-0.905	0.712	2009	-3.368	0.967
2010	0.271	0.433	2010	0.189	0.453
2011	-1.465	0.812	2011	-0.674	0.662
2012	-2.362	0.914	2012	-2.393	0.916
2013	2.125	0.107	2013	2.290	0.092
	Silk Bank			*Samba Bank*	
Year	**Naïve DD**	**DP logit**	**Year**	**Naïve DD**	**DP logit**
2006	0.316	0.422	2006	0.675	0.337
2007	0.380	0.406	2007	1.102	0.249
2008	1.055	0.258	2008	1.171	0.237
2009	-3.075	0.956	2009	-1.960	0.877
2010	-0.010	0.503	2010	-0.810	0.692
2011	-1.286	0.784	2011	-0.983	0.728
2012	-0.993	0.730	2012	-0.568	0.638
2013	1.472	0.187	2013	1.243	0.224

Table 12. DD and DP by using logit model (Islamic banks).

Meezan Bank			*Bank Islami*		
Year	**Naïve DD**	**DP logit**	**Year**	**Naïve DD**	**DP logit**
2006	1.052	0.259	2006		
2007	-0.140	0.535	2007	-0.935	0.718
2008	2.293	0.092	2008	1.144	0.242
2009	-1.125	0.755	2009	-1.426	0.806
2010	-0.541	0.632	2010	-0.247	0.561
2011	0.751	0.321	2011	-1.535	0.823
2012	0.603	0.354	2012	-0.448	0.610
2013	3.121	0.042	2013	0.221	0.445

It can easily be identified from Table 3. that how results are more meaningful and interesting. While comparing with Table 2. it can easily be utter that through normal distribution the jumps and high volatility in data cannot be covered, also we can analyze that through normal distribution approximately every bank was near to default as most of the banks were showing default probability more the 0.5%. While in logistic probability distribution default probabilities are not as higher. As Peters (1991) explains that results through normal distribution did not show much fat tails and skewness of data. More generally;

$$If\ DD > 0 \rightarrow DP_{logit} > DP_{normal}$$

$$IfDD < 0 \rightarrow DP_{logit} < DP_{normal}$$

$$IfDD = 0 \rightarrow DP_{logit} = DP_{normal}$$

There is also graphical presentation of Table 2 and Table 3 which show the difference between two probabilities based on results which are concluded after empirical analysis of default probabilities of all banks. Graphs also show clearly that cumulative logistic probability distribution have fatter tails then normal distribution function..

Figure 4.1. Conversion of DD to DP using normal distribution function.

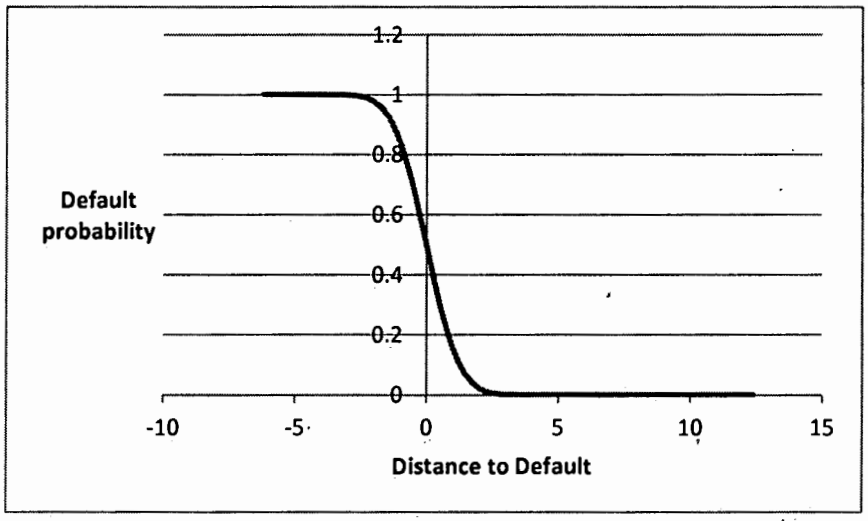
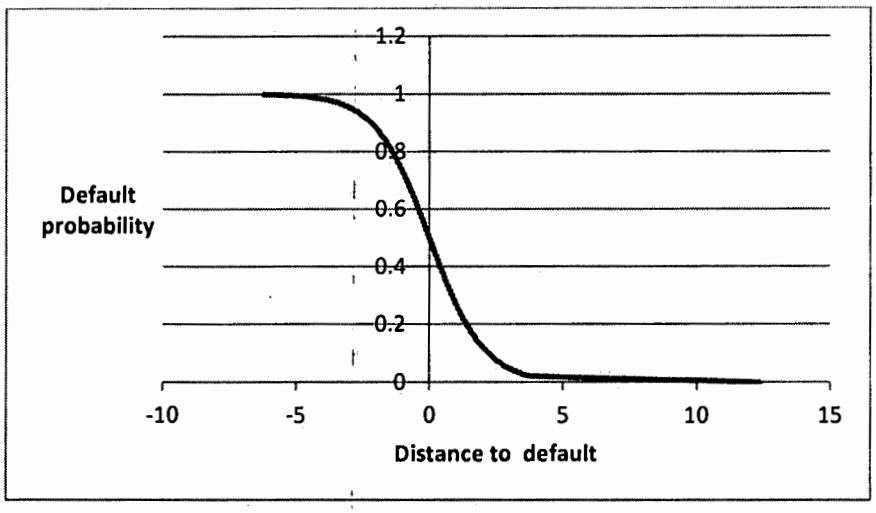


Figure 4.2. Conversion of DD to Naïve DP using logistic probability distribution.



5.4 Financial Crisis Analysis

The global financial crisis of 2008 was the worst crisis after 1930s. The financial markets all over the globe were severely affected by it. The financial crisis primarily evolved the subprime lending by USA. Financial institutions give extensive loans to housing industry and for this reason banking sector was direct victims of the crisis. In USA many banks defaulted in this crisis. However, Pakistan was not knocked by this crisis in first round[23]. So its sever effects more specifically in start of 2009 and end of 2008. There was no financial institution and bank which collapsed during financial crisis but there was worst impact on banking performance (Nazir et al. (2012)). Table 13. presents the pre and post financial crisis analysis of commercial banks in Pakistan. Distance to default and default probabilities clearly show the worst effect on banking performances during 2009. Volatility of equity was increased in 2009 which led to

[23] www.dawn.com

default probabilities high. Table 13. presents DP logit table with more clear results. As results declare that every bank including public sector banks with sound performance have high default probability in 2009. National banks of Pakistan and Bank of Punjab have 98% and 99% default probabilities. While larger banks also have high default probabilities Allied bank and MCB default probabilities are 0.98% and 0.89%. However, surprisingly United bank's results are showing robustness and positive results. United bank default probability is 0.17%, which is unexpectedly low.

The present study results are consistent with Mittoo and Varotto (2011). However, as Islamic banks were more robust during financial crisis. Islamic banks were not directly hit by crisis but as economy was down so Islamic banks had to face indirectly effect of financial crisis. Meezan bank performance was good during financial crisis as its default probability is low comparatively other conventional banks. Meezan bank default probability during 2009 was 0.7%. However, bank Islami did not show much robustness, the reason can be its smaller size. Bank Islami have 0.8% default probability which is even low then other conventional banks, because most of conventional banks' default probability during 2009 was 0.99% or 0.98%. These results declare that Islamic banks faced low level of financial crisis and were more resilient. Results of the present study are in line with the previous study of Mittoo and Varotto (2011); Boumediene (2010); Hanif et al. (2012) and Angbazo (1997).

Table 13: Pre and post analysis of financial crisis (Results are continued on next page)

Financial crises Pre analysis			Financial crises Post analysis		
Year	Naïve DD	Naïve DP logit	Year	Naïve DD	Naïve DP logit
National Bank of Pakistan					
Pre analysis			*Post analysis*		
2006	2.296	0.091	2009	-3.934	0.981
2007	1.257	0.221	2010	1.698	0.155
2008	0.656	0.342	2011	0.407	0.400
			2012	-1.746	0.851
			2013	0.829	0.304
Bank of Punjab					
Pre analysis			*Post analysis*		
2006	1.402	0.198	2009	-4.985	0.993
2007	0.286	0.429	2010	1.506	0.182
2008	0.288	0.428	2011	-2.640	0.933
			2012	-2.281	0.907
			2013	2.058	0.113

Bank of Khyber

Pre analysis			*Post analysis*		
2006			2009	-1.505	0.818
2007	-1.015	0.734	2010	-0.615	0.649
2008	-1.151	0.760	2011	-0.329	0.582
			2012	1.081	0.253
			2013	0.996	0.270

Alfalah Bank

Pre analysis			*Post analysis*		
2006	2.890	0.053	2009	-4.543	0.989
2007	-2.916	0.949	2010	-0.830	0.696
2008	0.972	0.274	2011	-1.314	0.788
			2012	0.196	0.451
			2013	2.242	0.096

Allied Bank

Pre analysis			*Post analysis*		
2006	12.377	4.21E-06	2009	-4.093	9.84E-01
2007	0.609	3.52E-01	2010	3.876	2.03E-02

2008	1.147	2.41E-01	2011	1.487	1.84E-01
			2012	-0.346	5.86E-01
			2013	1.963	1.23E-01

Askari Bank

Pre analysis			*Post analysis*		
2006	1.051	0.259	2009	-6.208	0.998
2007	-0.126	0.532	2010	2.172	0.102
2008	0.231	0.442	2011	-1.589	0.830
			2012	-2.171	0.898
			2013	2.110	0.108

Habib Bank

Pre analysis			*Post analysis*		
2006			2009	-2.714	0.938
2007			2010	2.839	0.055
2008	-1.148	0.759	2011	0.799	0.310
			2012	0.197	0.451
			2013	0.984	0.272

United Bank

Pre analysis			*Post analysis*		

2006	10.896	0.000	2009	-4.106	0.984
2007	1.322	0.210	2010	2.803	0.057
2008	0.762	0.318	2011	1.512	0.181
			2012	-0.403	0.599
			2013	2.307	0.091

Bank Al-habib

Pre analysis			*Post analysis*		
2006	1.574	0.172	2009	-3.068	0.956
2007	0.240	0.440	2010	1.268	0.220
2008	0.521	0.373	2011	0.802	0.310
			2012	-0.507	0.624
			2013	1.005	0.268

Standard Chartered Bank

Pre analysis			*Post analysis*		
2006			2009	-3.545	0.972
2007			2010	0.382	0.406
2008	0.524	0.372	2011	0.135	0.466
			2012	0.141	0.465
			2013	1.808	0.141

NIB Bank

Pre analysis			*Post analysis*		
2006	1.294	0.215	2009	-2.657	0.934
2007	-0.826	0.695	2010	0.189	0.453
2008	-0.086	0.521	2011	-0.660	0.659
			2012	-1.005	0.732
			2013	1.461	0.188

Habibmetropolitian Bank

Pre analysis			*Post analysis*		
2006	1.485	0.185	2009	-2.764	0.941
2007	-0.604	0.647	2010	-3.611	0.974
2008	0.702	0.331	2011	0.190	0.453
			2012	-1.986	0.879
			2013	0.901	0.289

Faysal Bank

Pre analysis			*Post analysis*		
2006	1.629	0.164	2009	-4.540	0.989
2007	0.129	0.468	2010	1.866	0.134

2008	0.891	0.291	2011	-0.260	0.565
			2012	-2.554	0.928
			2013	1.080	0.253

JS Bank

Pre analysis			*Post analysis*		
2006			2009	-2.280	0.907
2007			2010	-0.052	0.513
2008	1.031	0.263	2011	-1.639	0.837
			2012	-1.155	0.760
			2013	3.196	0.039

KASB Bank

Pre analysis			*Post analysis*		
2006	0.633	0.347	2009	-0.100	0.525
2007	0.415	0.398	2010	-1.660	0.840
2008	1.444	0.191	2011	-1.955	0.876
			2012	-2.053	0.886
			2013	1.960	0.124

Summit Bank

Pre analysis			*Post analysis*		

2006			2009	-0.905	0.712
2007			2010	0.271	0.433
2008			2011	-1.465	0.812
			2012	-2.362	0.914
			2013	2.125	0.107

Soneri Bank

Pre analysis			*Post analysis*		
2006	0.884	0.292	2009	-3.368	0.967
2007	0.115	0.471	2010	0.189	0.453
2008	0.301	0.425	2011	-0.674	0.662
			2012	-2.393	0.916
			2013	2.290	0.092

Silk Bank

Pre analysis			*Post analysis*		
2006	0.316	0.422	2009	-3.075	0.956
2007	0.380	0.406	2010	-0.010	0.503
2008	1.055	0.258	2011	-1.286	0.784
			2012	-0.993	0.730
			2013	1.472	0.187

Samba Bank

Pre analysis			*Post analysis*		
2006	0.675	0.337	2009	-1.960	0.877
2007	1.102	0.249	2010	-0.810	0.692
2008	1.171	0.237	2011	-0.983	0.728
			2012	-0.568	0.638
			2013	1.243	0.224

Meezan Bank

Pre analysis			*Post analysis*		
2006	1.052	0.259	2009	-1.125	0.755
2007	-0.140	0.535	2010	-0.541	0.632
2008	2.293	0.092	2011	0.751	0.321
			2012	0.603	0.354
			2013	3.121	0.042

Bank Islami

Pre analysis			*Post analysis*		
2006			2009	-1.426	0.806
2007	-0.935	0.718	2010	-0.247	0.561
2008	1.144	0.242	2011	-1.535	0.823

2012	-0.448	0.610
2013	0.221	0.445

Chapter 6

Conclusion and Policy Implications

Credit risk management gets significant importance from last few decades, especially after the financial crises. Developing countries face many constraints to manage the credit risk due to the relatively instable economies and less advanced technology. The study explores as to what extent banking industry in Pakistan is exposed to credit risk. The Naïve model which is based on Black Scholes Merton model has been used to estimate the results.

Specifically, the study focused on how credit risk affects the default probabilities of banks. Particularly, we first focused on default probabilities of public and larger sized private banks. Furthermore, we also focused on small sized conventional banks. The study focuses on Islamic banks default probabilities and compares the results of larger conventional banks and public banks and Islamic and conventional banks.

Unlike the existing literature which focuses on performance and efficiency of Pakistan banking sector, we explores the default probabilities of banks in financial crisis period. The results regarding to effect of the financial crisis on default probability of banks have negative, significant and sizable effect on credit risk of banks. Banks' default probability is negatively related to size of banks as for example results of National Bank and MCB banks depicts the low scale of default probability.

On the other side, default probability of small sized banks is positively increasing, which show the insightful picture of higher volatility of small sized banks. Banks with larger size and low level of volatility are more likely to manage the credit risk effectively. Furthermore, as results revels that Islamic banks are significantly managing credit risk, they are tend to face low scale of default probability. Islamic banks controlled the default probability efficiently in financial crisis period.

The study explores the default probabilities and distance to default of all listed banks of Pakistan. The sample data includes private, public and Islamic banks for the period 2006-2013. The variables that determine the default probability are value of equity and its volatility and value of assets and their volatility. The value of equity was taken as call option on underlying assets as explained by Black Scholes Option Pricing Theory. The study uses Naïve model for estimation of default probabilities. Naïve model uses the fundamentals of Black Scholes and Merton model, but it is slightly different from EDF/KMV Merton model as it does not employ solution of simultaneous equations. The results explain that Pakistan banking industry is relatively stable. Larger and public banks are more stable then small sized banks. Results also indicate that public has trust on government owned banks. However, financial crisis adversely affected the whole banking industry. Default probabilities of all banks increased significantly.

6.1 Key Findings

The key findings of the study conclude that banking industry of Pakistan is relatively stable. Most of the banks were facing large default probability in 2009. However, at

the end of the period under study i.e. 2006 to 2013, results are most favorable as volatility of banks decreases and banks manage their portfolios after facing financial crisis. The capital buffer of all banks also increases after financial crisis which help them to manage the credit risk problem. Small sized banks were less immunized to bear shock, since the default probability was high even after financial crisis of 2009. Public sector banks were more stable, and their capital buffer and absorption level of facing sudden shocks was higher. The results of large banks also presented hopeful picture of healthy financial system in Pakistan. These results explain that large banks adopted advanced level techniques to absorb such type of shocks. The trend of default probability was decreasing after financial crisis. Although Pakistan's banking industry faced high default probability in 2011 due to unfavorable economic conditions owing to certain reasons as sever effects of flood, downfall in stock markets. However, most of the banks were able to manage it and further reduce DP.

Default probability of Islamic banks was also larger in financial crisis period. However, Meezan bank, a leader in Islamic financial market, showed very positive results. The default probability remained comparatively lesser then all conventional banks. During financial crisis period the default probability of Meezan Bank was lesser than even large conventional banks, which indeed shows better credit risk management in Islamic banking industry. The reason can be attributed to the use of different tools which are based on PLS (profit and loss sharing). As Boumediene (2010) explained that Islamic banks did not have to face shortage of risk management tools as provided through *Shari'ah* framework. The only need is to implement rules

strictly. However the study was unable to analyze the whole Islamic banking industry due to data constraints.

6.2 Policy Recommendations

The study significantly contributes to measure the efficiency of banking industry in Pakistan. The policy recommendations of study are as following:

- It is helpful for banks, regulators, credit analysts and for rating agencies to effectively identify and manage the credit risk, especially those banks in which default probability is high.
- The findings of the study suggest specially for conventional banking sector to avoid credit risk through interest based pricing, covenants and credit insurance. Conventional banks need to be more vigilant while lending.
- The study recommend Islamic banking sector to increase capital base, as findings show that large size banks are more resilient. Commodity base lending and large size will help to avoid credit risk in Islamic banks.
- Banks can improve their efficiency by updating various tools to manage credit risk in small banks to avoid higher default probabilities.
- Financial management can distribute their portfolios in such way that effect of any sudden shock does not affect the market value of a bank. Banks are expected to be more conscious before generating any loan to customers.
- Banks need to update techniques relating to risk management to save from the financial crisis. Furthermore, as law and order situation is getting worse in

Pakistan, the banks need to build such financial controls that enable to absorb downfall in markets.

6.3 Limitation of the Study and Future Research

The study was constrained owing to following limitations.

- The focus of dissertation is to observe the effect of credit risk on default probabilities and distance to defaults of listed banks of Pakistan, we do not examine the unlisted and microfinance banks. The effects of credit risk, especially on microfinance banks are certainly expected to be different as microfinance banks are extensively granting loans to small entrepreneurs and newly established businesses which are more tend to default. Therefore, it would positively be worthwhile to inspect and find out the default probabilities of microfinance and unlisted banks.
- Since Islamic banking and conventional banking are different in operations as Islamic banking follows *Shari'ah* rules, the impact of credit risk is different on Islamic banks and conventional banks. The present study was unable to find more insightful results for Islamic banks owing to data constraints, as only 2 Islamic banks are listed on stock exchange. Due to this reason the study is limited to derive default probabilities of only two Islamic banks.
- There are many Islamic banking divisions of conventional banks which are extending Islamic banking industry. The study could not use data of Islamic banking divisions of conventional banks, because the model used for estimation needed stock prices. Thus it would be helpful for Islamic banking

industry and also for academics to examine the divisions' exposure to credit risk.

- Sabi (1996) and Isik and Hassan (2002) concluded that foreign banks are more efficient and robust then local banks. There are many foreign banks working in Pakistan and place pressure on local banks which are with limited resources. The economic conditions of Pakistan surely impact on performance of foreign banks. Thus it would be worth to explore the default probabilities of foreign banks. This exploration would be interesting for rating agencies as well, would be helpful to insight view of the performance of foreign banks.
- This research looks forward for future studies focusing new tools for management of risks, as well as, application of other models to measure the risk with an objective to select the best method of risk measurement.

Appendix

Islamic Banks	Conventional Banks
Bank Islami Limited	**Public Sector Banks**
Meezan Bank Limited	The Bank of Khyber
	The Bank of Punjab
	National Bank of Pakistan
	Private Banks
	Samba Bank Limited
	Js Bank Limited
	Allied Bank Limited
	KASB Bank Limited
	Summit Bank Limited
	MCB Bank Limited
	Askari Bank Limited
	NIB Bank Limited
	Bank Alfalah Limited
	Silk Bank Limited
	Bank Al Habib Limited
	Standard Chartered Bank (Pakistan) Limited
	Faysal Bank Limited
	United Bank Limited
	Habib Bank Limited
	Habib Metropolitan Bank Limited
	Soneri Bank Limited

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